3.6 Infrastructure Plan

BRT corridor between Suoi Tien Terminal Station and Binh Duong New City will be developed on the existing and constructing highways. In order to achieve the targeted on-time and fast performance, it shall consider not only hard infrastructures such as flyover at major intersections and block of crossing traffic on BRT corridor by closing median strip but also soft infrastructure and operational measures such as installation of a Public Transportation Priority System (PTPS) and introduction of dedicated/priority lane during a specified time. For the planning of BRT infrastructure, traffic safety shall be ensured taking into accounts a consistency with the related road facilities and minimized the negative impacts on general traffic. In this section, outline of BRT infrastructure is presented.

Ecuador Quito

Columbia Bogota

China Guangzhou

China Amoy

Source: http://www.transportphoto.net/

Photo Example of BRT Infrastructure in other countries

3.6.1 Design Standard for BRT Corridor

(1) Design Standard applied to the existing Highways for building BRT Corridor

BRT corridor will be built on the Binh Duong new city road, Pham Ngoc Thach road, My Phuoc – Tan Van road, internal road of industrial park and QL-1 and design standard applied to these highways is Urban Road Design Requirements (TCXDVN104-2007). Its major geometric design criteria and cross-sectional elements are shown in Table 3.6.1 and Table 3.6.2, respectively.

Table 3.6.1 Major Geometric Design Criteria

Item			Criteria
1	Road Classification		Urban Road
	Urban Category		Special Urban, Class-I
2	Terrain		Flat
3	Design Speed (km/h)		80
4	Horizontal Alignment	Horizontal Curve	
		Desirable Minimum Radii of Horizontal Curve (m)	400
		Absolute Minimum Radii of Horizontal Curve (m)	250
5	Vertical Alignment	Maximum Grade-Up (%)	5.0
		Critical Maximum Length of Grades	
		For 6.0 % (m)	-
		For 5.0 % (m)	700
		Vertical Curve	
		Minimum Radius of Crest Curve (m)	
		Desirable Minimum Radius (m)	3000
		Desirable Radius (m)	4500
		Minimum Radius of Sag Curve (m)	
		Desirable Minimum Radius (m)	2000
		Desirable Radius (m)	3000
6	Lateral Clearance (m)		Travelled width
	Vertical Clearance (m)		4.75

Source:TCXDVN104-2007

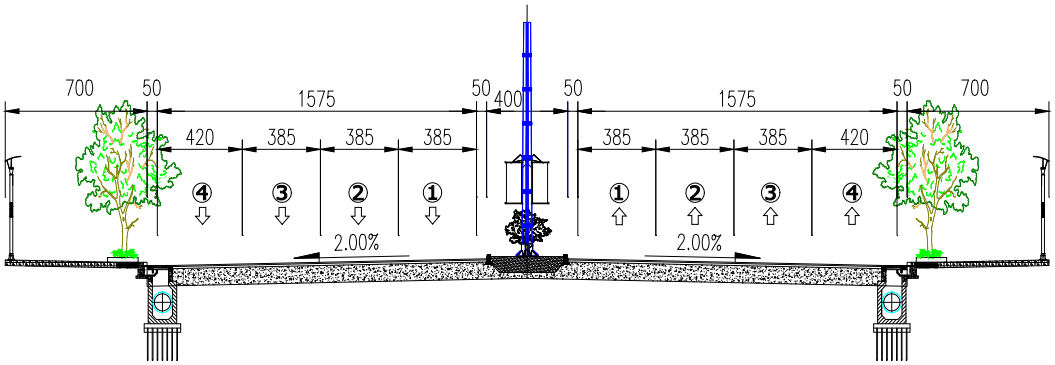
Table 3.6.2 Cross-Sectional Elements

Element	Criteria
Design Speed, Road Class	80km/h, Main urban Primary
Number of Travelled Way (minimum)	6
Formation Width (m)	
Travelled Way Width(m)	3.75m
Outer Shoulder Paved Width (m)	2.0 – 3.0m Takes width enough for emergency parking
Median Width (m)	3.0m for construction condition I 2.5m for construction condition II 2.0m for construction condition III
	Safety lane 0.75m for construction condition I 0.50m for construction condition II,III
Non-motorized vehicle lane	Separate from carriageway and shoulder by different elevation, barrier etc.

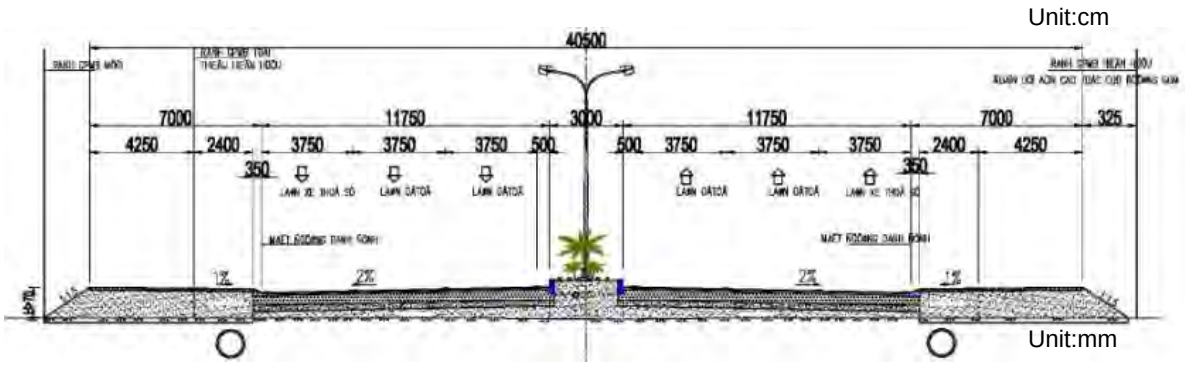
Side walk	Minimum width of sidewalk and lighting 7.5m for construction condition I 5.0m for construction condition II 4.0m for construction condition III * In case used for bus stop etc., this width must be wider than 2.0m.
Cross fall of Roadway (%)	2.0
Slope of Earthworks Fill	 V : H = 1:1.5
Auxiliary lane Right-turn lane Left-turn lane near central reservation Left-turn lane not near central reservation	 Not 0.25m smaller than next lane and >3m >3.0m Not 0.25m smaller than next lane and >3m

Source:TCXDVN104-2007

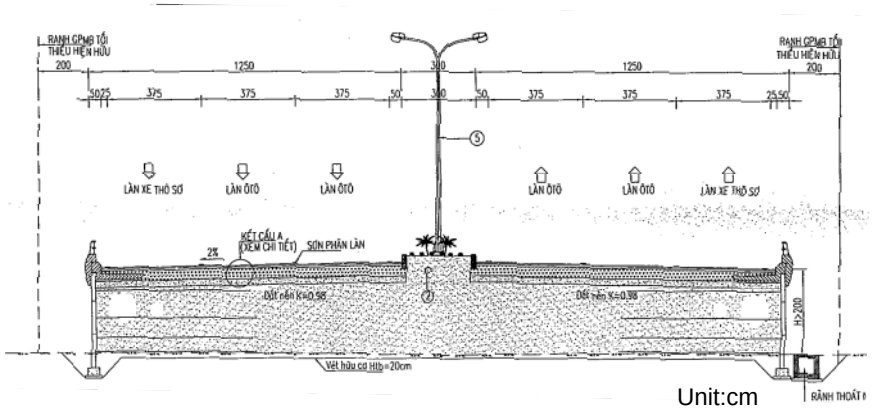
As shown in Figure 3.6.1, actual cross section of the existing roads does not strictly follow the standard and it is flexibly decided ex) outer shoulder utilizes for motorbikes and non-motorized vehicles.



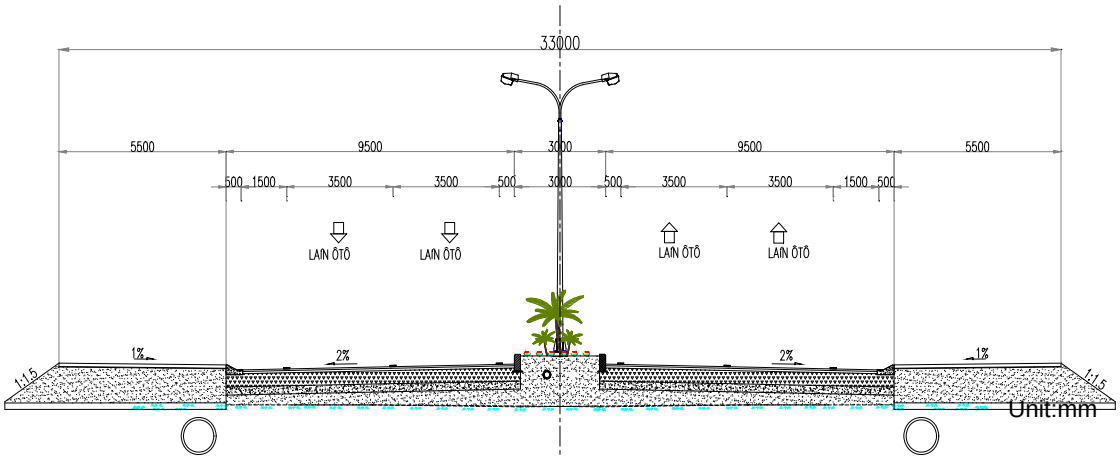
i) Pham Ngoc Thach Road



ii-1)My Phuoc – Tan Van Road (with sidewalk)



ii-2)My Phuoc – Tan Van Road KM4+975 – KM5+625 (without sidewalk)



iii) Internal Road of Industrial Park

iv) QL-1 between Tram2 IC and Tan Van IC

Source: Design Drawings of each Project, but i) and iii) are prepared by JICA Study Team

Figure 3.6.1 Typical Cross Section of the Existing Roads

(2) Design Standard applied to BRT Corridor

BRT corridor is proposed to basically apply same design standard (TCXDVN104-2007) as the existing road. However, in case not be able to conform to the standard due to a limited land area etc., other Vietnamese standards such as Specifications for Highway Design TCVN4054:2005 or design in other BRT projects will be considered for reference.

Table 3.6.3 Basic Policy on Application of Design Standard for BRT Corridor

Section	Standard
BRT Priority Lane/ Hourly Exclusive Lane	Urban Road Design Requirements TCXDVN104-2007 etc.
BRT Hourly Exclusive Lane	Specifications for Highway Design TCVN4054:2005 etc.
Flyover/ Viaduct	Specifications for Highway Design TCVN4054:2005 etc.

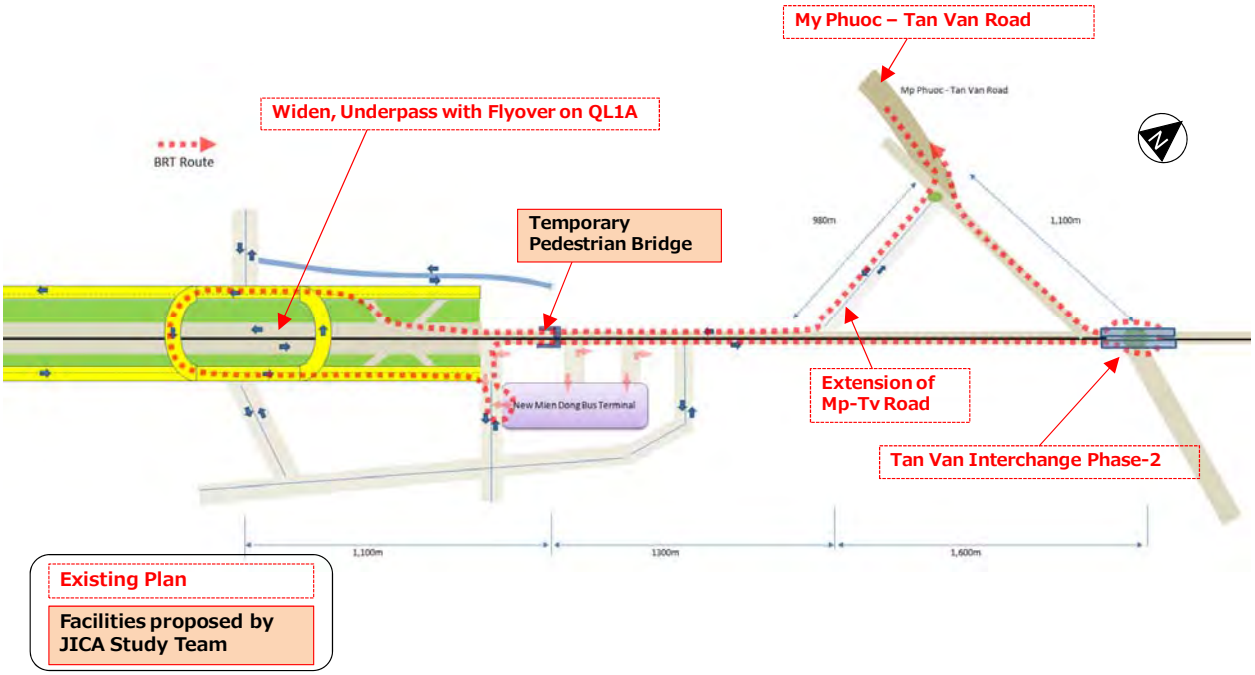
Source: JICA Study Team

3.6.2 BRT Route and Cross Section Plan

(1) BRT Route and Related Infrastructure to BRT Route

As described in section 3.3.4 Basic Concept and section 3.3.5 Route, BRT development plan has two phases (Phase-1 and 2) depending on the progress of development of infrastructure affected to the BRT route such as entire Mp-Tv road opening, new eastern bus terminal opening in 2017, and MRT Line-1 opening in 2019 etc.

Especially, at the section between new eastern bus terminal and beginning point of Mp-Tv road, there are many projects under planning and construction, which will affect to BRT operation. Figure 3.6.2 shows BRT route and related infrastructure in Phase-1. It is very important to implement and complete these infrastructures as schedule in order to achieve target operating time of BRT. At the Phase-1, pedestrian bridge across QL1A in front of new eastern bus terminal is proposed by JICA study team to ensure a path of pedestrians flow. This bridge is planned as temporary structure so that it can be easily removed when QL1A is widened.

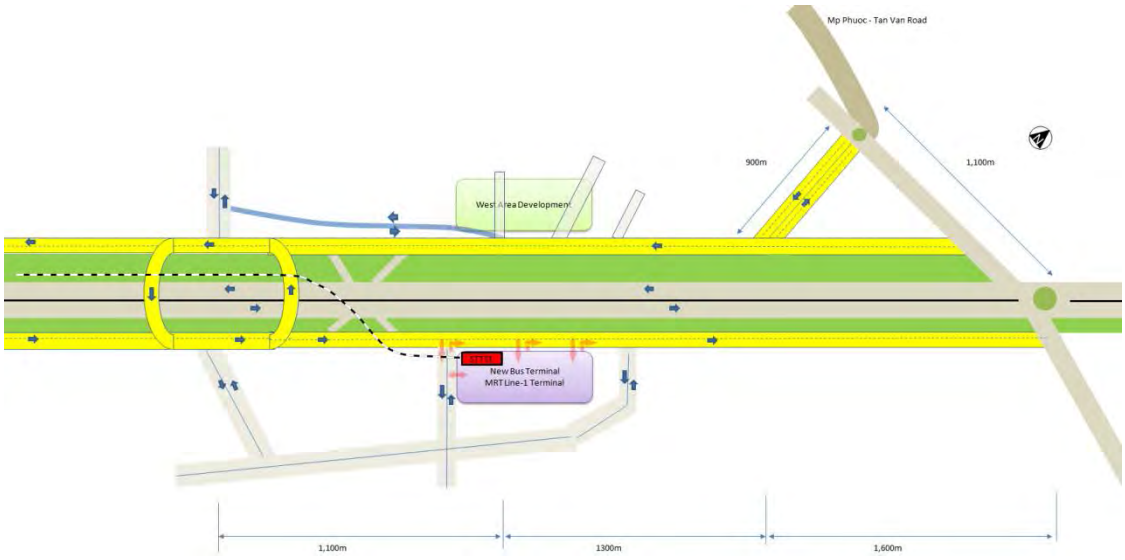


Source: JICA Study Team

Figure 3.6.2 BRT Route and Proposed Facility in Phase-1

According to the existing widening plan of QL1A as shown in Figure 3.6.3, accessibility to new eastern bus terminal and urban development at east & west area with the TOD concept is not

considered, in which will resulted ruin its development potential.



Source: JICA Study Team

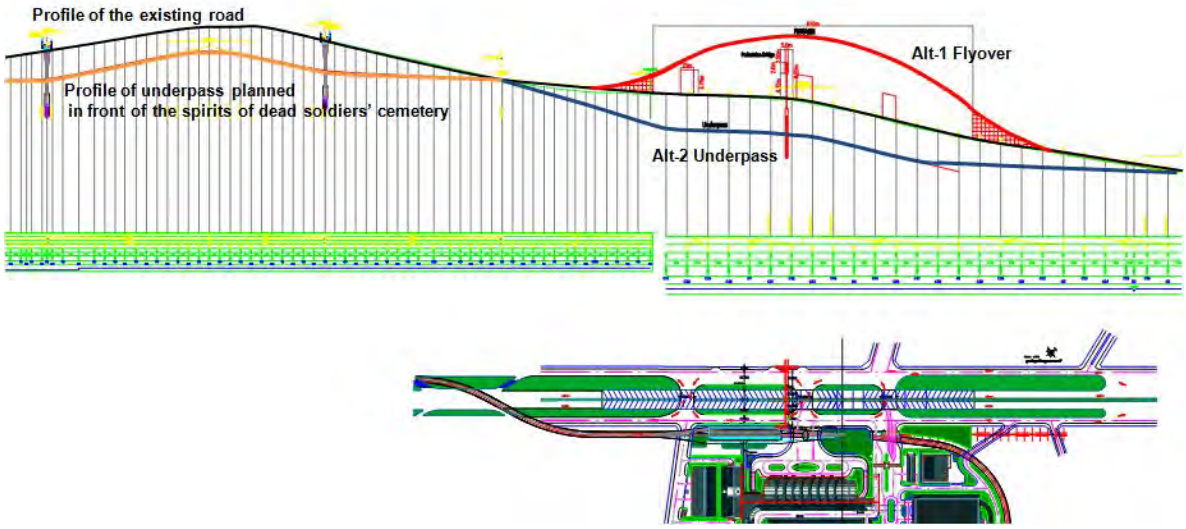
Figure 3.6.3 Future Plan of QL1A based on the Existing Plan

Therefore, JICA study team studied the infrastructures for improving accessibility and enhancing the value of the area from viewpoints of vehicle path flow and pedestrian path flow respectively, and proposed to the department of transport (DOT) of HCM City and Binh Duong Province.

Infrastructure for vehicle path flow	Infrastructure for pedestrian path flow
Alt-0 Base Case without Additional Infrastructure	Alt-1 Pedestrian Bridge
Alt-1 Flyover in the QL1A	Alt-2 Pedestrian Underpass
Alt-2 Underpass in the QL1A	
Alt-3 U-turn Bridge	
Alt-4 U-turn Tunnel	
Alt-5 At-grade Intersection	

i) Study on Infrastructure for vehicle path flow

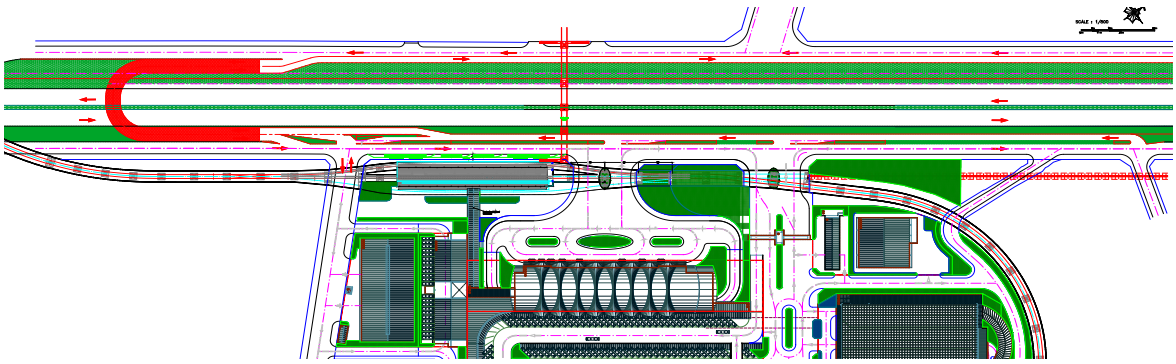
Alt-1 & 2 aims to ensure accessibility between east and west area at ground level by grade-separation of QL1A. Alt-2 has advantages of smoother vertical alignment connecting to the underpass planned in front of the spirits of dead soldiers' cemetery and higher flexibility using open space at ground level because of no piers.



Source: JICA Study Team

Figure 3.6.4 Alternatives of Flyover and Underpass

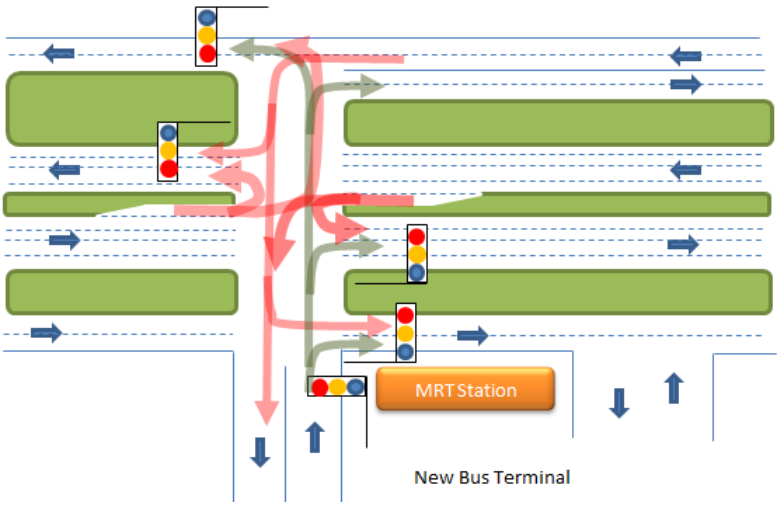
In Alt-3, U-turn Bridge with two-direction lane is built inside green belt and cross the QL1A. It is required to widen the service road for both directions and improve accessibility. In Alt-4, alignment of underpass tunnel is same as Alt-3. However, it has disadvantages that additional facilities such as road lighting, drainage and ventilation are required and its maintenance cost during operation will be charged, and high possibility of traffic accidents due to small radius R=30m. For common issue in Alt-3&4, traffic capacity is small which cause a traffic jam.



Source: JICA Study Team

Figure 3.6.5 Alternatives of U-Turn Bridge and U-Turn Tunnel

Alt-5 at-grade intersection as shown in Figure 3.6.6 has much advantage in the smaller investment cost than others. However, stop of high volume of traffic flow of QL1A, which counted at 42 thousand vehicles per day according to traffic count in JICA SAPI 2014, has a big negative impact on economic loss and environmental aspect such as traffic exhaust and noise.



Source: JICA Study Team

Figure 3.6.6 Alternative of At-grade Intersection

Table 3.6.4 Traffic Volume of QL1A (Year 2014)

Direction	Unit	Bicycle	Motorbike	Car	Taxi	Minibus	Standard Bus	Truck	Other	Total	Total except for MB, Bicycle
Ben Thanh to Suoi Tien	/day	315	42,373	6,672	875	1,689	1,925	10,759	187	64,801	22,113
Suoi Tien to Ben Thanh	/day	151	37,360	5,564	752	2,291	1,716	9,520	181	57,536	20,025
Total	/day	466	79,733	12,236	1,627	3,980	3,641	20,279	368	122,337	42,138

Source: Traffic count survey result of MRT Line-1 SAPI Study in 2014

The comprehensive comparison of each alternative from viewpoints of accessibility, alignment of the structure, construction difficulty, construction cost and traffic flow at peak hour based on the traffic simulation analysis is summarized in Table 3.6.5. Alt-1 Flyover is proposed taking into accounts accessibility, capacity of traffic, reasonable investment cost, and lower traffic congestion and economic loss.

Table 3.6.5 Comprehensive Comparison of Infrastructures for Vehicle Path Flow

Item	Alt-0 Base Case without Additional Infrastructure		Alt-1 Flyover	
Accessibility between east and west area	Traffic blocked by QL1A and concentrate traffic to U-turn bridge over underpass road	X	Arrange roundabout at ground level	O
Width, Alignment	One direction with 3-lane of service roads	△	2 parallel bridges with 16m width x 2-direction Total length applx.700m, vertical grade2~5%, Rmin(crest)=4,500m、Rmin(sag)=3,000m	O
Construction difficulty, other	No construction work	O	Desirable that construct when QL1A widening	△
Construction Cost (ratio)	0 billion VND No additional cost	◎	500 billion VND (100%)	O
Traffic in the Peak Hour*1/	Average time loss: 114 second/veh Economic loss due to congestion, signal: 41,782USD/day	X	Average time loss: 58 second/veh Economic loss due to congestion, signal: 18,439USD/day	◎

Evaluation	5th rank	X	1st rank (Recommend)	◎
Item	Alt-2 Underpass		Alt-3 U-Turn Bridge for BRT	
Accessibility between east and west area	Available open space at ground Level for more flexible access than Alt-1 because of no piers	◎	Low capacity of accessibility and cause traffic jam	X
Width, Alignment	Width 36m, total length 1,300m. vertical grade varies 0.4 ~3%, Rmin(crest)=4,500m, Rmin(sag)=3,000m	◎	Two-direction lane with emergency lane 2.5m+3.5m+3.5m+2.5m Maximum vertical slope 5.0%, minimum radius 30m (design speed 30km/h)	△
Construction difficulty, other	Desirable that construct when QL1A widening	△	Easy to construct even after completion of QL-1A widening	O
Construction Cost (ratio)	1,000 billion VND (200%)	X	220 billion VND (44%)	◎
Traffic in the Peak Hour*1/	Average time loss: 58 second/veh Economic loss due to congestion, signal: 18,439USD/day	◎	Average time loss: 114 second/veh Economic loss due to congestion, signal: 41,782USD/day	X
Evaluation	2nd rank	O	4th rank	△
Item	Alt-4 U-Turn Tunnel for BRT		Alt-5 At-grade intersection	
Accessibility between east and west area	Low capacity of accessibility and cause traffic jam Blind curve causes traffic accident	X	Low capacity of accessibility and cause traffic jam	X
Width, Alignment	Two-direction lane with emergency lane 2.5m+3.5m+3.5m+2.5m Maximum vertical slope 5.0%, minimum radius 30m (design speed 30km/h)	△	Accord with QL1A Traffic signal control is required.	O
Construction difficulty, other	Desirable that construct when QL1A widening Maintenance cost is required	X	Easy to construct even after completion of QL-1A widening	O
Construction Cost (ratio)	330 billion VND (66%) * open cut method	◎	5.5 billion VND (1.1%)	◎
Traffic in the Peak Hour*1/	Average time loss: 114 second/veh Economic loss due to congestion, signal: 41,782USD/day	X	Average time loss: 92 second/veh Economic loss due to congestion, signal: 45,001USD/day	X
Evaluation	6th rank	X	3rd rank	△

Note: *1/ Based on the traffic flow analysis around STT Station (Details to be referred to Appendix-**), Time Loss = difference between actual travel time and ideal travel time (travel with desired speed)
Definition of the Criteria ◎: very good, O: good, △: not bad, X: bad

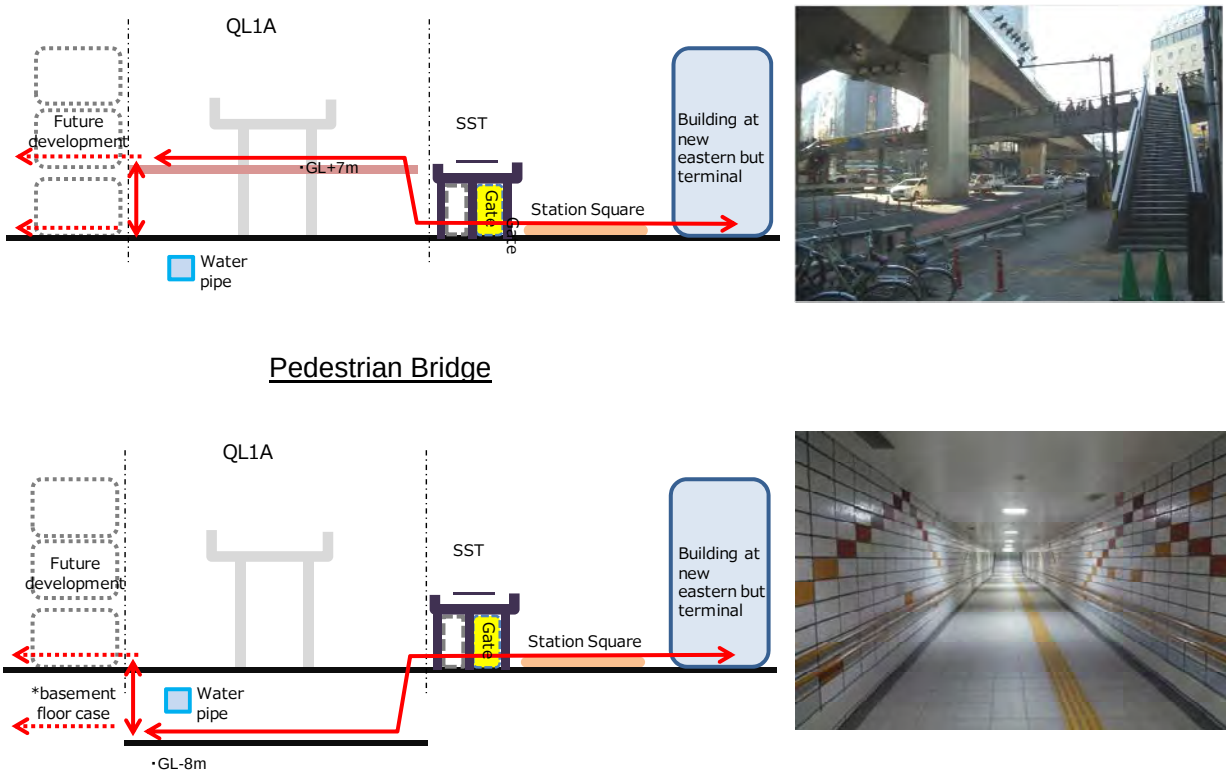
Source: JICA Study Team

ii) Study on Infrastructure for pedestrian path flow

In Alt-1 of Pedestrian Bridge, the elevation of the bridge deck is at GL+7m taking into accounts height clearance of QL1A and thickness of the deck. It can be allowed to connect the deck with future development building in western side at 2nd level by extension of bridge.

In Alt-2 of Pedestrian Underpass, the elevation of the underpass is at GL-8m taking into accounts buried water pipe. In case connecting with building at western side in future, a building developer

must arrange basement floor and it cause increasing cost.



Source: JICA Study Team

Figure 3.6.7 Alternatives of Pedestrian Bridge and Underpass

Based on the comprehensive comparison of each alternative summarized in Table 3.6.6, Alt-1 Pedestrian Bridge is proposed taking into accounts restriction of construction condition, O&M and investment cost.

Table 3.6.6 Comprehensive Comparison of Infrastructures for Pedestrian Path Flow

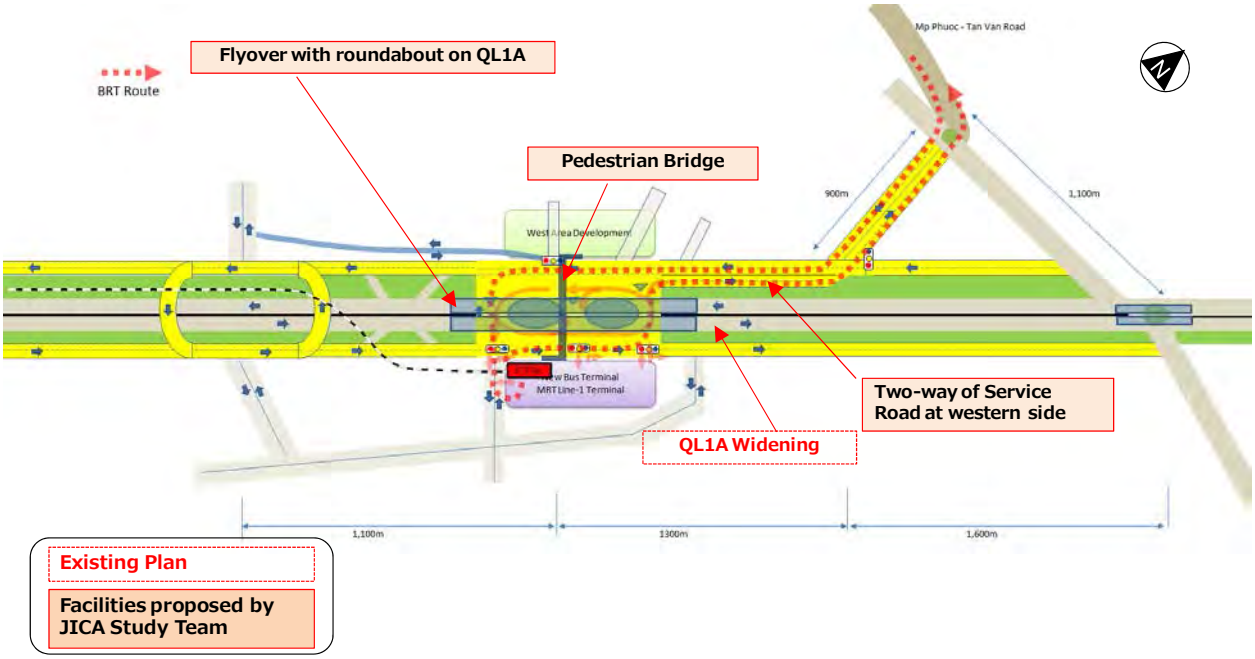
Item	Alt-1 Pedestrian Bridge		Alt-2 Pedestrian Underpass	
Accessibility	• Distance move up and down is smaller than Alt-2 • Flexible connection with building at Western side at 2nd level by extension of deck	O	• Distance move up and down is longer than Alt-1 • In case direct connection with building, basement floor is required.	△
Affect on flyover construction	• Maximum elevation of Flyover is higher but no increase cost because this pedestrian bridge is not control point for vertical alignment of flyover • Restrict condition in substructure and superstructure work	△	• Non special item	O
Construction cost	• 23.6billion VND including elevators	◎	• 56.5billion VND including elevators * open cut method case	X

Construction restrict	• Minimize affect to passing traffic on QL-1A • Construction period 8 months	O	• In case to commence construction after QL-1A widening, detour road and phased construction are required. • Construction period 12 months • Treatment of water pipe is required.	X
O&M	• Non special item	O	• Lighting, drainage, ventilation, security camera etc. are required and its operation cost is estimated at USD18,000/year. • Possible damage of pavement of QL1A due to uneven settlement between underground structure and other section	X
Evaluation	Recommend	O	Not Recommend	X

Note: Definition of the Criteria ◎: very good, O: good, △: not bad, X: bad

Source: JICA Study Team

Figure 3.6.3 shows BRT route and related infrastructure for Phase-2 including flyover on QL1A and pedestrian bridge, proposed by JICA Study Team, in front of new eastern bus terminal to improve the accessibility by utilizing space under flyover. In addition, two-way with each two lanes of service road at western side is proposed instead of one-way with two lanes to enhance convenience for access from Binh Duong Province.



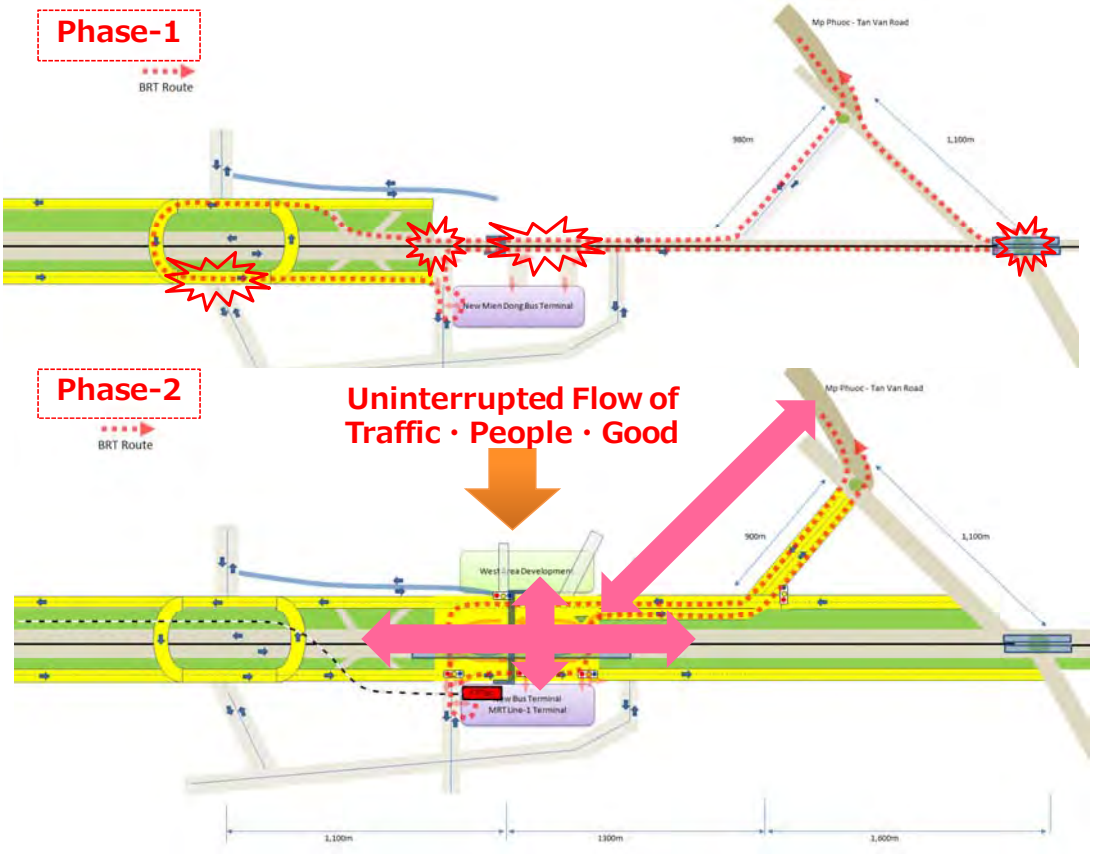
Source: JICA Study Team

Figure 3.6.8 BRT Route and Proposed Facilities in Phase-2

Following problems are concerned in circumstance of Phase-1 as shown in Figure 3.6.4. Accordingly, completion of all related infrastructure and shift to Phase-2 before 2020 are absolutely required.

- Negative influence to socio-economic due to chronic traffic congestion at QL1A
- Lower speed and operation time due to 4km longer driving distance than that of Phase-2 and traffic congestion, profitability of the BRT project will be affected.

- Due to lower accessibility to new eastern bus terminal, profitability of the public bus operator will be affected.
- In the case that MRT service starts in this condition, due to bad accessibility to MRT Suoi Tien Terminal Station, profitability of MRT project will be also affected.



Source: JICA Study Team

Figure 3.6.9 Problems concerned in circumstance of Phase-1

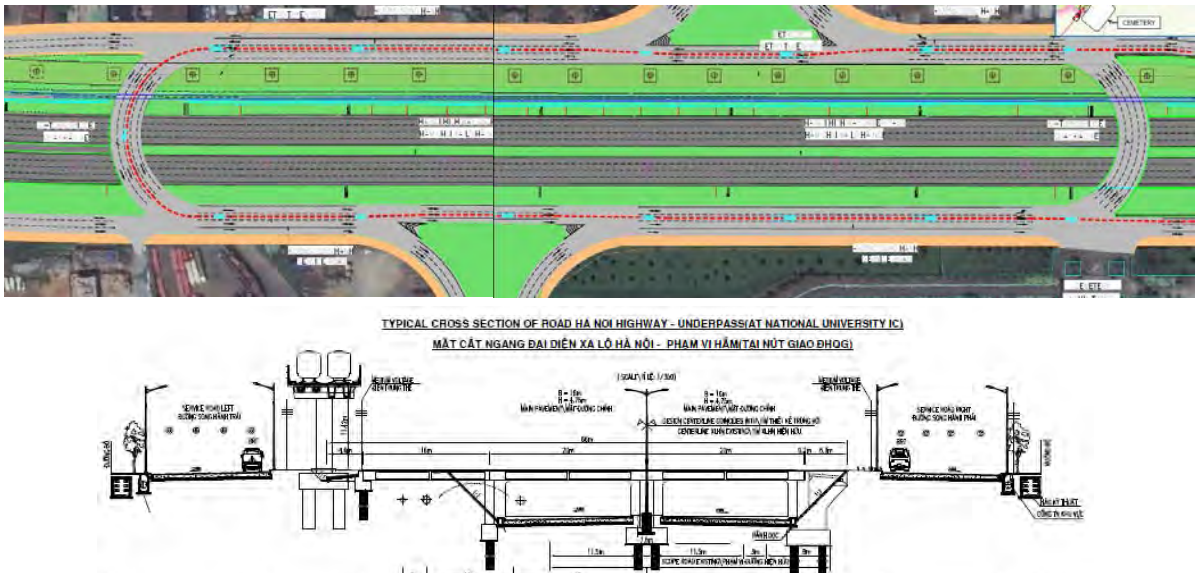
Since these infrastructure can say public infrastructure for city development around new eastern bus terminal/ Suoi Tien MRT terminal station, MRT and BRT, HCM PC's DOT and Binh Duong PC' DOT have been discussing for materialization.
Outline of related infrastructure is described below.

Phase-1 Infrastructure

i) Widening, Underpass with U-turn Bridge on QL1A

Underpass with U-turn bridge is planned at convex vertical alignment section of QL1A in front of the spirits of dead soldiers' cemetery as shown in Figure 3.6.10. A project owner of this project was initially Urban Transport Management Department No.2 of HCM City and finally main scope of the work including underpass and U-turn bridge was transferred to CII. Only service road, road lighting and planting tree were remained in the scope of Urban Transport Management Department No.2 of HCM City and currently it is under construction (as of July 2015). After completion of the service road, underpass work can be started to maintain traffic. However, the service road construction work has been delayed because resettlement of about twenty houses to be affected is not completed and the site for the western side service road had been taken over by MTR Line-1

Project. Accordingly, the timing of the completion is still not able to be assumed.

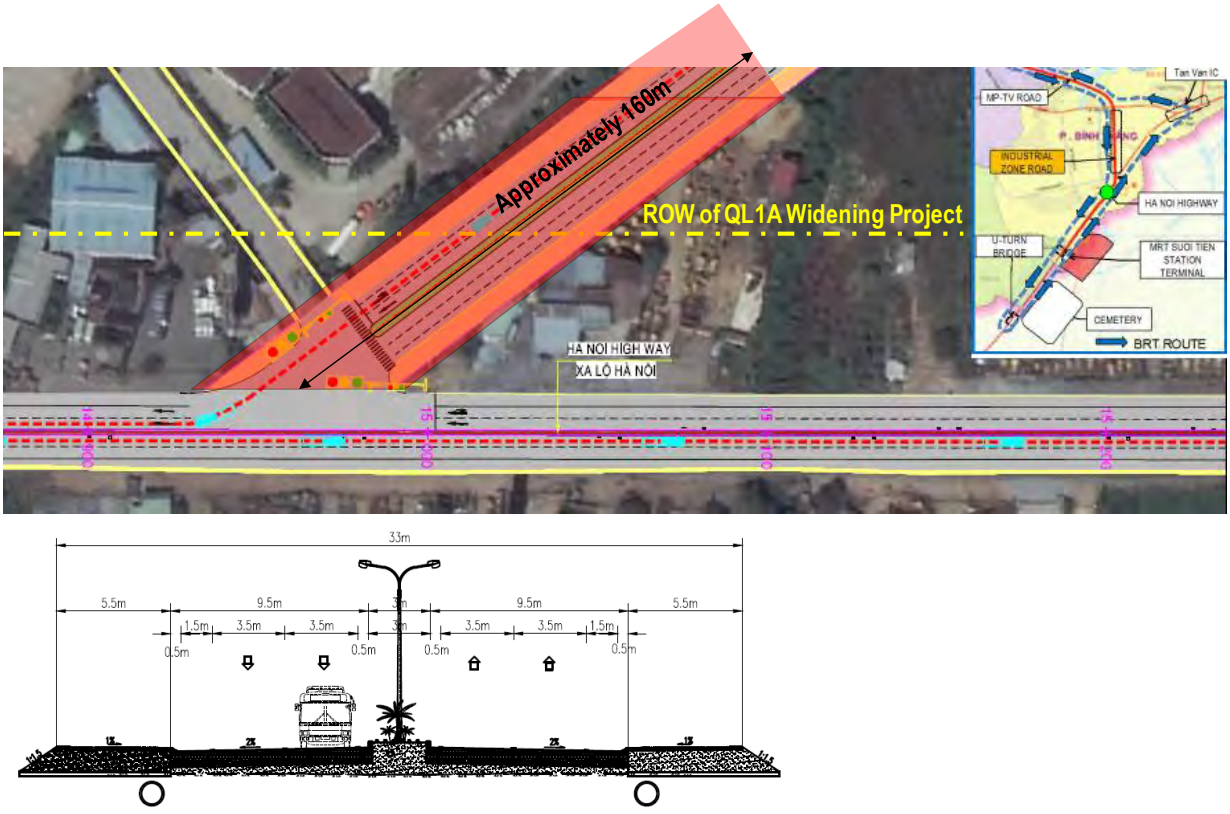


Source: JICA Study Team

Figure 3.6.10 Plan and Cross Section of Widening, Underpass with U-turn Bridge on QL1A

ii) Extension of Mp-Tv Road

Approximately 600m of road inside industrial park has completed at the side of Mp-Tv road and 420m length of remaining section to QL1A is required to be completed. A land acquisition has not been completed at approximately 160m out of the remaining section. BD Province intends to connect with QL1A before completion of QL1A widening project.



Source: JICA Study Team

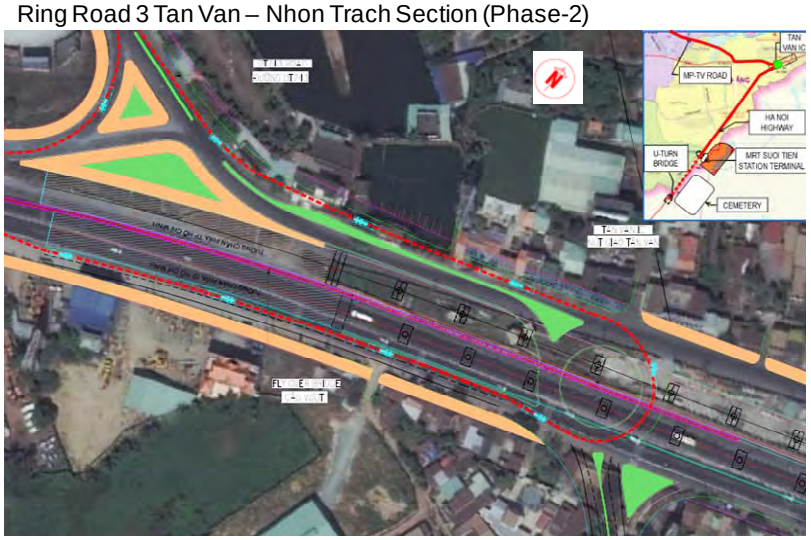
Figure 3.6.11 Plan and Cross Section of Extension of Mp-Tv Road

iii) Tan Van Interchange

Tan Van Interchange will be developed in two phases, and for the first phase, one way flyover was completed in 2014 under Dong Nai Bridge Project. Another flyover with roundabout beneath bridge will be constructed as Phase-2 under Ring Road 3 Tan Van – Nhon Trach Section.

One way flyover was completed in 2014 under Dong Nai Bridge Project (Phase-1)

Another flyover with roundabout will be constructed under Ring Road 3 Tan Van – Nhon Trach Section (Phase-2)

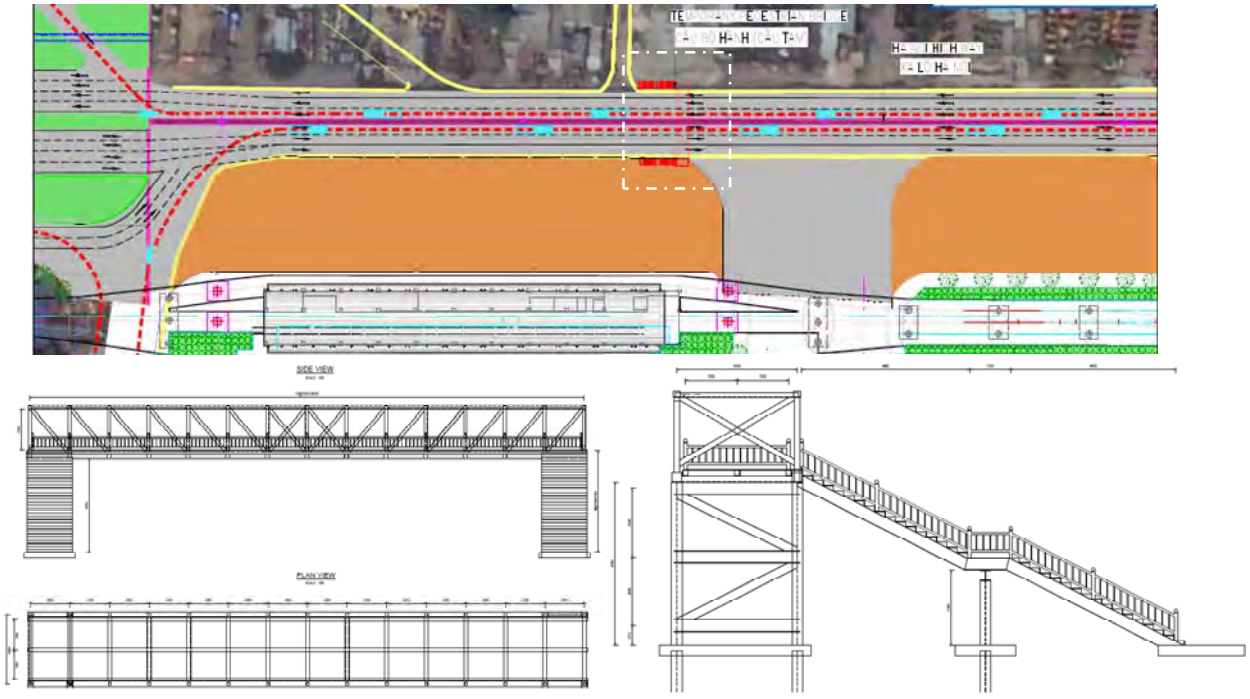


Source: JICA Study Team

Figure 3.6.12 Phased construction of Tan Van Interchange

Iv) Temporary Pedestrian Bridge across QL1A

To easily demolish in Phase-2 and for re-use of material, steel frame structure is proposed. Bridge length is 28m and width is 3.0m.



Source: JICA Study Team

Figure 3.6.13 General View of Temporary Pedestrian Bridge for access of East-West

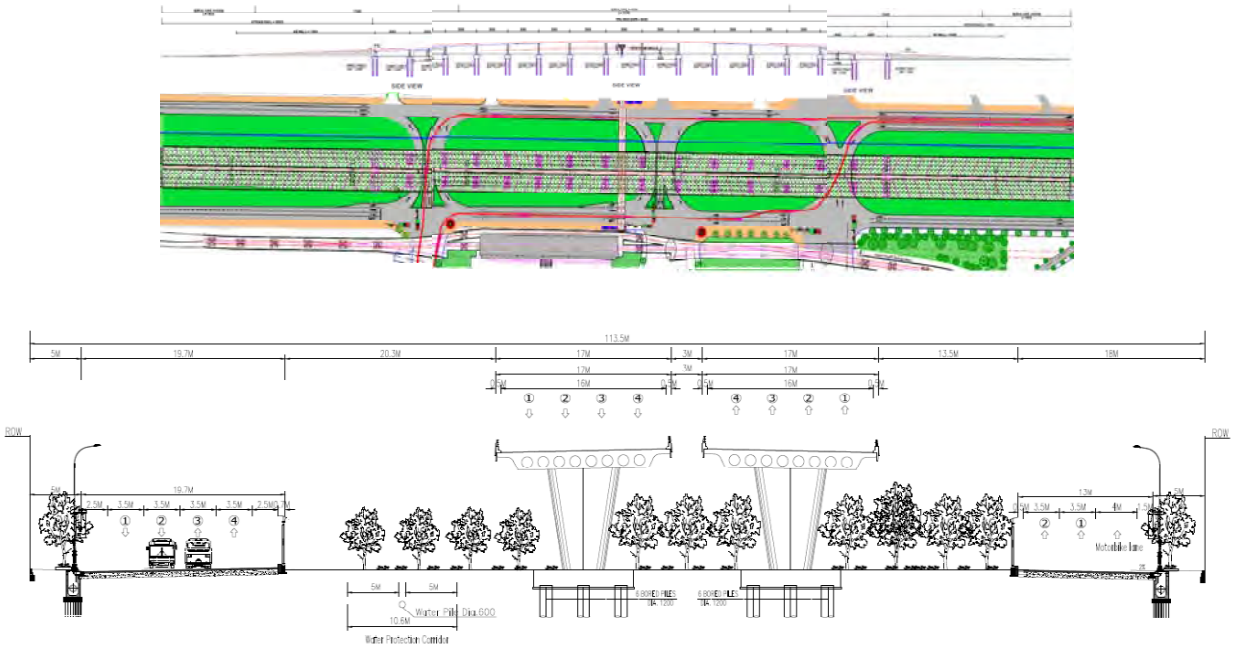
Phase-2

i) QL1A Widening Project (new eastern bus terminal - Tan Van Interchange)

Detailed Design for the section between new eastern bus terminal and Tan Van Interchange of QL1A Widening Project in Binh Duong Province is being implemented by the Project Owner CII and it is expected to compete by end of September 2015. The budget for land acquisition of this section is estimated at VND1,400 billion and it has not been arranged for the execution. Accordingly, implementation schedule of the work is not determined.

ii) Flyover with roundabout on QL1A

Hollow slab girder type is proposed taking accounts lower height of girder, shorter bridge length and lower cost than others. The flyover has 484m bridge length with 15 spans and MSE wall at approach bridge. Two flyovers will be constructed in parallel, each flyover has one-way direction of 4-lane with 17m width.

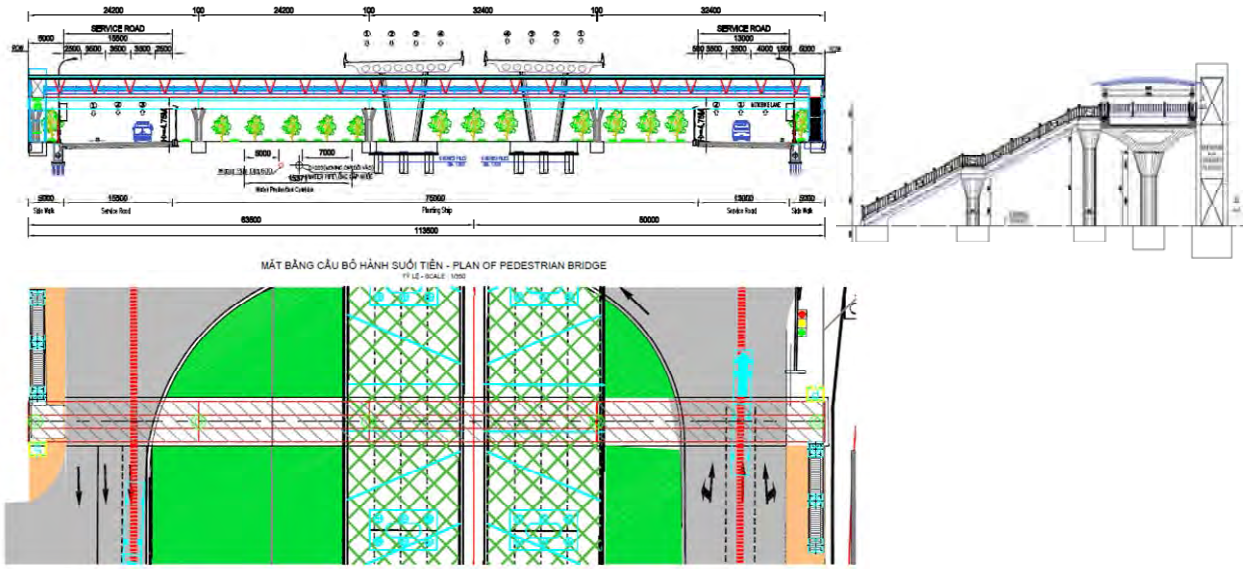


Source: JICA Study Team

Figure 3.6.14 General View of Flyover with roundabout on QL1A

iii) Pedestrian Bridge (Permanent)

The pedestrian bridge across QL1A will be arranged under flyovers and it has 113.5m length with 5.0m width and elevators will be equipped at both ends for disabled persons.

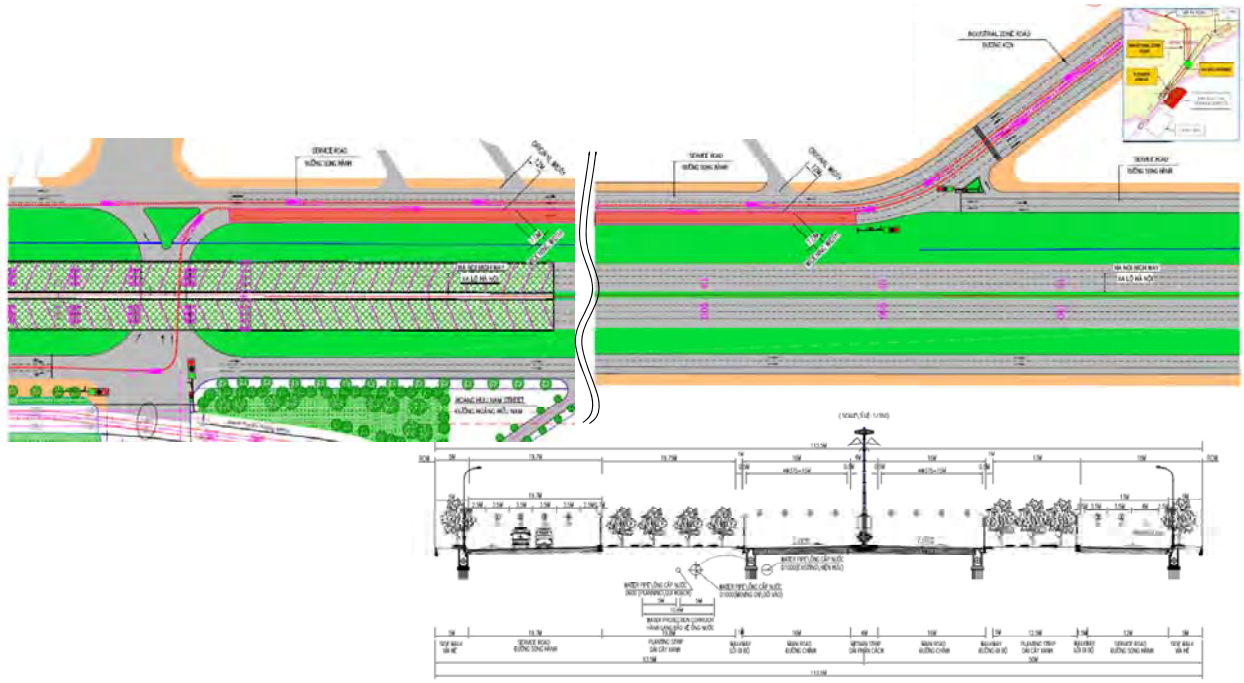


Source: JICA Study Team

Figure 3.6.15 General View of Pedestrian Bridge

iv) Two-way of Service Road at western side

Two-way total 4-lane service road is proposed to be built by widen 7m to the green belt of QL1A. Widening section of the service road is approximately 800m up to the road inside industrial park.



Source: JICA Study Team

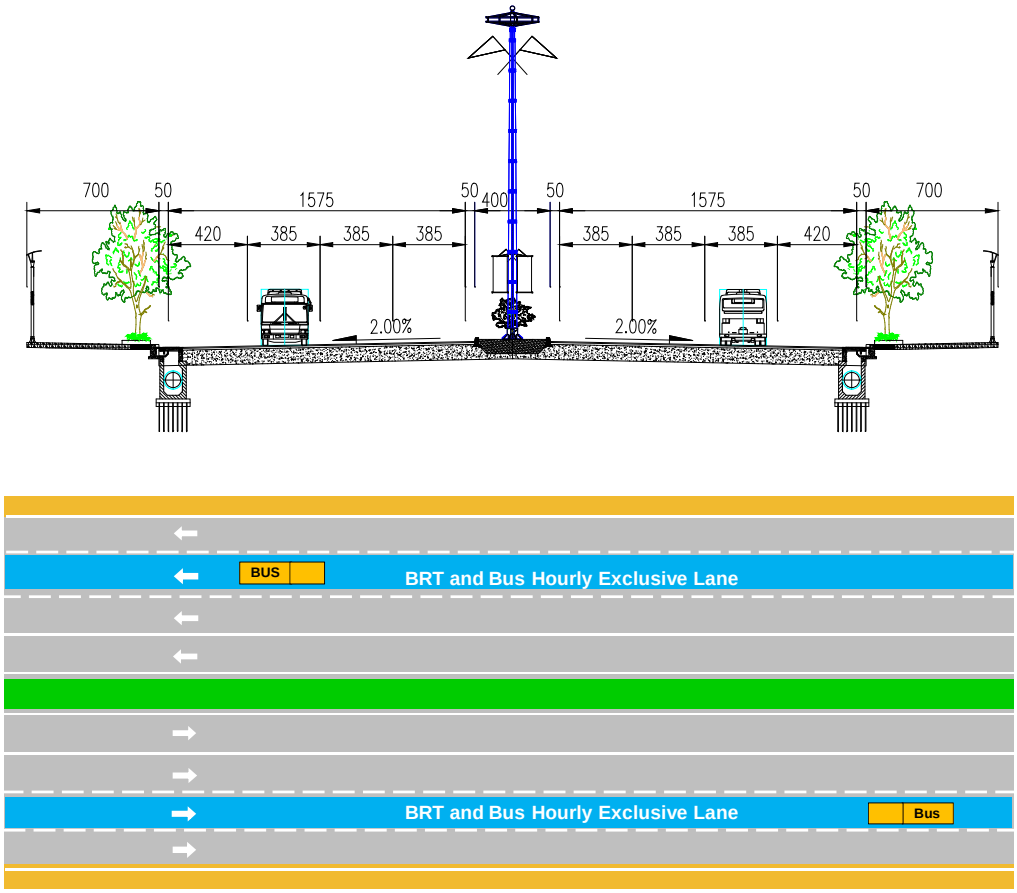
Figure 3.6.16 Plan and Cross Section of Two-way Service Road at Western Side

(2) Cross Section of BRT Route and Lane

1) Binh Duong New City Road and Pham Ngoc Thach Road Sections

In the section from bus terminal/depot and Pham Ngoc Thach road, priority lane or mixed lane with

other traffic will be applied. In the Pham Ngoc Thach road, as shown in Figure 3.6.17, the 2nd traffic lane is used as BRT priority lane since the 1st traffic lane is occupied by motorbikes. This is same route as a shuttle bus (KAZE Shuttle) operated by BECAMEX Tokyu Bus between Binh Duong New City and Thu Dau Mot.

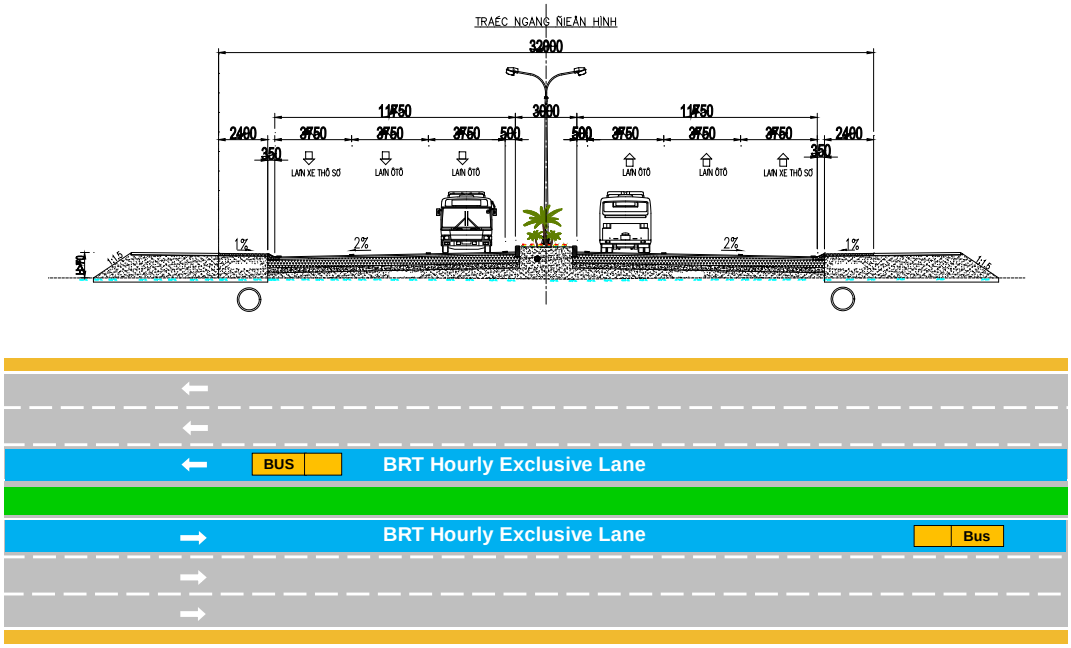


Source: JICA Study Team

Figure 3.6.17 BRT Route and Cross Section on Pham Ngoc Thach Road

2) My Phuoc – Tan Van Road Section

Mp-Tv road has three lanes in one direction and the 1st traffic lane (sidewalk side) has functions of shoulder and driving lane of motorbike/bicycle. The 3rd traffic lane (median side) is suitable for BRT driving lane because the most favorable conditions achieving the on-time and fast performance of BRT can be ensured taking into accounts traffic rule that vehicle must shift to right side lane to give way to the taking-over vehicle, and some motorbikes drive the 2nd lane.
BRT lane and cross section of My Phuoc – Tan Van Road is shown in Figure 3.6.18.

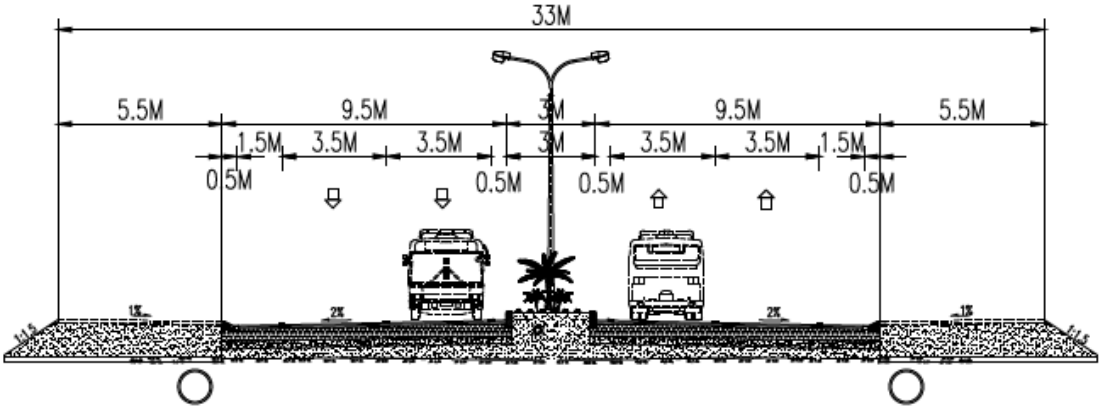


Source: JICA Study Team

Figure 3.6.18 BRT Lane and Cross Section on My Phuoc – Tan Van Road

3) Internal Road of Industrial Park Section

The length of BRT route can be shortened about 1.3km in case passing through the internal road of industrial park comparing to the detour route passing Tan Van Interchange. In this short section, mixed traffic with other vehicles can be acceptable. Cross section of the internal road is shown in Figure 3.6.19.



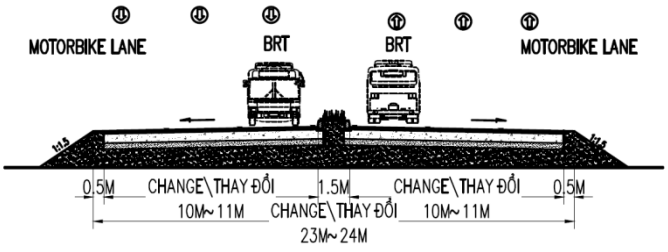
Source: JICA Study Team

Figure 3.6.19 Cross Section of Internal Road

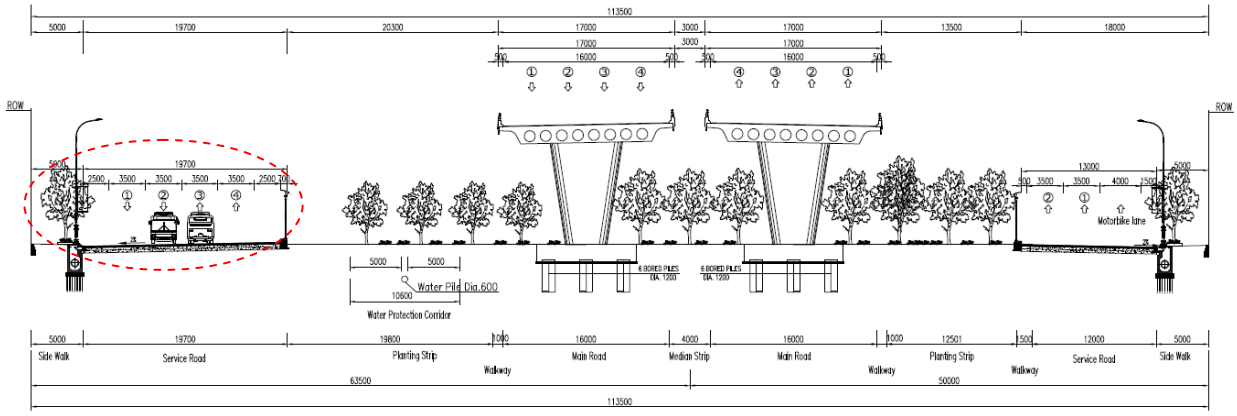
4) QL-1 Section

In Phase-1, priority lane or BRT hourly exclusive lane is difficult to be arranged in QL1A because of only two-lane in one direction except for motorbike lane and high traffic volume. Accordingly, BRT bus must drive with other traffic in the same lane.

In Phase-2, widened western service road is available for access from/to Binh Duong Province.



I) Phase-1



Ii) Phase-2

Source: JICA Study Team

Figure 3.6.20 Cross Sections of QL1A in Phase-1 and 2

3.6.3 BRT Facilities

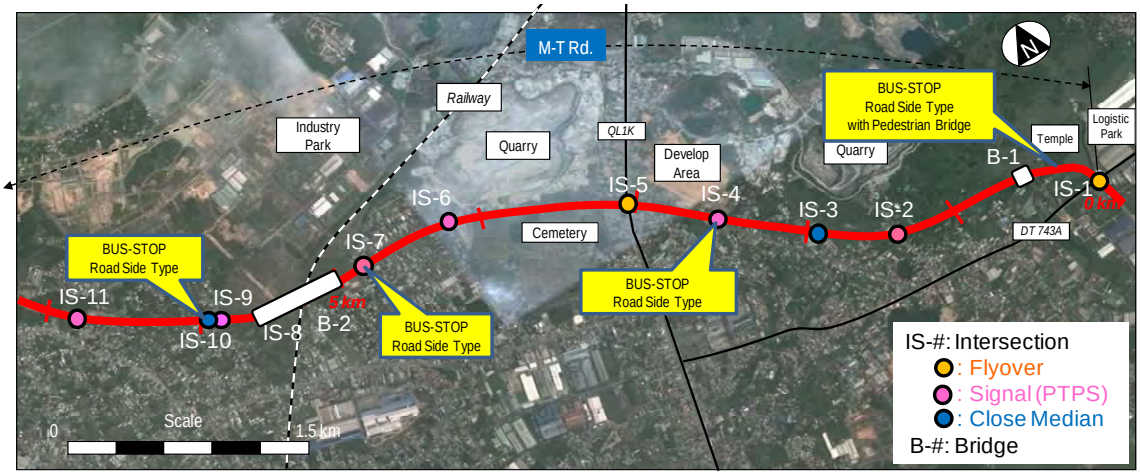
(1) Facilities for Improvement of Traffic Flow at Intersection

Three kinds of facilities are proposed to improve traffic flow at intersection and to achieve the targeted on-time and fast performance of BRT.

a) To construct a flyover at major intersection
b) To install a Public Transportation Priority System (PTPS) at intersection with other class of roads
c) To block of crossing traffic on BRT corridor by closing median strip at minor intersection

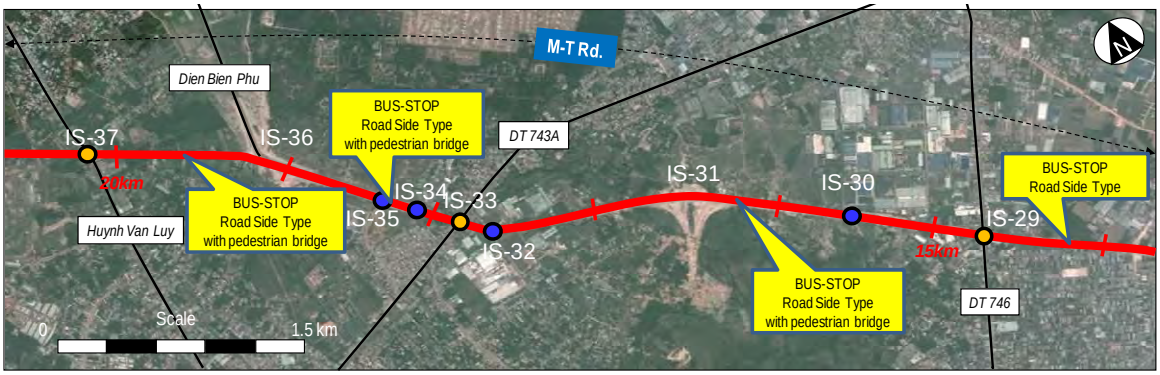
As for flyover location, in addition to 5 locations at major intersections such as National Highway (IS5) and Provincial Roads (IS1, IS29, IS33, IS37), two locations at city roads such as Nguyen Thi Minh Khai Street (IS13) and An Phu-Binh Chuan Road (IS23) is proposed. Nguyen Thi Minh Khai Street connects between city center of Di An District and DT743, and there are wide vacant area available and development plan of the industrial zone is announced. Since DT743A has a plan to widen to 40m width with flyover crossing My Phuoc – Tan Van road at IS22 and traffic concentrates into DT743A, detour traffic will use parallel road (An Phu – Binh Chuan Road) taking into account a road network in the surrounding area. Accordingly, these two city roads also have high traffic volume.

As shown in Figure 3.6.21, 7 flyovers, 13 PTPS and 15 closing median strip are planned. Another PTPS will be installed at intersection between Internal Road of Industrial Park Section and QL1A.

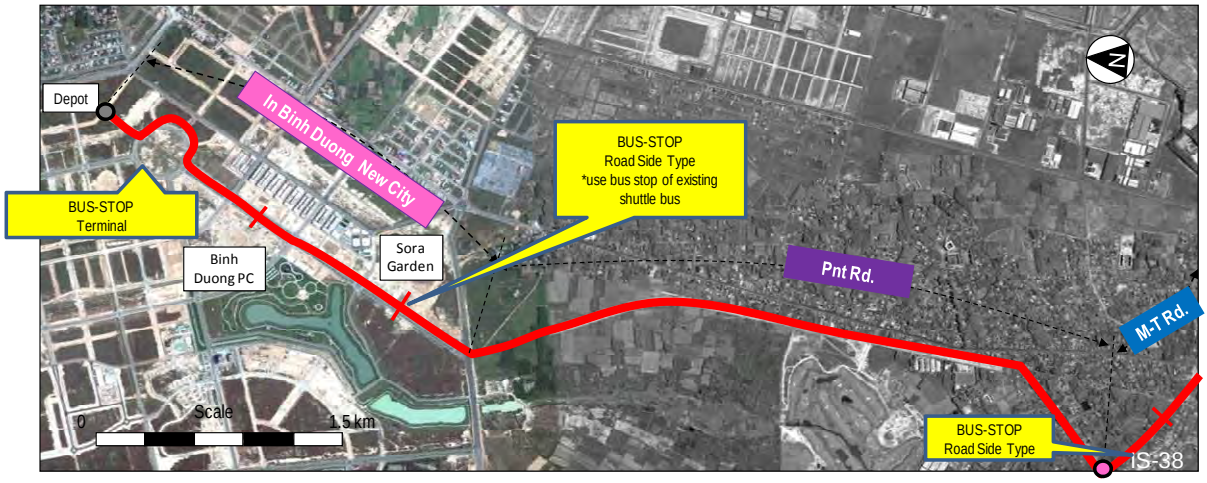


City/ Town	ID	STA	Crossing Road			Current Median Space (m)	Signaling 0: None, 1:Plan, 2: Existing	Improvement Plan
			Name	Current Width (m)	Future Width (m)			
Di An	IS-1	0 + 000	DT743A				1	Flyover
	IS-2	1 + 437	Vam Suoi	3	22	40.0	0	Signal
	IS-3	1 + 970	Chau Thoi	6	6	40.0	0	Close Median
	IS-4	2 + 500	Road to Xom Moi	6	17	40.0	0	Signal
	IS-5	3 + 078	National Highway 1K			80.5	1	Flyover
	IS-6	4 + 250	Road 5 Tan Dong Hiep Industrial zone	28	28	30.0	1	Signal
	IS-7	4 + 850	Dong Thanh	7	19	30.0	1	Signal
	IS-8	5 + 450				0.0	0	-
	IS-9	5 + 800	North South 6 planning Road	0	30	0.0	1	Close Median
	IS-10	5 + 925		7	17	25.0	1	Signal
	IS-11	6 + 800				33.0	0	Close Median

City/ Town	ID	STA	Crossing Road			Current Median Space (m)	Signaling 0: None, 1:Plan, 2: Existing	Improvement Plan
			Name	Current Width (m)	Future Width (m)			
Di An	IS-12	7 + 272	Le Van Mam			30.0	1	Close Median
	IS-13	7 + 471	Nguyen Thi Minh Khai	22	22	30.0	1	Flyover
	IS-14	8 + 225	Cay Da – Thanh Nien	7	22	40.0	1	Signal
	IS-15	8 + 275	Cay Da – Cay Da	7	20	0.0	0	Close Median
	IS-16	9 + 050	Bui Thi Xuan	22	30	27.5	1	Signal
	IS-17	9 + 442				30.0	1	Close Median
	IS-18	9 + 650				0.0	0	Close Median
	IS-19	9 + 900	Tran Quang Dieu	7	22	Open	0	Signal
Thu An	IS-20	10 + 309				0.0	0	Close Median
	IS-21	10 + 559	An Phu Intersection	16	22	15.0	1	Closed Median
	IS-22	10 + 611	An Phu Intersection (DT 743A)	23	40	40.0	1	Signal
	IS-23	11 + 075	An Phu – Binh Chuan	21	21	47.0	0	Flyover
	IS-24	11 + 710				0.0	0	Close Median
	IS-25	11 + 950	An Phu 16	6	17	65.0	1	Signal
	IS-26	12 + 570	An Phu 13	6	17	36.5	0	Close Median
	IS-27	12 + 875	Thuan An Hoa	17	17	58.0	0	Signal
	IS-28	13 + 740	Thuan Giao 02	10	22	47.0	2	Signal



City/ Town	ID	STA	Crossing Road			Current Median Space (m)	Signaling 0:None, 1:Plan, 2: Existing	Improvement Plan
			Name	Current Width (m)	Future Width (m)			
Thu An	IS-29	14 + 647	Thu Khoa Huan	15.5	32	30.0	2	Flyover
	IS-30	15 + 525				Open	0	Close Median
Thu Dau Mot	IS-31	16 + 450	Vanh Dai 3 (Ring Road 3)	0	N/A	50.0	0	Interchange
	IS-32	17 + 700	Nguyen Thai Binh	15	28	35.0	1	Close Median
	IS-33	17 + 874	Phu Loi (DT743)	22	22	46.0	2	Flyover
	IS-34	18 + 050				Open	0	Close Median
	IS-35	18 + 375				38.5	0	Close Median
	IS-36	19 + 143	Tao Luc 1	N/A	N/A	Open	2	Interchange
	IS-37	20 + 225	Huynh Van Luy	24	24	40.0	2	Flyover



City/ Town	ID	STA	Crossing Road			Current Median Space (m)	Signaling 0. None, 1:Plan, 2: Existing	Improvement Plan
			Name	Current Width (m)	Future Width (m)			
Thu Dau Mot	IS-38	21 + 210	Phạm Ngọc Thach	7	51.5	58.5	2	Signal

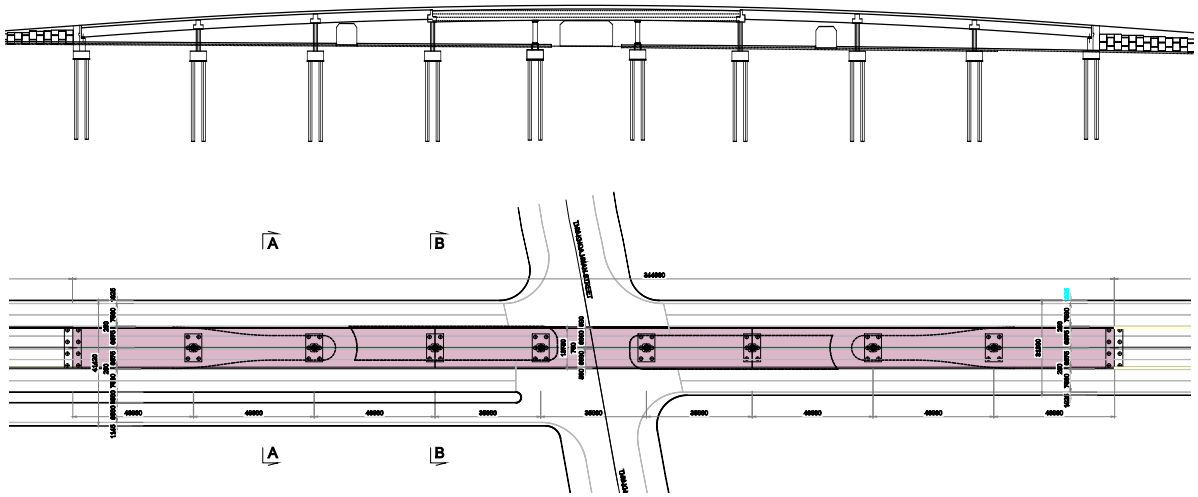
Source: JICA Study Team

Figure 3.6.21 Facilities for Improvement of Traffic Flow at Intersection along My Phuoc – Tan Van Road

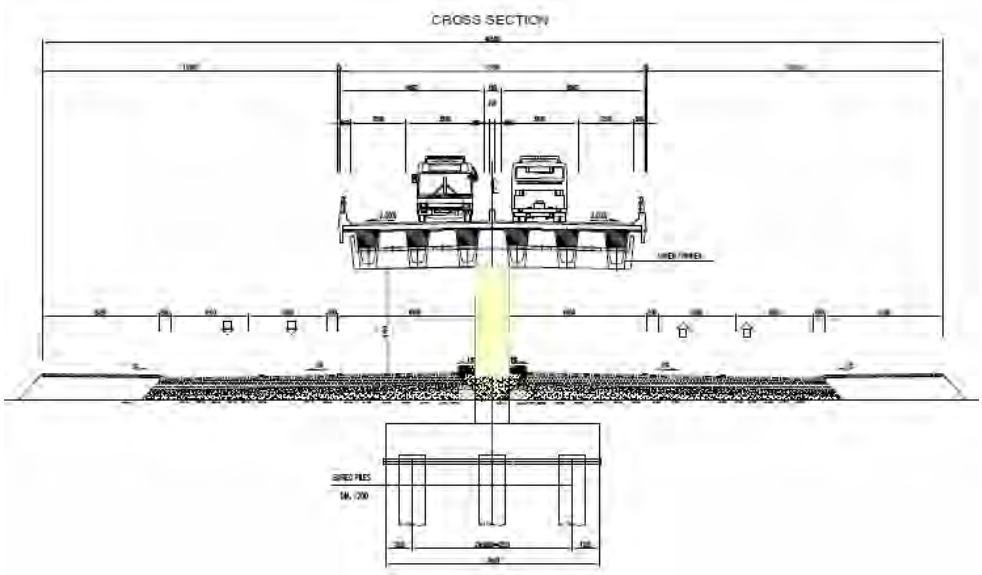
2) Flyover at intersection with major crossing roads

(i) Cross Sectional Element and Geometric Design

Flyover will be built at 7 intersections along Mp-Tv Road including one flyover at crossing with DT743A. The cross sectional element consists of two lanes for both directions with the width of 3.5 meters and the shoulder of 2.5 meters for emergency stop and maintenance.



i) plan of flyover



ii) typical cross section （Super-tee Girder）

Source: JICA Study Team

Figure 3.6.22 Plan and Cross Section of Flyover

Design speed of flyover is 80km/hour accommodating Mp-Tv Road. Horizontal alignment of the flyover will be planned along centerline of Mp-Tv road. As for vertical alignment, maximum grade-up is set at 4.0%, and minimum radius of crest curve and sag curve are 4,000m and 2,000m respectively. Design speed of 60km/h should be applied only to the flyover over DT743A at beginning point because this is a transition section between Mp-Tv road (80km/h) and Industrial Zone Road (60km/h).

Cross sectional element and geometric design criteria are summarized in Table 3.6.7.

Table 3.6.7 Cross sectional element and geometric design criteria for flyover

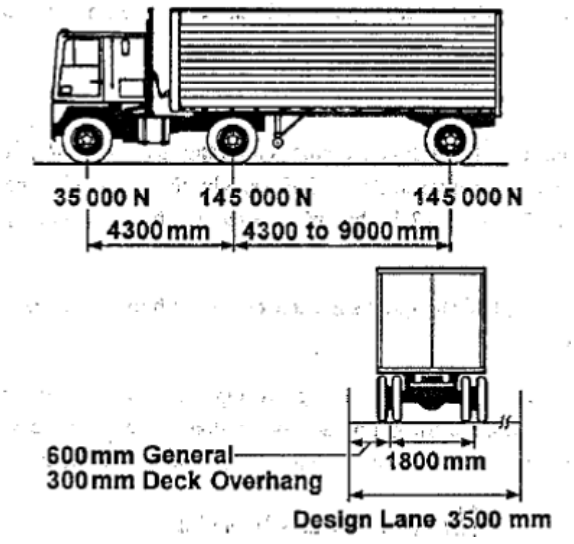
Item	Value
Cross Section	
Main track	2 x 3.50m
Shoulder/Emergency Lane	2 x 2.50m

Median strip	0.25m
Inner safety lane	2 x 0.25m
Parapet	2 x 0.50m
Total	13.75m
Geometric Design Criteria	
Minimum radius of horizontal curve	400m
Minimum radius of crest curve	4,000m
Minimum radius of sag curve	2,000m
Maximum grade-up	4.0%

Source: JICA Study Team

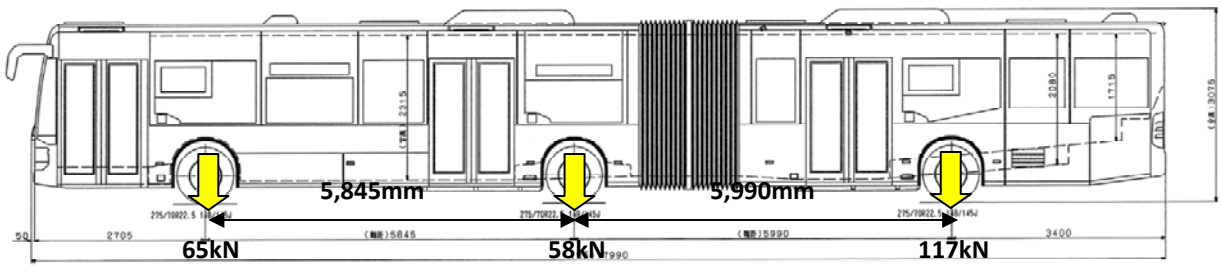
(ii) Design Live Load

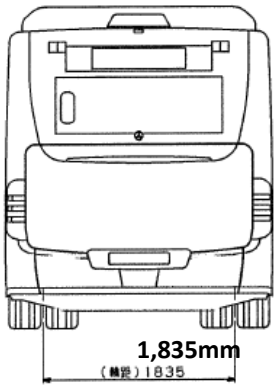
Designated truck and live load HL93 of the Specification for Bridge Design (22 TCN 272-05) will be applied for structural design on the flyover. As shown in Figure 3.6.22, weight of articulated BRT Bus is 240kN in total, axle weight 65kN, 58kN and 117kN when full capacity of passenger (131 persons), and it is lower weight and far distance between axles. Structural calculation shall be conducted in detailed design stage taking into accounts weight of BRT bus.



Source: Specification for Bridge Design (22 TCN 272-05)

(Designated Truck and Live Load HL93)





Source: Catalogue of Articulated Bus CITARO-G

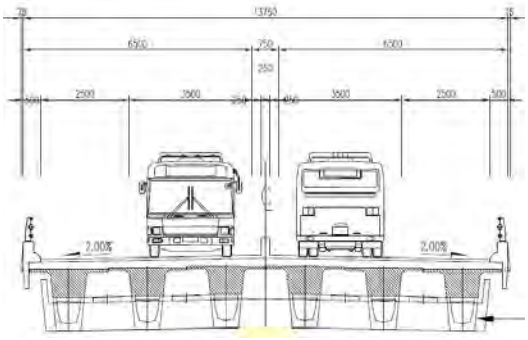
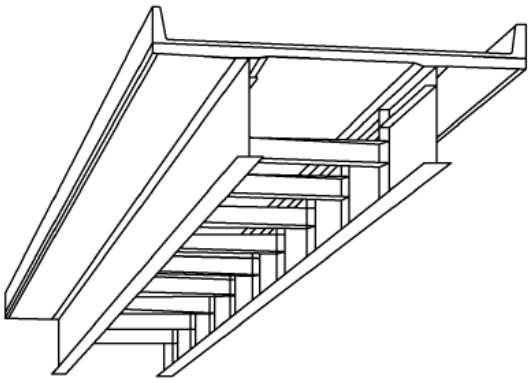
(Dimension of BRT Bus and Weight (CITARO-G type))

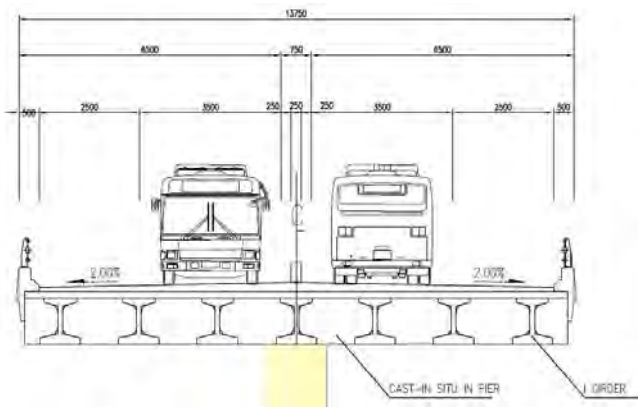
Figure 3.6.23 Design Live Load of Vietnam Standard and Weight of BRT Articulated Bus

(iii) Selection of the Girder Type

Since flyover crossing national and provincial roads with a high traffic volume, construction plan must consider safe and quick construction to minimize harmful effect on the traffic. As for superstructure, therefore, pre-cast girder type instead of cast-in-place type shall be selected.

Table 3.6.8 Comparison of Type of the Girders

Alternative	Super-Tee Girder	Steel Girder
Cross Section		
Advantage	・Standardize girder in Vietnam and selected in many projects ・Economical span length ranged from 35m to 40m ・Relatively low Initial cost	・Recently increase adoption for flyover project at major intersections in Vietnam such as I-shaped Girder and 2-Cell Steel Box Girder ・Economical span length ranged from 40m to 70m ・High adaptability to the horizontal alignment
Disadvantage	・Low adaptability to horizontal curve (Radius > 350m)	・High initial cost ・Periodic coating maintenance is required.
Unit Cost (per m^2)	26,000,000VND/m^2	47,000,000VND/m^2
Evaluation	Adoption for Straight section	Not Adoption
Alternative	I-Shaped Girder	

Cross Section	
Advantage	・Common type as same as Super-tee girder ・Higher adaptability to the horizontal alignment ・Economical span length ranged from 20m to 40m
Disadvantage	・Heavier weight of girder
Unit Cost (per m^2)	27,000,000VND/m^2
Evaluation	Adoption for curved section

Note: Unit cost (per sq.m) is cost of bridge with bored piles of dia.1.2m and length 50m.

Source: JICA Study Team

Based on the above comparison, Super-tee girder is adopted for straight alignment section and I-shaped girder is adopted for the curved section as summarized in Table 3.6.9.

Table 3.6.9 Plan of Flyover

No.	KM※1	Identification No. of Intersection (name of street)	Bridge Length/ Span Arrangement/ Girder Type
1	KM00+000	IS-1（DT743A）	280m = 8@35m I-Shaped Girder
2	KM03+078	IS-5 (QL1K)	400m =10@40m Super-tee
3	KM07+471	IS-13 (Nguyen Thi Minh Khai)	360m = 9@40m Super-tee
4	KM11+075	IS-23 (An Phu – Binh Chuan)	320m = 8@40m Super-tee
5	KM14+647	IS-29 (Thu Khoa Huan)	320m = 8@40m Super-tee
6	KM17+874	IS-33(DT743)	320m = 8@40m Super-tee
7	KM20+225	IS-37 (Huynh Van Luy)	320m = 8@40m Super-tee

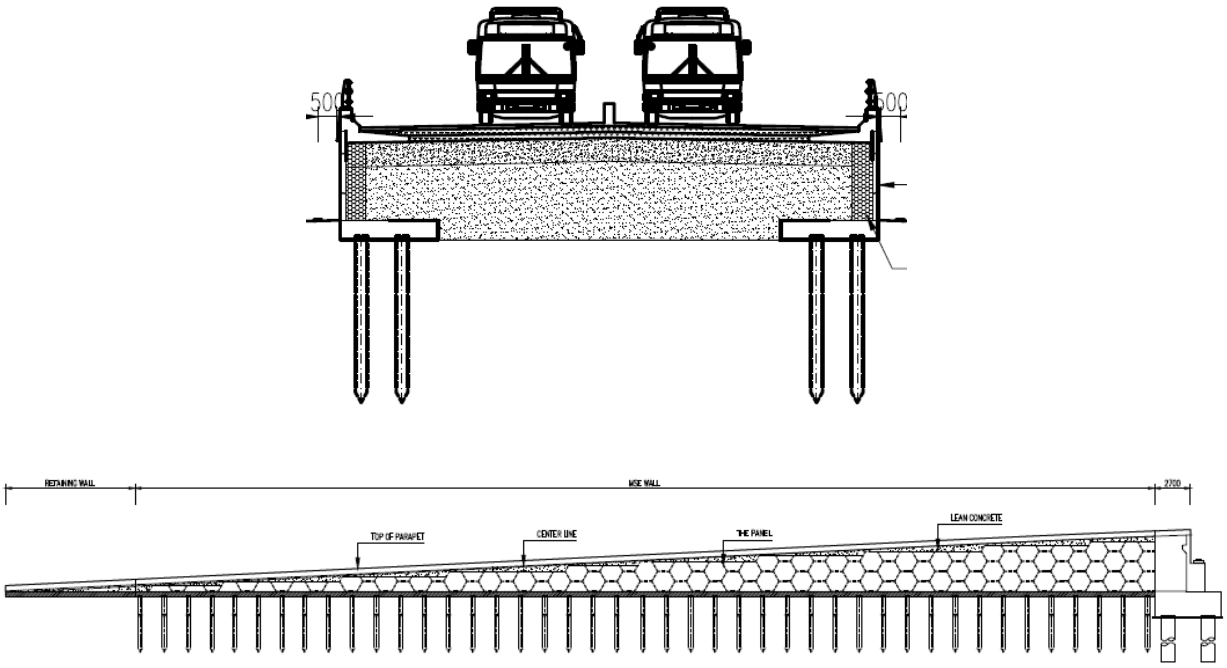
※1/ KM Station of My Phuoc-Tan Van Road

Source: JICA Study Team

Since there is no boring data available for planning of bridge foundation in this JICA Study, bored pile with 1.2m diameter is temporarily assumed.

iv) Approach Bridge

MSE (Mechanically Stabilized Earth) Wall as shown in Figure 3.6.23 is commonly used in Vietnam for approach bridge under condition of restricted ROW, especially at urban area and it has a superior landscape. This will be proposed to adopt for approach section of flyovers.

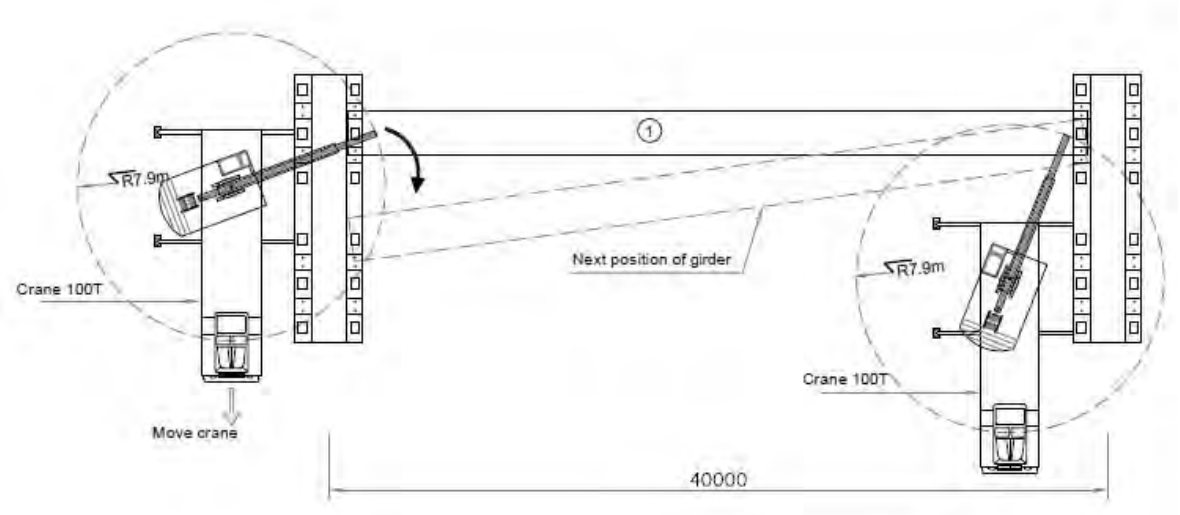


Source: JICA Study Team

Figure 3.6.24 Cross Section of MSE Wall

v) Erection Method of Girder

The appropriate erection method shall be selected taking into accounts conditions (restriction of traffic, availability of ground space beneath girder), safety and construction period etc. One of major method in Vietnam is an erection by crane, which has advantages of flexibility, short period and small preparation work, but traffic control is strictly required. In the other method, erection of girder by temporary erection girder has advantage of lower affect to traffic but there are several disadvantages such as higher cost for transportation, setting and dismantlement of the erection girder, and slow speed. In this pre-FS stage, erection by crane is selected as shown in figure below, and accordingly construction sequence and rough cost estimate are prepared.



Source: JICA Study Team

Figure 3.6.25 Erection Method of Flyover Construction by Crane

vi) Restriction of Passing Vehicles for Flyover

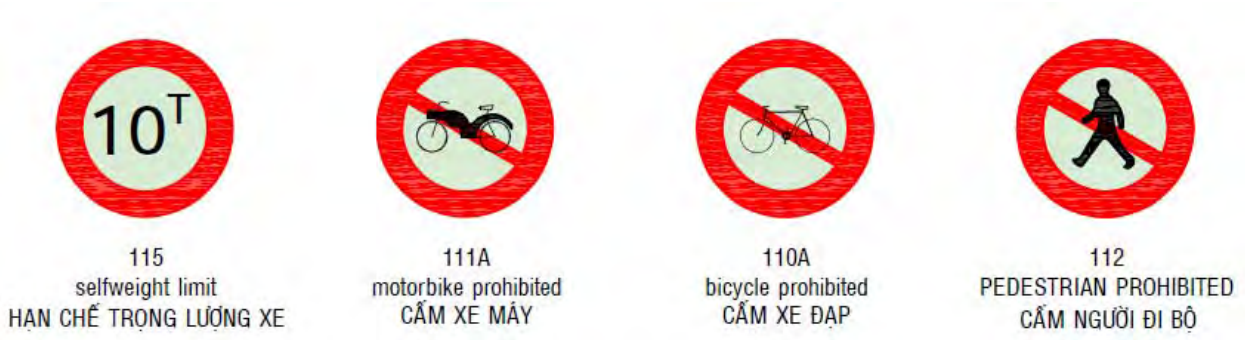
It is desirable to restrict traffic passing on flyover so that BRT can achieve his targeted on-time and fast performance. On the other hand, flyover has a role as public civil infrastructure to improve traffic congestion and environmental circumstances at the intersections. Accordingly, restriction of passing vehicle for flyover is proposed as listed in Table 3.6.10 taking into accounts actual operation at other flyovers in the city of HCM. The reason that motorbike is not allow to use flyover is to ensure traffic safety and to avoid traffic crossing between motorbike who changes lane from outside lane to inside lane and other traffic who go straight at middle lane. This issue shall be determined by BD Province DOT, Traffic Police and local city/ district. Although truck over 10 ton is proposed not to allow using flyover, it shall apply the design load in accordance with 22TCN 272-05 so that heavy truck can pass the flyover after finish of BRT operation.

Table 3.6.10 Proposal of Permission/ Restriction of Passing Vehicles for Flyover

Allow to pass	Not allow to pass
BRT	Truck (over 10 ton)
Bus on a regular route	Motorbike
Passenger Car	Motor three-wheeler
Truck (less than 10 ton)	Bicycle
	Pedestrian

Source: JICA Study Team

To manage the traffic, following traffic sign shall be installed at just before flyovers.

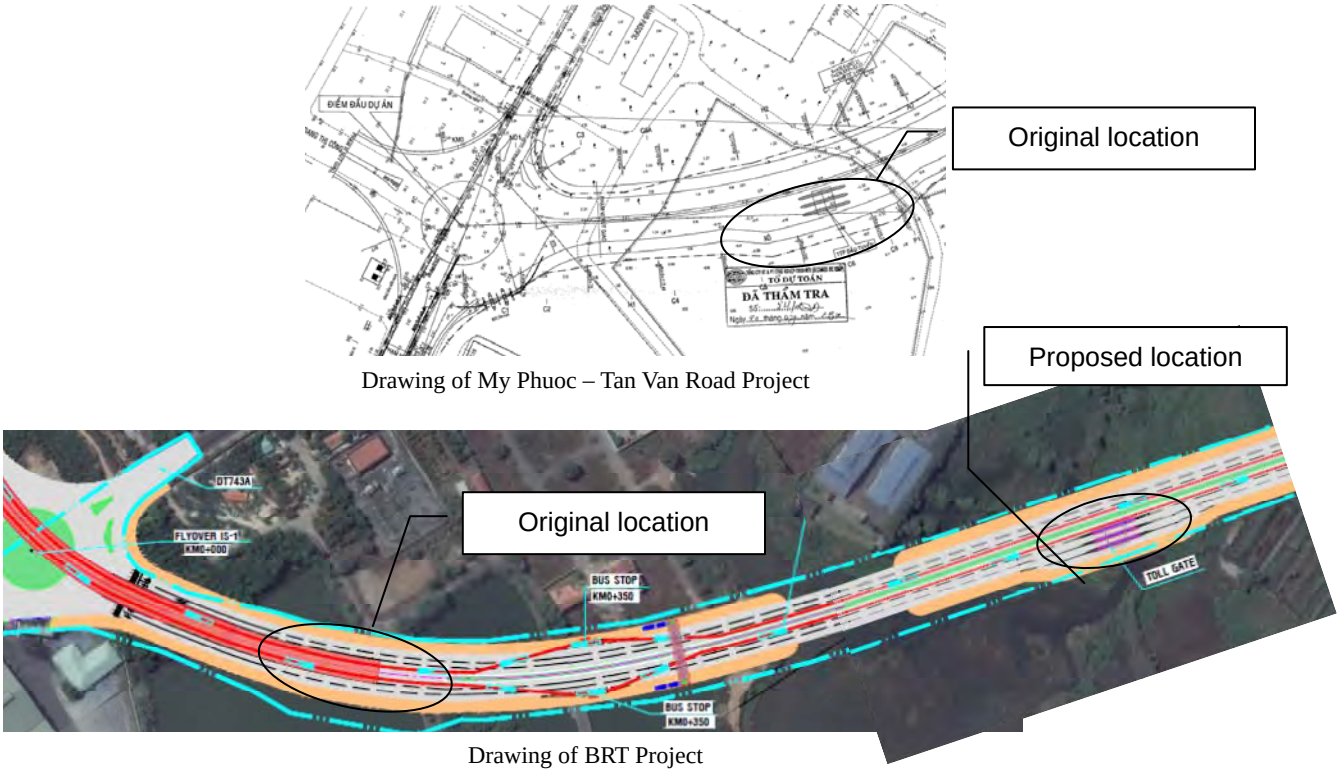


Source: JICA Study Team

Figure 3.6.26 Traffic Sign

vii) Relocation of Toll Gate

Toll gates are planned at beginning point and end point of the MP-TV road BOT project. One toll gate at KM00+220 must be shifted to other location because of construction of flyover. Relocation point is proposed at KM00+700 and it can be built within the existing ROW if width of side walk is reduced.



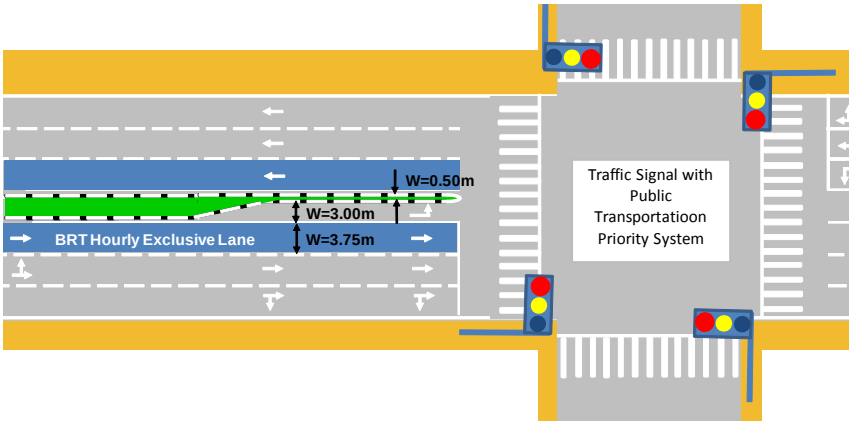
Source: JICA Study Team

Figure 3.6.27 Proposed Location of Toll Gate

3) Public Transportation Priority System (PTPS) at intersection with other class of roads

This PTPS can shorten the time of stopping at intersection by interactive communication between beacon installed along the street and on-board unit on bus and control traffic signal. Concretely, longer time of blue signal or shorten time of red signal when BRT bus is approaching to intersection is controllable. On the My Phuoc – Tan Van Road, PTPS will be installed at 13 intersections. Details can be referred to section 3.7.4.

At the section of BRT Hourly Exclusive Lane, it will be happened that BRT bus cannot go straight on even when blue signal because vehicles which turn left queue on the hourly exclusive lane. To avoid this situation, a turn left lane with 3m width shall be arranged by reducing median strip as shown in Figure 3.6.27.



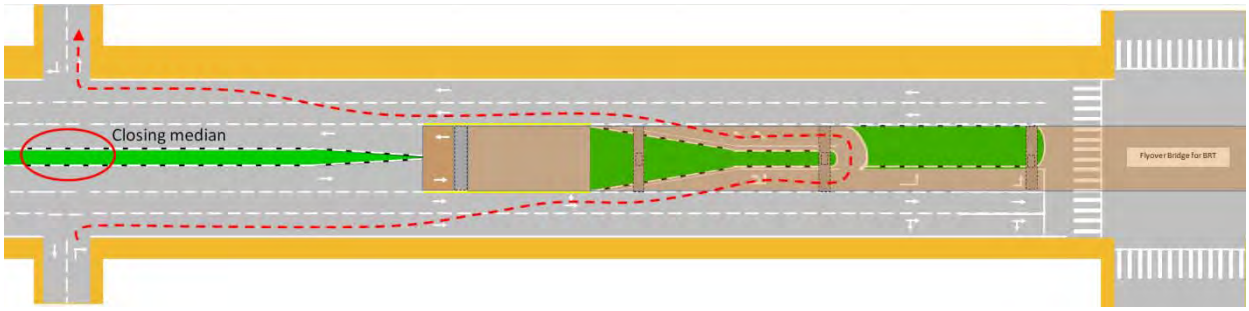
Source: JICA Study Team

Figure 3.6.28 Intersection with PTPS

4) Block of crossing traffic on BRT corridor by closing median strip at minor intersection

To improve traffic flow and safety of BRT vehicle and general traffic on main track of MP – TV Road, crossing flow from minor crossing roads at 15 locations is proposed to be blocked by closing median strip.

Vehicles going across can detour u-turn facility under flyover or intersection at the nearest. The location of closing median strip is selected so that distance of detour shall be within 1km taking into accounts convenience for neighboring residents.

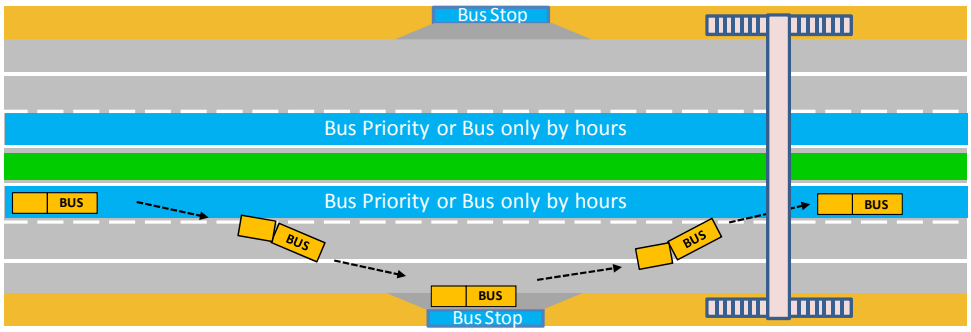


Source: JICA Study Team

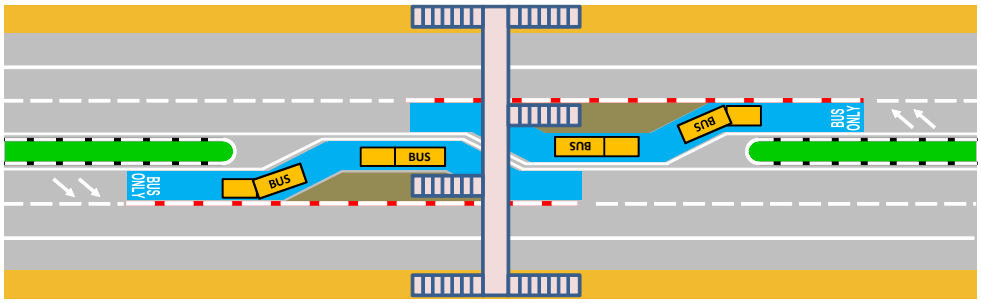
Figure 3.6.29 Blocked crossing point and detour route under flyover

(2) BRT Bus Stop

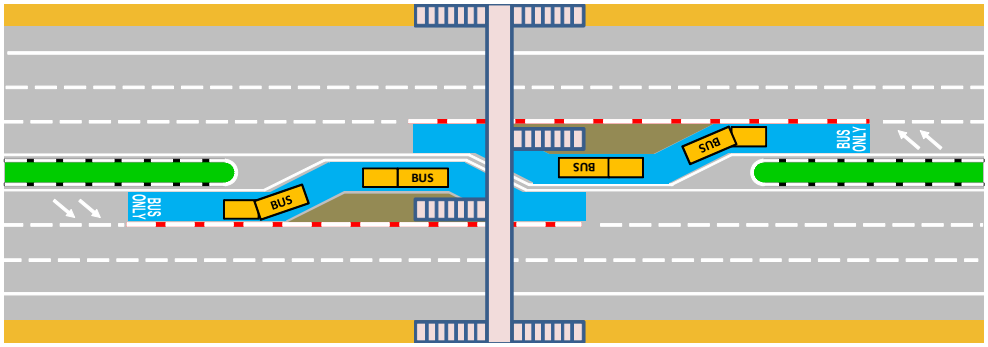
Location of BRT bus stop is studies among the road side, median without road widening, median with road widening and on the flyover. Image of each alternative and comparison table are shown in Figure 3.6.30 and Table 3.6.11, respectively.



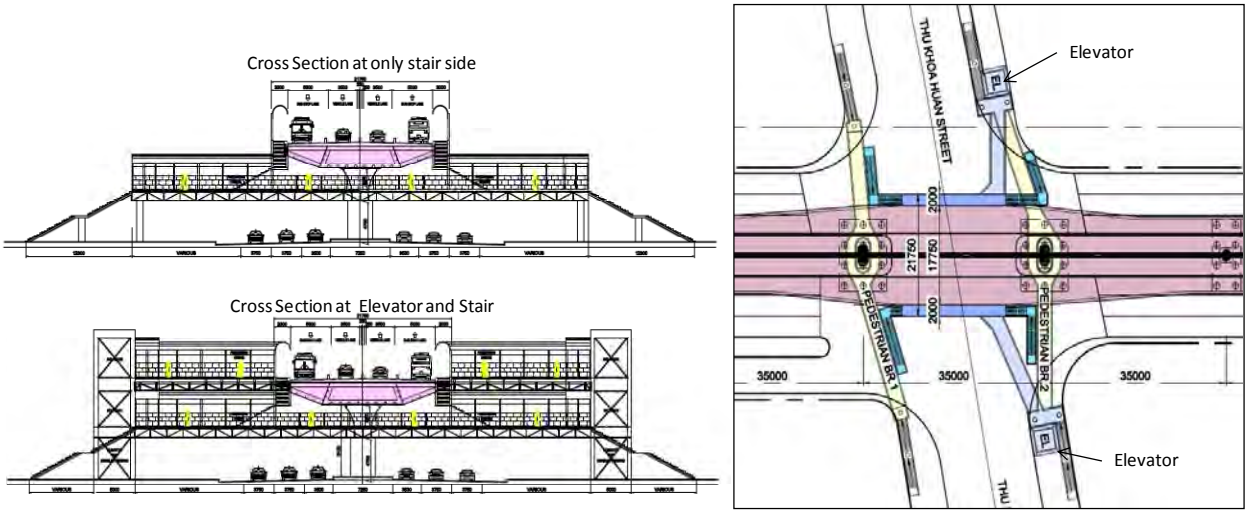
(i) Road side type



(ii) Median type (without road widening of Mp-Tv Road)



(iii) Median type (with road widening of Mp-Tv Road)



(iv) on the Flyover

Source: JICA Study Team

Figure 3.6.30 Alternatives of BRT Bus Stop

Table 3.6.11 Comparison of Alternatives of BRT Bus Stop Location

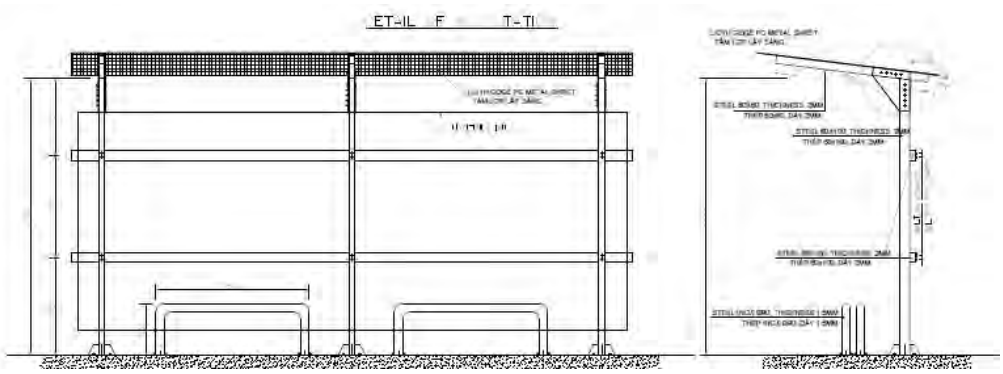
Item	(i) Road Side Bus Stop		(ii) Median Bus Stop (without road widening of Mp-Tv Road)	
Targeted on-time and fast performance of BRT	Second times shift of lane from BRT hourly exclusive lane at median side to the road side bus stop. It may be possible to minimize time loss by gradually shifting the lane in a long interval of bus stops, approximately 2km.	○	It is advantage to keep the fast performance of bus operation because the bus stop is located on the BRT hourly exclusive lane and no crossing with other traffic.	◎
Safety Traffic	The shift of lane approaching bus stop is common bus operation. For ensuring safety during shift of the late, signalization and installation of traffic signs etc. shall be considered as measures of alerting to the other traffic.	△	It has possibility for other vehicle to collide with BRT bus from behind at the bus stop. In addition, reduction of the number of lane from three to two lanes causes traffic congestion and accident.	X

Users' Convenient (accessibility)	Passenger requires using pedestrian bridge at either boarding or alighting.	○	Passenger requires using pedestrian bridge at both boarding and alighting.	△
Land Acquisition	Non	◎	Non	◎
Construction Cost	8.2 billion VND(100%)	◎	14.0 billion VND (170%)	○
Comprehensive Evaluation	Recommended	○	Not recommend	△
Item	(iii) Median Bus Stop (with road widening of Mp-Tv Road)		(iv) Bus Stop on the Flyover	
Targeted on-time and fast performance of BRT	It is advantage to keep the fast performance of bus operation because the bus stop is located on the BRT hourly exclusive lane and no crossing with other traffic.	◎	It is advantage to keep the fast performance of bus operation because the bus just needs to shift to the next lane and no crossing with other traffic.	◎
Safety Traffic	It has possibility for other vehicle to collide with BRT bus from behind at the bus stop, but it is lower risk than alternative (ii) because three lanes are opened to the other traffic.	△	BRT bus can approach to the bus stop in safe by utilizing shoulder lane as deceleration lane. When leaving, the bus can join traffic flow by utilizing shoulder lane as acceleration lane.	○
Users' Convenient (accessibility)	Passenger requires using pedestrian bridge at both boarding and alighting.	△	Passenger requires using pedestrian bridge at both boarding and alighting.	△
Land Acquisition	Additional land acquisition is required at approximately 400m length with 4.25m width toward the both sides of Mp-Tv Road.	X	None. However, it is essential to complete widening projects of crossing road as planned by another projects and sufficient sidewalk space is ensured for arranging stairs access to the bus stop on the flyover. Otherwise, additional land acquisition is required.	△
Construction Cost	16.8 billion VND (204%) *exclusive of land acquisition cost	○	187 billion VND (2,300%) *only different cost from flyover without bus stop	X
Comprehensive Evaluation	Not recommend	X	Not recommend	X

Note: Definition of the Criteria ◎: very good, O: good, △: not bad, X: bad

Source: JICA Study Team

From the above comprehensive comparison, bus stop on the road side is recommended. Since the facilities of bus stop need to be arranged within limited space of sidewalk, it should be minimized and roof and chairs will be equipped as same as a bus on regular route.



Source: JICA Study Team

Figure 3.6.31 Roof and Chair of Bus Stop

BRT Bus Stop will be arranged at road side at 12 locations along Mp-Tv road as shown in Figure 3.6.21. Pedestrian bridge should be considered in case no across measure is available near bus stop in order to ensure the users' convenient and safe. Pedestrian bridge is planned at four locations as listed below:

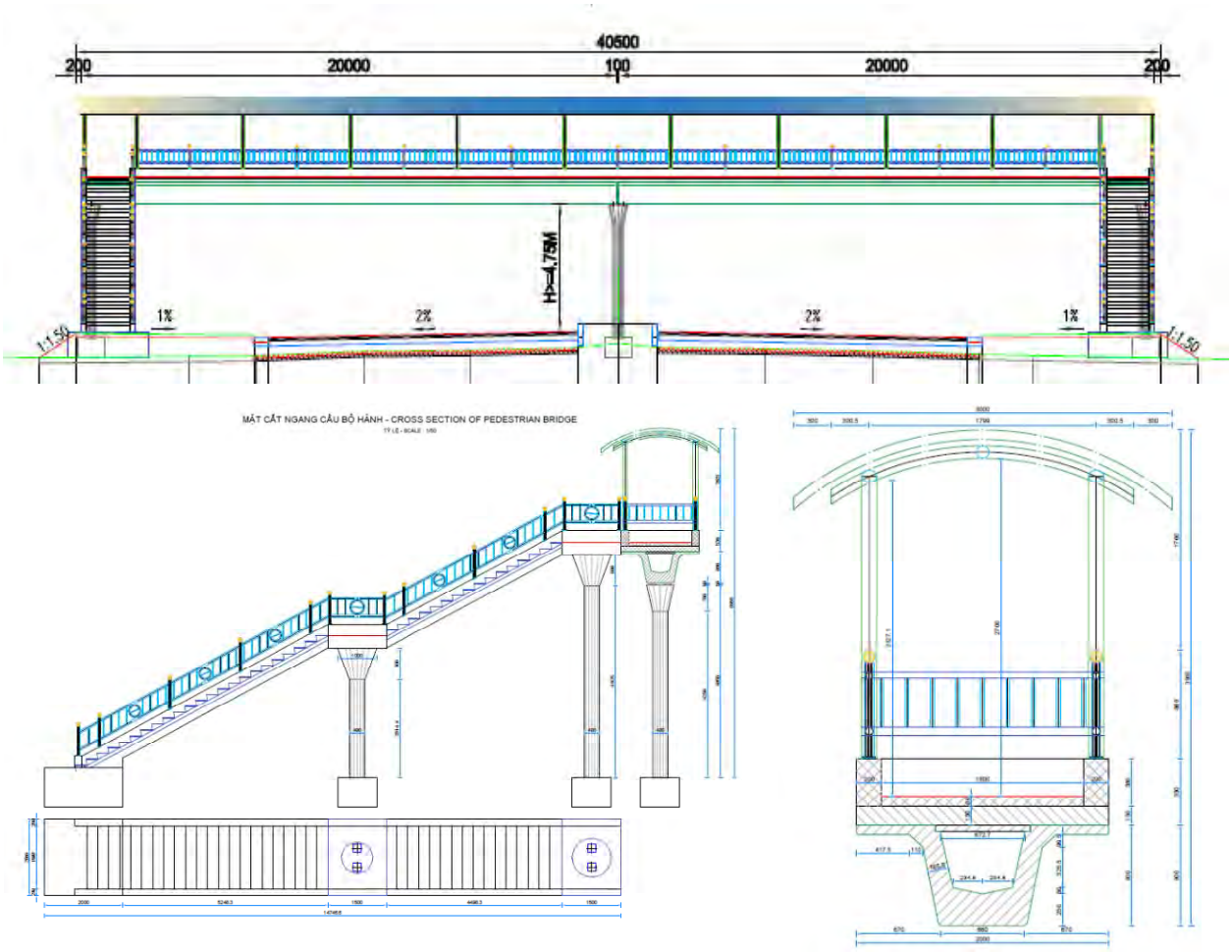
Table 3.6.12 List of Pedestrian Bridge

No.	KM*[1]	Bridge Length
1	KM00+425	40.5m
2	KM15+925	40.5m
3	KM18+275	70.680m
4	KM19+725	40.5m

*1/ KM Station of My Phuoc-Tan Van Road

Source: JICA Study Team

As shown in Figure 3.6.32, width of pedestrian bridge is proposed at 2.0m, girder type is precast U-shaped girder as generally adopted in other pedestrian bridges in HCM city. Foundation is assumed as diameter 0.8m and length 50m. In the next stage, foundation design shall be studied based on the geological investigation.



Source: JICA Study Team

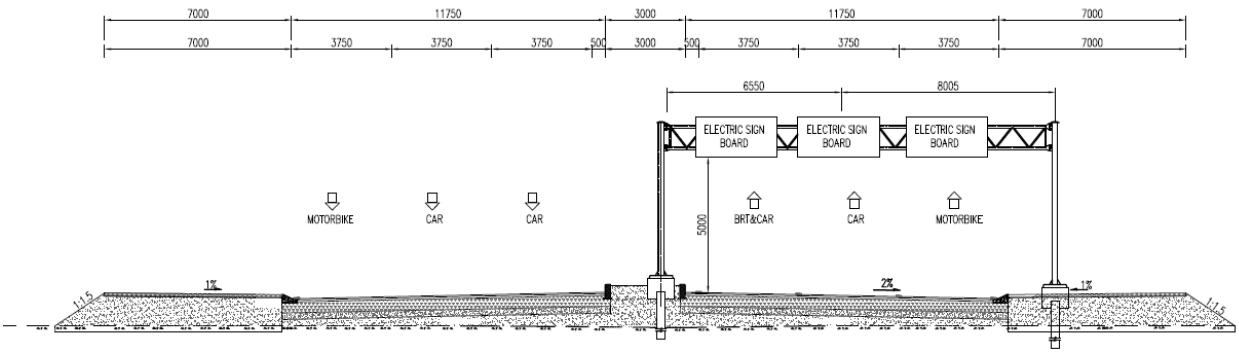
Figure 3.6.32 General View of Pedestrian Bridge at Bus Stop

(3) Other BRT Facilities

Since BRT will be operated along the hourly exclusive lane which will not physically separated with other vehicles, electric traffic sign board and color pavement will be introduced for widely known.

i) Electric Traffic Sign Board

Electric traffic sign board is planned to install at 8 locations both directions. The display can be changed according to the BRT operation schedule at weekday, weekend, morning and evening etc.



Source: JICA Study Team

Figure 3.6.33 Electric Traffic Sign Board

Table 3.6.13 Proposed Location of Electric Traffic Sign Board

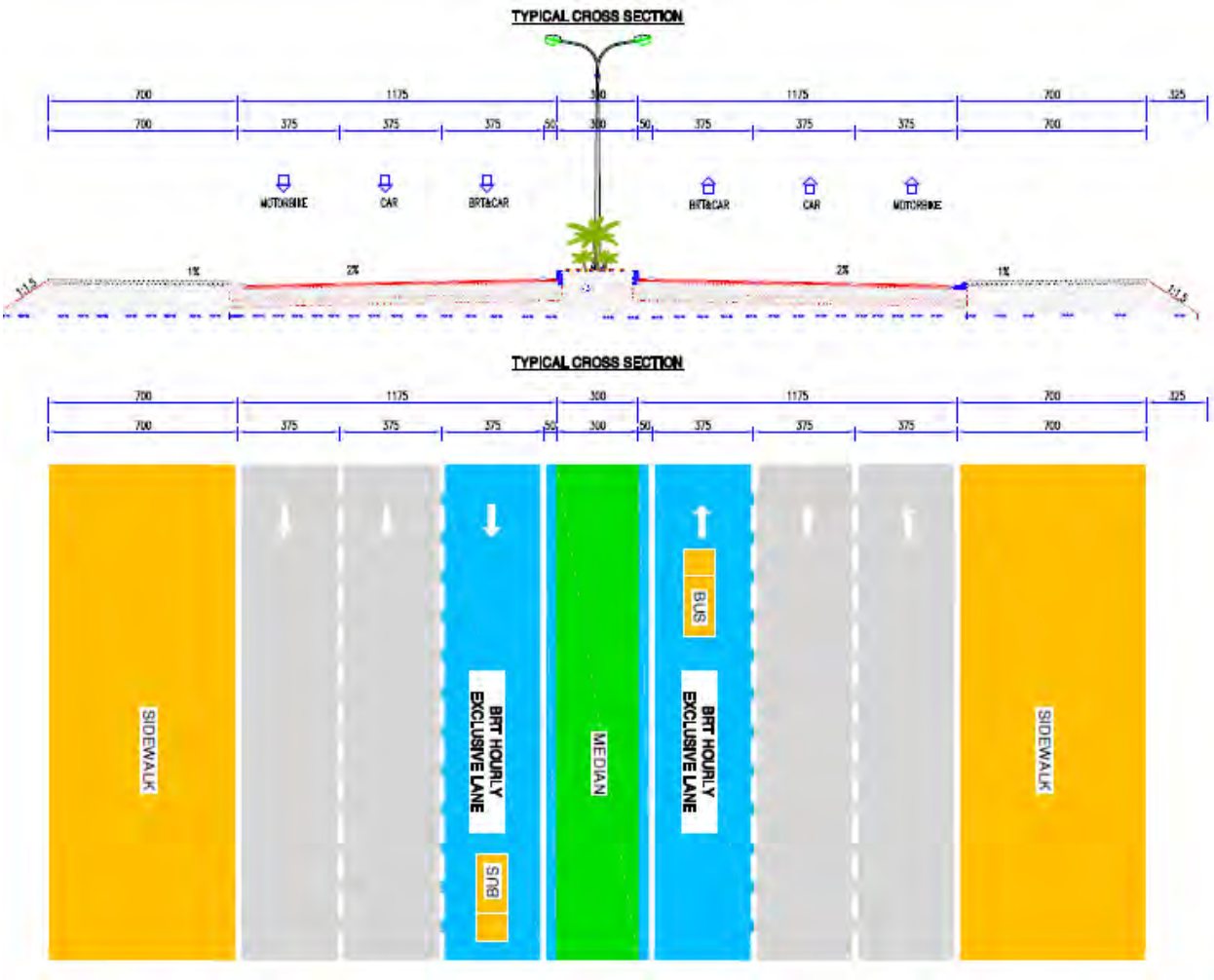
No.	STT⇒BD Direction	BD⇒STT Direction
1	KM01+000	KM20+900
2	KM06+500	KM15+700
3	KM11+350	KM11+350
4	KM15+700	KM06+500

Note: KM Station of My Phuoc-Tan Van Road

Source: JICA Study Team

ii) Color Pavement for BRT Hourly Exclusive Lane

It is expected that people easily recognize the BRT lane instantly by its visual effect. In addition to color pavement, road marking "BRT Hourly Exclusive Lane" will be displayed at the interval. Selection of the color will be determined by the relevant authorities.



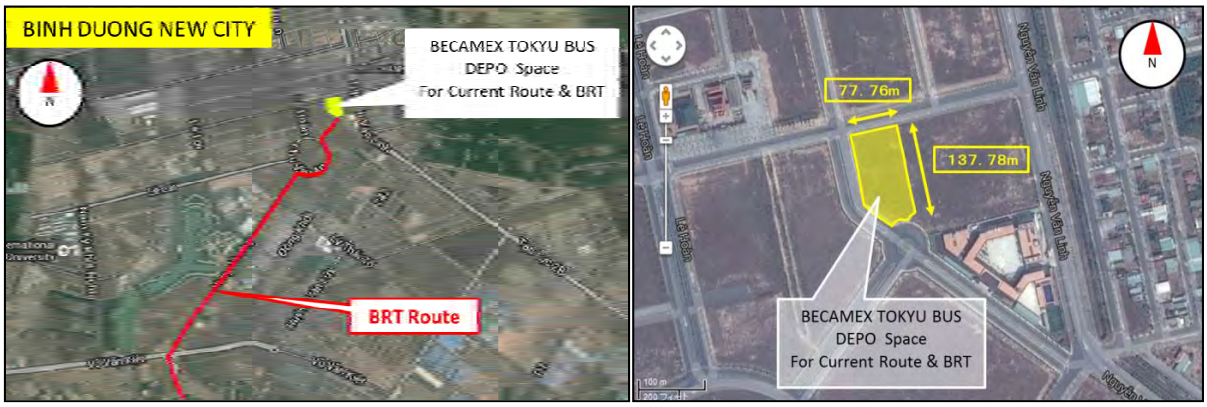
Source: JICA Study Team

Figure 3.6.34 Plan of Color Pavement

3.6.4 BRT Depot

(1) Depot Location and Function

BECAMEX TOKYUBUS CO., LTD., who expects to operate BRT route, will establish 2 bus routes at Binh Duong New City, and has a plan to construct the management center at this city in 2015. About constructed land (about 10,000m2), BECAMEX TOKYUBUS CO.,LTD. signed the land lease agreement with BECAMEX TOKYUBUS CO.,LTD State company, location of this land zone shown in following figure.



Source: JICA Study Team

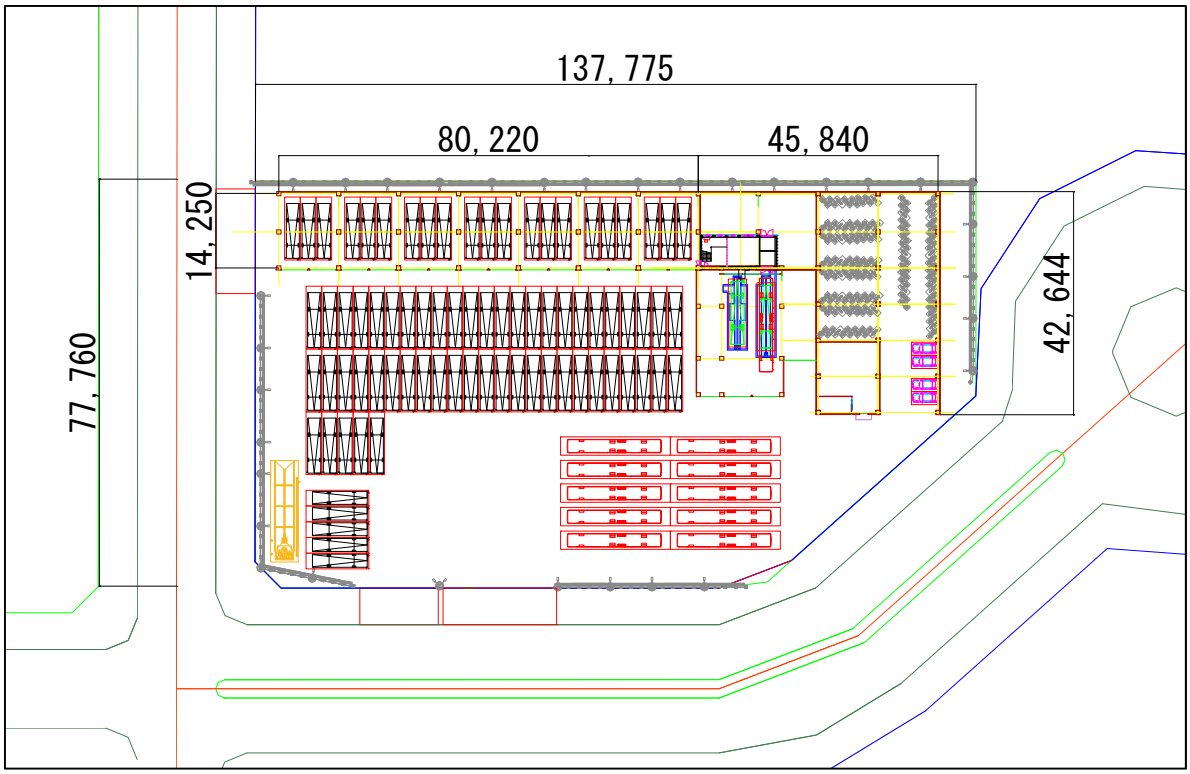
Figure 3.6.35 BRT depot location

Necessary functions to be installed at depot are synthesized in following table, Site plan is shown in figure 3.5.2. These functions will serve for the existed routes, however it is necessary to expand, construct more works for BRT which will be appropriated to business condition of BRT route, and these expanded works will be the subjects received ODA capital.

Table 3.6.14 Major functions at depot

Depo Function		Unit	Quantity	For Existing Bus	For BRT	Intended Use
Office	Office	㎡	300	200	100	Operation manegement,Ticket Sale office
	Maintenance Office	㎡	200	200	—	Maintenance manegement
	Driver Room	㎡	1,500	500	1000	Dressing and rest room of Drivers
	Meeting Room	㎡	300	200	100	
	Warehouse	㎡	200	200	—	
	Cafeteria	㎡	500	200	300	For Welfare
	Total	㎡	3,000	1500	1500	
Maintenance Place	Maintenance Field	㎡	600	600		For regular inspection and maintenance
	Triple Lift		1		1	For efficient maintenance of articulated bus
	Maintenance Equipment		1		1	For efficient maintenance of articulated bus
Covered Garage		㎡	1,200			Storage of unused buses
Parking pavement	For Existing Bus		15	4,000	—	(12m×4m≒50㎡)／1 standard bus
	For BRT		50		6,000	(20m×4m≒80㎡)／1 Articurated bus
Automatic Washing machine			1		1	Automatic, Water strage,drinege facilities
Gas station			1		1	For Diesel

Source: JICA Study Team



Source: JICA Study Team

Figure 3.6.36 Site plan of BRT dpot

(2) Facilities for Repair and Maintenance

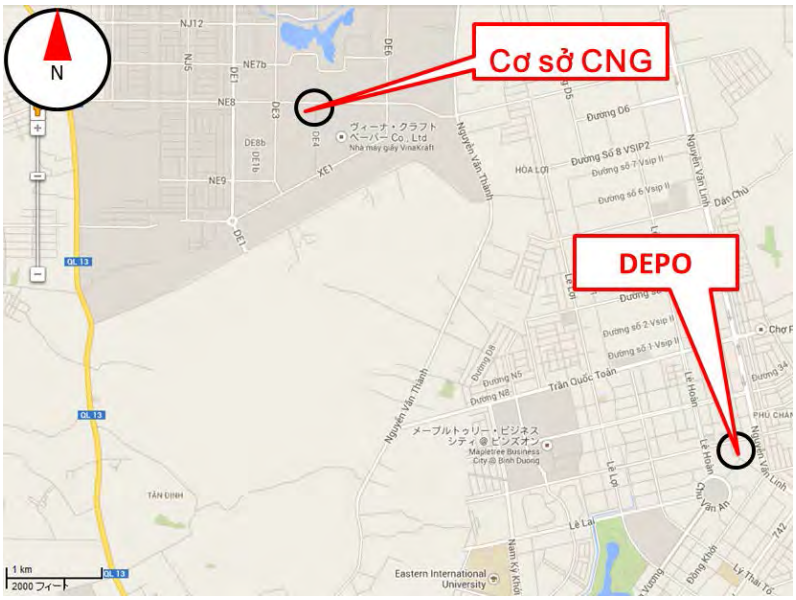
Currently, the repair and maintenance in Vietnam just have been done by simple tools, and there is not any bus business that has been installed modern equipment system to perform the repaired procedures safely and effectively. About this technique, Vietnam may be lower than Japan 40 years. In future, to improve public facilities development, as well as support passengers safest vehicles after full maintained performance, so that the installation of an effective system of repair and maintenance is very essential. Specially, the dynamic power lifting equipment run by oil will be indispensable when carrying out repair for low connected coach buses with underneath has complex structure.

Source: JICA Study Team

Photo The dynamic power lifting equipment run by oil for repair

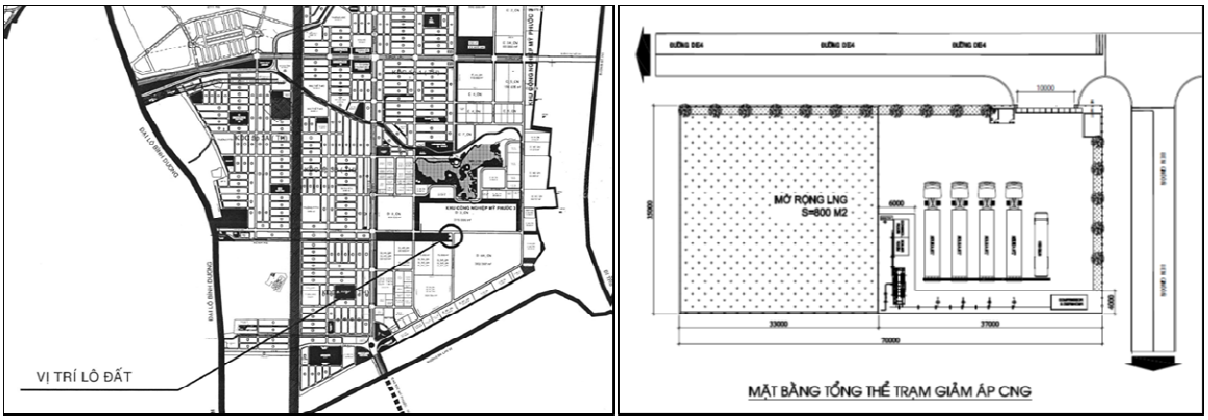
(3) Petrol Supply

At Becamex Tokyu Bus Company, currently has used CNG buses, on the depot of petrol supply has been planned that will be built by the supplier in My Phuoc Industrial Zone. Then in case of using CNG for BRT, petrol still has been supplied normally.



Source: JICA Study Team (with Google Earth Pro)

Figure 3.6.37 Location of CNG supply facility



Source: JICA Study Team

Figure 3.6.38 Layout of CNG supply facility

3.7 Vehicle and System Plan

3.7.1 Vehicle Plan

(1) Door Position

In the example of BRT of each country, with the road section of an exclusive way and the installation position of a bus stop institution BRT runs, and the door position of vehicles to introduce, as shown in following table, the vehicles type varies.

On the other hand, as for the city type general bus vehicles which pass through a local street, in the case of right-hand traffic, the getting-on-and-off door is installed in right-hand side.

Table 3.7.1 The vehicles type by the position of a door

Door placement	Feature	Cross-sectional configuration of BRT interval
Right door	Not only to BRT interval, also traveling the open road. Bus of general also can travel the BRT route.	①BRT lane at both ends of the road. ②In the center lane BRT (by shifting back and forth by width) is disposed on both sides of the station. ③The centrally located station, to set up a reverse driving lane.
Left door	The runs only BRT interval, do not stop at the open road.	It was placed in the middle of the station, we established a BRT lane on both sides.
Both left and right door	Not only to BRT interval, also traveling the open road.	It was placed in the middle of the station, we established a BRT lane on both sides.

Source: JICA Study Team

The cross-sectional plan and bus stop institution of the road of the entire interval including a My Phuoc-Tan Van road is shown in the following table. Although the special delivery nature of BRT is maintained, in order to minimize lot buying over, to utilize a limited road section effectively to the utmost and to aim at coexistence with the shipping-freight-traffic vehicles from an industrial complex, common vehicles, and a motorbike, it is difficult to install the exclusive way of BRT. Therefore, it is most effective to set up "the bus lane according to time zone" and a "bus priority lane", and to plan overall optimization of all the vehicles.

Source: JICA Study Team

Photo Median strip type bus stop at Seoul

In the road section and bus stop institution, the bus vehicles which can be used do not need to

install a getting-on-and-off door in platform types at right-and-left both sides.
Therefore, BRT is manageable by adopting "the ready-made vehicles of a right door" which can also use the bus stop institution installed in the sidewalk of a general way.

(2) Vehicle Type

The type of the vehicles currently produced as a made-up article in every country in the world has a general bus and an articulated bus, as shown in following table. It is used in the urban areas of every country in the world, since a general bus also has much volume of production, it is relatively cheaper than an articulated bus in a price field, but since the vehicles capacity is restricted, as for the time zone of a demand peak, many number is needed.
On the other hand, articulated bus has become a vehicle of capacity more than doubled compared to the general car, but there are also countries where the spread of the articulated bus has not progressed from the traffic environment and legal constraints on the maximum size. The vehicle price is more expensive rate capacity of the vehicle because it is not a mass production.

Table 3.7.2 Bus vehicle type of BRT

Type	Standard Bus	Articulated Bus
Appearance		
Length	10.5m～12m	18m～20m
Number of Doorways by a side	2～3	3～4
Vihicle Capacity	60～80（Seat=27～38）	140～170（Seat=42～58）

Source: JICA Study Team

(3) Floor Height and Step Type

It means that from 4.1.1, to introduce a ready-made vehicle that has been mass-produced, this BRT is, eliminate from consideration for the vehicle structure of platform-type boarding facilities for currently, the type of vehicle to be produced around the world, there are three kinds of the number of steps and the height of the floor. In developed countries, for the ratio of the number of elderly people as a percentage of the entire population also increased, handicapped also eliminate the failure of going out when moving, barrier-free public facilities has been required socially.
Are shown in following table, Characteristics of the type of the vehicle step is, Non-Step vehicle was developed for barrier-free is structured so as to easily boarding for all users.
However, the structure of the chassis Non-Step vehicle, which is complicated compared to the Two-Step typical vehicle, vehicle cost has become expensive.
For example, in Japan, there are subsidies by government agencies in order to promote legal barrier-free. If the bus operators to purchase Non-Step vehicle, bus operators can be receive the difference between the purchase price of Two-Step vehicle. In Vietnam, it is assumed that the young-man generation who uses the present motorcycle by development of a public transportation facility will use a public transportation facility by a modal shift from now on.

However, it is thought that a possibility that the social needs to barrier-free will increase quickly for the time being is low. It is believed, however, that the average age of the people from those elderly population will increase and increased certainty. In addition, in the process of going to steadily promote modal shift, in order to prevent tipping accidents when getting on and off of the bus, the promotion of barrier-free access is required.

From the above, there is no problem in Two-Step vehicle vehicles to be introduced initially. It should go aim the introduction of Non-Step vehicle in the future.

Table 3.7.3 Step type of BRT vehicle

	Two-Steps	One-Step	Non-Step
Appearance			
Floor Height	800mm～1,100mm	500mm～600mm	300mm～382mm
Features	・Since there is a step of the entrance, it has become a barrier to a healthy person other than. ・Do not take some time getting on and off of the elderly, fall accident occurs. ・The floor is flat over the whole car. ・Seated to the seat of the tire house on also easy	・Getting on and off is easy because there are steps less than the Two-Step ・There is a step in the rear is in the car.	・Since there is no step in the entrance, getting on and off easy anyone ・On the road there is a curb, not a step almost. ・Vehicle tilts in the kneel function with air suspension ・There is a step of two-stage in the car rear. ・Minimum ground clearance is low, the step of the approach and departure angle than necessary road
For Wheelchair User	Requires installation of the lift If do not have a lift, four people lift about	The passenger possible by the installation of slope plate It established a fixing bracket to the car floor	The passenger possible by the installation of slope plate It established a fixing bracket to the car floor
Cost	About 18～20 Million Yen	About 22～25 Million Yen	About 24～27 Million Yen

Source: JICA Study Team

(4) Regulation of Gas Emission

In HCMC located at the center of a southern part economic bloc including a Binh Duong province, particulate concentration and carbon dioxide levels are over environmental standards by the increase in a motorcycle and cars at two or more points, and the air pollution by exhaust gas is aggravating.

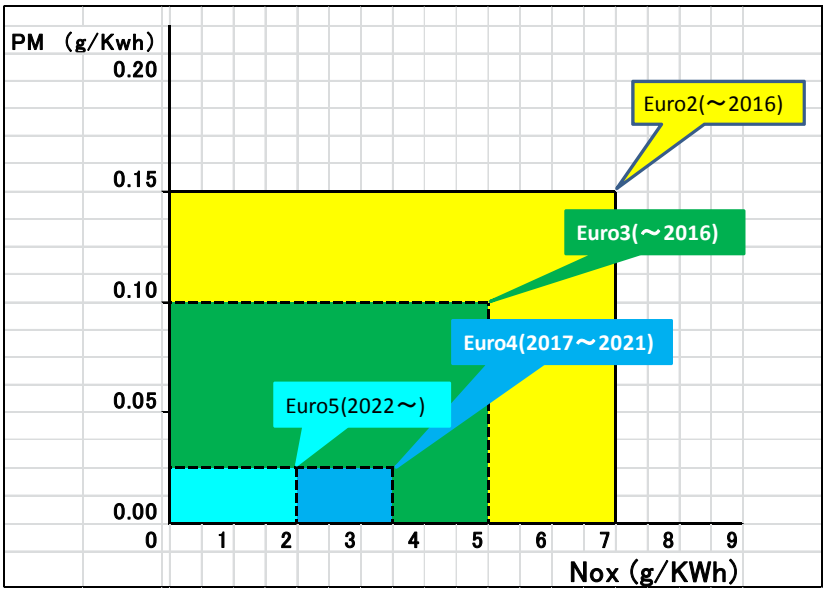
In Vietnam, the road map (work schedule) turned to toughening of regulations of emission gas by the prime minister determination No. 49 of proclamation in January, 2011 is specified. (49/2011/QD-TTg)In the emission gas regulatory standard over the car produced in Vietnam, and the car imported, the European "Euro 4" is due to be applied from January, 2017. Furthermore, "Euro 5" is due to be applied from January, 2022.Since it is due to be started in 2018, this BRT project needs to supply vehicles with the engine which suits exhaust fume standard Euro4.

However, it is determined by the government that application of the "Euro 4" to a domestic engine maker is postponed till the end of 2018.For this reason, when supplying the diesel engine vehicle of

Euro4, the low sulfur diesel oil which demonstrates the performance which suited the engine may not be supplied by oil-refining makers.

Therefore, in selection of a diesel engine vehicle, the prudent selection after talking also with a vehicles maker and oil-refining makers is required. (In Japan, since new long-term regulation (in 2007 emission-gas standard) of Euro4 level was enforced in 2005, oil-refining makers supplied the low sulfur diesel oil which suits it.)It has natural gas underground abundantly in the southern Vietnam area, and started introduction of compressed-natural-gas (CNG) bus vehicles in HCMC (from 2012), or a Binh Duong Province (from 2014).The CNG bus is filling exhaust fume standard Euro4, and can reduce fuel cost by 20～25% compared with light-oil fuel. Since the toxic substance is not contained in exhaust gas, aggravation of environmental pollution can be suppressed.

The Vietnam domestic maker imported the CNG engine and the chassis, and started production of the CNG bus in Vietnam. And 300 CNG buses are due to be supplied for the bus transit companies of HCMC by 2015.From the above thing, the performance and specification of a diesel bus and a CNG bus are examined about the Vietnam domestic car and an imported car.



Source: JICA Study Team

Figure 3.7.1 Emission gas regulation in Vietnam

(5) Vehicle Specification

In carrying out this BRT project, in Vietnam, the specification (vehicles size, a capacity, chassis structure, engine) of common vehicles and articulated bus vehicles is shown in following table about the bus vehicles by the domestic production and import which can be supplied.

Table 3.7.4 BRT Vehicle specification

		一般バス Normal Bus	連節バス Articulated Bus
Overall dimension	Length	11～11.5 m	18～20 m
	Width	～2.5 m	2,5～2,55 m
	Height	～3.3 m	～3.3 m
Kerb weight of vehicle		11 t	17 t
Gross vehicle weight		16 t	24,5 t
Axle weight(Kg)	Front	6 t	6.5 t
	Centre	-	6 t
	Rear Drive	10 t	～12 t
Max speed		100 Km/h	70 Km/h
Minimum Turning Radius		9 m	9.5 m
Passenger Capacity	Seats	35	20+25=45
	Standing	45	55+30=85
	Total	80	130～140
Floor Steps	Two Steps	○	-
	One Step	○	○
	Non Step	○	○
Engine-Type	Diesel / CNG	Deisel ／ CNG	Deisel ／ CNG
	Displaement	11,000～12,000 CC	11,000～12,000 CC
	Output	210 Kw ／ 2000 rpm	260 Kw ／ 2000 rpm
	Max.torque	1100 N･m ／ 1400 rpm	1600 N･m ／ 1100 rpm
Suspension	Reaf／Air	Reaf spring / Air Suspension	Air Suspension

Source: JICA Study Team

(6) Procurement and Maintenance

Regarding the sources of the vehicle specifications for ordinary buses stated in the foregoing section, Saigon Transportation Mechanical Corporation (SAMCO) imported engine chassis for CNG buses made by Hyundai to assemble the bodies and sell them in 2015. Regarding the same point for articulated buses, we received a reply from Mitsubishi Fuso Truck and Bus Corporation, which has a track record of Mercedes Benz Citaro G deliveries in Japan, that the company could export them to Vietnam or outsource their sales to Mercedes-Benz Vietnam, its affiliate.

As for maintenance and management, there is a sufficient service organization for buses manufactured by Hyundai because they occupy an overwhelming share of the bus market in southern Vietnam. Mercedes-Benz Vietnam is also able to supply parts. The company can offer services because it sells large-sized vehicles made by Mitsubishi Fuso Truck and Bus Corporation. The per-vehicle costs of ordinary buses and articulated buses are as shown in the following table.

In addition to bus bodies, we need to install destination guide displays for passengers and onboard equipment, such as receipt issuing machines and drive recorders for preventing crimes. We can procure all onboard equipment whose unit prices are stated in the table below in Vietnam. We will ask our outsources for daily maintenance and management duties to perform periodic inspections and maintenance once each month under the management of bus operating companies.

Table 3.7.5 Vehicle Prices for Ordinary and Articulated Buses (Estimates)

				Japanese yen (thousand yen)	Vietnamese dong (thousand VND)
Articulated buses	Bus body (Mercedes Benz Citaro G)	480,000	Euro (1 euro=140 yen)	67,200	11,904,480
	Land transportation (first time)	Based on actual deliveries in Japan by Mitsubishi Fuso Truck and Bus Corporation		800	141,720
	Secondary equipment (for conductorless buses)			7,000	1,240,050
	Drawings and specifications			180	31,887
	Land transportation (second time)			500	88,575
	Registration substitution expenses			50	8,858
	Subtotal			75,730	13,415,570
	Recycling expenses			89	15,766
	Automobile tax			29	5,137
	Income tax			1,485	263,068
	Weight tax			70	12,401
	Subtotal			1,673	296,372
	Reserve			2,597	460,059
	Total			80,000	14,172,000
Standard buses	HYUNDAI Super Aero City CNG EURO IV assembled by SAMCO	Selling price adopted by SAMCO		18,036	3,195,000
	Reserve			1,964	348,000
	Total			20,000	3,543,000

Source: JICA Study Team

Table 3.7.6 Unit Prices of Onboard Equipment

	VND	Japanese yen
Boarding ticket machines	20,900,000	117,979
LED destination display devices	43,230,000	244,030
Onboard monitoring cameras (including wiring)	43,120,000	243,410
Distance monitoring equipment	6,204,000	35,021
Fare boxes	2,786,667	15,731
Automatic broadcasting equipment and onboard indicators	11,220,000	63,336
LED destination indicator device cases	7,700,000	43,466
Total	135,160,667	762,973

Source: JICA Study Team

3.7.2 Automatic Fare Collection System (AFC)

(1) Current Situation and Future Trend for Fare Collection Method

The fare collection method in Vietnam Binh Duong Province of current, first, the passenger pays cash to the conductor in the bus, then, passengers receive from the conductor receipt (ticket) based on the laws and regulations. In the bus some of HCMC, one-man operation is getting gradually advances, fare box is installed in the driver's seat side of the entrance. After the passengers are put cash in the fare box, the driver has been distributed receipts (ticket) to passengers, but it is necessary to perform the exchange business in order to return to the passengers change, driver's burden are increasing.

Even in developed countries, Prior to economic growth, fare collection by the conductor has been implemented. However, from the fact that labor costs was raised along with the rapid economic growth of the past, profitability of the bus business has deteriorated, bus operators was changed to one-man operation of the only driver in order to improve the efficiency, fare collection method mechanization of has been promoted.

The cash toll collection system in each country, the situation is different depending on the type of bill and coins of each country, but in the case of Japan, mechanization has progressed significantly in the bus. The machine of Japan, it is possible to return the change from the bill and coins and currency exchange to the coins from the bill by the passengers themselves is possible, and has become a service unique to Japan.

On the other hand, in Europe such as the UK, France, Germany, was carried out the one-man operation at an early stage but, until before the IC card will be realized, that to achieve the mechanization of fare collection method was small. Because for passengers, bus operators did not provide most of the services such as currency exchange and change, fare collection rules that must be prepared fare without change by the users themselves in advance has become a habit. Fare collection method varies greatly with the development of ICT technology, from the spread of tickets by the paper ticket, prepaid card of is achieved in the 1990s, it has evolved to the IC card from the 2000s in Japan. With the advent of the IC card, to use before each transportation, there is no need for the user to purchase a ticket in cash. It will be available in seamless public transport, such as rail and multiple bus in a single IC card, smooth operation and shortening of time in getting on and off bus is realized.

In future, economic growth for the advance in Vietnam, one-man operation of the operator shall be required due to the rise in labor costs in the bus business, it is necessary to construct a fare collection method for efficiently abolished the conductor.

It is possible by introducing an IC card system fare collection system, for the user convenience is improved, for bus operators side, thereby reducing the work of the driver by the one-man operation. Also, by managing electronic data in the sales proceeds, it becomes possible that reliability is improved, and a business processing efficiency.

Currently, under construction of Line 1 city rail in Vietnam Ho Chi Minh City, it is planned that IC card is introduced in the automatic fare collection. In the BRT route that connects to Line 1 urban railway in Suoi Tien Terminal station, by the realization of the mutual use or common use can be in the IC card owned by the user, so that convenience is improved for the user.

(2) Fare Collection Method

Following table shows typical characteristics for each type of fare collection method

Table 3.7.7 Type of Fare Collection Method

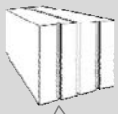
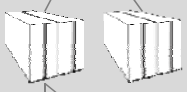
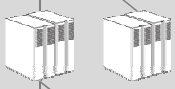
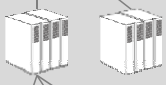
Fare toll collection location	The vehicle-mounted device in buses	Automatic ticket gate of bus stop facilities
Type of Bus-Stop	If the sidewalk side bus stop also commonly used in conjunction (Ticket gate system requires investment of 2 times in the vertical direction)	If the Island-type bus stop closer to the center on a dedicated road (Also used in both directions up and down)
Number of Bus-stop Number of Buses	If the stop number is greater than the number of vehicles, low-cost than automatic ticket gate system	If the stop number is less than the number of vehicles (however,Total investment is the case of a low-cost)
Necessary equipment	Reader/Writer	Automatic ticket gate
	Fare box	Automatic ticket vending machine
	Automotive deposit machine	Office (equipment such as a back yard)
		Backup power supply / communication network
Facilities	With only shed, security of no particular unnecessary	Facilities around the entire intrusion prevention fence (home door) Security measures (security camera), and the like need
Operational challenges		Recovery of cash is required at each bus stop
Advantage	Low cost	Time of getting off and ride to the bus shortest
Disadvantage	Ride time and time to get off the bus, longer than the ticket system	High cost

Source: JICA Study Team

(3) IC Card System

1) General Automatic Fare Collection (AFC) System

In each country of the world, AFC (Automatic Fare Collection) Systems are constructed as one of the public transportation system for the MRT (Mass Rapid Transit), BRT(Bus Rapid Transit), etc. Even in Vietnam, several construction projects for MRT and BRT decided to use the IC Card for tickets. And these projects have began to design and develop the AFC. AFC is shown as the 6 hierarchical model of the equipment configuration in following figure.

Level	Name of Equipment		Image	Function *
5	CCHS			-Clearing and Settlement Manage the daily / monthly clearing data for each operators. -Card Information Management Manage the most up-to-date data of IC card based on the data received from lower level. -Blacklist Management Manage the most up-to-date blacklist and deliver it to the lower levels. -Relaying data in lower level
4	AFC	Operator Server		-Revenue Management Manage the daily / monthly revenue data **for each operators**. -Statistics Management Manage the daily / monthly statistical data **for each operators**. -Relaying data in higher/lower level
3		Line Server		-Revenue Management Manage the daily / monthly revenue data **for each lines**. -Statistics Management Manage the daily / monthly statistical data **for each lines**. -Relaying data in higher/lower level
2		Station Server, Bus Depot Server		-Revenue Management Manage the daily / monthly revenue data **for each stations and depots**. -Statistics Management Manage the daily / monthly statistical data **for each stations and depots**. -Relaying data in higher/lower level
1		AFC Equipment		-Communicating with IC card wirelessly and updating data in IC card. -Creating data for servers in higher level.
0		Ticket Media		-Holding Card ID, Usage Data, etc. -Communicating with equipment wirelessly.

* Sometimes, functions of CCHS are exist in the level 3 or 4

Source: JICA Study Team

Figure 3.7.2 General system hierarchy for AFC

Generally, the types of smart cards varies depending on read and write method, payment method, a place of usage, etc. In this study, the contactless and prepaid type smart card used for public transport is described as "Transport Smart Card". And the transport smart card equipped with e-money function usable in retail stores is categorized as "comprehensive smart card"

a) Read and write method

Two types, contact and contactless, are considered. For the ticket for public transport, the processing speed is important, thus the contactless smart card is generally adopted.

b) Payment method

It is largely categorized into two types, prepaid and postpaid. The prepaid smart card is often adopted to ticket for public transport.

c) Place to use

It is often used as a ticket for public transport and micropayment of retail stores.

2) Necessary equipment for BRT

As the usage point and number of cards expand , it is necessary to expand the system structure of AFC. in the future, BRT IC Card of this study will connect with the other AFC(IC Card) in surrounding areas. The way toward interoperable IC Card for the transportations includes the following 3 steps.

1st stage: IC cards for BRT start operation in each district.
2nd stage: Begin the interoperation with Bing Duong Bus.
3rd stage: Begin the interoperation with HCMC MRT, BRT and Bus.

a) 1st stage

At the phase of commencement of the IC card for BRT, it is assumed that there will only be ONE(1) BRT line and ONE(1) Bus Depot. In this case, the minimum requirement for the AFC system would be Level 0/1/2 and Level 3/4/5 is unnecessary.

: Necessary equipment for BRT

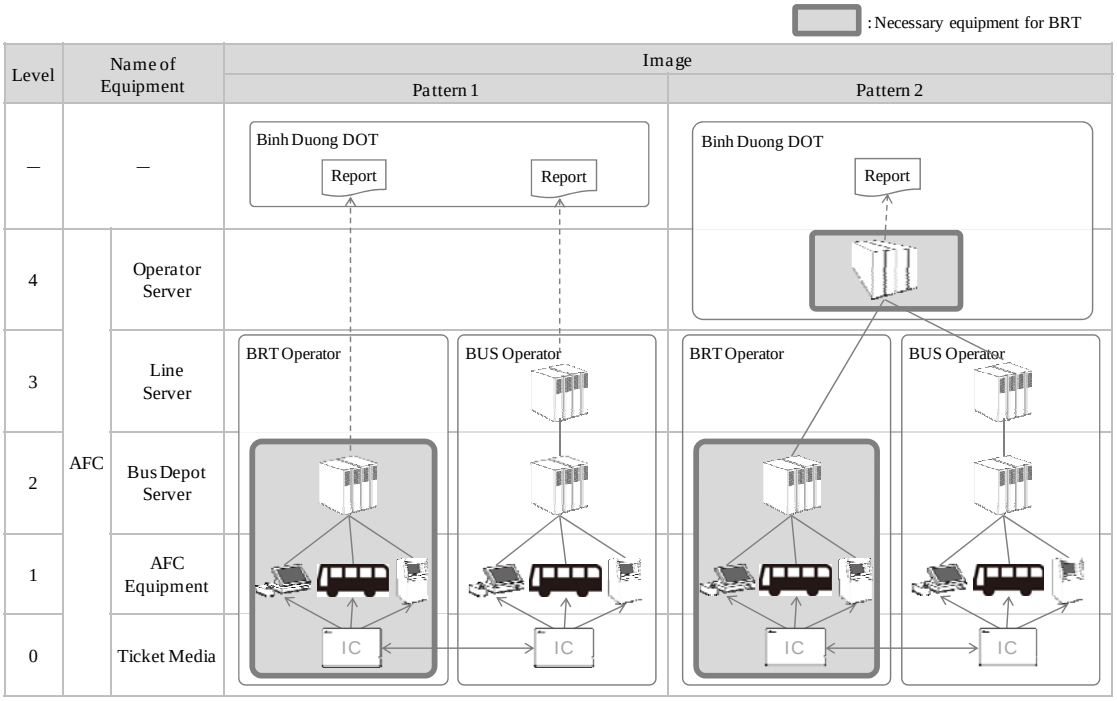
Level	Name of Equipment		Image	Function
–	–		Binh Duong DOT Report	System is not necessary. (Only receive the reports)
2	AFC	Bus Depot Server	BRT Operator	-Card Information Management -Blacklist Management -Revenue, Statistics Management -Stock Management -Relaying data
1		AFC Equipment		-Communicating with IC card wirelessly and updating data in IC card. -Creating data for servers in higher level.
0		Ticket Media	IC	-Holding Card ID, Usage Data, etc. -Communicating with equipment wirelessly.

Source: JICA Study Team

Figure 3.7.3 Necessary equipment for 1st stage

b) 2nd stage

As the interoperation with Bing Duong Bus start, the hierarchical model for the AFC system is as shown on Figure X.3. In this figure, there are two model patterns as suggestions.
The 1stt pattern involves Level 0/1/2/3 with no Level 4 in the model. In this case, BRT Operator and Bus Operator will produce their own revenue and statistic report and submit the reports to Bing Duong DOT on their own. Binh Duong DOT will have to manually aggregate the data from the reports that were submitted for the overall data.
The 2nd pattern on the other hand, will have Level 0/1/2/3 at the Bus AFC system, with additional Level 4 that is mutually shared between BRT and Bus AFC system. BRT Operator and Bus Operator will produce their own revenue and statistic report and submit the reports to Level 4. Aggregation of the overall reports and data can be automatically sent to Binh Duong DOT from Level 4. .



Source: JICA Study Team

Figure 3.7.4 Necessary equipment for 2nd stage

c) 3rd stage

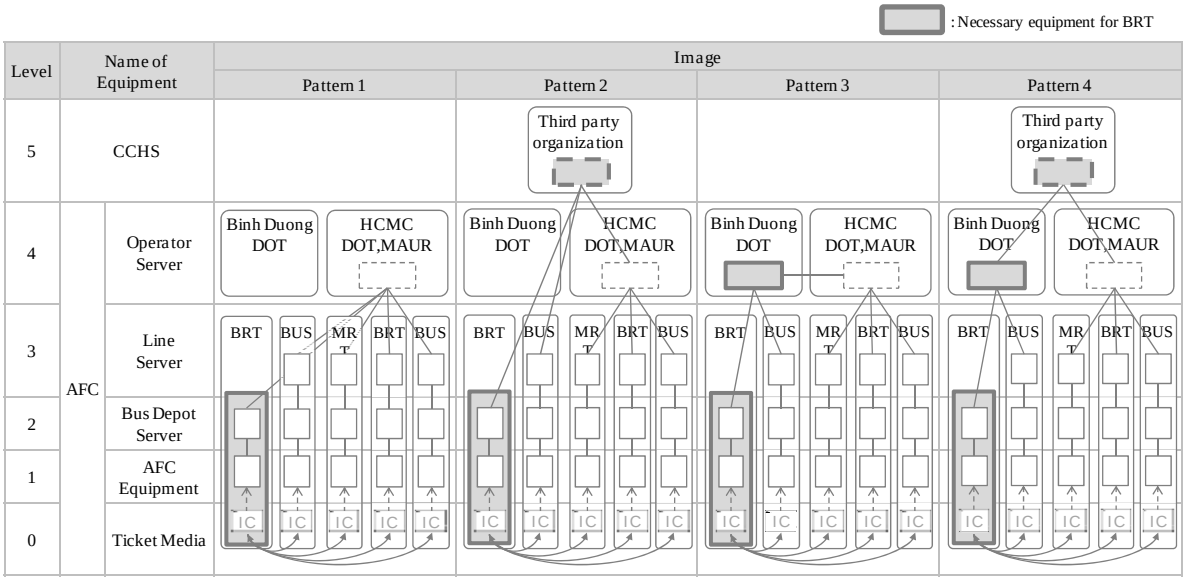
In the 3rd stage, when interoperation with HCMC MRT, BRT and Bus is made available, possible 4 patterns of the hierarchical model are shown in the following Figure.

The 1st pattern involve having the Binh Duong BRT Level 2 and Binh Duong Bus Level 2 being connected to Level 4 of HCMC. In this case, equipments on Binh Duong side can be minimized. However, it is necessary to confirm if there is any plan to build Level 4 in HCMC, and if it is possible to connect the equipments at the Binh Duong side.

In the 2nd pattern, the model will have a third party organization to host a mutual CCHS in between Binh Duong and HCMC. This model will also minimize equipments in Binh Duong side, but there will be some challenges such as: the agreement of HCMC on this model and the realization a third party to manage the Level 5.

As for the 3rd Pattern, Binh Duong DOT will have their own Level 4 and connect with HCMC Level 4. In this case, mutual 3rd party organization and CCHS will be unnecessary. However, there is a need to have the same functions of Level 4 in between Binh Duong and HCMC.

In the 4th Pattern, Binh Duong DOT will have their own Level 4 then have another third party organization to host CCHS in Level 5. In this case it will involve the most number of equipment. However, this model will enable a clearer responsibility distribution in between Binh Duong and HCMC, as well as a better structure and flexibility to adapt in the event of more lines increase in the future.



Source: JICA Study Team

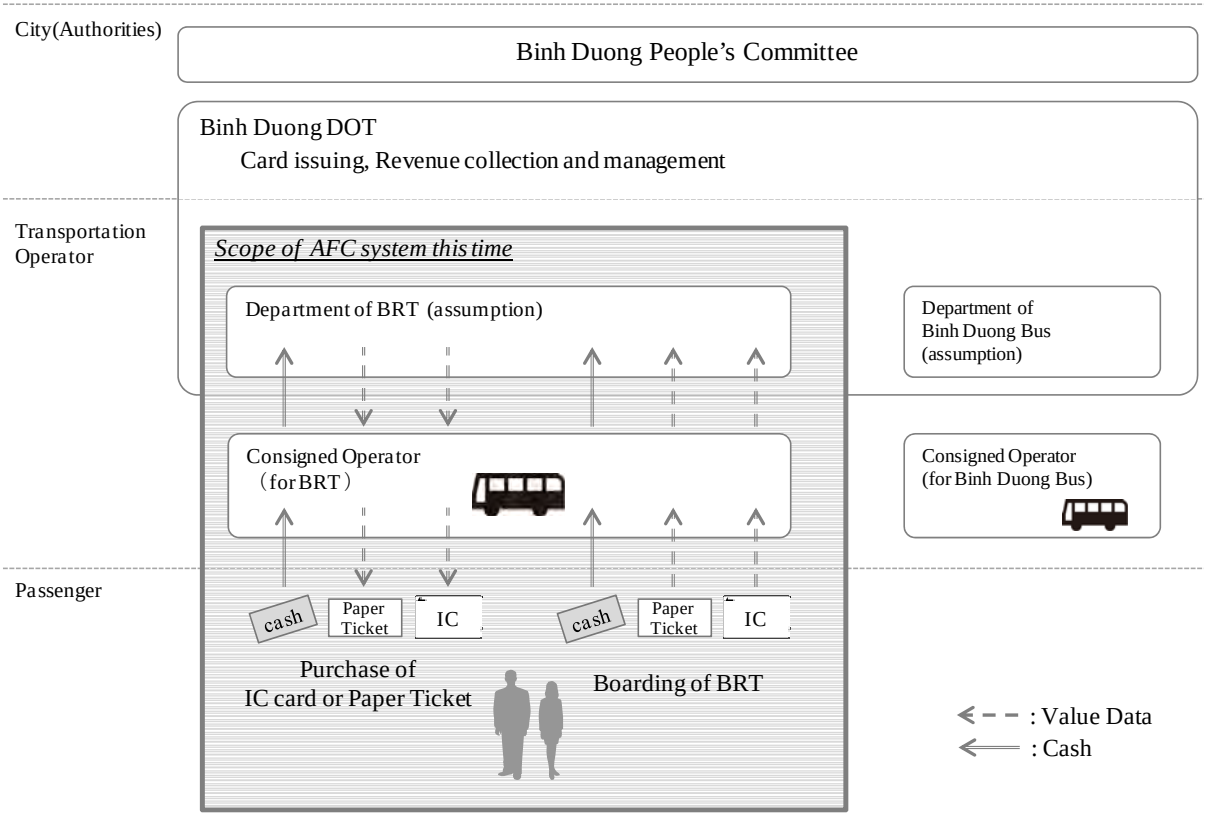
Figure 3.7.5 Necessary equipment for 3rd stage

3) Requirements for AFC

Requirements for AFC are described below.

(Roles of each Organization)

It is considered that the BRT is operated by a consigned operator under the management of Binh Duong DOT. For this reason, it is assumed that the actor who actually issues transportation IC cards, sales paper tickets, and processes boarding of BRT will be the consigned operator. There also can be two options, one of them is that the Binh Duong DOT gather and manage money received by the sales of IC cards and paper tickets, and the other is that the consigned operator does. The figure below shows the roles of each organization when the Binh Duong DOT gather and manage money.

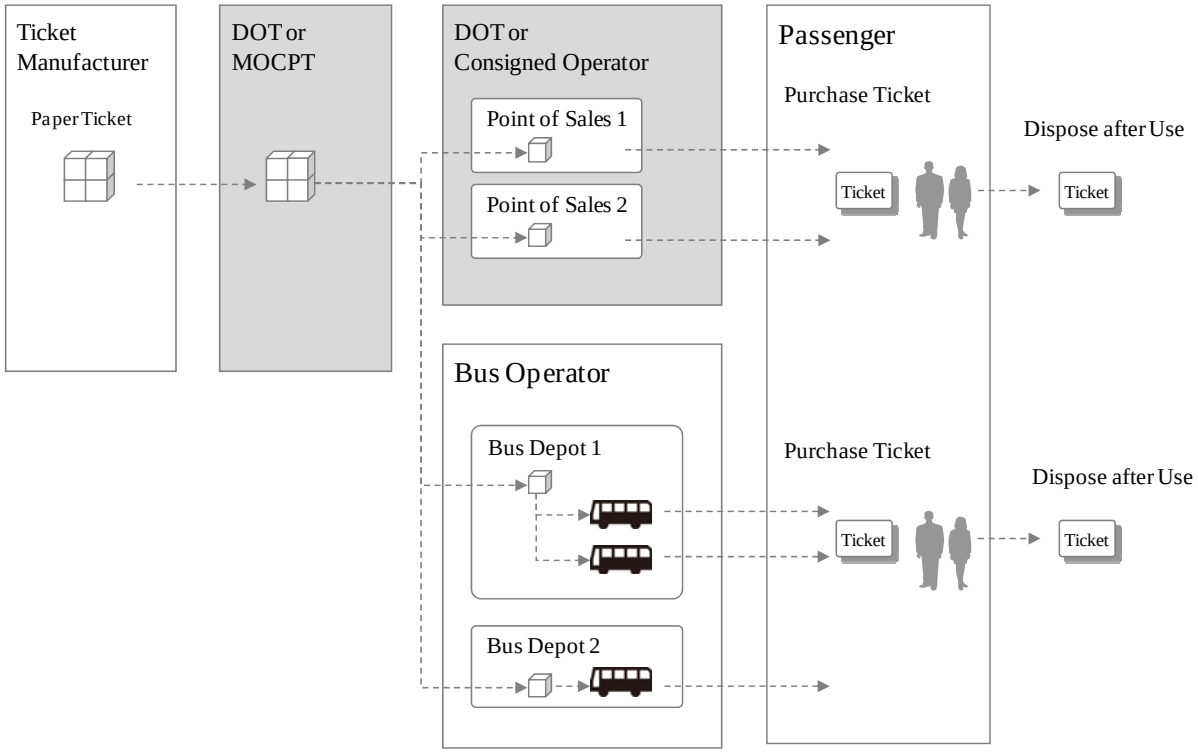


Source: JICA Study Team

Figure 3.7.6 Conceptual Diagram of Roles of each Organization

(Ticket issue management)

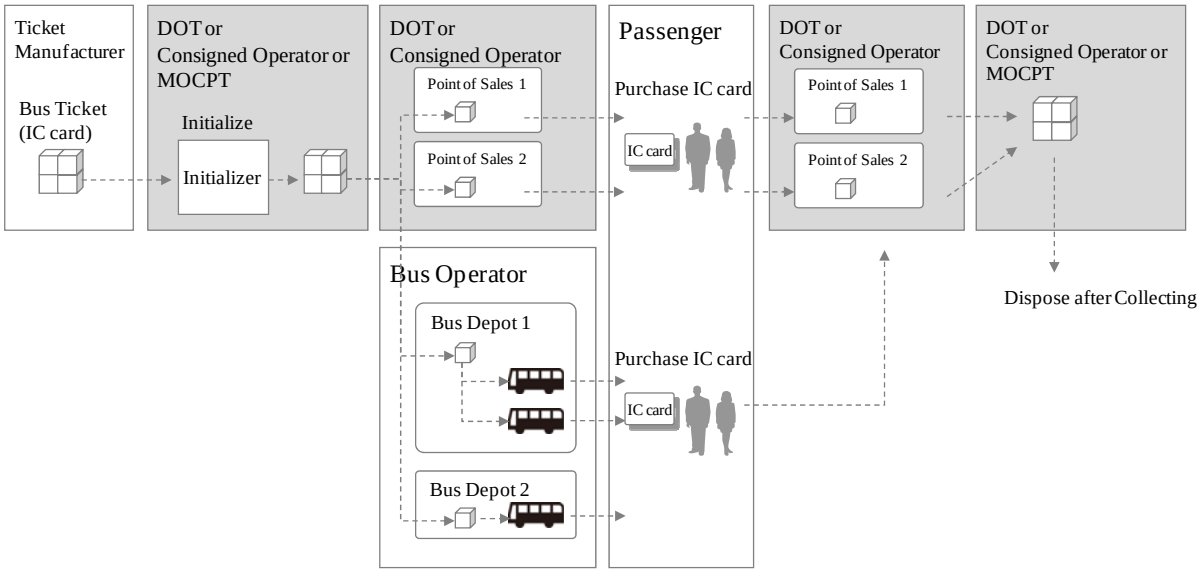
It is assumed that the issue of the ticket for BRT is performed at each point of sales by Binh Duong DOT responsible for the ticket management or the consigned operator. There are two cases about the procurement of IC cards, one of them is that the Binh Duong DOT or MOCPT (Management and Operations Center for Public Transport) is an exclusive ticket purchases, on the other hand, there are the case that others(such as staff at point of sales and bus operator) directly purchase from the ticket manufacturer. The figure below shows the flow when the Binh Duong DOT or MOCPT exclusively purchases tickets.



Source: JICA Study Team

Figure 3.7.7 Operation of Issuing Paper Ticket

It is assumed that the issue of the IC card for BRT is performed at each point of sales by the Binh Duong DOT responsible for the ticket management or the consigned operator, as same as a paper ticket. It is also assumed that the transportation IC card is initialized by the Initializer (equipment to initialize the smart card) at the Binh Duong DOT, the consigned operator or MOCPT to be sold to the passengers at each point of sale.



Source: JICA Study Team

Figure 3.7.8 Operation of Issuing IC card

(Reference data for the system)

Reference data for the system is described below to consider the size of AFC system. If the reference data is modified greatly, the configuration and prerequisite of AFC system need to be reconsidered.

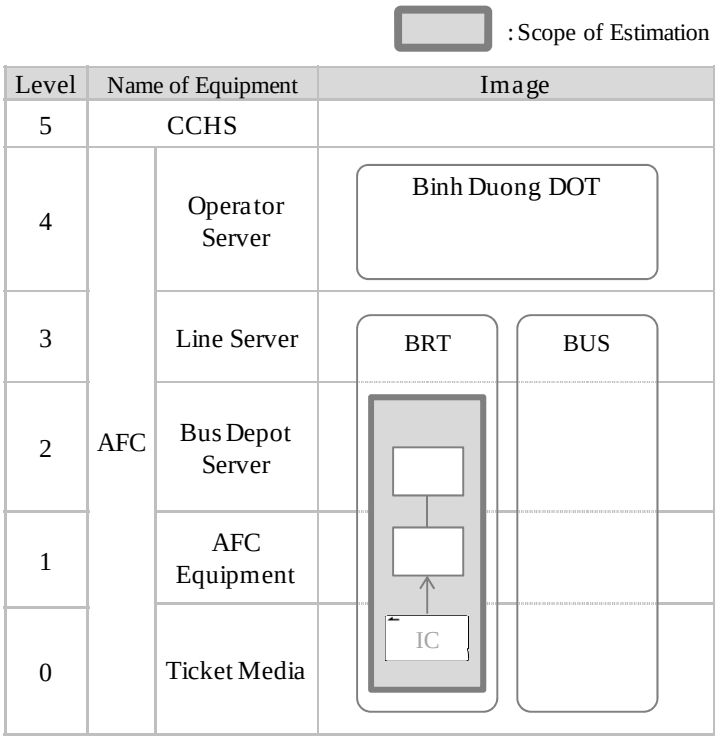
Table 3.7.8 Reference Data for the System

No.	Item		Reference Data		Remarks
			BRT	Binh Duong Bus	
1	Basic Information	Number of Routes	1	21	
2		Number of Stops	15	-	
3		Number of Major Terminals	1	3	
4		Number of BRT/Buses (approximate)	100	200	
5		System of Fare	Distance or Area	-	
6	Number of Equipments	Top-Up Machine	100	200	One equipped to each BRT/Bus.
7		IC Card R/W on BRT/Bus	100	200	One equipped to each BRT/Bus.
8		Ticket Vending Machine	2	6	Two equipped to each Major Terminals.
9		Ticket Office Machine	2	6	Two equipped to each Major Terminals.
10	Usage Data	Daily ridership number	0.1 million	0.5 million	Prediction of 5th year after the start of operation.
11		Number of IC cards issued	0.2 million		Prediction of 5th year after the start of operation.

4) Cost for Implementation and Maintenance of AFC

The cost for the implementation and maintenance of AFC (as an example) is shown below. The cost is described in 3 steps as mentioned in X.2.
1st stage: IC cards for BRT start operation.
2nd stage: Begin the interoperation with Bing Duong Bus.
3rd stage: Begin the interoperation with HCMC MRT, BRT and Bus.

(1st stage)
In the 1st stage, Level 0/1/2 which are basic of AFC need to be installed. The minimal functions necessary for IC card operation such as Card Information Management and Blacklist Management should be implemented in Level 2, Bus Depot Server.
In the 1st stage, transportation IC card is used only for BRT. However, it is advisable that the IC card specification and the interface for the interoperation in the future should be considered early as soon as possible to apply them to AFC equipment and IC card in the 1st stage. The estimation scope in the 1st stage is shown below.



Source: JICA Study Team

Figure 3.7.9 Scope of Estimation for AFC in the 1st stage

As to the cost of the 1st stage, there are two patterns. For the 1st pattern, the Binh Duong DOT has the Initializer. On the other hand, in case of the 2nd pattern, the consigned operator is in charge of initializing.

(1st pattern: The Binh Duong DOT has the Initializer.)

Table 3.7.9 Cost for the Implementation of AFC (example) 1st Pattern for the 1st stage

No.	Category		Item		Price (M JPY)
1	System Implementation	Depot Server	Hardware		7.1
2			Software		50.0
3			Subtotal		**57.1**
4		Equipment	Safety Box Terminal	Hardware	1.5
5				Software	12.0
6			Ticket Office Machine	Hardware	5.0
7				Software	65.0
8			IC Card R/W on BRT/Bus	Hardware	222.2
9				Software	50.0
10			Top-Up Machine	Hardware	284.2
11				Software	71.8
12			Ticket Vending Machine	Hardware	18.2
13				Software	7.8

14			Other Appurtenance	2.0
15			Test Center	35.0
16			Miscellaneous	100.0
17			Subtotal	**874.7**
18		IC card	IC card Media	37.0
19			IC card Issuing System	140.0
20			Subtotal	**177.0**
21		General System Integration		200.0
22	Total			**1308.8**

Source: JICA Study Team

Table 3.7.10 Cost for the Annual Maintenance of AFC (example) 1st Pattern for the 1st stage

No.	Category	Item	Price (M JPY)
1	Depot Server and Equipment	Hardware	9.0
2		Software	27.0
3		Subtotal	**36.0**
4	IC card	IC card Issuing System	14.0
5		Subtotal	**14.0**
6	General System Integration		35.0
7	Total		**85.0**

Source: JICA Study Team

Conditions or premises are listed below.

- System performance is based on the number of data shown in Table X.1
- Main servers are installed in a single machine room.
- Support services of hardware and software is assumed correspondence during day-time on the weekday.
- The cost above does not include the modification for the interoperation with other transportation IC card. To realize the interoperation, the cost for the addition of the functions and the test implementation toward the interoperation should be considered besides the cost this time.

(2nd pattern: consigned operator is in charge of initializing.)

Table 3.7.11 Cost for the Implementation of AFC (example) 2nd Pattern for the 1st stage

No.	Category		Item		Price (M JPY)
1	System Implementation	Depot Server	Hardware		7.1
2			Software		50.0
3			Subtotal		**57.1**
4		Equipment	Safety Box Terminal	Hardware	1.5
5				Software	12.0
6			Ticket Office	Hardware	5.0

7			Machine	Software	65.0
8			IC Card R/W on BRT/Bus	Hardware	222.2
9				Software	50.0
10			Top-Up Machine	Hardware	284.2
11				Software	71.8
12			Ticket Vending Machine	Hardware	18.2
13				Software	7.8
14			Other Appurtenance		2.0
15			Test Center		35.0
16			Miscellaneous		100.0
17			Subtotal		**874.7**
18		IC card	IC card Media		39.0
19			Subtotal		**39.0**
20		General System Integration			200.0
21	Total				**1,170.8**

Source: JICA Study Team

Table 3.7.12 Cost for the Annual Maintenance of AFC (example) 2nd Pattern for the 1st stage

No.	Category	Item	Price (M JPY)
1	Depot Server and Equipment	Hardware	9.0
2		Software	27.0
3		Subtotal	**36.0**
4	General System Integration		35.0
5	Total		**71.0**

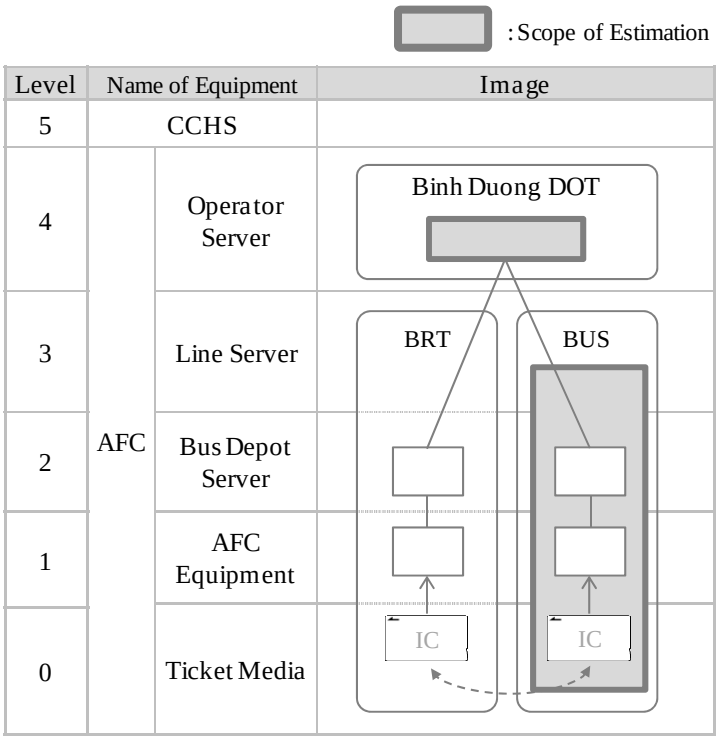
Source: JICA Study Team

Conditions or premises are same as the 1st pattern.

(2nd stage)

The 2nd stage needs to involve Level 0/1/2 in Binh Duong Bus. In this stage, Level 0/1/2 of Binh Duong Bus need to be designed under the consideration of the specification and the interface of the IC card for BRT to realize the interoperation with BRT which has already started to operate.

Binh Duong DOT also needs Level4, Operator Server, to manage the revenue and the statistics of BRT and Binh Duong Bus. Operator server in Level 4 needs to involve the necessary function for the IC card operation such as Card Information Management and Blacklist Management. The scope of the estimation of the 2nd stage is shown below.



Source: JICA Study Team

Figure 3.7.10 Scope of Estimation for AFC in the 2nd stage

To realize the interoperation with other transportation IC card actually, the cost for the addition of the functions and the test implementation toward the interoperation should be considered besides the cost this time.

Table 3.7.13 Cost for the Implementation of AFC (example) 2nd stage

No.	Category		Item		Price (M JPY)
1	System Implementation	Operator Server	Hardware		80.0
2			Software		300.0
3			Implementation (personnel expenses)		120.0
4			Miscellaneous		140.0
5			Subtotal		**640.0**
6		Depot Server	Hardware		21.3
7			Software		50.0
8			Subtotal		**71.3**
9		Equipment	Safety Box Terminal	Hardware	4.5
10				Software	12.0
11			Ticket Office Machine	Hardware	15.0
12				Software	65.0
13			IC Card R/W on BRT/Bus	Hardware	444.4
14				Software	50.0
15			Top-Up Machine	Hardware	568.4
16				Software	71.8
17			Ticket Vending Machine	Hardware	54.6
18				Software	7.8
19			Other Appurtenance		2.0
20			Test Center		35.0
21			Miscellaneous		100.0
22			Subtotal		**1,430.5**
24		General System Integration			400.0
25	Total				**2,541.8**

Source: JICA Study Team

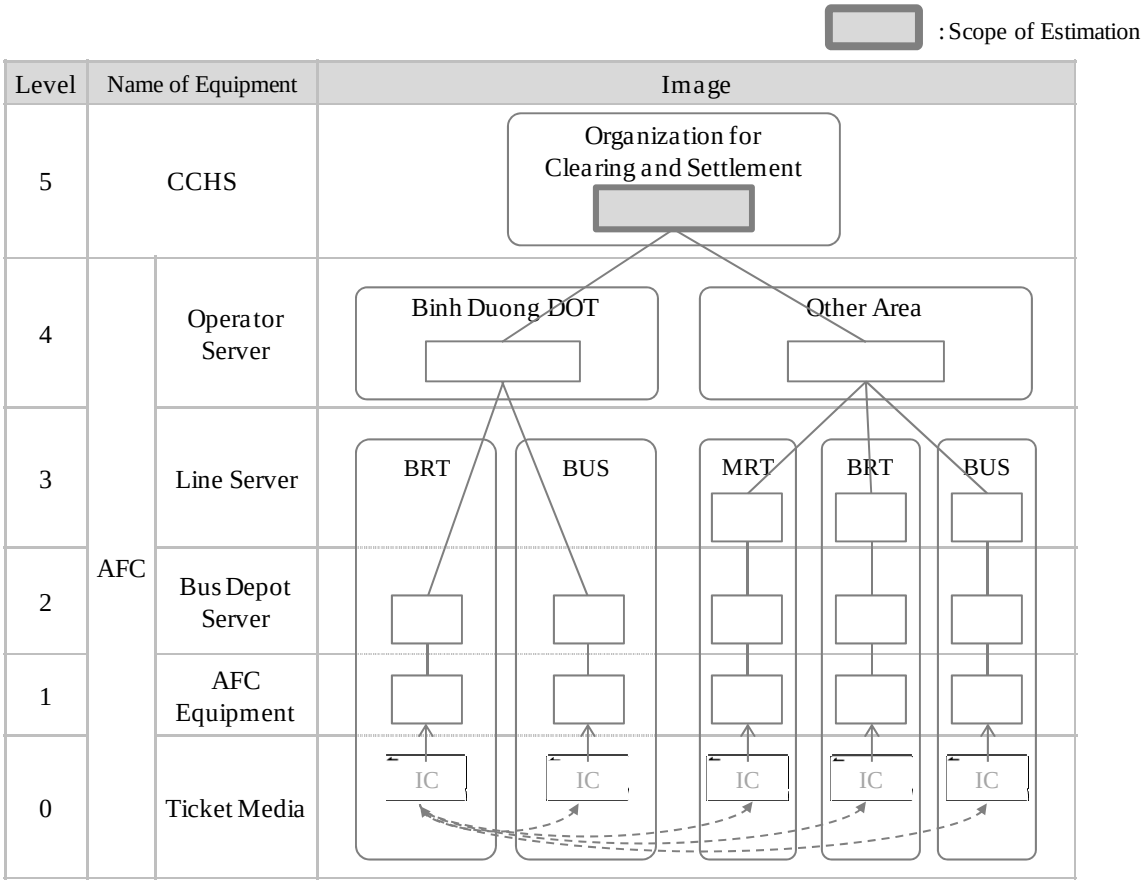
Table 3.7.14 Cost for the Annual Maintenance of AFC (example) 2nd stage

No.	Category	Item	Price(M JPY)
1	Operator Server	Hardware	10.0
2		Software	30.0
3		Implementation (personnel expenses)	25.0
5		Subtotal	**65.0**
6	Depot Server and Equipment	Hardware	18.0
7		Software	27.0
3		Subtotal	**45.0**
6	General System Integration		70.0
7	Total		**180.0**

Source: JICA Study Team

Conditions or premises are same as the 1st Pattern for the 1st stage.

(3rd stage)
The 3rd stage needs to involve Level 5, CCHS, as the third party organization for the clearing and settlement to realize the interoperation with the transportation in other areas. As a precondition of this, public transportation such as MRT, BRT and Bus in other area also must involve the necessary configuration in Level 0/1/2/3/4, although they are out of scope of the estimation this time. IC card for MRT, BRT and Bus in the other area needs to be designed under the consideration of the specification and the interface of the IC card for BRT and Bus in Binh Duong to realize the interoperation with BRT and Bus in Binh Duong which have already started to operate.
The interoperation between Binh Duong and the other area has the clearing and settlement service among multiple operators. For this reason, a bank might involve with the issue and operation of IC card. The scope of the estimation of the 3rd stage is shown below.



Source: JICA Study Team

Figure 3.7.11 Scope of Estimation for AFC in the 3rd stage

To realize the interoperation with other transportation IC card actually, the cost for the addition of the functions and the test implementation toward the interoperation should be considered besides the cost this time.

Table 3.7.15 Cost for the Implementation of AFC (example) 3rd stage

No.	Category		Item	Price (M JPY)
1	System Implementation	CCHS	Hardware	104.0
2			Software	322.0
3			Implementation (personnel expenses)	312.0
4			Subtotal	**738.0**
5	Total			**738.0**

Source: JICA Study Team

Table 3.7.16 Cost for the Annual Maintenance of AFC (example) 3rd stage

No.	Category	Item	Price (M JPY)
1	CCHS	Hardware	11.0
2		Software	47.0
3		Implementation (personnel expenses)	38.0
4		Subtotal	**96.0**
5	Total		**96.0**

Source: JICA Study Team

Conditions or premises are same as the 1st Pattern for the 1st stage.

(4) Fare Collection in the BRT business

1) Banking regulation restriction on interoperation between IC cards

When introducing a fare collection system using IC cards, attention must be paid to the definition of bank card stated in the Banking Act No. 20 of Vietnam. According to this Act, a prepaid card that can be used for several services is defined as a bank card and can only be released by a corporation that has received the permission of the banking business.

The following description is written in “A Report on Research into Electronic Money and the Transportation System IC Card of Vietnam” by JICA: As the premises for implementing IC cards in the Hanoi public transportation system while being exempted from the Banking Act, it is necessary to establish an organization such as a public transportation fare management center that consolidates the management of the freight revenues and the monetary balance of the transportation systems in order to achieve the interoperation of IC cards of urban railways, BRT and fixed-route buses. Preparation for the release of IC cards is promoted primarily by the organization.

In HCMC, the management bodies of urban railways, BRT and fixed-route buses are not yet ready for promoting the study of the management of freight revenues and the monetary balance as well as the release of IC cards that are interoperable between the transportation systems. In the future, if a public transportation fare management center similar to that of Hanoi cannot be established in HCMC, or if the release of IC cards and the management of freight revenues and the monetary

balance are not operated by a corporation that has received the permission of the banking business, each management body of the transportation system will have to release its own IC cards and manage the monetary balance. As a result, public transportation users will have to hold multiple IC cards for each route or mode of transportation.

Furthermore, in order to make IC cards interoperable between the public transportation systems of HCMC and its neighboring Binh Duong Province beyond the boundaries of municipalities, the present Banking Act requires a corporation that has received the permission of the banking business to provide services across a wide region. At this point, however, no specific action has yet come from the major banks. Considering the business feasibility of investment return based on the total number of transactions, it is highly unlikely that a bank will implement consolidated management and release cards at the dawn of the spread of IC cards with a small number of transactions.
Accordingly, from the perspective of regulation restriction and business feasibility, it would be very difficult to achieve the interoperation of IC cards released respectively by HCMC Urban Railway Line 1 and Binh Duong Province BRT at this point.

One of the ways of achieving interoperation between municipalities is to lobby the central government and central bank to request deregulation.
For example, public transportation tickets are exempted from the financial settlement regulations in Japan. If a similar deregulation could occur in the Banking Act in Vietnam, freight and the payment amount could be settled between the public transportation fare management center of each municipality that does not have the permission of the banking business. In doing so, interoperation of IC cards can be achieved.

2) Cost of bus-mounted devices and related devices

In Japan, where public transportation is well developed, bus-mounted devices (R/W) equipped with an IC card system and devices such as fare indicators and fare machines that can give change (hereafter referred to as “one-man operated bus devices”) are manufactured by two or three companies for the tens of thousands of buses operating throughout Japan. The cost per device is under two million yen. Development of the bus-mounted devices (R/W) and the one-man operated bus devices manufactured in Japan began more than 40 years ago for automation in the one-man operation following the abolition of bus conductors. These are very Japan-specific, complicated devices developed through digitization of wide range of devices. There has been no track record of export to, and system development for the developing countries of Southeast Asia or the European countries that use simple fare collection.
If these Japan-made one-man operated bus devices are to be exported to Vietnam, the new development of expensive software will be required. There are only about 300 fixed-route buses operating throughout Binh Duong Province. The unit price will be expensive without the cost advantages of large-scale introduction.

3) Cost for development of environment of IC card payment

In Japan, railway and bus public transportation networks are in place throughout the country. Most users add money to their prepaid cards at a nearby railway station, although this can also be done inside a bus.
In Hanoi and HCMC, railway systems are under development and a public transportation network is yet to be built. It is necessary to establish an environment that allows money to be added onto prepaid cards inside a bus so that IC cards become popular among users, because there are few

nearby stations.

In particular, it is necessary to develop an automated payment machine that is compatible with Vietnamese banknotes in order to implement one-man operation. However, the Japanese bus machine manufacturers do not have this experience, and the cost of development by railway machine manufacturers will be extremely expensive in the absence of the cost advantages of large-scale introduction.

Adding money to prepaid cards can also be performed by a conductor without the automated machines. However, including a conductor on a bus will degrade the effect of the labor cost reduction due to one-man operation and will not contribute to the return on the expensive investment.

4) Investment efficiency (cost-effectiveness) and introduction of IC card system

As stated above, a public transportation network has not yet been developed. The investment efficiency is poor when the investment cost per unit cannot be reduced for the limited number of BRT or Binh Duong Province's fixed-route buses. Under this situation, the business profitability of BRT will deteriorate if the IC card system is introduced to the BRT business. Even if the IC card system is introduced to all the bus routes of Binh Duong Province, it will increase the financial burden on the province. At this point, we think it would be advisable not to introduce the IC card system to the BRT business.

For the BRT business, the fares will be received by conductors or through boarding tickets in the case of one-man operation. The fare indicator, boarding ticket vendor as well as the IC system reserve will be recorded as a business fee.

5) Future development

At this point, we can only conclude as stated in 4) above. To introduce the Japanese IC card(FeliCa) system to the BRT business or Binh Duong Province's fixed-route buses in the future, we must continue collecting information because it may rapidly lead to specific discussions.

In addition, the introduction of the IC system by Binh Duong Province alone or by the ODA of the BRT business is facing difficult challenges. More consideration including further support from Japan is needed due to the following reasons.

a) SUOI TIEN TERMINAL is the last stop of Binh Duong Province's BRT and also the last stop of HCM Urban Railway Line 1 built by the ODA of Japan. Despite the restriction of the banking regulation, the system should be aiming at using one IC card for both BRT and HCM Urban Railway Line 1 in the future, and it should adopt the same Japanese IC card(FeliCa). Even if Binh Duong Province's BRT business or Binh Duong Province alone cannot use the IC system, a study needs to be conducted regarding the sharing and consignment of the system of HCM Urban Railway Line 1, which will adopt the Japanese IC card(FeliCa) system.

b) For the BECAMEX TOKYU BUS, more than 5000 Japanese IC cards(FeliCa) have been released as season tickets in the study conducted by the Japanese Ministry of Land, Infrastructure and Transport in 2014. An additional number of IC cards will also be released in the pilot PJ of the public traffic management capacity strengthening project (technical cooperation) held by JICA beginning from 2015. This Japanese IC card(FeliCa) is formatted by a common technical specification developed with the support of the Japanese Ministry of Land, Infrastructure and Transport, and is therefore compatible with passenger tickets such as SF.

c) The Japanese IC card(FeliCa) is fast in terms of response and reliable when compared with other types of card, and there have never been any security problems such as the replication of monetary value.

d) A preliminary study was conducted by JICA in December 2015. In the future, a feasibility study will be implemented for the introduction of the Japanese IC card(FeliCa) system to all the fixed-route buses in Hanoi in the future. If the devices of the IC card system by Japanese manufacturers are expected to be applied to all the fixed-route buses in Hanoi, the device cost per unit will be reduced.

In the future, concrete study toward the introduction of IC cards to all the routes of HCMC's fixed-route buses will be promoted. Introduction to the buses operating across different municipalities must also be studied. It is also necessary to study the interoperation of Japanese IC cards(FeliCa) including the possibility of the sharing and consignment of the IC card system of the fixed-route buses of HCMC.

3.7.3 Public Transportation System (PTPS)

(1) System Overview

Public Transportation Priority System (PTPS; Public Transportation Priority System) is a system to smooth the operation of the bus is a large amount of public transportation.

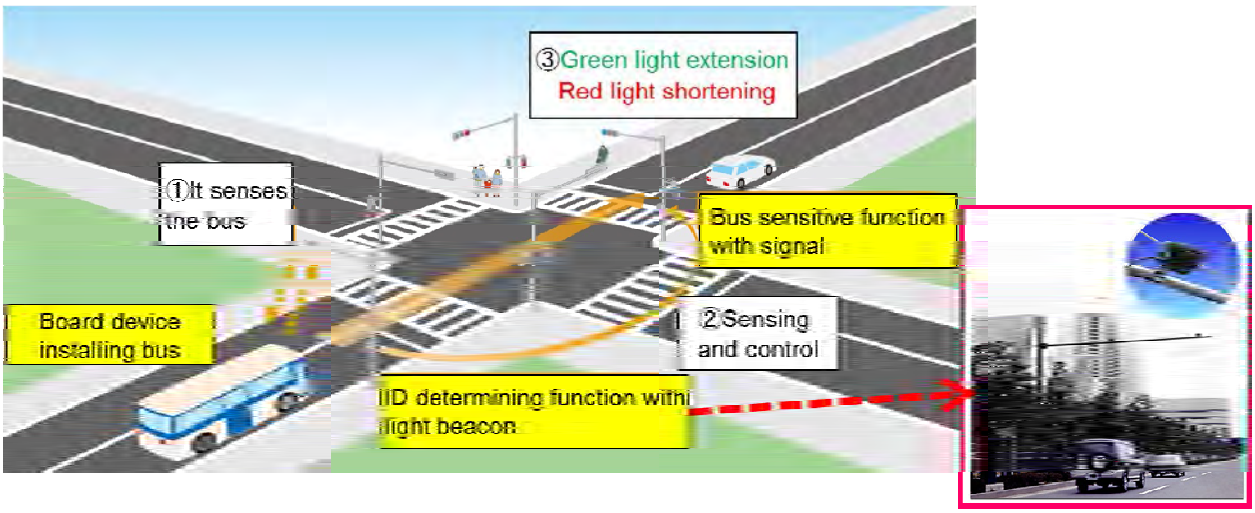
It means that by introducing this system, it is possible to secure the punctuality of the bus, the bus usage opportunities for the user is promoted, thereby improving the efficiency of the road.

This system is intended to match a system for controlling the transportation infrastructure such as traffic signals and traffic control measures such as bus lanes.

In Japan, March 31, 2008, 40 prefectures [1], introduced in 95 businesses, spanning 695.2km total length [2].

The system, which is currently commercialized in Japan, the communication information transmitted from the vehicle-mounted device mounted on the bus is received by the light beacon installed on the road. Thus, control or extend the time of the green light traffic signal in the path of the bus, the control for shortening the time of a red signal is made, the bus easily passes through the intersection of the signal. In addition, it is also possible to perform the warning with respect to the general vehicle traveling the bus lane that is detected by the optical beacon, placing the display board.

The shortening of the time required for bus operation by shortening the stop time of the signal, part-time course of the bus operation is ensured, enhancing convenience for the bus users, the introduction effect of this system is such that it leads to promote use.



Source: JICA Study Team

Figure 3.7.12 PTPS System

(2) Issues for introducing PTPS

The signal of several that have been installed in My Phuoc – Tan Van road BRT is planning the operation, countdown indicator is installed to the number of seconds remaining time of the red light and green light. Therefore, to reduce the time of a red signal or time extension of the green light by the system, it is necessary to change the appearance of countdown in seconds.

Display of the remaining time in Japan, are displayed in the "hourglass-type" in the pedestrian signal. Display of change of the signal cycle by PTPS has enabled control by delaying the progress of the "hourglass".

In addition, many municipalities in Japan, "control center" has been established in order to implement the traffic flow smooth in conjunction control a plurality of signals, one hundred billion yen from several billion yen in this installation investment has been.

If you want to introduce to PTPS signal system to which the control center is installed, refurbishment of the control center is also required in the 100 million yen scale.

In Vietnam, the introduction has been started on a trial basis as congestion measures of HCMC center in the 2014 time. In Binh Duong Province to operating the BRT, for the time being, be considered that there is no need for the introduction of the control center, because you do not interlock control a plurality of signals, it is can be installed the PTPS system alone at the intersection each.

Lane of BRT is a plan to or "hourly bus lanes" and "bus priority lane" the median strip side. The intersection of introducing PTPS, placing the left lane on the center line side of the bus lane is also effective resistance and express traffic safety on the BRT.

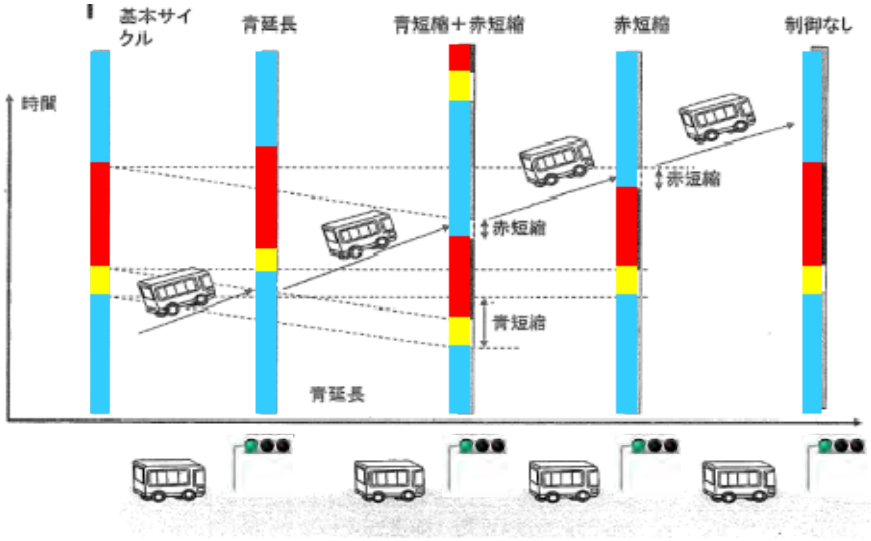


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Figure 3.7.13 Signal control example by interlocking PTPS

Source: JICA Study Team

Photo Control center

3.7.4 Bus Location Information System

(1) System Overview

At each bus stop, in order to provide location information and approach information of the bus to the user, and to build a system that utilizes the information of the itinerary monitoring device installation are required by law from 2010 in Vietnam is to, is a system built the most efficient way.
The itinerary monitoring device, information such as the opening and closing time of the bus speed vehicle, GPS location information, the door is recorded.
In systems from multiple vendors maker of delivery of the device, in order to contract manage information, to gather information on a mobile phone line, for businesses, and position information of the bus to the map of the WEB on operation management for in already developed applications to be displayed, and thereby realizing the information already provided.
It is possible to provide a bus location information on the WEB by performing customized bus user for this information.

3.8 Cost Estimation and Construction Plan

This chapter is not published, because the publication has a risk to threaten the project formulation.

3.9 Business Plan

This chapter is not published, because the publication has a risk to threaten the project formulation.

3.10 Environmental and Social Consideration

3.10.1 Survey Plan for Environmental and Social Considerations

Surveys for environmental and social considerations for Binh Duong BRT Development Project were carried out in line of JICA Environmental Guidelines. The following surveys are carried out:

a) Confirmation of current land use situation,
b) Confirmation of current natural environment,
c) Confirmation of current socio-economic condition,
d) Due diligence review of involuntary resettlement.
e) EIA implementing organization and institution in Vietnam
f) Environmental scoping,
g) Environmental baseline survey
h) Socio-economic survey
i) Formulation of environmental assessment report (EIA level)

The surveys covers an area along the BRT route (started from the BRT depot in Binh Duong New City and ended at Suoi Tien Terminal Station of HCMC MRT Line 1, with about 31km of extension), and within 500m from the road sides. A local consultant (Center for Biodiversity and Development, CBD) was entrusted to carry out the surveys.

3.10.2 Confirmation of current land use situation

Current land use situation in the survey area is summarized in Table 3.10.1. Residential land occupies 30.5% of total surface area. Besides, industrial land occupies 12.9%, and land for reforestation and agriculture occupies 11.1% of the total surface area. Details on the survey are summarized in a separate report titled “Survey on current natural and socio-economic conditions of the areas along the planned BRT route”.

Table 3.10.1 Current land use situation in the survey area

No.	Land use type	Area (ha)	Portion (%)
1	Residential Areas	1,028.65	30.50
2	Industrial Land	435.44	12.91
3	Planted forest/Vegetation	375.47	11.13
4	Bare land	354.94	10.52
5	Agriculture Land	317.37	9.41
6	Road	268.05	7.95
7	Planned Residential Land	157.53	4.67
8	Park Land	119.60	3.55
9	Quarry	56.34	1.67
10	Cemetery	47.38	1.40
11	Freight Yard	42.64	1.26
12	Education Land	29.37	0.87
13	Constructing Area	22.01	0.65
14	Lake	20.18	0.60
15	Martyrs 's Cemetery	18.29	0.54

No.	Land use type	Area (ha)	Portion (%)
16	Wetland	16.25	0.48
17	Sport Facilities	14.48	0.43
18	Aquaculture Land	12.64	0.37
19	Religious Land	9.96	0.30
20	Waterway	7.94	0.24
21	Constructing Road	6.20	0.18
22	Cultural Land	4.16	0.12
23	Wild Vegetation	2.97	0.09
24	Railway	2.11	0.06
25	Water Pipeline	1.32	0.04
26	Land for Health	0.99	0.03
27	Electricity Facilities	0.34	0.01
	Total	3,372.61	100.0

Data source: JICA Study Team

3.10.3 Confirmation of Current natural environment

Based on the review of existing documents, reports, etc., and on the field reconnaissance survey, the following items of current natural environment of the area are surveyed:

- Topographic characteristics, land elevation, etc.
- Meteorological data (rainfall, sunshine, evaporation, etc.)
- Drainage system / sewage system / river system
- Road network, road area ratio
- Green space/area, landscape
- Land use situation, residential condition, outline of ecosystem
- Landmarks, outstanding structures (market, school, hospital, government office, temple, church, relics, high voltage electric power cable, high voltage electric power pole, etc.)
- Housing development areas, industrial zones, and other larger-scaled development areas
- Environmentally sensitive structures / areas
- Data on air quality, noise, vibration, groundwater quality, surface water quality, etc.
- Flooding, drainage condition
- Others

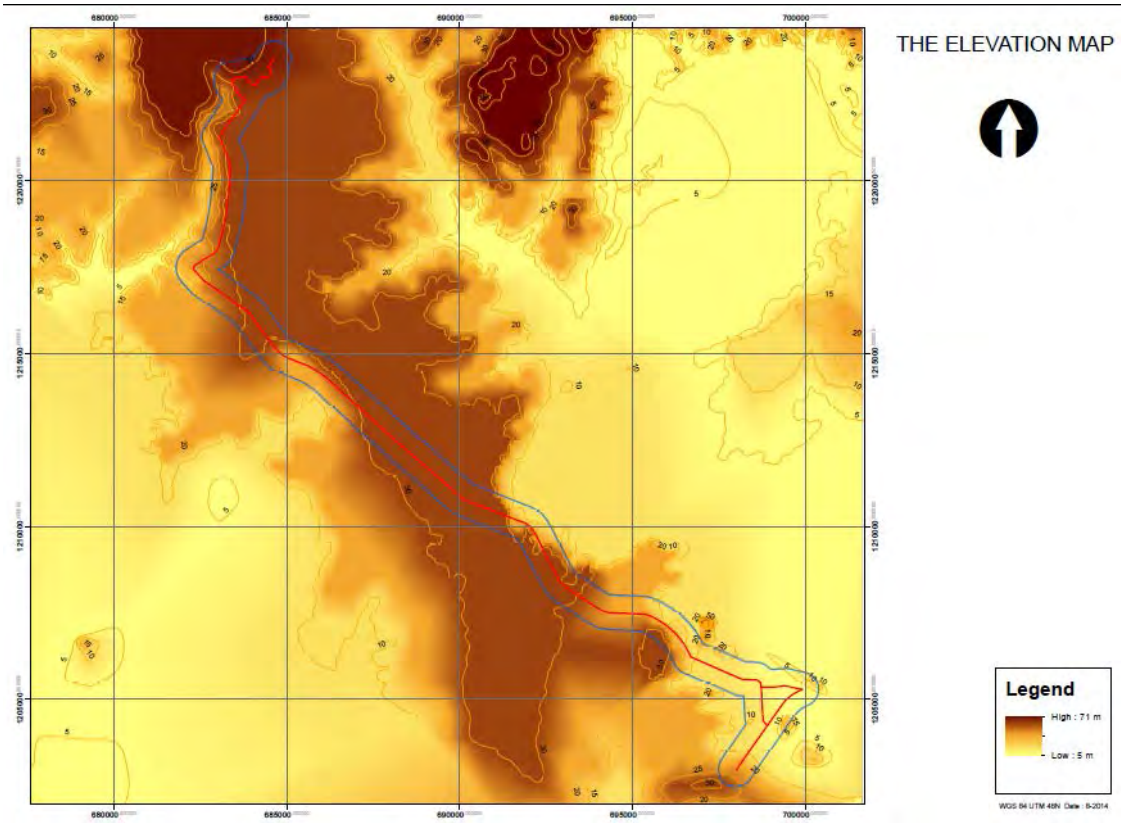
Result of the survey is summarized as following. Details on the survey are summarized in a separate report titled “Survey on current natural and socio-economic conditions of the areas along the planned BRT route”.

1) Topographic characteristics: The survey area can be divided into 3 sections depending on their topographic characteristics as followings.

- In the first section, from Suoi Tien Terminal Station to the starting point of My Phuoc – Tan Van Road, the elevation varies significantly. There are several sites on National Highway No.1 where the land is very low (elevation is +1m), but in the other sites, elevation changes from +2m to +37m. The average elevation in this section is +15.4m.
- In the second section, from the starting point of My Phuoc – Tan Van Road to the intersection with Pham Ngoc Thach Street (at the entrance to Binh Duong New City), the land is relatively high with elevation changes slowly from +13m (in the south-eastern site) to +36m (in the north-western

site). The average elevation in this section is +30.1m.

- In the third section, from My Phuoc – Tan Van Road to the planned BRT depot, the land is quite high, with elevation varies from +20m to +39m. The average elevation in this section is +31.3m.



Source: JICA Study Team

Figure 3.10.1 Elevation map of the survey area

2) Drainage system: In general, drainage systems are found in the newly-constructed residential areas. Besides, almost all industrial zones are equipped with wastewater treatment system. Rainwater flows into the small ditches and then into Sai Gon River or Dong Nai River.

3) Green lands, wetlands, etc.: Green lands in the survey area are found mainly in Binh Duong New City Park, Thu Dau Mot Golf Course, Cultural and Historic Park, and Martyrs Cemetery.

4) Ecosystem: The study area is almost urbanized and the natural environment became unsuitable for valuable animals/plants to inhabit.

5) Acoustic environment: The noise levels measured at all 12 sites along My Phuoc – Tan Van Road had already exceeded the maximum permitted noise level stated by the Vietnamese noise standard.

6) Ambient air: At several sites along My Phuoc – Tan Van Road, the measured concentrations of TSP and SO2 had already exceeded the maximum permitted levels stated by the Vietnamese ambient air standard.

Table 3.10.2 Noise levels and concentrations of pollutants in ambient air measured at the sites along My Phuoc – Tan Van Road

No.	Item	Noise level (dBA)			Concentration of pollutants in ambient air (µg/m^3)			
		L_{min}	L_{max}	L_{eqa}	TSP	CO	NO_2	SO_2
1	GS/348	65.1	84.5	74.3	230.73	3406	51.65	144.26
2	GS/349	51.0	80.2	72.2	247.87	4073	159.89	254.86
3	GS/350	60.1	93.9	80.2	616.28	187	33.03	224.4
4	GS/351	63.2	97.6	84.0	219.22	331	60.20	170.38
5	GS/352	72.2	96.4	83.1	250.69	296	39.34	165.38
6	GS/353	61.0	80.5	68.2	458.76	1670	166.9	334.58
7	GS/354	60.3	90.7	88.8	452.02	3001	125.23	365.37
8	GS/355	71.4	99.0	82.9	707.81	2193	66.95	207.23
9	GS/356	62.6	90.8	78.4	379.51	3948	37.08	248.83
10	GS/357	57.9	74.8	67.2	340.45	5820	65.64	458.65
11	GS/358	72.9	91.3	82.4	782.98	3931	68.69	452.7
12	GS/359	74.1	94.5	81.2	851.42	5000	54.87	417.42
	Permitted levels	55- 70 (1)			300(2)	30,000(2)	200(2)	350(2)

Source: EIA Report 2009, CERM

Note:

(1) QCVN 26:2010: Maximum permitted noise level - National Technical Regulation on Noise

(2) QCVN 05:2013/BTNMT: National Technical Regulation on ambient air quality

(3) Codes of surveyed sites :

GS/348: Intersection of MPTV Highway and Pham Ngoc Thach Street
GS/349: Hiep Thanh Residential area No. 3
GS/350: Intersection of MPTV Highway and Huynh Van Luy Street
GS/351: Intersection of MPTV Highway and Thu Khoa Huan Street
GS/352: Intersection of MPTV Highway and Road No. 743
GS/353: Intersection of MPTV Highway and Tao Luc Road No. 1
GS/354: Intersection at Thuan Giao Residential area
GS/355: An Phu Intersection
GS/356: Flyover at Tan Dong Hiep Ward
GS/357: Flyover at Dong An Residential area
GS/358: National Highway No. 1A
GS/359: End point of MPTV Highway

7) Flooding: There is no report on flood caused by high tide or heavy rain in the survey area.

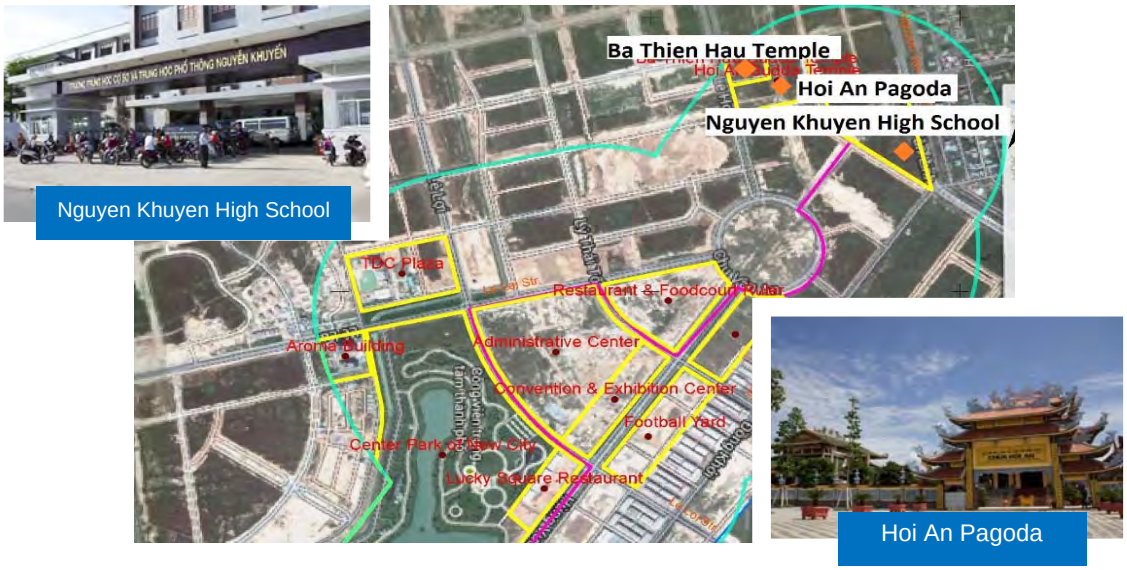
8) Outstanding facilities, environmentally sensitive spots: Identified outstanding facilities and environmentally sensitive spots are shown in Table 3.10.4. In particular, the sensitive spots found in the area within 100m from the road sides are shown in Figure 3.10.2 ~ Figure 3.10.5.

Table 3.10.3 Outstanding facilities, environmentally sensitive spots

Name	Distance from BRT road	Name	Distance from BRT road
Nguyen Khuyen High School;	200 m	Nam Binh Pagoda	Road edge
Hoi An Pagoda;	270 m	Tan Ninh Pagoda	50 m
Ba Thien Hau Temple;	400 m	Tan Dong Hiep High School	440 m
Petrus Ky High School	330 m	Tan Dong Hiep primary School	430 m
Thu Dau Mot Vocational School	300 m	Tan An Temple	80 m

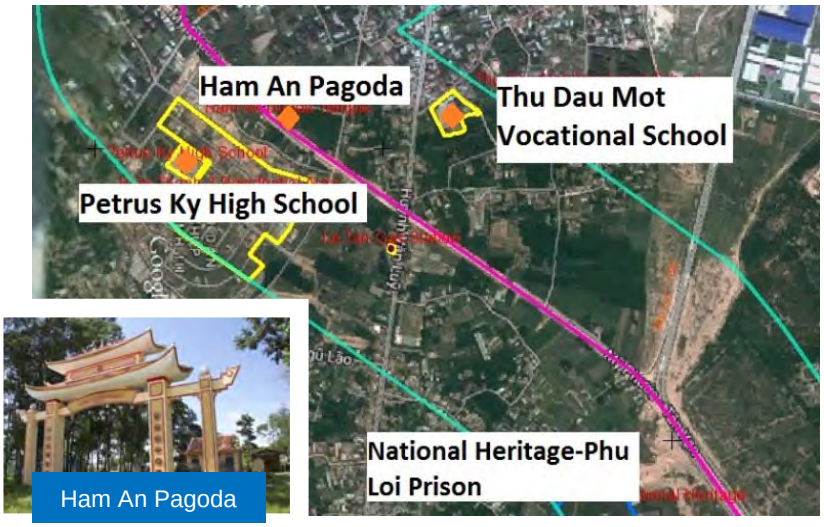
Name	Distance from BRT road	Name	Distance from BRT road
National Heritage-Phu Loi Prison	400 m	Doan Thi Diem Primary School	Road edge
Ham An Pagoda	Road edge	Binh An Secondary School	320 m
Phu Hoa 2 Primary School	500 m	Ngai Thang Pagoda	200 m
Hoang Dieu Preschool	400 m	Nghia Son Church	360 m
An Phu Primary School	150 m	Xa loi Pagoda	220 m
Tan Binh High School	370 m	Dormitory of VNU-HCM	450 m
Phuoc Dong Tu Pagoda	140 m	Hung Kings Temple	300 m
An Nhon Temple	80 m	Cao Thai Church	410 m

Source: JICA Study Team



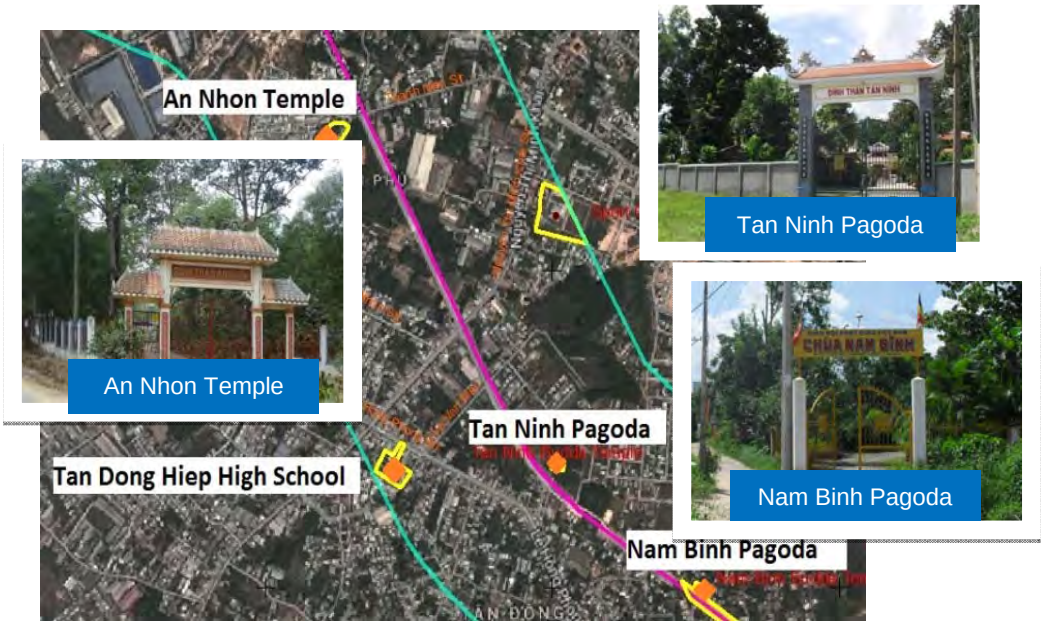
Source: JICA Study Team

Figure 3.10.2 Outstanding facilities, environmentally sensitive spots (1/4)



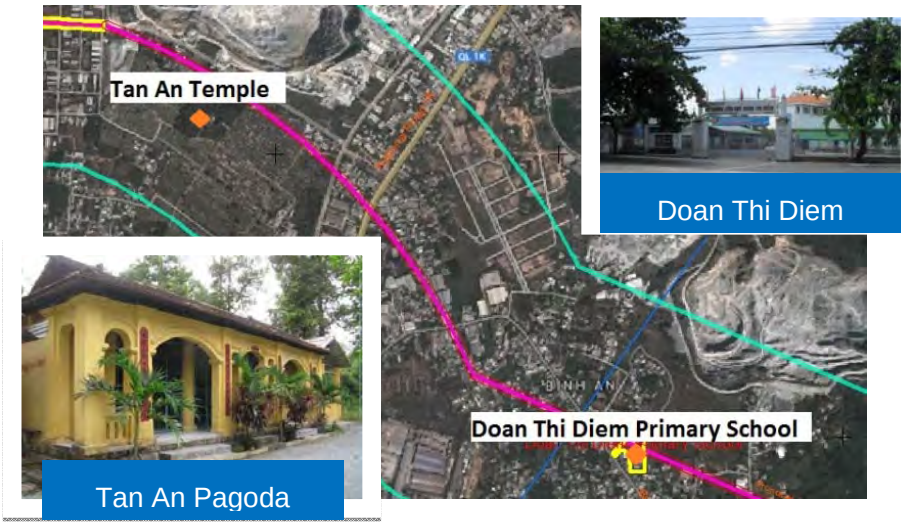
Source: JICA Study Team

Figure 3.10.3 Outstanding facilities, environmentally sensitive spots (2/4)



Source: JICA Study Team

Figure 3.10.4 Outstanding facilities, environmentally sensitive spots (3/4)



Source: JICA Study Team

Figure 3.10.5 Outstanding facilities, environmentally sensitive spots (4/4)

3.10.4 Confirmation of Current socio-economic condition

The current socio-economic condition of the communes identified along the BRT route was surveyed. Collected information on socio-economic condition of the communes include the followings:

- - Population density
- - Commune demography (population, number of households, household size, HH income, etc.)

- - HH living condition (electric, piped water, toilet, sewage, internet, etc.)
- - Major economic activities, occupations, means of livelihood
- - Other outstanding characteristics of the areas/communes.

Result of the survey is summarized as following.

Table 3.10.4 Current socio-economic condition of the target communes

District	Ward	Perman-ent resident (Person)	Number of HH (HH)	Popula-tion density (person /km²)	Poverty/ Close to poverty[1] (HH)	Economic structure		
						Industry - construction (%)	Trade-service (%)	Agriculture-Forestry (%)
Thu Dau Mot	Hoa Phu	4,473	1,114	17	06/15	55.0	45.0	0.0
	Phu My	12,744	3,441		68/53	32.0	63.0	5.0
	Hiep Thanh	18,813	5,137		54/134	12.5	87.4	0.1
	Phu Loi	36,928	7,466	259	199/144	27.0	72.0	1.0
	Phu Hoa	19,201	4,860	2914	34/64	23.0	76.0	1.0
Thuan An	Thuan Giao	10,592	2,571	923	12/69	50.3	29.7	20.0
	Binh Chuan	16,156	3,818	1416	60/43	70.6	29.4	0.0
	An Phu	65,098[2]	3,468[2]	5967[2]	31/19	60.0	30.0	10.0
Di An	Tan Binh	45,000	5,540	4344	51/126	60.0	30.0	10.0
	Tan Dong Hiep	48,257	13,636	3417	33/66	89.9	9.7	0.4
	Binh An	26,214	4,075	435	52/35	40.0	50.0	10.0
	Binh Thang	13,616	1,979	2490	11/20	35.0	65.0	0.0
	Dong Hoa	55,484	7,903	5407	31/22	20.0	40.0	40.0
District 9	Long Binh	18,231	4,884	859	84/377	-	-	-

Source: JICA Study Team (based on data provided by the commune PCs)

Table 3.10.5 Summarized socio-economic characteristics of the target communes

Communes	Summarized socio-economic characteristics
1) Hoa Phu	Binh Duong New City is a part of this commune. The road network is well developed with many wide roads. Population density is low. Residential areas are widely dispersed. Large scale industrial zones include VSIP (119 factories), Dong An II (22 factories). Besides, the province administrative office building, the TDC Plaza, the Sora Tower are well known in the locality.
2) Phu My	A large part of the commune territory is located along Huynh Ngoc Luy Street and Pham Ngoc Thach Street (under construction). Outstanding facilities include: the Vietnam-Korean Vocational College, Phu My Sport Center, Dai Dang Industrial Zone, Song Than Industrial Zone.
3) Hiep Thanh	The north-western area of the commune is adjacent to BRT route. Outstanding facilities include Hiep Thanh III Residential Area, Hiep Thanh III Apartment (10 stories high) .
4) Phu Loi	The national historical relic namely “Phu Loi Prison”, Dai Dang Industrial Zone (275ha, 39 factories), Phu Hoa Residential Area are well known in the locality.
5) Phu Hoa	Shija Vietnam Company, Thu Dau Mot University are outstanding in the commune. It is said that among households affected by the My Phuoc-Tan Van Road Development Project, 18 households are now still refusing to relocate.
6) Thuan Giao	Outstanding spots include: Viet Huong Industrial Zone (50 factories), Vietnam-Singapore Industrial Zone (140 factories), Thuan Giao Residential Area (4 ha), and several large-scaled super markets.
7) Binh Chuan	The commune is well known with Binh Chuan Residential Zone (in the North of My Phuoc-Tan Van Road), Binh Thanh Company, Hai My Market, etc.
8) An Phu	The commune lays in the North-South direction along Provincial Road No. 743. Population density is quite high (5,967 persons/km^2). Outstanding spots include: Tan Binh Industrial Zone, Viet-Sing Industrial Zone, Viet-Sing Residential Area, An Phu Residential Area, An Phu Bus Terminal, Binh Duong Water Treatment Facility, etc.
9) Tan Binh	Population is fairly high (4000 persons/km^2). The commune is well known with many industrial zones, such as Tan Phuoc Industrial Zone, Biconsi Industrial Zone, etc.

Communes	Summarized socio-economic characteristics
10) Tan Hiep Dong	A part of the commune territory is crossed by the national railway. Tan Dong Hiep A Industrial Zone (53ha) and Tan Dong Hiep B Industrial Zone (163ha) are working places of about 30,000 persons. There is a large quarry in the western part of the commune.
11) Binh An	There is a large quarry in the northern part of the commune. Population density is quite low (435 pers/km^2). The outstanding National Agriculture College is located in the South of the commune.
12) Binh Thanh, 13) Dong Hoa	National Highway No.1, Tan Van Bus Terminal, Binh An Garment Factory, and the Cultural and Historical Park are located in the South-West of the communes.
14) Long Binh	The commune is bordered with National Highway No.1 and the Martyrs Cemetery in the North-West, and Dong Nai River in the East.

Source: JICA Study Team

3.10.5 Due diligence review of involuntary resettlement

Main infrastructure planned in this project includes: (1) a BRT bus depot planned in Binh Duong New City, (2) a number of flyovers planned in major road intersections, (3) a number of bus stops planned along the bus route, (4) a short-cut road connecting Mp-Tv Road with NH No,1 and STT Station.

Additional land acquisition for the planned flyovers and bus stops is not required, because these facilities are planned within the ROW of Mp-Tv Road.

Besides, the construction of the short-cut-road is planned under the Mp-Tv Road Construction Project and the NH No.1 Widening Project. This short-cut-road is being constructed as a part of Mp-Tv Road, regardless of whether the BRT project will be implemented or not. Therefore, the construction of this short-cut-road is considered not inseparably related with the BRT Project.

Land for the planned BRT bus depot is a part of land that had been acquired under the Binh Duong New City Development Project. However, because this land lot is to be converted from other land use purpose to land used for bus depot, then it needs to carry out the due diligence review of land acquisition, compensation, and resettlement. Result of the due diligence review is summarized as following. Details on the review are summarized in a separate report titled “Due Diligence Review of involuntary resettlement for the land lot proposed for the BRT depot in Binh Duong New City”.

The BRT bus depot is planned in a land lot (with 24,000 m2 of surface area) located in the North of Binh Duong New City. This land lot is a part of the land affected by the Binh Duong Industrial – Service and Residential Complex (the BD Complex) Development Project. The process to acquire land for the BD Complex Development Project had been started in 2003 and ended in 2010. The project required acquisition of 4,196 ha of land. About 7,000 households (30,000 persons) were affected, of which 6,200 households had been forced to relocate to other places.

The due diligence review of involuntary resettlement for the BRT depot was carried out in this PPP F/S in line of JICA Environmental Guidelines. The review has aim to confirm if the process of compensation payment, provision of supports, resettlement of people affected by land acquisition for the planned BRT depot meets JICA Environmental Guidelines. Result of the review is summarized as following.

(1) Scale of land acquisition, resettlement

Figure 3.10.6 shows a satellite image (Google Earth Pro) taken in 2004 of the land lot proposed for the BRT depot. From this satellite image, the Study Team identified 3 houses built in the land lot. With cooperation from Binh Duong Province PC’s staff in charge of land acquisition for the Binh Duong Complex Development Project, the Study Team found out 3 households who had lived in this land lot until 2004, and carried out an interview survey to these households.

Source: JICA Study Team (Google Earth Pro)

Figure 3.10.6 Houses and lands identified from the satellite image taken in 2004

Based on result of the interview survey to these three households, the compensation supports, and resettlement implemented at the time being is as following.

Table 3.10.6 Performance of compensation and resettlement for the three households who had lived in the land lot proposed for the BRT depot until 2004

No.	Name of head of HH	Affected land	Performance of compensation and resettlement
1	Do Van Tri	Residential land: 300 m^2 Agricultural land: 6 ha	Received 1 land lot (300m^2) in the resettlement site. Received 6 land lots (1800m^2) in the resettlement site as compensation to affected agricultural land. Now, cultivating rubber tree and pepper in Binh Phuoc Province (70 km from the house).
2	Nguyen Van Muoi	Residential land: 300 m^2 Agricultural land: 480 m^2	Received 1 land lot (300m^2) in the resettlement site. Received cash as compensation to affected agricultural land. Now, cultivating rubber tree and pepper in Binh Phuoc Province (70 km from the house).
3	Nguyen Van My	Residential land: 400 m^2 Agricultural land: 9000 m^2	Received 1 land lot (300m^2) in the resettlement site. Received cash as compensation to affected agricultural land. Now, running an apartment-for-rent near the house

Source: JICA Study Team

And the living condition of these three households before and after resettlement is as following.

Table 3.10.7 Living condition before and after resettlement of the three households who had lived in the land lot proposed for the BRT depot untill 2004

No.	Name of head of HH	Living condition before resettlement	Living condition after resettlement
1	Do Van Tri	Farmer (cultivated rubber tree and pepper near home).	Farmer (cultivating rubber tree and pepper far away from home).

		Income: ~20 mil VND/month. HH member: 7 pers.	Income: ~90 mil VND/month. HH member: 7 pers.
2	Nguyen Van Muoi	Farmer (cultivated rubber tree and pepper near home). Income: ~7 mil VND/month. HH member: 6 pers.	Farmer (cultivating rubber tree and pepper far away from home). Income: ~7 mil VND/month. HH member: 5 persons (one daughter got married and is living separately).
3	Nguyen Van My	Farmer (cultivated rubber tree near home). Income: ~12 mil VND/month. HH member: 5 pers.	Income is mainly from running an apartment-for-rent. Income: 12 mil VND/month (became more stable than before). HH member: 5 pers.

Source: JICA Study Team

In order to collect more information about the implementation process of land acquisition and resettlement for the Binh Duong Complex Development Project, in addition to 3 affected households who had lived in the land lot proposed for the BRT depot until 2004, the Study Team also carried out interview to other 5 affected households who had lived near the land lot. Following table summarizes the result of the interview to these 8 households.

Table 3.10.8 Summary of the result of the due diligence review of involuntary resettlement for the land lot proposed for the BRT depot

No.	Item	Result of review	Evaluation
1	Efforts to avoid/ minimize social impacts	Among affected 3 HHs, 1 HH has significantly improved living standard and livelihood, other 2 HHs have livelihood improved in some extent. There is no complaint from interviewed HHs on the implementation of compensation and resettlement. Based on the confirmation on the field, it can say that living condition of affected HHs is significantly improved after resettlement.	It is difficult to verify the implementing process of compensation, supports, and resettlement that had been done more than 10 year ago. However, based on the result of interview to affected HHs, it can conclude that agencies in charge of resettlement had paid great effort to carry out the due compensation and help affected HHs in resettlement.
2	Preparation of RAP	RAP had not been prepared. The New Law on Land was ratified by the National Assembly at the end of 2003, but resettlement for this project was started in June 2003.	The New Law on Land 2003 and its relevant regulations were not applied. However, Binh Duong Province PC's policies on compensation and resettlement were generally relevant.
3	Eligibility for receiving compensation, supports, etc.	All interviewed HHs said that entitlement for compensation, supports and resettlement was properly defined, and compensation was duly implemented. The project owner had developed a number of resettlement sites and allocated appropriate land to affected HHs. A part of affected HHs had fully used these allocated land lots to improve their livelihood.	In general, inventory of loss, definition of entitlement for compensation, calculation of compensation amount, etc. were properly implemented. There is not significant discrepancy in comparison with Vietnamese regulations and JICA Environmental Guidelines.
4	Assistances to affected people for livelihood restoration	Affected people received a land lot of 300m^2 in the resettlement site as compensation to each 1 ha of affected agricultural land. Some got new means of livelihood by selling these land lot(s) when the land price rose up and investing to rubber tree plantation or running apartment-for-rent. Besides, the local authorities has carried out many free training courses on orchid planting, cricket breeding, ornamental tree planting, etc. Local companies were requested to give priority for affected people to work in the company.	Large-scaled resettlement sites were developed, and affected people were compensated with relatively large land lots in these resettlement sites. A part of affected people could use these land lots for restoring their livelihood. Besides, there are many industrial zones around the Binh Duong New City those can provide working place for affected people.
5	Grievance redress mechanism	District Compensation Committee was not established. All complaints on compensation, resettlement, etc. were received and redressed by	There was no complaint raised by the 3 households who had lived in the land lot proposed for the BRT depot. It is said that

No.	Item	Result of review	Evaluation
		the Project Implementation Steering Committee (established under Binh Duong Province PC).	all complaints raised by other affected people had been completely redressed at the time of due diligence review.
6	Considerations to socially vulnerable groups	Households recognized as "family to be supported by the social welfare policy" are provided with an allowance in cash.	There is no recorded problem on the considerations to socially vulnerable groups.
7	Consultation with affected people	Meetings to explain to affected people about the project plan and policies on compensation and resettlement had been organized many times. However, it is unable to collect the records of these meetings.	It is unable to verify the process of consultation with affected people.
8	Monitoring	Plan to monitor the performance of compensation payment, provision of supports, living condition and livelihood of affected people after resettlement, etc. has not been prepared. There is no agency responsible for monitoring the RAP implementation.	Monitoring system has not been established.

Source: JICA Study Team

3.10.6 Vietnam legal framework on environmental impact assessment

(1) Laws and regulations on environmental protection

Following table lists up main laws and regulations on environmental protection in Vietnam.

Table 3.10.9 Main laws and regulations on environmental protection

Date	Code/Number	Title
2000/08/08	Circular No. 10/2000/TT-BXD	Guiding the formulation of EIA report for a construction project
2002/06/26	Decision No. 82/2002/QD-TTg	Establishment, Mandate and Operations of the Vietnam Environment Protection Fund
2002/07/16	Decision No. 53/2002/QD-KHCNMT	Promulgating the Organization and Operation Charter of Vietnam Environmental Protection Fund (expired)
2002/08/09	Decision No. 62/2002/QD-BKHCNMT	Promulgating the Regulation on the Protection of the Environment in Industrial Parks
2002/11/11	Decree No. 91/2002/ND-CP	Prescribing the Functions, Tasks, Powers and Organizational Structure of the Ministry of Natural Resources and Environment
2003/04/02	Decision No. 45/QD-TTg	Establishment of provincial Department of Natural Resources and Environment.
2003/05/08	Decision No. 600/2003/QD-BTNMT	Specifying mandates, responsibilities; powers and organizational structure of the Department of Water Resources Management
2003/06/23	Decision No. 782/2003/QD-BTNMT	Promulgating the Charter on organization and operation of Vietnam Environment Protection Fund
2005/12/12	Order No. 29/2005/L-CTN	Law on Environmental Protection
2005/12/12	Decision No. 328/2005/QD-TTg	Approving the state plan on environmental pollution control till 2010
2006/06/23	Decree No. 65/2006/ND-CP	Organization and Operation of the Natural Resources and Environment Inspectorate
2006/08/09	**Decree No. 80/2006/ND-CP**	**Providing detailed guidelines for Implementation of a Number of Articles of the Law on Environmental Protection** (Note *)
2006/08/09	Decree No. 81/2006/ND-CP	Sanctioning of Administrative Violation in the Domain of Environmental Protection
2006/09/08	Circular No. 13/2006/TT-BTNMT	Stipulation of organizations and operation of the assessment board for reports on Strategic Environmental Assessment (SEA) and EIA

Date	Code/Number	Title
2006/09/09	Circular No. 08/2006/TT-BTNMT	Guiding the preparation of Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment
2006/11/22	Decree No. 140/2006/ND-CP	Providing for the Environmental Protection at Stages of Elaboration, Evaluation, Approval and Implementation of Development Strategies, Planning, Plans, Programs and Projects
2007/08/27	Circular No. 06/TT-BKH	On environmental protection in appraising and approving programs and projects
2007/08/27	Decision No. 1281/QD-BTNMT	Authorizing directors of departments to review and approve the EIA reports
2007/11/26	Decision No. 19/2007/QD-BTNMT	Promulgating the Regulation on the conditions for and provision of the service of appraising environmental impact assessment reports
2008/02/28	**Decree No. 21/2008/ND-CP**	**Amending and supplementing a number of articles of the Government's Decree No. 80/2006/ND-CP of August 9, 2006, detailing and guiding the implementation of a number of articles of the Law on Environmental Protection** (Note *)
2008/07/15	Circular No. 03/2008/TTLT-BTNMT - BNV	Guiding the functions, tasks, powers and organizations of the natural resources and environment related specialized units under the people's committees at all levels
2008/09/15	Decree No. 102/2008/ND-CP	On the collection, management, exploitation and use of natural resources and environmental data
2008/09/18	Circular No. 04/2008/TT-BTNMT	Guiding the formulation and approval or certification of environmental protection schemes and the examination and inspection of implementation of environmental protection schemes
2008/09/30	Decision No. 132/2008/QD-TTg	On function, tasks, responsibilities, and organization structure of Vietnam Environmental Protection Administration under MONRE
2008.12.08	Circular No. 05/2008/TT-BTNMT	Replace Circular 08/2006/TT-BTNMT on Guiding the preparation of Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment
2009.11.16	Circular No. 25/2009/TT-BTNMT	On the promulgation of National Technical Regulations on Environment.
	Circular No. 39/2010/TT-BTNMT	National Technical Regulations on Environment.
	Circular No. 09/2010/TT-BTNMT	On environmental protection in developing transport infrastructure
2010/03/18	Circular No. 08/2010/TT-BTNMT	Stipulation on the preparation of national environmental report, sectorial environmental situation report, and provincial environmental status report
2010/04/06	Circular No. 09/2010/TT-BGTVT	Stipulation on environmental protection for transportation infrastructure development projects
2011.04.14	Circular No. 12/2011/TT-BTNMT	On management codes of harmful wastes
2011/04/18	Decree No. 29/2011/ND-CP	Stipulation on strategic environmental assessment (SEA), environmental impact assessment (EIA), and environmental protection commitment (EPC) (Replaced by Decree 18/2015/ND-CP)
2011/07/18	**Circular No. 26/2011/TT-BTNMT**	**Guiding in detail numbers of articles of Decree No. 29/2011/ND-CP dated 18 April 2011 on strategic environmental assessment (SEA), environmental impact assessment (EIA) and environment protection commitment (EPC). (Note *)**
2012/03/16	Circular No. 01/2012/TT-BTNMT Replaces Circular No. 04/2008/TT-BTNMT	Regulation on setting-up, assessment, approval, inspection and certification of the implementation of detailed environmental protection project; setting-up and registration of simple environmental protection project
2013/11/14	Decree No. 179/2013/ND-CP	Decree on the sanction of administrative violations in the domain of environmental protection
2014/03/25	Decision No.25/2014/QD-TTg	Stipulation on function, responsibility, right, and organization structure of Vietnam Environmental Administration (VEA)
2014/04/29	Decree No.	Amending and supplementing a number of articles of the Government's

Date	Code/Number	Title
	35/2014/ND-CP (will come into effect on 15 June 2014)	Decree No. 29/2011/ND-CP of stipulation on strategic environmental assessment (SEA), environmental impact assessment (EIA), and environmental protection commitment (EPC). (Replaced by Decree 18/2015/ND-CP))
2014/05/05	Circular No. 22/2014/TT-BTNMT	Providing regulations and guidelines on the implementation of Decree No. 35/2014/ND-CP dated 29 April 2014 amending and supplementing a number of articles of Decree No.29/2011/ND-CP dated 18 April 2011 providing for the strategic environmental assessments, environmental impact assessments and environmental protection commitments
2014/06/23	**Law No.55/2014/QH13**	**Law on Environmental Protection (2nd revision) (Note*)**
2014/08/28	Circular No.50/2014/TTLT-BTNMT-BNV	On function, responsibility, right, and organization structure of agency in charge of natural resources and environment in provinces, cities, districts.
2015/01/06	Decree No.03/2015/ND-CP	Stipulations on confirmation of damages to environment
2015/02/14	**Decree No.18/2015/ND-CP**	**Stipulations on environmental protection master plan, strategic environmental assessment, environmental impact assessment, and environmental protection plan. (Note *)**
2015/02/14	**Decree No.19/2015/ND-CP**	**Stipulations on the implementation of several articles of Environmental Protection Law. (Note *)**

Note: Important law or regulation relating to the preparation of environmental impact assessment (EIA) of this Project*

Source: JICA Study Team

Table 3.10.10 Main laws and regulations on regarding drainage

Date	Code/Number	Title
1999/07/16	Decision No. 155/1999/QD-TTg	Issuing Regulation of hazardous waste management
2003/06/13	Decree No. 67/2003/ND-CP	Environmental protection fees imposed on wastewater
2004/07/27	Decree No. 149/2004/ND-CP	Regulating the probing, extraction and use of water resources, and discharge of wastewater to water sources
2005/06/24	Circular No. 02/2005/TT-BTNMT	Guiding implementation of Decree 149/2004/ND-CP
2007/01/08	Decree No. 04/2007/ND-CP	Amending and supplementing a number of articles of Decree 67/2003/ND-CP dated 13/06/2003 on environmental protection fees imposed on wastewater
2007/05/28	Decree No. 88/2007/ND-CP	Wastewater Disposal for Urban Areas and Industrial Zones

Source: JICA Study Team

Table 3.10.11 Main laws and regulations regarding solid waste

Date	Code/Number	Title
1999/07/10	Decision No. 152/1999/QD-TTg	Ratifying the Strategy For Management of Solid Waste in Vietnamese Cities and Industrial Parks till the Year 2020
2005/06/21	Directive 23/2005/CT-TTg	Enhancing the Management of Solid Wastes in Urban Centers and Industrial Parks
2006/12/26	Decision No. 23/2006/QD-BTNMT	Issuance of list of hazardous wastes
2007/04/09	Decree No. 59/2007/ND-CP	Solid Waste Management (including management of hazardous wastes)
2007/12/31	Circular No. 13/2007/TT-BXD	Guiding a Number of Articles of the Government's Decree No. 59/2007/ND-CP of April 9, 2007, on Solid Waste Management
2008/10/06	Decision No. 1440/2008/QD-TTg	Approving the planning on construction of solid waste treatment facilities in three northern, central and southern key economic regions up to 2020

Source: JICA Study Team

Table 3.10.12 Main laws and regulations onclimate change

Date	Code/Number	Title
2007/04/06	Decision No. 47/2007/QD-TT	Approving the Plan on organization of the implementation of the Kyoto Protocol under the United Nations Framework Convention on Climate Change in the 2007-2010 period
2007/07/04	Decision No. 1016/QD-BTNMT	Establishing a Steering Committee to implement United Nations Frame Convention on Climate Change and Kyoto Protocol
2009/02/09	Decision No. 142/QD-BTNMT	Establishment of the Office on National Target Program to Respond to Climate Change
2009/04/20	Decision No. 743/QD-BTNMT	Establishing the steering committee of UNFCCC and Kyoto Protocol

Source: JICA Study Team

Besides, the Government of Vietnam has joined 32 international environmental conventions/ agreements/ treaties, and is reviewing the plan to join other 6 ones (refer to the document "Register of International Treaties and Other Agreements in the Field of the Environment", published by UNEP in 2005, and website of Vietnam Environmental Protection Agency). Following table lists main international conventions/ agreements/ treaties relating to environmental protection which Vietnam has engaged.

Table 3.10.13 List of international environmental conventions/agreements/treaties which Vietnam engaged to

No	Name	Effective Date in Vietnam	Management Body
1.	Cartagena Protocol on Bio-safety	2004 Ac	VEPA, MONRE
2.	Kyoto Protocol on Climate Change	2002 R	GDMH, MONRE
3.	Stockholm Convention on Persistent Organic Pollutants (POPs)	05/2001 R	VEPA, MONRE
4.	UN's International Declaration on Cleaner Production	22/9/1999	MPI
5.	UN Convention to Combat Desertification	23/11/1998 Ac	MARD
6.	Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and their Disposal	13/03/1995 Ac	VEPA, MONRE
7.	Agreement on Cooperation for the Sustainable Development of the Mekong River Basin	1995 S	MFA
8.	United Nations Convention on the Law of the Sea (UNCLOS)	25/07/1994 R	MFA
9.	Vienna convention for the protection of the ozone layer including the Montreal Protocol on Substances that Deplete the Ozone Layer	26/01/94 Ac	GDMH
10.	United Nations framework Convention on Climate Change	16/11/1994 R	MONRE
11.	Convention on Biological Diversity (CBD)	16/11/1994 R	VEPA, MONRE
12.	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	20/01/1994 R	MARD
13.	MARPOL International Convention for the Prevention of Pollution from Ships	29/08/1991 S	VNMB, MOT
14.	Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar)	20/9/1988	MONRE, MARD
15.	Convention Concerning the Protection of the World Cultural and Natural Heritage	10/10/1987 At	MOCI
16.	Convention on the Conservation of Migratory Species of Wild Animals (CMS)	Under discussion	
17.	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction	1998 R	NP
18.	Agreement on the Network of Aquaculture Centers in Asia and the Pacific	1989	MONRE
19.	Agreement for the Establishment of the Asia-Pacific Fishery Commission	1995 At	MOF

No	Name	Effective Date in Vietnam	Management Body
20.	Agreement on the Conservation of Nature and Natural Resources	Under discussion	

Legend: GDMH:General Department of Meteorology and Hydrology, MOF: Ministry of Fishery, VNMB: Vietnam Marine Bureau, MFA: Ministry of Foreign Affairs, MOT: Ministry of Trade, MONRE: Ministry of Natural Resources and Environment, MARD: Ministry of Agriculture and Rural Development, MPI: Ministry of Planning and Investment, MOH: Ministry of Health, MOST: Ministry of Sciences and Technologies, MOT: Ministry of Transportation, MOCI: Ministry of Culture and Information, now is the Ministry of Culture, Sport and Tourism. NP: National President
S: Signed, R: Ratification, At: Accepted, Ap: Approval, Ac: Accession
Source: JICA Study Team

(2) Law on Environmental Protection

In Vietnam, the Law on Environmental Protection (LEP) is the umbrella law and the most comprehensive legal base relating to environmental protection. Its first version was approved in 1993, and amended first time in 2005 and second time in 2014. The Law on Environmental Protection amended in 2014 (hereinafter referred to as "the 2014-amended-LEP") was passed on June 23, 2014 by the XIIIth National Assembly (with the Law Code 55/2014/QH13), and became effective since January 1st, 2015. Table 3.9.11 shows the content of the 2014-emended-LEP.

Table 3.10.14 Content of the 2014-amended-LEP
(ratified on June 23, 2014 at the 8th National Assembly, 7th session)

Chapter I : GENERAL PROVISIONS	
Article 1.	Governing scope
Article 2.	Applicable entities
Article 3.	Interpretation of terms
Article 4.	Principles of environmental protection
Article 5.	Regulatory policies on the environmental protection
Article 6.	Course of actions that are advised to take to protect the environment
Article 7.	Prohibited acts
Chapter II : PLANNING FOR ENVIRONMENTAL PROTECTION, STRATEGIC ENVIRONMENT ASSESSMENT, ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL PROTECTION PLAN	
Section 1. PLANNING FOR ENVIRONMENTAL PROTECTION	
Article 8.	Principle, level and term of the planning for environmental protection
Article 9.	Basic contents of the planning for environmental protection
Article 10.	Responsibility for preparing the planning for environmental protection
Article 11.	Consultation on, inspection and approval of the planning for environmental protection
Article 12.	Review and modification of the planning for environmental protection
Section 2. STRATEGIC ENVIRONMENT ASSESSMENT	
Article 13.	Strategic environment assessment objects
Article 14.	Carrying out the strategic environment assessment
Article 15.	Main subject-matters of the report on strategic environment assessment
Article 16.	Verification of the report on strategic environment assessment
Article 17.	Receiving the verification comments and reporting the conclusive result of verification of the report on the strategic environment assessment
Section 3. ENVIRONMENTAL IMPACT ASSESSMENT	
Article 18.	Environmental impact assessment objects
Article 19.	Carrying out the environment impact assessment
Article 20.	Remaking the report on the environment impact assessment
Article 21.	Consultation to be required in the process of the strategic environment assessment
Article 22.	Main subject-matters of the report on environmental impact assessment
Article 23.	Authority to appraise the report on environmental impact assessment
Article 24.	Appraisal of the report on environmental impact assessment
Article 25.	Approval of the report on the environmental impact assessment
Article 26.	Responsibility assumed by the project owner after being granted the approval of their report on the environmental impact assessment
Article 27.	Responsibility assumed by the project owner before bringing the project into operation.
Article 28.	Responsibility of the agency in charge of approving the report on the environmental impact assessment
Section 4. ENVIRONMENTAL PROTECTION PLAN	
Article 29.	Objects that require the formulation of environmental protection plan

Article 30.	Subject-matters of the environmental protection plan
Article 31.	Time of registration and certification of the environmental protection plan
Article 32.	Responsibility for confirmation of the environmental protection plan
Article 33.	Responsibility assumed by the project owner and owner of manufacturing or business establishment upon completion of certification of the environmental protection plan
Article 34.	Responsibility of the agency in charge of certifying the environmental protection plan
Chapter III : ENVIRONMENTAL PROTECTION CONCERNS DURING THE EXTRACTION AND UTILIZATION OF NATURAL RESOURCES	
Article 35.	Environmental protection concerns during the inspection, assessment and preparation of the planning for utilization of natural resources and biodiversity
Article 36.	Protection and sustainable development of forest resources
Article 37.	Environmental protection concerns during the basic survey, exploration, extraction and utilization of natural resources
Article 38.	Environmental protection concerns during the exploration, extraction and processing of minerals
Chapter IV : RESPONSE TO CLIMATE CHANGE	
Article 39.	General provisions on the response to climate change
Article 40.	Integration of main contents of responses to climate change with the strategy, planning and proposal for socio-economic development
Article 41.	Management of greenhouse gas emissions
Article 42.	Management of ozone-depleting substances
Article 43.	Renewable energy development
Article 44.	Eco-friendly production and consumption
Article 45.	Waste-to-energy process
Article 46.	Rights and responsibilities of the human community for the response to climate change
Article 47.	Development and application of technological and scientific advances for the response to climate change
Article 48.	International cooperation in the response to climate change
Chapter V : PROTECTION OF MARINE AND ISLAND ENVIRONMENT	
Article 49.	General provisions on the protection of marine and island environment
Article 50.	Controlling and processing of marine and island environment pollution
Article 51.	Prevention of and response to marine and island environmental emergencies
Chapter VI : ENVIRONMENTAL PROTECTION FOR WATER, LAND AND AIR	
Section 1. ENVIRONMENTAL PROTECTION FOR RIVER WATER	
Article 52.	General provisions on the environmental protection for river water
Article 53.	Processes for monitoring and controlling the river-water environmental pollution
Article 54.	Responsibility of provincial People's Committees for the environmental protection for water derived from provincial rivers
Article 55.	Responsibility of the Ministry of Natural Resources and Environment for the river-water environmental protection
Section 2. ENVIRONMENTAL PROTECTION FOR OTHER SOURCES OF WATER	
Article 56.	Environmental protection for lake, pond, canal and ditch water
Article 57.	Environmental protection for water reservoirs or lakes for the purpose of irrigation and hydropower
Article 58.	Environmental protection for underground water
Section 3. PROTECTION OF LAND ENVIRONMENT	
Article 59.	General provisions on the environmental protection for land
Article 60.	Management of land environmental quality
Article 61.	Controlling of land environmental pollution
Section 4. PROTECTION OF AIR ENVIRONMENT	
Article 62.	General provisions on the aerial environment protection
Article 63.	Management of aerial environment quality
Article 64.	Controlling of aerial environment pollution
Chapter VII : ENVIRONMENTAL PROTECTION IN MANUFACTURING, TRADING, AND SERVICE PROVISION	
Article 65.	Environmental protection in economic zones
Article 66.	Environmental protection in industrial parks, export-processing zones, and hi-tech zones
Article 67.	Environmental protection in industrial complexes and concentrated business zones
Article 68.	Environmental protection in manufacturing and business establishments
Article 69.	Environmental protection in agricultural production
Article 70.	Environmental protection in trade villages
Article 71.	Environmental protection in aquaculture
Article 72.	Environmental protection in hospitals and medical facilities
Article 73.	Environmental protection in construction
Article 74.	Environmental protection in transport
Article 75.	Environmental protection in goods import and transit
Article 76.	Environmental protection during import of scrap
Article 77.	Environmental protection during festivals and in the tourism industry

Article 78.	Environmental protection with regard to chemicals, pesticides, and veterinary medicines
Article 79.	Environmental protection by research institutes and laboratories
Chapter VIII : ENVIRONMENTAL PROTECTION IN URBAN AREAS AND RESIDENTIAL AREAS	
Article 80.	Environmental protection requirements applied to urban areas and residential areas
Article 81.	Environmental protection in public places
Article 82.	Environmental protection requirements applied to households
Article 83.	Autonomous environmental protection organizations
Article 84.	Environmental protection during burial and cremation
Chapter IX : WASTE MANAGEMENT	
Section 1. GENERAL REGULATIONS ON WASTE MANAGEMENT	
Article 85.	Requirements applied to waste management
Article 86.	Minimization and recycling of wastes
Article 87.	Collecting and treating discarded products
Article 88.	Responsibilities of the People's Committees for waste management
Article 89.	Responsibilities of investors in industrial parks, export-processing zones, hi-tech zones for waste management
Section 2. MANAGEMENT of HAZARDOUS WASTES	
Article 90.	Document compilation, registration and licensing of hazardous waste treatment
Article 91.	Classification, collection, and storage of hazardous wastes prior to processing
Article 92.	Transport of hazardous wastes
Article 93.	Conditions of facilities that process hazardous wastes
Article 94.	Waste management contents in environmental protection planning
Section 3. MANAGEMENT CONVENTIONAL SOLID WASTES	
Article 95.	Responsibility to classify conventional solid wastes
Article 96.	Collection and transport of conventional solid wastes
Article 97.	Recycling and treating conventional solid wastes
Article 98.	Conventional solid waste management contents in environmental protection planning
Section 4. WASTEWATER MANAGEMENT	
Article 99.	General regulations on wastewater management
Article 100.	Collection and treatment of wastewater
Article 101.	Sewage treatment system
Section 5. MANAGEMENT AND CONTROL OF DUST, EXHAUST GASES, NOISE, VIBRATION, LIGHT, AND RADIATION	
Article 102.	Management and control of dust and exhaust gases
Article 103.	Management and control of noise, vibration, light, and radiation
Chapter X : POLLUTION CONTROL, ENVIRONMENTAL REMEDIATION AND IMPROVEMENT	
Section 1. ACTIONS AGAINST ESTABLISHMENTS CAUSING SERIOUS ENVIRONMENTAL POLLUTION	
Article 104.	Actions against establishments causing serious environmental pollution
Section 2. ENVIRONMENTAL REMEDIATION	
Article 105.	General regulations on environmental pollution reduction and classification of polluted areas
Article 106.	Pollution reduction and environmental remediation
Article 107.	Pollution reduction and environmental remediation
Section 3. PREVENTING AND RESPONDING TO ENVIRONMENTAL EMERGENCIES	
Section 108.	Preventing environmental emergencies
Article 109.	Environmental emergency response
Article 110.	Developing environmental emergency response forces
Article 111.	Determination of damage caused by environmental emergencies
Article 112.	Responsibility for environmental remediation
Chapter XI : ENVIRONMENTAL TECHNICAL REGULATIONS, ENVIRONMENTAL STANDARDS	
Article 113.	Environmental technical regulation system
Article 114.	Principles of constructing environmental technical regulations
Article 115.	Symbols of environmental technical regulations
Article 116.	Requirements for technical regulations on surrounding environment quality
Article 117.	Requirements for technical regulations on waste
Article 118.	Construction and promulgation of environmental technical regulations
Article 119.	Environmental standards
Article 120.	Construction, appraisal and promulgation of environmental standards
Chapter XII : ENVIRONMENTAL MONITORING	
Article 121.	Environmental monitoring
Article 122.	Environmental components and emissions to be monitored
Article 123.	Environmental monitoring program
Article 124.	Environmental monitoring system
Article 125.	Environmental monitoring responsibilities
Article 126.	Conditions of environmental monitoring

Article 127.	Environmental monitoring data management
Chapter XIII : ENVIRONMENTAL INFORMATION, DIRECTIVE, STATISTICS AND REPORTING	
Section 1. ENVIRONMENTAL INFORMATION	
Article 128.	Environmental information
Article 129.	Collection and management of environmental information
Article 130.	Announcement and supply of environmental information
Article 131.	Publishing of environmental information
Article 132.	Environmental indicators
Article 133.	Environmental statistics
Section 3. ENVIRONMENTAL REPORTING	
Article 134.	Annual environmental protection reporting responsibilities
Article 135.	Report of environmental protection tasks
Article 136.	Annual socio-economic report on environmental protection
Article 137.	Environmental quo status reporting responsibilities
Article 138.	Environmental quo status report
Chapter XIV : RESPONSIBILITIES OF REGULATORY AGENCIES FOR ENVIRONMENTAL PROTECTION	
Article 139.	State management on environmental protection
Article 140.	State management responsibilities of the Government for environmental protection
Article 141.	State management responsibilities of the Minister of Natural Resources and Environment to environmental protection
Article 142.	State management responsibilities of Ministers, heads of ministerial level bodies on environmental protection
Article 143.	State management responsibilities of the people' committees of all levels on environmental protection
Chapter XV : RESPONSIBILITIES OF VIETNAM FATHERLAND FRONT, SOCIO-POLITICAL ORGANIZATIONS, SOCIO–OCCUPATIONAL ORGANIZATIONS AND RESIDENTIAL COMMUNITY FOR ENVIRONMENTAL PROTECTION	
Article 144.	Responsibilities and rights of Vietnam Fatherland Front
Article 145.	Responsibilities and rights of socio-political organizations, socio-occupational organizations
Article 146.	Rights and obligations of local communities
Chapter XVI : RESOURCES FOR ENVIRONMENTAL PROTECTION	
Article 147.	Expenditure of state budget on environmental protection
Article 148.	Cost of environmental protection
Article 149.	Environmental protection fund
Article 150.	Environmental service development
Article 151.	Incentives and support for environmental protection tasks
Article 152.	Development and application of science and technology to environmental protection
Article 153.	Environmental industry development
Article 154.	Communicating and popularizing the law on environmental protection
Article 155.	Provision of environmental education and provision of training for environmental protection forces
Chapter XVII : INTERNATIONAL COOPERATION ON ENVIRONMENTAL PROTECTION	
Article 156.	Signing and becoming a member in the international treaty of environmental protection
Article 157.	Environmental protection during international economic integration
Article 158.	Expanding international cooperation on environmental protection
Chapter XVIII : INVESTIGATING, INSPECTING AND HANDLING VIOLATIONS, SETTLING ENVIRONMENTAL DISPUTES, CLAIMS AND ACCUSATIONS	
Article 159.	Responsibilities for organizing and directing the investigation and inspection of environmental protection tasks
Article 160.	Actions against violations
Article 161.	Environmental disputes
Article 162.	Complaints, accusations and lawsuits
Chapter XIX : COMPENSATIONS FOR ENVIRONMENTAL DAMAGES	
Article 163.	Damages caused by environmental pollution and degradation
Article 164.	Principles of handling responsibilities of organizations, individuals causing environmental pollution
Article 165.	Determination of damages caused by environmental pollution, degradation
Article 166.	Determination of damages caused by deterioration in environmental function and productivity
Article 167.	Liability insurance for environmental damages
Chapter XX : EXECUTION PROVISIONS	
Article 168.	Transitional clause
Article 169.	Effect
Article 170.	Detailed regulations

Source: 2014-amended-LEP

Among articles of the 2014-amended-LEP, the following ones are considered applicable in the process to implement the Project.

1) Article 18: Environmental impact assessment objects.

   Clause 1 - Environmental impact assessment objects consist of: (a) Projects subject to the decision on investment intentions made by the National Assembly, Government and the Prime Minister; (b) Projects that use land parcels situated in wildlife sanctuaries, national parks, historical – cultural monuments, world heritage sites, biosphere reserves, scenic beauty areas that have been ranked; (c) Projects that can cause bad effects on the environment. Clause 2: List of projects mentioned at Points b and c Clause 1 of this Article shall be regulated by the Government.

2) Article 19: Carrying out the environment impact assessment.

   Clause 1: Owners of projects regulated in Clause 1 Article 18 of this Law shall carry out, on his own, or hire an advisory organization to carry out the environmental impact assessment and take statutory responsibility for the conclusive result after carrying out such assessment. Clause 2: The environment impact assessment must be performed in the preparatory stage of the project. Clause 3: The conclusive result yielded after carrying out the environment impact assessment shall be expressed in the form of the report on environmental impact assessment. Clause 4: Expenses incurred from the formulation and inspection of the report on environmental impact assessment, and included in total investment budget shall be covered by the project owner.

3) Article 21: Consultation to be required in the process of the strategic environment assessment.

   Clause 1: The consultation to be required in the process of environmental impact assessment is aimed at completing the report on environmental impact assessment, helps minimize the bad impacts on the environment and human beings and ensure the sustainable development of the project. Clause 2: Project owners are obliged to consult with regulatory agencies, organizations and communities that are directly affected by the project. Clause 3: Projects that do not require the consultation include: (a) Those in conformity with the planning for concentrated manufacturing, trading and service provision areas under the approval of the report on environmental impact assessment at the infrastructural construction stage for the project; (b) Those specified in the list of state secret projects.

4) Article 22: Main subject-matters of the report on environmental impact assessment.

   1. Origin of the project, project owners, and the competent authority's approval of the project; method of the environmental impact assessment.
   2. Evaluation of technological choice, work items and any activity relating to the project which can cause bad effects on the environment.
   3. Assessment of current status of natural and socio-economic environment carried out at areas where the project is located, adjacent areas and demonstration of the suitability of the selected project site.
   4. Assessment and forecast of waste sources, and the impact of the project on the environment and community health.
   5. Assessment, forecast and determination of measures for managing the risks of the project posed to the environment and community health.
   6. Waste disposal measures.
   7. Measures for minimizing the impact of the project on the environment and community health.
   8. Consultation result.
   9. Environmental management and monitoring programs.
   10. Budget estimate for the construction of environmental protection facilities and measures to be

taken to minimize the environmental impact.
11. Alternatives to the application of measures for the environment protection.

5) Article 23: Authority to appraise the report on environmental impact assessment

Clause 1: The Ministry of Natural Resources and Environment shall arrange to appraise the report on environmental impact assessment in respect of the following projects: (a) Projects subject to the decision on investment intentions made by the National Assembly, Government and the Prime Minister; (b) Interdisciplinary or inter-provincial projects stipulated at Points b and c Clause 1 Article 18 in this Law, exclusive of those classified as the secret projects in the field of national defense and security; (c) Projects verified by the Government's authorized entities. Clause 2: Ministries and quasi-ministerial agencies shall appraise the report on environmental impact assessment in respect of projects that shall be permitted under their decision and approval, but are not specified in regulations mentioned at Points b and c Clause 1 of this Article. Clause 3: The Ministry of National Defense and the Ministry of Public Security shall arrange to appraise the report on environmental impact assessment in respect of projects that shall be permitted under their decision and approval, and those classified as the secret projects in the field of national defense and security. Clause 4: Provincial People's Committees shall arrange to appraise the report on environmental impact assessment in respect of investment projects within their territories that are not regulated at Clause 1, 2 and 3 of this Article.

6) Article 24: Appraisal of the report on environmental impact assessment

Clause 1: The Head or the person who takes over as a leader of the agency in charge of the approval task shall arrange to carry out the appraisal of the report on environmental impact assessment by means of seeking the permission from the appraisal council or obtaining advisory opinions from relevant agencies and organizations, and concurrently bear legal responsibility for their appraisal result. Clause 2: Members of the appraisal council and entities that are requested to contribute their advisory opinions shall be legally responsible for such of their opinions. Clause 3: When necessary, the agency in charge of appraisal shall arrange to conduct a poll to obtain the critical opinions from other institutions, organizations and experts in relation to the appraisal of the report on environmental impact assessment. Clause 4: Within an appraisal period, where any adjustment or supplementation is required, the appraisal agency is responsible to send a written notification thereof to the project owner.

7) Article 25: Approval of the report on the environmental impact assessment

Clause 1: Within a period of 20 days which begins with the date when the report on environmental impact assessment is received after being adjusted at the request of the verification agency, the head or the person who takes over as the leader of the approval agency shall be responsible to approve the report on environmental impact assessment; if the report is rejected, the project owner must be notified in writing in which the reasons for such rejection must be clearly explained. Clause 2: Decision on approving the report on environmental impact assessment shall serve as the ground for the competent authority's following tasks: (a) Decision on the intention to invest in the projects specified in Article 18 of this Law must be granted if the project is required to obtain such decision in accordance with laws. (b) Issuing and revising the prospecting permit, mineral extraction permit in respect of the mineral exploration and extraction projects; (c) Approving the plan for prospecting or exploration, and the plan for mine development in respect of petroleum exploration and extraction; (d) Issuing and revising the construction permit in respect of the

projects on the development of works or structures that are required to obtain the construction permit before commencement; (e) Issuing the investment certificate with reference to projects that are not regulated at Points a, b, c and d in this Clause.

8) Article 26: Responsibility assumed by the project owner after being granted the approval of their report on the environmental impact assessment

Clause 1: Comply with the requests specified in the approval of their report on environmental impact assessment. Clause 2: Where any change in the project size, capacity and technology applied in the project execution is blamed for the bad impact on the environment in comparison with the alternatives given in the approved report on environmental impact assessment, but is not too serious to make another report as stipulated at Point c Clause 1 Article 20 of this Law, the project owner must send their explanation to the agency who grants the approval of the report on environmental impact assessment, and the project shall be commenced only after obtaining the permission from such agency.

9) Article 27: Responsibility assumed by the project owner before bringing the project into operation.

Clause 1: Apply measures for the environmental protection under the decision on the approval of their report on environmental impact assessment. Clause 2: Notify the agency who grants the approval of the report on environmental impact assessment on the progress of developing environmental protection works functioning as an ancillary part of major projects that can cause bad impacts on the environment in accordance with the Governmental regulations. These projects will be commenced only after the agency in charge of the approval of the report on environmental impact assessment has inspected and certified the completion of environmental protection works.
In addition, the Government of Vietnam has issued Decree 18/2015/ND-CP, and then Decree 19/2015/ND-CP as the instructive guidance for implementation of LEP.
Decree 18/2015/ND-CP is particularly important since it states relatively in detail the process necessary for implementing EIA for the Project. Following table shows the content of this Decree.

Table 3.10.15 Content of Decree 18/2015/ND-CP

Chapter 1. GENERAL PROVISIONS		
	Article 1	**Scope**: This Decree promulgates environmental protection planning (EPP), strategic environmental assessment (SEA), environmental impact assessment (EIA) and/or environmental protection plans of the Law on Environment protection.
	Article 2	**Regulated entities:** This Decree shall apply to agencies, organizations, or individuals involved in EPP, SEA, EIA, and/or environmental protection plans in the territories of the Socialist Republic of Vietnam.
Chapter 2. ENVIRONMENTAL PROTECTION PLANNING (EPP)		
	Article 3	Formulation of EPP (national EPP, provincial EPP)
	Article 4	Assessment of EPP
	Article 5	Approval for national EPP
	Article 6	Approval for provincial EPP
	Article 7	Disclosure of EPP
Chapter 3.		
	Article 8	Implementation of strategic environmental assessment (i.e. responsibility of owners of projects listed in Appendix I)
	Article 9	Preconditions of organization in charge of implementing strategic environmental assessment
	Article 10	Appraisal of report on strategic environmental assessment
	Article 11	Obligatory reporting on result of appraisal of report on strategic environmental assessment
Chapter 4.		
	Article 12	Implementation of environmental impact assessment (i.e. responsibility of owners of

		projects listed in Appendix II)
	Article 13	Preconditions of organization in charge of implementing environmental impact assessment
	Article 14	Appraisal and approval of report on environmental impact assessment
	Article 15	Remaking and re-submission of report on environmental impact assessment
	Article 16	Responsibility of the project owner after the report on environmental impact assessment is approved
	Article 17	Inspection and verification of environmental protection facility in the operation phase of the project
Chapter 5.		
	Article 18	Registration of environmental protection plan (responsibility of owners of projects not listed in Appendix II)
	Article 19	Confirmation of environmental protection plan
Chapter 6.		
	Article 20	Financial sources for environmental protection planning, strategic environmental assessment, environmental impact assessment, environmental protection plan, and for implementation of environmental protection proposal
	Article 21	Reporting system
Chapter 7.		
	Article 22	Management of environmental protection, environmental assessment carried out before the effective date of this Decree
	Article 23	Effective date of the Decree (April 1st, 2015)
	Article 24	Agencies responsible for implementation of the Decree

Source: Decree 18/2015/ND-CP

Appendix II of Decree No.18/2015/ND-CP lists 113 projects where the project owner should carry out the environmental impact assessment.

According to the Article no. 12 and Appendix II of the Decree 18/2015/ND-CP, for transportation sector that construction projects for road bridges or rail bridges with the length at least 500 m (excluding feeder roads) shall implement EIA. The main component of the BRT project is to build new 08 flyovers at intersections with the total length of more than 500m therefore it is obligatory to carry out EIA.

In addition, the Government of Vietnam (GoV) has issued Decree 19/2015/ND-CP as the instructive guidance for implementation of LEP. Furthermore, many regulations on environmental protection have been issued, such as Circular 27/2015/TT-BTNMT by MONRE which stipulate regulations on Environmental Protection Planning, Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA), and Environmental Protection Plans, etc.

(3) Technical framework for EIA

The projects which are obligated to make EIA report are defined in detail and listed up in Appendix II of Decree 18/2015/ND-CP (issued on February 14, 2015). Accordingly, before implementation of an individual project, the concerned development policy/plan/program should be approved, and the concerned environmental impacts should be anticipated and assessed. Preparation of EIA for the project shall follow the Circular 27/2015/TT-BTNMT dated May 29, 2015 by MONRE which stipulated detailed guidance on implementation of articles of Decree No. 18/2015/ND-CP.

(4) Gaps between JICA Environmental Guidelines and Vietnam's legal framework on environmental assessment

The current EIA system in Vietnam is basically consistent with international practice. However, it lacks concrete procedures and requirements for information disclosure, public consultation. In addition, it lacks consideration on impacts to local socio-economy such as the followings.

a) Local economy such as employment, livelihood, etc.
b) Utilization of land, local resources, etc.

c) Social institutions, local decision-making institutions
d) Vulnerable social groups (the poor, indigenous peoples, etc.)
e) Equality of benefits and losses, equality in the development process
f) Gender, children's rights
g) Local conflicts of interest

Following table lists up major deviations between Vietnam's impact assessment legal framework and JICA Environmental Guidelines.

Table 3.10.16 Deviations between Vietnam's EIA legal framework and JICA Guidelines

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
Underlying principles		
1. Environmental impacts that may be caused by projects must be assessed and examined in the earliest possible planning stage. Alternatives or mitigation measures to avoid or minimize adverse impacts must be examined and incorporated into the project plan.(Appendix 1, 28p)	According to the new Law on Environmental Protection, implementation of strategic environment assessment (SEA) is required before stage of F/S, for general strategy and planning for socio-economic development of keys regions, centrally-governed cities, industrial zones, etc. Only for the project which causes significant impacts (as listed up in Appendix II of Decree 18/2015/ND -CP), implementation of EIA is required during F/S stage.	In this Preparatory Survey, the environmental assessment is carried out based on the framework of EIA report stated in JICA Environmental Guidelines and World Bank OP.
2. Such examinations must be endeavored to include an analysis of environmental and social costs and benefits in the most quantitative terms possible, as well as a qualitative analysis; these must be conducted in close harmony with the economic, financial, institutional, social, and technical analyses of projects. (Appendix 1, 28p)	There is no particular provision on this item in the legal framework on EIA in Vietnam.	Analysis of alternatives and mitigation measures is carried out in the most quantitative terms possible. Particularly, mitigation measures for impacts of air pollution and noise are examined and assessed quantitatively based on results of traffic volume forecast, etc.
3. The findings of the examination of environmental and social considerations must include alternatives and mitigation measures, and must be recorded as separate documents or as a part of other documents. EIA reports must be produced for projects in which there is a reasonable expectation of particularly large adverse environmental impacts. (Appendix 1, 28p)	A project that may cause significant adverse environmental impacts should prepare an EIA report as stipulated in the new Law on Environmental Protection (Article 19) and Decree 18/2015/ND-CP.	In this Preparatory Survey, an EIA report is prepared based on both legal framework on EIA in Vietnam and in conformity with requirements of JICA Environmental Guidelines.
4. For projects that have a particularly high potential for adverse impacts or that are highly contentious, a committee of experts may be formed so that JICA may seek their opinions, in order to increase accountability. (Appendix 1, 28p)	There is no particular provision on this item in the legal framework on EIA in Vietnam.	The Study Team intends to monitor and confirm the accountability of the project activities, during its implementation process, through the local stakeholder consultation meetings and other on-site studies. If it observes any identified critical problem, then proper solutions will be examine.
5. When assessment procedures already exist in host countries, and projects are subject to such procedures, project proponents etc. must officially finish those procedures and obtain the approval of the government of the host country. (Appendix 2, 30p)	According to the new Law on Environmental Protection and Decree 18/2015/ND-CP, the Hai Phong Arterial Road Construction Project should prepare an EIA report and obtain the approval by MONRE.	During the Preparatory Survey, the JICA Study Team will assist the Vietnam counterpart agencies in preparing an EIA report in accordance with Vietnam regulations.
Examination of Measures		
1. Multiple alternatives must be examined in order to avoid or minimize adverse	Examination of alternatives on the project location was stipulated in	In the Preparatory Survey, several alternatives including zero-option,

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
impacts and to choose better project options in terms of environmental and social considerations. In the examination of measures, priority is to be given to avoidance of environmental impacts; when this is not possible, minimization and reduction of impacts must be considered next. Compensation measures must be examined only when impacts cannot be avoided by any of the aforementioned measures. (Appendix 1, 28p)	Circular 26/2011/ TT-BTNMT. But, such examination is not mentioned in the recently- issued Circular 27/2015/TT-BTNMT. It seems that alternatives for a road construction project are examined only during the establishment of the socio-economic development master plan and the transportation master plan of the province, or region, or transportation sector. However, the suitability of the project location should be assessed and described in the EIA report, taking into account the natural environment and socio-economic condition of the project area, according to Circular 27/2015/TT-BTNMT.	alternatives on the bus routes, etc., are examined. Measures to minimize/mitigate impacts are examined only when these impacts cannot be avoided.
2. Appropriate follow-up plans and systems, such as monitoring plans and environmental management plans, must be prepared; the costs of implementing such plans and systems, and the financial methods to fund such costs, must be determined. Plans for projects with particularly large potential adverse impacts must be accompanied by detailed environmental management plans. (Appendix 1, 28p)	The structure and content of and EIA report are stated in detail in Appendix 2.3 of Circular 27/2015/TT-BTNMT issued by MONRE on May 29, 2015. According to this Circular, an environmental management plan and an environmental monitoring program should be described in detail in Chapter 5 of an EIA report.	In the Preparatory Survey, an environmental management plan and an environmental monitoring program are prepared and described in the EIA report in conformity with Vietnam regulations on EIA.
Impacts to be assessed.		
1. The impacts to be assessed with regard to environmental and social considerations include impacts on human health and safety, as well as on the natural environment, that are transmitted through air, water, soil, waste, accidents, water usage, climate change, ecosystems, fauna and flora, including trans-boundary or global scale impacts. These also include social impacts, including migration of population and involuntary resettlement, local economy such as employment and livelihood, utilization of land and local resources, social institutions such as social capital and local decision-making institutions, existing social infrastructures and services, vulnerable social groups such as poor and indigenous peoples, equality of benefits and losses and equality in the development process, gender, children's rights, cultural heritage, local conflicts of interest, infectious diseases such as HIV/AIDS, and working conditions including occupational safety. (Appendix 1, 29p)	According to Appendix 2.3 of Circular 27/2015/TT-BTNMT (stipulating in detail a number of articles of Law on Environmental Protection and Decree 18/2015/ND-CP), impacts in pre-construction phase, construction phase, and operation phase should be anticipated and assessed. In pre-construction phase, the suitability of the project location should be assessed. In construction phase and operation phase, all project activities should be identified and impacts caused by these activities should be anticipated and assessed while taking into considerations the source of impact, subject of impact, extent of impact, occurrence frequency of impact, recovering possibility, etc. Major impacts which need to be assessed as listed in Appendix 2.3 of Circular 27/2015/TT-BTNMT are: (1) impacts to natural environment; (2) impacts to biodiversity; (3) impacts to public health; and (4) impacts to climate change. Considerations to vulnerable people such as the poor, woman headed-households, etc. are discussed in the "*plan of compensation, supports, and resettlement"* as measures to mitigate impacts to people directly affected by the land acquisition.	It can say that in Vietnam, stipulations on impact assessment for items such as natural environment and pollution are relatively well prepared. There are many detailed provisions, technical specifications, standards, etc. relating to ambient air, water quality, noise, vibration, soil pollution, etc. But it can say that stipulations on assessment of impacts to social environment of the communities around the project area are not properly mentioned. Under this situation, the following environmental factors will be particularly considered by the JICA Study Team during the Preparatory Survey: (1) local economy (employment, livelihood, etc.); (2) utilization of land, etc.; (3) local resources, social institutions, local decision-making institutions; (4) vulnerable social groups (the poor, indigenous peoples, etc.); (5) equality of benefits and losses; (6) equality in the development process; (6) gender, children's rights; and (7) local conflicts of interest.
2. In addition to the direct and immediate impacts of projects, their derivative,	There is no particular provision on this item in the legal framework on EIA in	In addition to the direct and immediate impacts of the project,

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
secondary, and cumulative impacts as well as the impacts of projects that are indivisible from the project are also to be examined and assessed to a reasonable extent. It is also desirable that the impacts that can occur at any time throughout the project cycle should be considered throughout the life cycle of the project. (Appendix 1, 29p)	Vietnam.	the derivative, secondary and cumulative impacts as well as the impacts of projects that are indivisible from the project are also examined and assessed in this Preparatory Survey.
Compliance with Laws, Standards, and Plans		
1. Projects must comply with the laws, ordinances, and standards related to environmental and social considerations established by the governments that have jurisdiction over project sites (including both national and local governments). They must also conform to the environmental and social consideration policies and plans of the governments that have such jurisdiction. (Appendix 1, 29p)	According to Appendix 2.3 of Circular 27/2015/TT-BTNMT, all laws and regulations that form the basis of the EIA study should be listed up in the preface of an EIA report.	The Preparatory Survey is planned in conformity with the Law on Environmental Protection and other regulations, technical specifications, standards, etc., on EIA in Vietnam.
2. Projects must, in principle, be undertaken outside of protected areas that are specifically designated by laws or ordinances for the conservation of nature or cultural heritage (excluding projects whose primary objectives are to promote the protection or restoration of such areas). Projects are also not to impose significant adverse impacts on designated conservation areas. (Appendix 1, 29p)	Any project that requires to use the land of national parks, wildlife sanctuary, world heritage sites, biosphere reserved, historic -cultural sites, or national scenic beauties should prepare an EIA report as stipulated in Appendix II of Decree 18/2015/ ND-CP. Development project in these areas/sites is not strictly forbidden, but an EIA report should be prepared and approved.	There is no designated protection area or historic-cultural heritage around the project area.
Social Acceptability		
1. Projects must be adequately coordinated so that they are accepted in a manner that is socially appropriate to the country and locality in which they are planned. For projects with a potentially large environmental impact, sufficient consultations with local stakeholders, such as local residents, must be conducted via disclosure of information at an early stage, at which time alternatives for project plans may be examined. The outcome of such consultations must be incorporated into the contents of project plans. Consultations with relevant stakeholders, such as local residents, should take place if necessary throughout the preparation and implementation stages of a project. Holding consultations is highly desirable, especially when the items to be considered in the EIA are being selected, and when the draft report is being prepared. (Appendix 2, 31p) In preparing EIA reports, consultations with stakeholders, such as local residents, must take place after sufficient information has been disclosed. Records of such consultations must be prepared. (Appendix 2, 31p)	According to Decree 18/2015/ ND-CP (Article 12), consultation with affected people is carried out through the following methods: (1) Consultation with the People's Committee of communes (commune PCs) where the project is carried out, and with organizations or community under the direct impact of the project; (2) Consultation with the community under the direct impact of the project, in the form of community meeting co-chaired by project owner and the commune PC where the project is carried out together with the participation of representatives of Vietnamese Fatherland Front of communes, socio-political organizations, socio-professional organizations, neighborhoods, villages convened by the commune PC. All opinions of delegates attending the meeting must be sufficiently and honestly stated in the meeting minutes.	In Vietnam, requirement of carrying out consultation meeting with the project-affected community during the EIA implementation is stipulated by law. However, there is no clear provision which states that project-affected people should be invited to the consultation meetings. The concept of "local stakeholders" is not commonly recognized in Vietnam. And the main objective of the consultation in the communes is just to check whether the communes agree with the project or not. In this Preparatory Survey, the following efforts are paid with aim to improve local residents' awareness about the project and promote their participation into the project activities: Carrying out a socio-economic survey (household survey); carrying out the meetings, group discussions with local key persons whenever possible.
2. Appropriate consideration must be given to vulnerable social groups, such as women, children, the elderly, the poor, and ethnic minorities, all members of which are	There is no particular provision on this item in the legal framework on EIA in Vietnam.	Comments, requests, etc., of vulnerable social groups are collected through the socio-economic surveys (household

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
susceptible to environmental and social impacts and may have little access to decision-making processes within society.		surveys), group discussions, etc., and are reflected in the EIA report prepared during the project implementation.
Information disclosure		
- JICA discusses frameworks with project proponents etc. in order to ensure information disclosure, and comes to an agreement in an early stage of cooperation projects. (Section 2.1, 12p) - Project proponents etc. disclose scoping drafts, which consist of project name, countries, locations, project outlines, categorizations and the reasons behind them, alternatives, impacts, and contents. Project proponents etc. also consult with local stakeholders reflecting stakeholder analysis for Category A projects and, if necessary, for Category B projects. (Section 3.1, 20p) - EIA reports are required to be made available to the local residents of the country in which the project is to be implemented. The EIA reports are required to be available at all times for perusal by project stakeholders such as local residents and copying must be permitted.(Appendix 2, 32p)	In Vietnam, there is no comprehensive regulation on information disclosure. There is no regulation or law on the compulsory disclosure of EIA report for the development project widely to the people. In Decree 18/2015/ND-CP (Article 16), there is a statement saying: (after obtained the EIA approval), the project owner should make an environmental management plan (EMP) on the basis of program for environmental management and monitoring suggested in the EIA report, and posted it at the premises of the commune PC where the consultation is taken place when implementing EIA. However, at the present time, there is no concrete guidance on this provision, and on the penalties should be done in cases of default. In the new Law on Environmental Protection (Article 131 stating the publishing of environmental information), the "environmental reports" are referred to as the information to be made known in the public. However, concrete provisions on how to disclose these information have not been issued. And in actuality, people may only see a copy of the decision to approve the EIA report at the office of the commune PC.	It is commonly known that people in Vietnam do not easily access to information, documents, etc., relating to the development projects. Awareness on the need to disclosure these information, documents, etc., is different among local authorities. In actuality, it is commonly seen that the local authorities have no incentive to disclose such information widely to the public. Under such condition, the JICA Study Team had paid efforts to discuss with Binh Duong Province DOT on any possibility to disclose information on the project through mass media, etc. Particularly, in the future, if the project is planned to be implemented with JICA cooperation, it will need to organize two rounds of local stakeholder consultation meetings in accordance with JICA Environmental Guidelines.
Ecosystem and Biota		
1. Projects must not involve significant conversion or significant degradation of critical natural habitats and critical forests. (Appendix 1, 30p)	An EIA report should be prepared and approved by competent authority for any project that requires deforestation, change in forest land uses, and change in paddy land uses, as stipulated in Appendix II of Decree 18/2015/ ND-CP.	There is no valuable natural habitats or critical forest observed around the project area.
2. Illegal logging of forests must be avoided. Project proponents etc. are encouraged to obtain certification by forest certification systems as a way to ensure the prevention of illegal logging. (Appendix 1, 30p)	Activities that cause damages to natural resources and illegal exploitation of natural resources are prohibited (Article 7 of Law on Environmental Protection).	There is no natural forest observed around the project area.
Concern about Social Environment and Human Rights		
JICA respects the principles of internationally established human rights standards such as the International Convention on Human Rights, and gives special attention to the human rights of vulnerable social groups including women, indigenous peoples, persons with disabilities, and minorities when implementing cooperation projects. (Section 2.5, 15p)	In Article 4 (Principles of environ-mental protection) of the new Law on Environmental Protection, there is a statement saying: *"Environmental protection must harmonize with the economic growth, social security, assurance about the children's right, promotion of gender equality, development and conservation of biodiversity, response to climate changes, in order to ensure the human right to live in a pure environment"*. However, there is no concrete guidance	Through the socio-economic surveys, the focus group meetings, etc., the needs of vulnerable social groups, such as fatherless family, persons with disabilities, elderly, poor, etc., is confirmed, and measures to support them are discussed and reflected in the EIA report.

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
	on how to realize this principle.	
Indigenous Peoples		
1. Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives. When, after such an examination, avoidance is proved unfeasible, effective measures must be taken to minimize impacts and to compensate indigenous peoples for their losses. (Appendix 1, 30p)	There is no particular provision on indigenous peoples in legal framework on EIA in Vietnam.	Indigenous peoples are not observed in the project area.
2. When projects may have adverse impacts on indigenous peoples, all of their rights in relation to land and resources must be respected in accordance with the spirit of relevant international declarations and treaties, including the United Nations Declaration on the Rights of Indigenous Peoples. Efforts must be made to obtain the consent of indigenous peoples in a process of free, prior, and informed consultation. (Appendix 1, 30p)	- ditto -	- ditto -
3. Measures for the affected indigenous peoples must be prepared as an indigenous peoples plan (which may constitute a part of other documents for environmental and social consideration) and must be made public in compliance with the relevant laws and ordinances of the host country. In preparing the indigenous peoples plan, consultations must be made with the affected indigenous peoples based on sufficient information made available to them in advance. When consultations are held, it is desirable that explanations be given in a form, manner, and language that are understandable to the people concerned. It is desirable that the indigenous peoples plan include the elements laid out in the World Bank Safeguard Policy, OP4.10, Annex B. (Appendix 1, 30p)	- ditto -	- ditto -
Monitoring		
1. After projects begin, project proponents etc. monitor whether any unforeseeable situations occur and whether the performance and effectiveness of mitigation measures are consistent with the assessment's prediction. They then take appropriate measures based on the results of such monitoring. (Appendix 1, 31p)	Article 22 of the Law on Environmental Protection stipulates that a chapter on environmental management plan and environmental monitoring program should be prepared as a part of the EIA report.	There is not gap between JICA Guidelines and Vietnam regulations on EIA about the need to formulate the environmental monitoring program.
2. In cases where sufficient monitoring is deemed essential for appropriate environmental and social considerations, such as projects for which mitigation measures should be implemented while monitoring their effectiveness, project proponents etc. must ensure that project plans include feasible monitoring plans. (Appendix 1, 31p)	- ditto -	In the stage of F/S or D/D of the project, the environmental management plan (EMP) and the environmental monitoring program (EMoP) should be prepared (or updated) and incorporated in the EIA report (or the updated EIA report). In addition, it needs to confirm the organizational capacity of the entities in charge of implementation of EMP and EMoP, and provide them with capacity strengthening in case of necessary.
3. Project proponents etc. should make efforts to make the results of the	In Decree 18/2015/ND-CP (Article 16), there is a statement saying: "(... after	Binh Duong Province PC should examine the framework to disclose

JICA Guidelines	Vietnam Regulations on EIA	Measures to fulfil gaps
monitoring process available to local project stakeholders. (Appendix 1, 31p)	obtained the EIA approval), the project owner should make an environmental management plan (EMP) on the basis of program for environmental management and monitoring suggested in the EIA report, and posted it at the premises of the commune PC where the consultation is taken place when implementing EIA." However, in the legal framework on impact assessment in Vietnam, there is no provision on the project owner's obligation to publicize results of monitoring process, and the procedure to settle complaints raised by the public on environmental issues relating to the project.	results of environmental monitoring, if the project implementation is planned with cooperation from JICA.
4. When third parties point out, in concrete terms, that environmental and social considerations are not being fully undertaken, forums for discussion and examination of countermeasures are established based on sufficient information disclosure, including stakeholders' participation in relevant projects. Project proponents etc. should make efforts to reach an agreement on procedures to be adopted with a view to resolving problems. (Appendix 1, 31p)	In actuality, when local residents find out that impacts of air pollution, dust, noise, vibration, etc., are intolerable, the only way they can do is sending the complaints to the head of residential block. But it is very rare for the complaints being forwarded to the contractors and properly treated by the contractors.	In the construction phase, it needs to establish and enforce a system that can appropriately disclose information on monitoring results to local residents, and can get local residents' participation into the tasks to monitor the obligation of contractors.

Source: JICA Study Team

(5) Outlines of relevant agencies

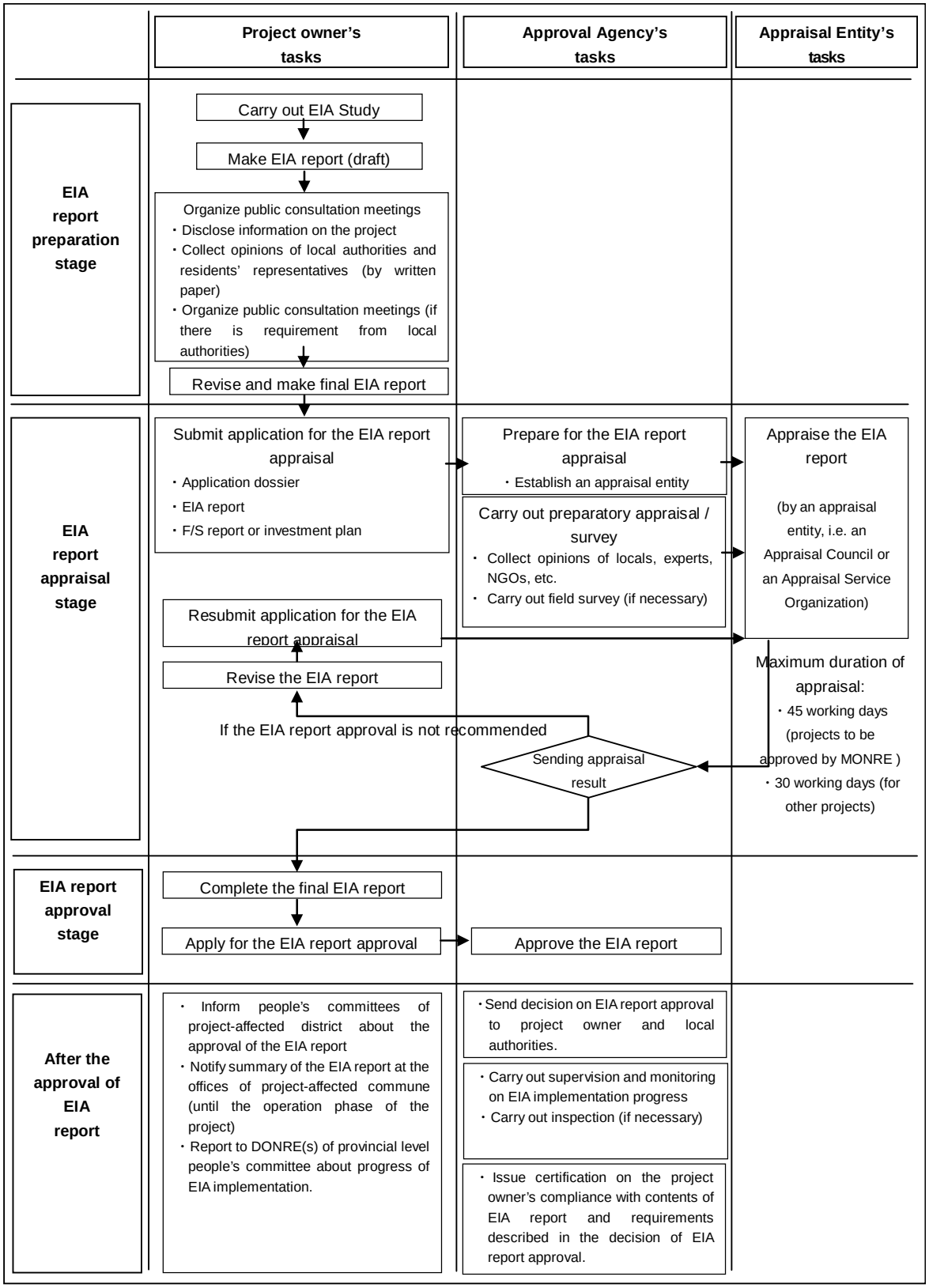
There are provincial and local agencies playing different roles in the appraisal and approval of the EIA report as follows

- The People's Committee of the province shall evaluate and approve EIA reports of projects in the province and under its competence as described in Article 11 of the Decree 18/2015/ND-CP
- Department of Natural Resources and Environment (DONRE) of Binh Duong Province which is an agency assisting PPC in management of environmental issues. The DONRE have delegated powers to make decisions on numerous issues (including EIA under authorization of PPC) related to the use and management of local resources and environment; cooperate with the People's Committee of local districts in the project areas to monitor the environment of the project in the construction stage and operation stage. The environmental protection division under DONRE is to assist Director of DONRE to appraise and approve EIA report (if PPC authorized DONRE), environmental protection plans; assist the director to guide, inspect and confirm the implementation of EIA after approval.
- EIA appraisal and approval council: The assessment of EIA report shall be conducted by the EIA report assessment council established by the Heads of the EIA report assessment authority with at least 07 members. Members of EIA report assessment council shall consist of 01 President, 01 Vice President where necessary, 01 Secretary member, 02 opponent members and other members, which at least 30 percent of the Assessment council members having at least 06 years' experience in the EIA field.

- People committee and Fatherland Front Committees act as responsible authorities and communities. They act as a go-between for the local community and the proponents and may initiate public involvement.

(6) Required procedure of environmental assessment, etc. for the project

Procedures of Environmental Impact Assessment (EIA) for the proposed project Vietnamese Law on Environmental Protection (No. 55/2014/QH13, took effect in 2015) requires owners of the projects with a potential risk of causing an adverse impact on the environment to carry out an environmental impact assessment (EIA) concurrently with the project feasibility study (Article 18 and 19). The detailed procedures concerning the preparation, appraisal and approval of the EIA are prescribed in Decree No.18/2015/ND-CP and Circular 27/2015/TT-BTNMT, as presented in the following figure.



Source: JICA Study Team

Figure 3.10.7 Process for EIA Prepration of this project

3.10.7 Examination of alternatives

(1) Zero-option

The Zero-option (existing bus route) is operated between Binh Duong New City and Ben Thanh along NH 13. Total travel time of this existing route is 113 minutes. The BRT route proposed by JICA Study Team is planning to connect Binh Duong New City and Suoi Tien Terminal station through Pham Ngoc Thach Road – My Phuoc-Tan Van Road - Planned road in Industrial Park – NH 1A. Terminal of BRT is located at Suoi Tien Terminal Station and passengers therefore can go to Ben Thanh via MRT Line-1. Total travel time of BRT and MRT is shorter compared to 113 minutes as existing travel time of bus on national highway 13.

Source: JICA Study Team

Figure 3.10.8 Existing bus route and planned BRT route

(2) Other alternatives

There is a risk that related projects will not be developed, which has a negative impact on BRT operation speed by congestion and impassible sections. For such cases, two alternative routes have been studied as follows;

Alt-1: U-turn at Tram 2 IC on QL-1:
Mp-Tv Rd => TL-743C => Tan Van IC => NH-1A (to HCMC) => Tram 2 IC => NH-1A (to Dong Nai) => Suoi Tien Terminal Station.

Alt-2: Pass through in National University

Mp-Tv Rd => NH-1K => (Narrow Road) => Roads in National University, HCMC => U turn Lane at HCMC Marty's Cemetery => Suoi Tien Terminal Station.

Source: JICA Study Team

Figure 3.10.9 Alternative BRT (draft)

The above figure shows alternative routes in case that two related projects are undeveloped, planned road in industry zone and NH-1A Flyover in front of STT St. They were proposed to Binh Duong Province and HCMC at 6th Monthly Meeting, but both routes are judged to be unrealistic. Alt-3 takes long way and waste time by detouring NH-1A for access to STT St. Alt-4 has narrow section, where BRT hardly pass through, and need to coordinate for going through roads in VNU-HCM.

(3) Consideration of alternatives

The consideration of a range of alternatives helps to produce a solution that satisfies the purpose and need for the project while protecting environmental, cultural, and community resources. The following table describes the examination of environmental impacts for alternatives of without-the-project (zero-option), with-the-project (Mp-Tv – NH 1A – Industrial park – Suoi Tien Terminal Station) and two other alternative routes.

Table 3.10.17 Examination of alternatives of Binh Duong BRT

Alternatives	Alternative 1 Zero option (without-the-project)	Alternative 2 (Mp-Tv – QL1 – Industrial park – Suoi Tien Terminal Station)	Alternative 3 (U-turn at Tram 2 IC on QL-1)	Alternative 4 (Pass through in National University)
Description of alternatives	Existing bus route is operated between Binh Duong New city and Ben Thanh along QL-13	Binh Duong New City – Pham Ngoc Thach Road – My Phuoc-Tan Van Road – Planned road in Industrial Park – NH 1A – Suoi Tien Terminal Station. From Suoi Tien Terminal Station to Ben Thanh via MRT Line-1	Mp-Tv Rd – TL-743C – Tan Van IC – NH 1A (to HCMC) – Tram 2 IC – NH 1A (to Dong Nai) – Suoi Tien Terminal Station.	Mp-Tv Rd. – NH 1K – (Narrow Road) - Roads in National Univ, HCMC – U turn Lane at Cemetery – Suoi Tien Terminal Station.
Social impacts	Operation of bus on NH-13 contributes to heavy traffic congestion of the highway especially in peak time of morning and evening. Total travel time is 113 minutes. No land acquisition will be required	Travel time from Binh Duong New City to Ben Thanh is shorter, it is schedule 10 minutes shorter compared to existing bus route. Land acquisition will be required for the section in the South of Industrial Park to NH 1A Employment creation and population growth along the BRT Route especially area near bus stations, resulting in increase in tax revenue	It has longer distance and travel time due to detouring NH-1A for access to Suoi Tien St. No land acquisition will be required Employment creation and population growth along the BRT Route especially area near bus stations, resulting in increase in tax revenue	It has a narrow section (W=6 m, L=860m), where BRT hardly pass through Land acquisition will be required for the section through VNU-HCM Employment creation and population growth along the BRT Route especially area near bus stations, resulting in increase in tax revenue
Environmental impacts	More emission loading of air pollution due to longer bus travel distance and time. Moreover traffic congestion enhances the emission. No pollution due to construction of additional structures.	Alleviate air pollution by bus on NH 13 Temporary environmental impacts such as air pollution, noise from building structures (flyover on Mp-Tv road and in the Industrial Park, Mp-Tv road expansion) during construction phase	Same as Alternative 1	Same as Alternative 1 Moreover noise impacts to residents along the narrow section would be significant in operation phase as due short distance from the noise source (buses) to the receptors (houses)

Source: JICA Study Team

3.10.8 Stakeholder consultation meetings

(1) Requirements of public consultation

According to Decree No. 18/2015/ND-CP and Circular 27/2015/TT-BTNMT, in the process of making the EIA report, the project owner should carry out consultation with PCs of affected wards/communes and representatives of the affected communities. The consultation with the

community (in the form of community meeting) is required for EIA preparation (Decree No. 18/2015/ND-CP). In this study, 200 project-affected households (who are residing near the planned flyovers along My Phuoc-Tan Van Road) were consulted through a socio-economic survey carried out during February and March, 2015. Project-affected households' opinions on the project necessity, predicted impacts, suggested impact-mitigation measures, etc., were collected through this survey.

Details of the survey results are presented in a separated report titled "Report on Socio-economic Survey for BRT Project". The following section summarizes main points of the consultation.

(2) Expected benefits of the project

About one-fifth of the respondents agreed that the project will generate significant benefits to the community, because they know about the current traffic problems in the project areas, and recognize that the project will help to reduce traffic jams in the project area. However, another large number of them (64%) found that the project will bring both benefits and impacts to the locality. Nevertheless, 9% of the households said that they cannot find any benefit of construction of the BRT project whereas other 8% answered carefully that at the moment, they do not recognize any benefit from the project. Among those who found no benefit, about one fifth is living in Thu Dau Mot City .

Table 3.10.18 Perception on Benefit of the Project (%)

Do you think the project brings you with benefit?	Thu Dau Mot (N=51)	Thuan An (N=97)	Di An (N=50)	Total (N=198)
Yes	23.6	12.4	30.0	19.7
No	19.6	6.2	2.0	8.6
Both benefit and impact	52.9	71.1	60.0	63.6
Cannot answer now	3.9	10.3	8.0	8.1
Total	100	100	100	100

Source: JICA Study Team

Once the respondents said *"yes"* for the question *"Do you think the project brings you with benefit?"*, they were asked to rank about project's benefits that they are expected. A large number of respondents recognizes that the project will firstly help to *"smooth the transportation"* (79.5%); secondly to *"ensure the safety for moving within the city/province"* (66%); thirthly to *"reduce trafic jam"* (62%) and finally to *"reduce transportation costs"* (61%). It is calculated more than a quarter of respondents (27%) think that the project will not *"improve environmental quality nor reduce exhaust gas and dust from current vehicles"* .

Table 3.10.19 Specific Benefits of the Project (%)

Benefits	None	Not significant	High
Increase income by providing services/business for bus stops (N=196)	36.7	34.7	28.6
Smooth the transportation (N=200)	11.5	9.0	79.5
Ensure the safety for the family while moving within the city/province (N=198)	16.7	17.2	66.1
Reduce trafic jam (N=200)	21.0	17.0	62.0
Reduce transportation costs (N=196)	18.4	20.4	61.2
Improve environmental quality, reduce exhaust gas and dust from motorbikes and private cars (N=198)	26.8	31.3	41.9

Source: JICA Study Team

(3) Impacts of the project

Nearly a half of interviewees said that the project will generate minor environmental impacts such as air pollution, noise and vibration during construction and operation of the BRT system. Another quarter of interviewees said that the project may cause potential impacts including air pollution and noise pollution (26% and 29% of respondents respectively) to the community.

Regarding social impacts of the project, a majority of interviewees believed that there will be not significant impact on their society. However, some interviewees worried that the project may cause social disturbance in the area (20% of interviewees) or create more social evils (18% of interviewees) due to the migration and/or movement of a large number of people. Furthermore, other 22% of interviewees expressed concern about the impacts on local travelling, especially during the construction phase of the project. Table 3.9.17 presents interviewees' perception on the project's impacts.

Table 3.10.20 Interviewed residents' perception on impacts of the project (%)

Benefits	None	Not significant	High
Environmental Impacts			
Air pollution	30.7	42.2	26.1
Noise during construction of the BRT	30.0	41.5	28.5
Vibration during construction of the BRT	41.0	46.0	13.0
Reduce landscape beauty and values	51.0	37.4	11.6
Social Impacts			
Appearance of immigrants and/or movement of a huge number of people may cause the disorder in the area	51.8	28.1	20.1
Social evils will be increased	53.8	28.1	18.1
Construction of the BRT will affect HH's current business/service	55.5	24.0	20.5
Impacts on travelling of the HH	53.5	24.7	21.8

Source: JICA Study Team

3.10.9 Environmental scoping

Impacts that may be caused by the planned BRT project in pre-construction phase, construction phase and operation phase are summarized in following Table.

Table 3.10.21 Result of Environmental Scoping

Item	No.	Environmental factor	Assessment		Basis of assessment
			Pre-construction& Con-struction	Opera-tion	
Pollution	1	Air pollution	B-	C±	[Construction stage] • Dust and polluted gas will be generated from the operation of construction machine around the construction sites of flyovers, depot, bus stops. [Operation stage] • Operation of buses may cause more air pollution by exhaust gas. • However, it is expected that total volume of exhausted CO2 and other polluted substances in the project area will be decreased due to the decrease in private vehicle and the mitigation of traffic congestion.
	2	Water	C-	C-	[Construction stage]

Item	No.	Environmental factor	Assessment		Basis of assessment
			Pre-construction& Con-struction	Opera-tion	
		pollution			• Polluted water generated by construction works of flyovers and depot may cause negative impact to surface water environment. [Operation stage] • Polluted water and waste oil generated from the depot may cause negative impact to the surrounding water bodies.
	3	Wastes	C-	C-	[Construction stage] • Construction wastes and general wastes from construction sites of flyovers and depot may cause negative impact to the surrounding environment. [Operation stage] • Improperly-disposed wastes from the depot and the bus stops may cause negative impact to environment.
	4	Soil pollution	D	C-	[Construction stage] • Materials which may cause soil pollution will not be used for construction works. [Operation stage] • Waste oil and polluted water from the depot may cause soil pollution to the surrounding area.
	5	Noise, vibration	B-	B±	[Construction stage] • Levels of noise and vibration may increase due to construction works. [Operation stage] • Level of noise and vibration may increase due to the bus operation. • However, noise level in total may decrease due to the decrease in private vehicles.
	6	Ground subsidence	D	D	[Construction stage / Operation stage] • Construction of flyovers and depot with light structures on the solid land in the project area is expected not cause ground subsidence.
	7	Offensive odor	D	D	[Construction stage / Operation stage] • Construction works and its maintenance do not generate offensive odor.
	8	Bottom sediment	D	D	[Construction stage / Operation stage] • Large-scale soil reclamation or civil work is not required for construction of flyovers, depot, and bus stops. Therefore, the Project is expected not caused bottom sediment to the surrounding water bodies.
Natural environment	9	Protected areas	D	D	[Construction stage / Operation stage] • There is not any protected areas such as national park observed in the project area.
	10	Eco-system	D	D	[Construction stage / Operation stage] • The areas around the project site are already urbanized and occupied by many industrial zones and residential areas.
	11	Hydrological situation	D	D	[Construction stage / Operation stage] • The construction and operation of the BRT system is expected not cause affect to the flow of rivers those are located far from the BRT route.
	12	Topography and	D	D	[Construction stage / Operation stage] • The project areas is occupied mainly by fairly flat low hills. Impact to

Item	No.	Environmental factor	Assessment		Basis of assessment
			Pre-construction& Con-struction	Opera-tion	
		geo-graphical features			topography and geographical features around the depot and flyovers is not predicted.
Social environment	13	Involuntary resettlement	C-	D	[Pre-construction stage] ・The BRT Project requires land for the depot and the bus route. However, land for the depot had been acquired by Binh Duong PC during the 2003-2010 period, under the Binh Duong Industrial – Service and Residential Complex Development Project. Due diligence survey is required to ensure that the process of land acquisition for this land is conform to JICA Environmental Guidelines. ・Land required for the BRT route had been almost acquired under the Mp-Tv Road Construction Project, Pham Ngoc Thach Road Construction Project, etc ・Construction of 8 flyovers and 13 bus stops along Mp-Tv Road is planned in Phase 1 (by 2018). However, there is no need to acquire additional land for these flyovers and bus stops, because they are planned within the ROW of Mp-Tv Road. [Operation stage] ・Requirement of additional land acquisition and resettlement is not expected during operation stage of the BRT bus.
	14	The poor	D	C+	[Construction stage / Operation stage] ・The Project is expected not cause impact to the poor. ・The Project may help to improve accessibility of the poor, the elderly people, the handicapped persons, etc.
	15	Indigenous and ethnic people	D	D	[Construction stage / Operation stage] ・Indigenous and ethnic people are not observed residing around the project area.
	16	Local economy such as employment and livelihood	C±	B+	[Construction stage] ・Residents and business activities near the construction sites may be affected by dust, noise, traffic jam, etc. temporarily during construction stage. ・Local residents may have opportunity to work as construction worker for the project. [Operation stage] ・Local economy and industry may be promptly developed due to the improved accessibility to Suoi Tien Terminal Station, New Eastern Bus Terminal, Cai Mep-Thi Vai International Port, Hi-Tech Park, HCMC University, Ben Thanh Business Center, etc. ・The Project may contribute to economic development of the areas around the bus stops
	17	Land use and utilization of local resources	B+	A+	[Construction stage / Operation Stage] ・There may be significant change in land use in the areas along Mp-Tv Road, especially in the areas around the bus stops, where agricultural land may change into residential land, urban land, commercial land, etc. ・The flyovers and the pedestrian bridge built at the bus stops may help local residents to across Mp-Tv Road in more easier and safer manner. ・Improvement of traffic condition may distribute to the efficient use of local resources.

Item	No.	Environmental factor	Assessment		Basis of assessment
			Pre-construction& Con-struction	Opera-tion	
	18	Water usage or water rights and rights of common	D	D	[Construction stage / Operation Stage] • There is not any river or lakes in the project area. The project is expected not cause impact to the water usage of local residents.
	19	Existing social infrastructures and service	B-	B+	[Construction stage] • Traffic jam may occur on the roads around the construction sites during construction. [Operation stage] • The BRT buses may help improve local residents' accessibility to public facilities in large area.
	20	Social capitals, local organizations, such as authorities to make decisions	D	D	[Construction stage / Operation stage] • Mp-Tv is a newly constructed road, and therefore the BRT project will not cause significant impact to the existing public transportation system of the locality.
	21	Misdistribu-tion of benefit and damage	C-	C-	[Construction stage] • Residents who reside near the construction sites may suffer more direct impact of dust, noise, traffic jam, etc. than residents who reside far from the construction sites. [Operation stage] • Residents who reside right near the bus stops may earn more direct benefits (such as increased land price, reduction of travel time, etc.) from the project than residents who reside far from the bus stops.
	22	Local conflict of interests	D	D	[Construction stage / Operation stage] • Conflict of interests between local residents/communes is not predicted by the Project.
	23	Cultural, historical heritage	B-	B-	[Construction stage / Operation stage] • One national heritage relic (Phu Loi Prison) is found in the project area, but it is located 400 m far from the planned BRT route. • Some sensitive spots (churches, pagodas, schools, etc.) are found within 500m from the planned BRT route. Among these spots, Ham An Pagoda (Hiep Thanh Ward) and Doan Thi Diem Primary School (Binh An Ward) are located right near the BRT route and may be affected directly by noise, air pollution, traffic jam, etc..
	24	Landscape	C-	D	[Construction stage] • The appearance of temporary structures, construction machines, etc. may cause damage to the local landscape during the construction stage. [Operation stage] • Negative impact to landscape is not predicted, due to no any scenic landscape is observed in the area along the BRT route.
	25	Gender	D	D	[Construction stage / Operation stage] • Impact to gender that requires particular consideration is not

Item	No.	Environmental factor	Assessment		Basis of assessment
			Pre-construction& Con-struction	Opera-tion	
					expected.
	26	Children's right	D	C+	[Construction stage] • Impact to children's right that requires particular consideration is not expected. [Operation stage] • The bus operation and the pedestrian bridge at the bus stop may help improve children's accessibility to other areas.
	27	Hazard (risk), infectious diseases such as HIV/AIDS	C-	C-	[Construction stage] • Risk of HIV/AIDS infection may increase among construction workers, amusement places around construction sites. [Operation stage] • Rural communes along the BRT route may be quickly developed in term of economy, and will be easily communicated with other areas, and therefore, may face increased risk of infection.
	28	Working environment (including working safety)	C-	D	[Construction stage] • Dust and exhaust gas generated by construction works may cause negative affect to workers' health. • Wastes from worker camps and construction office may worsen sanitary condition of the surrounding areas. [Operation stage] • Impact to working environment that requires particular consideration is not expected.
Others	29	Accident	B-	B-	[Construction stage] • There is risk of traffic accident on the roads around the construction sites. [Operation stage] • Traffic accident may occur around the bus stops due to the inattention of both drivers and pedestrians.
	30	Trans-boundary impacts, global warming	C-	B+	[Construction stage] • Greenhouse gas (CO_2) will be generated by construction works. [Operation stage] • It is expected that total volume of greenhouse gas will be decreased, due to the decrease in motorbikes and other means of private transportation. • The BRT buses using compressed natural gas (CNG) as fuel will be introduced to the Project with aim to reduce green house gas.

Note A+/-: serious positive/negative impact is expected;
B+/-: positive/negative impact is expected to some extent;
C+/-: extent of impact is unknown, further study is needed;
D : limited impact/negligible impact, further study is not needed.
Source: JICA Study Team

3.10.10 Results of surveys on environmental and social considerations

(1) TOR for surveys on environmental and social considerations

The impacts which were assessed as "A-", "B-" or "C-" through the scoping mentioned above are subjects to the further detailed surveys. Table 3.10.22 shows TOR for these surveys.

Table 3.10.22 TOR for the detailed surveys on impacts assessed as "A-", "B-" or "C-"

Item	No.	Environmental factor	Assessment		Survey items	Survey methods
			Pre-construction / Construction	Operation		
Pollution	1	Air pollution	B-	C±	1.Ambient air quality 2.Environmental standards 3.Construction activities 4.Estimated traffic volume	・Review of existing documents ・Measurement of concentrations of air pollutants along the bus route ・Confirmation of method and content of construction ・Estimation of total volume of air pollutants generated in the future based on estimated traffic volume ・Estimation of concentrations of air pollutants at specified sites along the bus route
	2	Water pollution	C-	C-	1.Quality of surface water and groundwater 2.Water quality standards 3.Water usage situation	・Review of existing documents ・Analysis of quality of surface water and groundwater ・Hearing to relevant persons ・Confirmation of method and content of construction
	3	Wastes	C-	C-	1.Wastes disposal methods at construction sites and the surroundings	・Hearing to relevant persons ・Study on similar cases
	4	Soil pollution	D	C-	1.Construction plan and operation plan for the bus depot	・Hearing to relevant persons ・Study on similar cases
	5	Noise, vibration	B-	B±	1.Current noise and vibration levels 2.Environmental standards 3.Location of sensitive spots (hospitals, schools, etc.) 4.Impacts from construction works	・Hearing to relevant persons ・Study on similar cases ・Review of existing documents ・Measurement of noise levels and vibration levels along the bus route ・Estimation of noise levels in the future based on estimated traffic volume ・Confirmation of construction methods/contents
Social environment	13	Involuntary resettlement	C-	D	1.Scope of resettlement (surface area of acquired land, number of affected households, other affected properties, etc.) 2.Resettlement plan	・Survey on legal framework, institution ・Confirmation of resettlement plan (compensation, resettlement, etc.) ・Study on similar cases
	16	Local economy such as employment and livelihood	C±	B+	1.Living situation of affected households 2.Local current economic activities 3.Situation of vehicles and pedestrians crossing the road	・Socio-economic survey ・Review of existing documents ・Field reconnaissance ・Study on similar cases
	19	Existing social infrastructures and service	B-	B+	1.Condition of utilities allocatedalong the bus route 2.Situation of vehicles and pedestrians crossing the road	・Field reconnaissance ・Review of existing documents ・Hearing to relevant persons ・Study on similar cases
	21	Misdistribution of benefit	C-	C-	1.Living situation of affected households 2.Resettlement plan	・Socio-economic survey ・Review of existing documents ・Study on similar cases

Item	No.	Environmental factor	Assessment: Pre-construction / Construction	Assessment: Operation	Survey items	Survey methods
		and damage				
	23	Cultural, historical heritage	D	B-	1.Religious structures along thebus route	・Field reconnaissance ・Hearing to relevant persons
	24	Landscape	C-	D	1.Street trees along the bus route	・Field reconnaissance ・Review of existing documents ・Hearing to relevant persons
	27	Hazard (risk), infectious diseases such as HIV/AIDS	C-	C-	1.Health situation of workers	・Hearing to relevant persons ・Study on similar cases
	28	Working environment (including working safety)	C-	D	1.Working environment	・Hearing to relevant persons ・Study on similar cases
Others	29	Accident	B-	B-	1.Working accidents 2.Number of occurred traffic accidents	・Hearing to relevant persons ・Study on similar cases ・Review of existing documents
	30	Transboundary impacts, global warming	C-	B+	1.Impacts of construction works 2.Forecasted traffic volume	・Confirmation of construction method/content ・Estimation of total to-be- exhausted greenhouse gas (CO2) in the future, based on the forecasted traffic volume

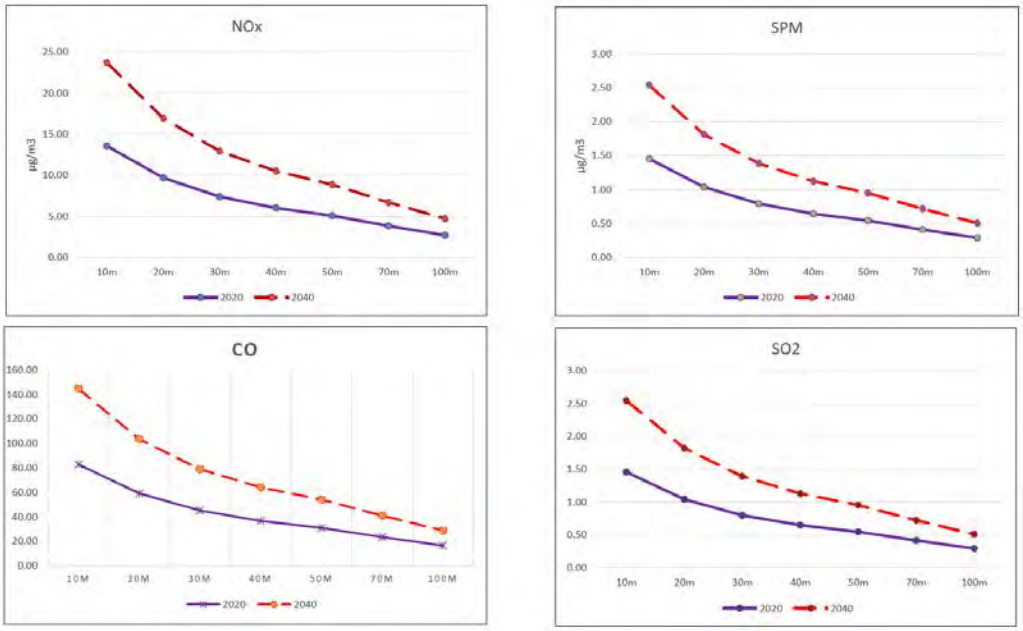
Source: JICA Study Team

(2) Results of surveys on environmental and social considerations (including impact prediction)

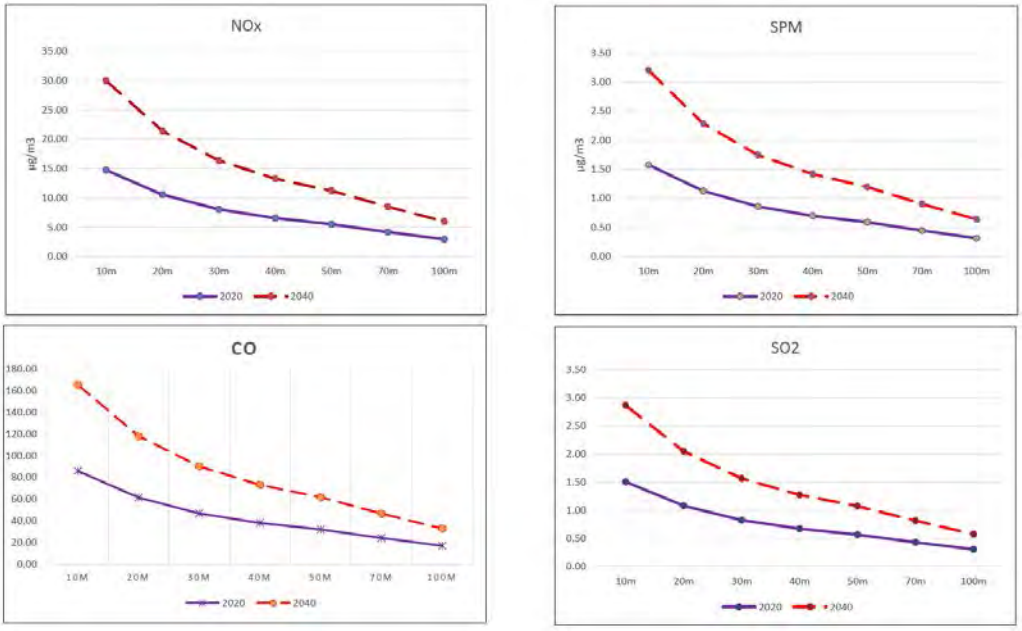
Table 3.10.23 shows the results of surveys for the impacts factors described in Table 3.10.22.

Table 3.10.23 Results of surveys on environmental and social considerations

Impact factor	Survey / prediction results
Air pollution B- / C±	**[In the construction phase]** In the construction phase, ambient air environment and people living near the construction sites (bus depot, flyovers) would be affected due to the following causes: - Soil works such as digging and leveling which cause dust. - Operation of vehicles transporting construction materials; - Loading and unloading construction materials and equipment from cranes, - Increased dust and gas emissions on dry days. Total amount of dust, exhaust gases arising from combustion of the fuel of construction equipment is based on the amount of diesel consumption from construction activities. If a truck (with size from 3.5 to 16 tons) consumes 1 ton of diesel, it will emit into the air about 4.3 kg of TSP; 20S kg of SO_2 (S as a function of sulfur in diesel, according QCVN01: 2007/BKHCN, S = 0.05%); 55kg of NOx; 28kg of CO, and 12kg of VOC. The experience and data from other road/highway construction projects (such as Hochiminh - Long Thanh - Dau Giay expressway) showed that, except for TSP, concentration of other air parameters measured near construction sites were lower than the allowable level of standards (QCVN/BTNMT 05:2013). Near the construction sites (BRT depot, flyovers, bus stops), there are several residential areas

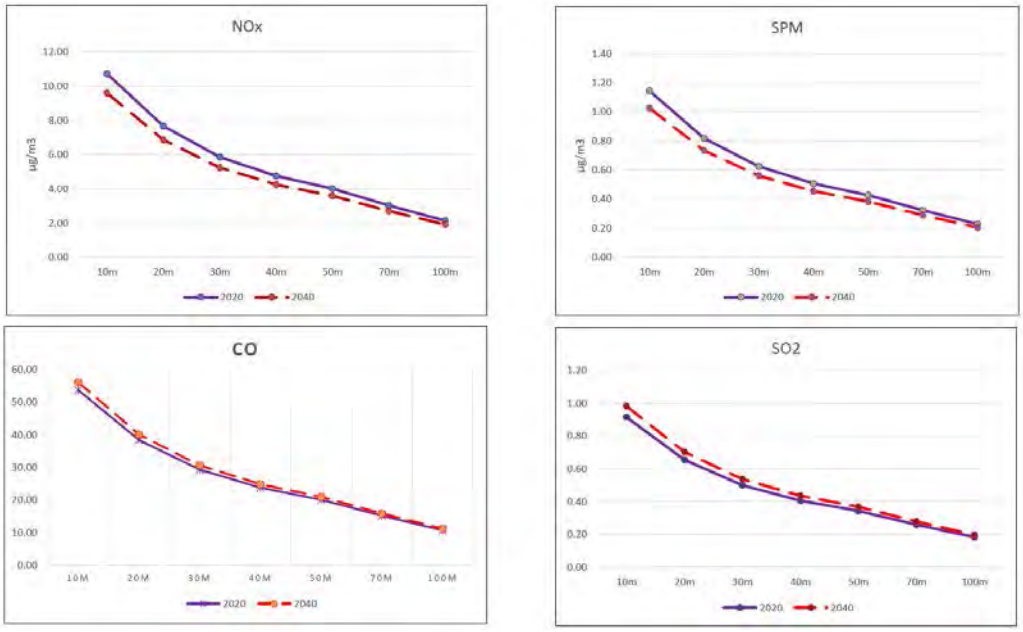
Impact factor	Survey / prediction results
	which may directly affected by air pollution such as the following: - Km 3 + 078 (Bus stop-2, IS-5, intersection with National Highway 1K) - Km 7 + 272 (IS-12) - Km 7 + 471 (IS-13, intersection with Nguyen Thi Minh Khai road) - Km 10 + 559 (IS-21, An Phu intersection) - Km 10 + 611 (IS-22, An Phu intersection (DT743A) However, Ham An Pagoda and Doan Thi Diem School and other sensitive spots are located far from the construction sites and will be not affected by air pollution. The impact of air pollution is unavoidable during the construction period. However, this impact can be mitigated to acceptable condition by applying appropriate technical and management measures. **[In the operation phase]** The construction of 7 flyovers along My Phuoc – Tan Van Road is recommended with aim to improve the running speed of BRT buses operating between Binh Duong New City and Suoi Tien Station / New Eastern Bus Terminal. According to result of surveys on current environmental and social conditions of the areas along My Phuoc – Tan Van Road, the areas around these flyovers are almost urbanized, populated and may be affected by the project during the operation phase, especially in terms of air pollutions, noise, traffic accidents, etc. A prediction is carried out to confirm the extents of impacts of air pollution which may be caused by the moving vehicles, including BRT buses, to the areas adjacent to the planned flyovers in 2020 and 2040. Since the meteorological conditions of the study area are almost similar with insignificant differences in wind velocity, wind direction; and the road cross sections are almost the same (road width, height of road embankment, etc.), it is reasonable to carry out prediction calculation only for the road sections with heavy traffic volume and where there is residential area located nearby. Consequently, the road sections nearby the flyover IS5, IS21, and IS29 are selected for the prediction. Figures 3.10.10~15 show results of prediction.  Source: JICA Study Team **Figure 3.10.10 Estimated concentrations of air pollutants – Flyover IS5, in case of without BRT Project**

Impact factor	Survey / prediction results



Source: JICA Study Team

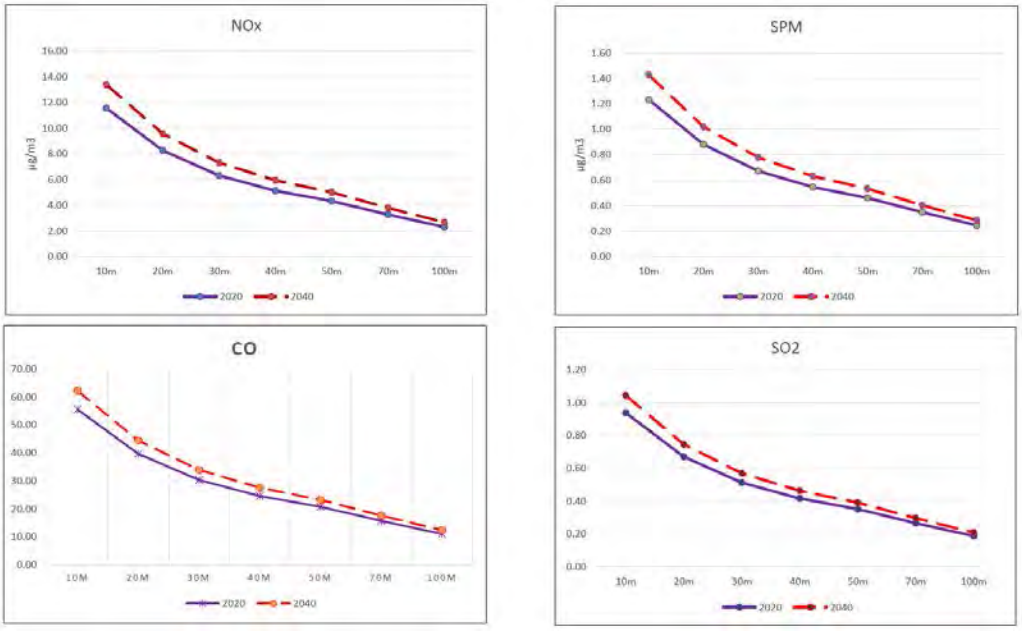
Figure 3.10.11 Estimated concentrations of air pollutants – Flyover IS5, in case of with BRT Project



Source: JICA Study Team

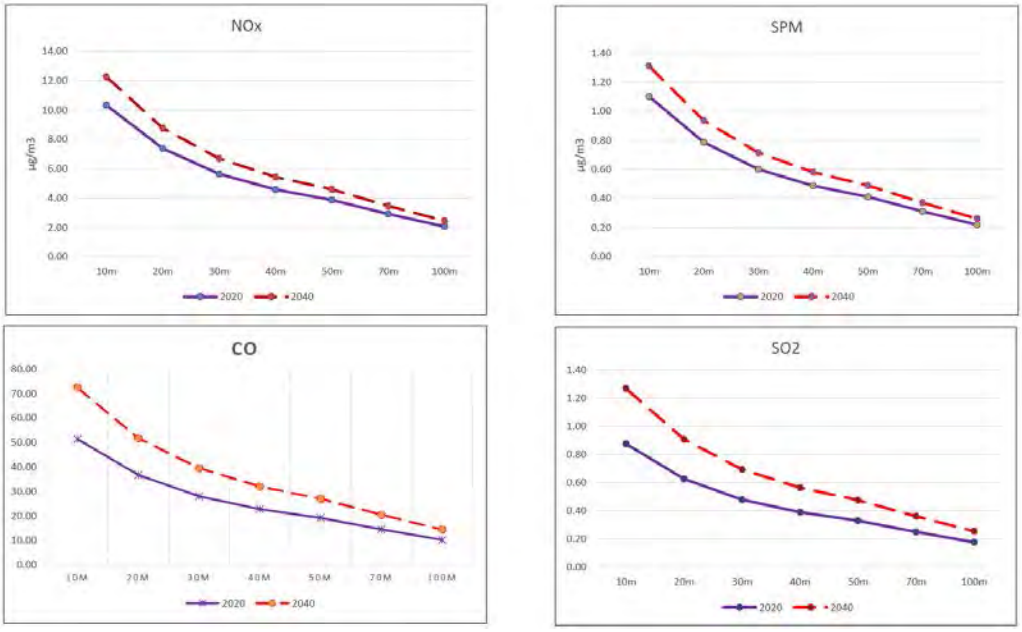
Figure 3.10.12 Estimated concentrations of air pollutants – Flyover IS21, in case of without BRT Project

Impact factor	Survey / prediction results



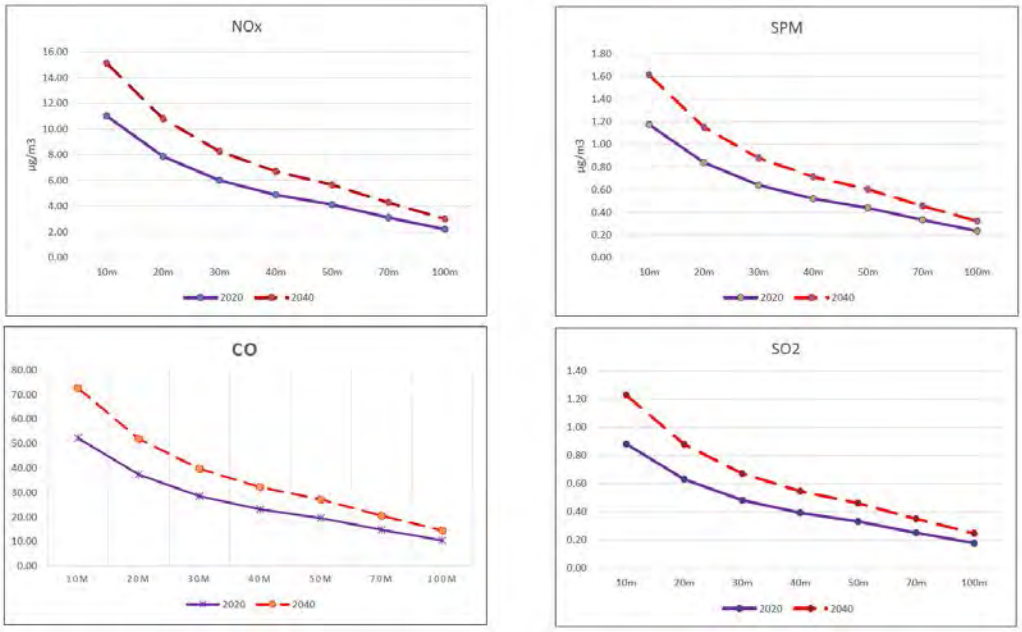
Source: JICA Study Team

Figure 3.10.13 Estimated concentrations of air pollutants – Flyover IS21, in case of with BRT Project



Source: JICA Study Team

Figure 3.10.14 Estimated concentrations of air pollutants – Flyover IS29, in case of without BRT Project

Impact factor	Survey / prediction results
	 Source: JICA Study Team **Figure 3.10.15 Estimated concentrations of air pollutants – Flyover IS29, in case of with BRT Project** In comparison between estimated air pollutant concentrations and allowable maximum of air pollutant concentrations stated in QCVN 05:2010/BTNMT, it can conclude that: - Even in case of occurrence of traffic jam (hour vehicle velocity = 10km) in peak hour, concentrations of TSP, CO, NO_2, SO_2 predicted in 2020 and 2040 at all road sections nearby the planned flyovers IS5, IS21, and IS29 are smaller than the allowable maximum concentrations stated in QCVN 05:2010/BTNMT. - There are no remarkable differences between the air pollutant concentrations predicted in case of "with BRT" and "without BRT". Consequently, it can conclude that impact of air pollutants generated by the Project in operation phase is insignificant. - The predicted traffic volumes in peak hour in all road sections in 2020 and 2040 are relatively low. The heaviest traffic volumes predicted in 2040 in peak hour are 7,116 small-car-units at IS5, and 155 big-car-units at IS12 and IS13. These small traffic volumes are considered as main factors contributing to the low levels of air pollutant concentration.
Water pollution C- / C-	**[In the construction phase]** Polluted water generated from the construction works, especially for the depot may cause negative impact to surface water environment. However, impact of water pollution is predicted insignificant and limited, since the depot is a small-scaled structure, and the use of heavy construction machine is not expected. **[In the operation phase]** The wastewater in operation phase is only generated at the depot, including both domestic wastewater and wastewater from car washing and maintenance activities. Assume that a person working in the depot will use 65 liters of clean water per day [Note 1)1], then the estimated volume of wastewater generated from the depot is about 8,5 m3/per day. In 2020, 16m3/day in 2030, and 24 m3/day in 2040. This waste water should be treated before discharging to drainage system. Domestic wastewater from the depot shall be treated by septic tank. Based on the estimated volume of wastewater at the depot in 2040, the tank capacity shall be as follow: Volume of domestic wastewater = 24 m^3/day * 2 day of storage = 48 m^3;

[1] Note 1) Volume of water used in a common office, as result of a survey in Tokyo, http://www.mhlw.go.jp/topics/bukyoku/kenkou/suido/ryuiki/dl/06.pdf

<table>
<tr><th>Impact factor</th><th>Survey / prediction results</th></tr>
<tr><td></td><td>In addition, wastewater also generated from washing buses. This wastewater contains organic substances, oil and suspended solids that require treatment before discharging to drainage system. Assume that it needs 3 m^3 of water to wash a bus per day, then the estimated total wastewater generated from bus washing is 133 m^3/per day in 2020, 264m^3/day in 2030, and 414 m^3/day in 2040
Wastewater from washing buses shall be collected and screened to extract out solid wastes, before moving to a stabilization tank. Then wastewater shall be stabilized before being discharged into a flotation tank, where oil and suspended solids are removed. Then it shall be discharged into a coagulation and sedimentation tank with supporting of coagulating chemicals. The wastewater needs to be disinfected before discharged to drainage system.</td></tr>
<tr><td>Wastes
C- / C-</td><td><u>[In the construction phase]</u>
Wastes generated during construction phase include solid waste from domestic activities, construction waste and waste hazardous (oil and grease waste).
Domestic-generated solid waste: Domestic solid waste generated from workers' facilities contains organic wastes such as paper, plastics, cartons, food waste. Average generation of domestic solid waste is about 0.4 – 1.0 kg/person/day (Vietnam National Environment Report 2011 – Solid waste). It is estimated 30 – 50 workers/camp (for each construction site of flyovers and BRT depot), the daily solid waste generation caused by this project during construction phase is 12 - 50 kg/day/camp. This waste consists of organic substances (food waste) and other non-biodegradable wastes such as cans, plastic, paper, etc. Beside the impact on the aesthetics, biodegradable wastes would cause bad odor and source of pathogens if proper treatment is not applied.
Construction waste: debris from digging to create ground (background construction) and unsuitable materials, mortar residue and excess concrete, used fuel containers, and oily cloths. This waste mainly causes impact on aesthetics of the area. Hazardous waste sources are oily contaminated waste from regular maintenance such as used fuel containers and oily cloths. The amount of this waste is little and not a regular waste.
<u>[In the operation phase]</u>
At the BRT Depot, waste generated from activities of operational center, fuel recharge station, parking and washing areas. Assume that one person working in the depot will discharge 0.5 kg of solid waste per day, then 65 kg, 125 kg, and 190 kg of solid waste generated from the depot should be collected and treated in 2020, 2030, and 2040, respectively. In addition, hazardous wastes such as waste batteries, tires, oily waste will be generated from the operational and maintaining activities of BRT buses. These hazardous wastes need to be separated, collected, transferred and treated properly to avoid negative impacts on environment as well as public health.
Based on the prediction of BRT demand, estimation of average waste generation at each bus stop station, with about 0.015 kg of waste generated by a passenger per trip, will be 130 kg/day in 2020 and 530 kg/day in 2030.
Table 3.10.24 Planned capacity of the depot
<table>
<tr><th>Year</th><th>2020</th><th>2030</th><th>2040</th></tr>
<tr><td>Shuttle bus (unit)</td><td>9</td><td>9</td><td>9</td></tr>
<tr><td>Feeder bus (unit)</td><td>6</td><td>6</td><td>6</td></tr>
<tr><td>BRT bus (unit)</td><td>29</td><td>73</td><td>123</td></tr>
<tr><td>Total number of bus (unit)</td><td>44</td><td>88</td><td>138</td></tr>
<tr><td>General Manager (pers)</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Staff (pers)</td><td>7</td><td>13</td><td>20</td></tr>
<tr><td>General Affairs Manager (pers)</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Advisor (pers)</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Accountant Chief (pers)</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Accountant staff (pers)</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>Other managers (pers)</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Engineers (pers)</td><td>7</td><td>14</td><td>22</td></tr>
<tr><td>Total staff working at depot (pers)</td><td>22</td><td>35</td><td>50</td></tr>
<tr><td>Bus drivers (pers)</td><td>107</td><td>213</td><td>333</td></tr>
<tr><td>Total personnel number (pers)</td><td>129</td><td>248</td><td>383</td></tr>
</table>
Source: JICA Study Team</td></tr>
<tr><td>Soil pollution
D / C-</td><td><u>[In the operation phase]</u>
Soil pollution in the operation phase is expected mainly from the operation of the BRT depot. Waste oil, oily solid wastes from the bus maintenance work, polluted water from the bus washing, etc., may cause soil pollution to the areas around the depot.</td></tr>
</table>

Impact factor	Survey / prediction results
Noise, vibration B- / B±	**[In the construction phase]** During construction phase, noise may be arised from the following equipments: - Building equipment. - Construction of bored piles for flyovers - Convey soil, stone, materials. The main sources of noise will be construction machines with the noise levels as high as 76 – 89 dBA, which however significantly decrease over distances. Result of noise level at different distances is presented in the following table.

Table 3.10.25 Noise levels from the operation of construction machine

Equipment	Distance (m)					
	1.5*	10	20	30	40	50
Backhoe	78	68.9	65.6	63.7	62.3	61.2
Compactor	83	73.9	70.6	68.7	67.3	66.2
Truck	76	66.9	63.6	61.7	60.3	59.2
Excavator	81	71.9	68.6	66.7	65.3	64.2
Jackhammer	89	79.9	76.6	74.7	73.3	72.2
Gradder	85	75.9	72.6	70.7	69.3	68.2
Bulldozer	82	72.9	69.6	67.7	66.3	65.2
Concrete mix machine	79	69.9	66.6	64.7	63.3	62.2
Crane	81	71.9	68.6	66.7	65.3	64.2
Chain saw	84	74.9	71.6	69.7	68.3	67.2

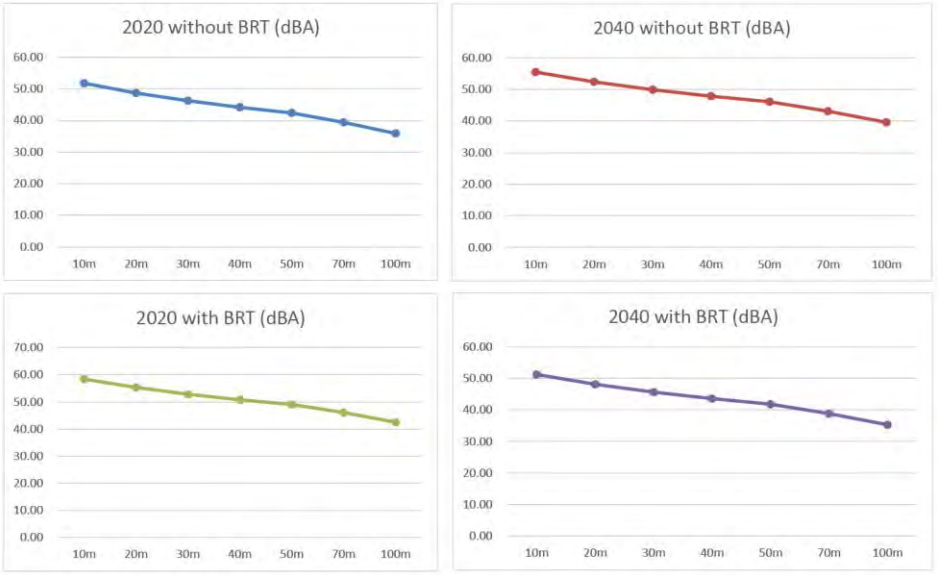
出典: Construction noise handbook (US Department of Transportation, 2006)

In this project, light construction machinery such as backhoe, truck, excavator, bored pile drilling machine will be used to construct flyovers. The noise at distance of 30m is predicted lower than the permissible standard of 70dB from 6h00 to 21h00 (QCVN 26:2010/BTNMT). Accordingly, the noise impact to local residential areas can be rated as moderate and temporary.
Regarding impact of vibration, construction of the flyovers will not apply equipment generating high level of vibration. For construction of BRT depot, soft-soil treatment machine such as pile driving, soil compacting would be used but the vibration caused by these machine is minor. Moreover, the BRT depot is located in an area surrounded mostly by vacant land. There is only a school, Nguyen Khuyen High School, located about 100m from the proposed BRT depot. The impact of vibration therefore is predicted insignificant.

[**In the operation phase]**

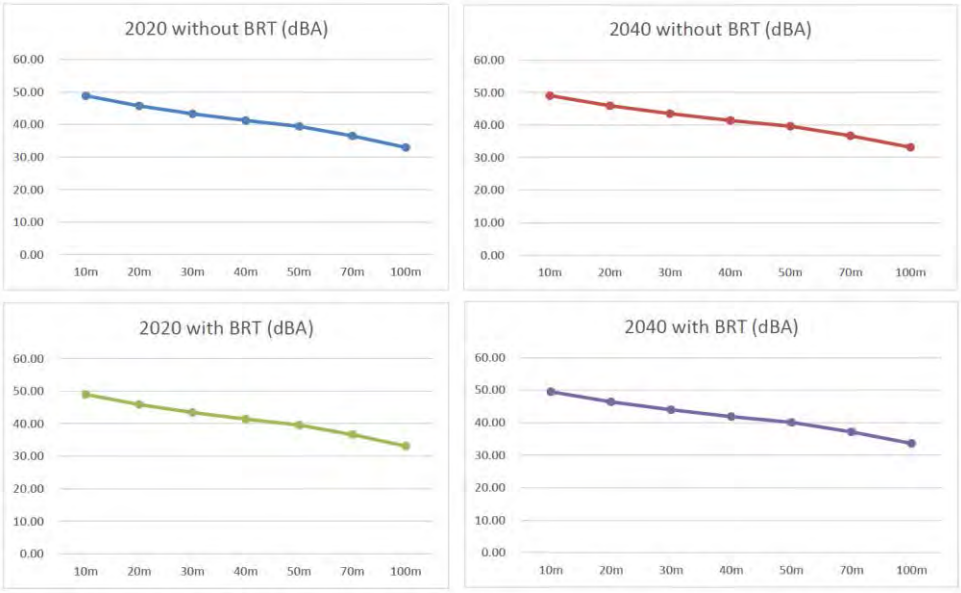
The Model ASJ 2003 (developed by the Acoustic Society of Japan) was used to predict noise levels in the operation phase at several sites along the BRT route. Figure 3.10.16~18） show the results of prediction.

Impact factor	Survey / prediction results



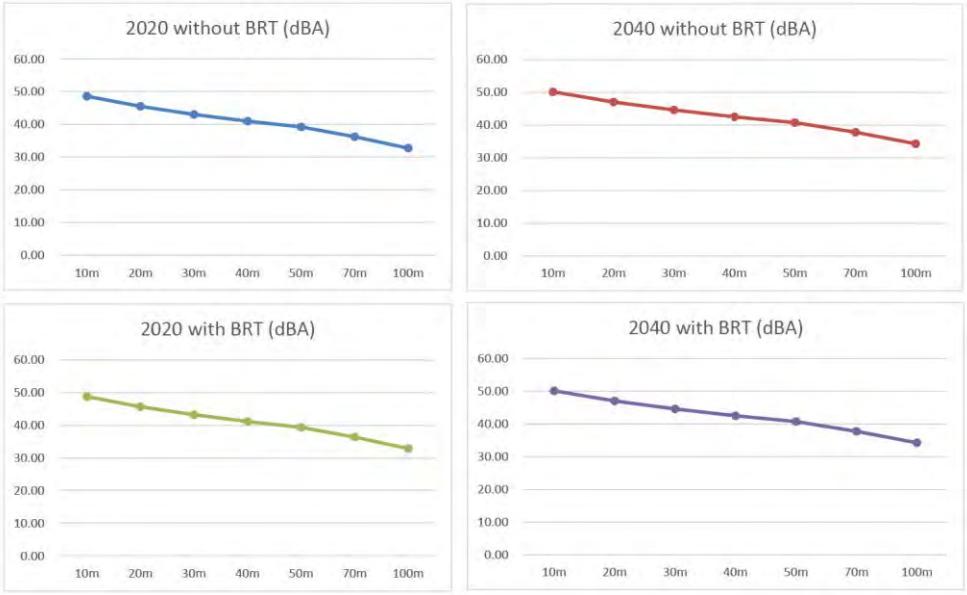
Source: JICA Study Team

Figure 3.10.16 Predicted noise level – at Flyover IS5



Source: JICA Study Team

Figure 3.10.17 Predicted noise level – at Flyover IS21

Impact factor	Survey / prediction results
	 Source: JICA Study Team **Figure 3.10.18 Predicted noise level – at Flyover IS29** Based on the above-mentioned result of estimation, the impact noise in the operation phase can be assessed as below. - The highest noise level (58.4 dBA) is predicted in case of with BRT at the road section nearby the planned flyover IS5 in 2020. Besides, the noise level predicted in case of without BRT at the same road section in the same year of 2020 is 51.8 dBA. Difference between these noise levels is 6.6 dBA. This small difference leads to the conclusion that impact of the BRT Project to acoustic environment is insignificant. - This noise impact assessment does not take into consideration the background noise level, due to the lack of baseline data. However, the noise level monitored on February 11, 2015 at the site nearby the planned flyover IS21 (near An Phu Intersection) is 76.5 dBA and exceeds allowable maximum noise level (70 dBA) stated in QCVN 26:2010/BTNMT "Technical regulation on noise". At some other sites along My Phuoc – Tan Van Road, especially at the sites near the major intersections, the monitored noise levels are also high and exceed the allowable maximum noise level. Therefore, it is recommended to continue monitoring the noise level along My Phuoc – Tan Van Road, and take proper measures to mitigate impact of noise at the sites nearby the sensitive receptors, such as hospital, school, religious facility, etc. Attention should be paid to the two sensitive spots are located right near the BRT route and may be affected directly by the project, Ham An Pagoda (Hiep Thanh Ward) and Doan Thi Diem Primary School (Binh An Ward).
Involuntary resettlement C- / D	**[In the construction phase]** Main infrastructure planned in this project includes: (1) a BRT bus depot planned in Binh Duong New City, (2) a number of flyovers planned in major road intersections, (3) a number of bus stops planned along the bus route, (4) a short-cut road connecting Mp-Tv Road with NH No,1 and STT Station. Land for these facilities and road had been acquired (or is being acquired) by the Binh Duong New City Development Project, or the Mp-Tv Road Construction Project, or the NH No.1 Widening Project. It also does not need to acquire additional land for the planned flyovers and bus stops, because these facilities are planned within the ROW of Mp-Tv Road. Results of the due diligence review of involuntary resettlement for the BRT depot carried out in this PPP F/S can be summarized as following: 1) It is difficult to verify the implementing process of compensation, supports, and resettlement that had been done more than 10 year ago. However, based on the result of interview to affected HHs, it can conclude that agencies in charge of resettlement had paid great effort to carry out the due compensation and help affected HHs in resettlement. 2) The New Law on Land 2003 and its relevant regulations were not applied. However, Binh Duong Province PC's policies on compensation and resettlement were generally relevant.

Impact factor	Survey / prediction results
	3) In general, inventory of loss, definition of entitlement for compensation, calculation of compensation amount, etc. were properly implemented. There is not significant discrepancy in comparison with Vietnamese regulations and JICA Guidelines. 4) Large-scaled resettlement sites were developed, and affected people were compensated with relatively large land lots in these resettlement sites. A part of affected people could use these land lots for restoring their livelihood. Besides, there are many industrial zones around the Binh Duong New City those can provide working place for affected people. 5) There was no complaint raised by the 3 households who had lived in the land lot proposed for the BRT depot. It is said that all complaints raised by other affected people had been completely redressed at the time of due diligence review. 6) There is no recorded problem on the considerations to socially vulnerable groups. 7) It is unable to verify the process of consultation with affected people. 8) Monitoring system has not been established.
Local economy such as employment and livelihood C± / B+	**[In the construction phase]** Residents and business activities near the construction sites of the flyovers may be temporarily affected by dust, noise, traffic jam, etc. during construction stage. However, local residents may have opportunity to work as construction worker for the project.
Existing social infrastructures and service B- / B+	**[In the construction phase]** During construction phase, accidents accompanied with excavation works, construction machinery, etc. may occur. The social survey revealed that serious traffic jams and accidents caused by heavy lorries and trucks are occurred frequently on MP-TV Road. Currently, traffic jams often occur at intersection of MP-TV Road with DT 743A Road, An Phu roundabout, and Phu Loi Road (DT 743). Vehicles for construction work of flyovers may cause increased risk of accidents and traffic jam on the roads around the construction sites. Traffic would be encroached due to arrangement of work items such as scaffold, material yard, machines. Vehicles carrying materials, wastes to and from the construction area may drop spoil or soil on the road surface which creates slippery condition and increases the risk of unsafe traffic. These impacts could be mitigated with implementation of traffic safety management for these vehicles.
Misdistribution of benefit and damage C- / C-	[**In the construction phase]** Residents who reside near the construction sites may suffer more direct impact of dust, noise, traffic jam, etc. than residents who reside far from the construction sites. **[In the operation phase]** Residents who reside right near the bus stops may earn more direct benefits (such as increased land price, reduction of travel time, etc.) from the project than residents who reside far from the bus stops.
Cultural, historical heritage D / B-	**[In the operation phase]** One national heritage relic (Phu Loi Prison) is found in the project area, but it is located 400 m far from the planned BRT route. Among sensitive receptors located along My-Tv Road, Ham An Pagoda (Hiep Thanh Ward) and Doan Thi Diem Primary School (Binh An Ward) may be affected directly by air pollution, noise, traffic accident, etc. caused by the operation of BRT buses. Particular attention should be paid to these two facilities.
Landscape C- / D	[**In the construction phase]** The appearance of temporary structures, construction machines, etc. may cause damage to the local landscape during the construction stage. However there is no outstanding scenic landscape along the BRT route that needs particular consideration.
Infectious diseases such as HIV/AIDS C- / C-	**[In the construction phase]** During the construction phase, risk of HIV/AIDS infection may increase among construction workers, amusement places around construction sites. **[In the operation phase]** Rural communes along the BRT route may be quickly developed in term of economy, and will be easily communicated with other areas, and therefore, may face increased risk of infection.
Working environment (including	[**In the construction phase]** Dust and exhaust gas generated from the construction works may cause negative affect to workers' health. Dust (particulate matters) pollution are generated by earth work activities and truck

Impact factor	Survey / prediction results
working safety) C- / D	movement. Airborne high dust concentrations may cause respiratory difficulty. Chemical hazards generated by exhaust emissions containing high concentration of SO2, CO, VOC, etc., from construction equipment, trucks and painting, which may cause lung diseases. These impacts depends on organization of construction activities and distance from the construction sites/impact generators and the receptor, but they are expected as minor and would be avoided by preventive measures such as personal protective equipment for workers. Besides, accident risks such as the followings may occur at the work place due to improper implementation of safety regulations: - Traffic accidents could occur if the traffic management such as signs and guide management for construction equipment and transportation of raw materials is poorly implemented - Carelessness in labor, lack of personal protection equipment, or lack of strict safety practices could also cause unfortunate accident; - Working hours and long-term continuity can significantly affect the health of workers, causing fatigue, dizziness or fainting spells for workers at construction sites; - Besides, there are other risks of incidents including working on high elevation, electricity shock, working in slippery condition during rainy days, etc.
Accident B- / B-	**[In the construction phase]** During construction phase, the increase of vehicles for the flyover construction works may cause more traffic congestions on the local road network, and increase the risk of traffic accidents around the construction sites. A part of roads around the project sites may be temporarily blocked and cause traffic congestion at some sections. Traffic would be encroached due to arrangement of work items such as scaffold, material yard, machines. The vehicles carrying the materials, wastes to and from the construction area may drop spoil or soil on the road surface which creates slippery condition and increases the risk of unsafe traffic. **[In the operation phase]** There will be an increase of traffic volumes during the operation phase. Traffic accident may occur around the bus stops due to the inattention of both drivers and pedestrians. There would be an increase of the risk of traffic congestion especially at peak hours (3-5 minutes interval of buses) in urban sections which are crowded of many transportation means.
Transboundary impacts, global warming C- / B+	**[In the construction phase]** Greenhouse gas (CO_2) will be generated from the construction works.

Source: JICA Study Team

Following table shows impact assessment in the stage of scoping and the ones based on results of surveys

Table 3.10.26 Impact assessment in scoping stage and after surveys

Items	No.	Environmental factors	Assessment				Reason of assessment
			Scoping		After survey		
			Pre-construction/ construction	Operation	Pre-construction/ construction	Operation	
Pollution	1	Air pollution	B-	C±	B-	D	[Construction stage] ・Dust and polluted gas will be generated from the operation of construction machine around the construction sites of flyovers, depot, bus stops. [Operation stage] ・Impact caused by the operation of buses on ambient air is expected insignificant ・It is expected that total volume of exhausted CO2 and other polluted substances in the project area will be decreased due to the decrease in private vehicle and the mitigation of traffic congestion.
	2	Water pollution	C-	C-	D	B-	[Construction stage] ・Polluted water generated from the construction works, especially for the depot may cause negative impact to surface water environment. However, impact of water pollution is predicted insignificant and limited, since the depot is a small-scaled structure, and the use of heavy construction machine is not expected. [Operation stage] ・Polluted water and waste oil generated from the depot may cause negative impact to the surrounding water bodies.
	3	Wastes	C-	C-	B-	B-	[Construction stage] ・Construction wastes and general wastes from construction sites of flyovers and depot may cause negative impact to the surrounding environment. [Operation stage] ・Improperly-disposed wastes from the depot and the bus stops may cause negative impact to environment.
	4	Soil pollution	D	C-	D	B-	[Construction stage] ・Materials which may cause soil pollution will not be used for construction works. [Operation stage] ・Waste oil and polluted water from the depot may cause soil pollution to the surrounding area.
	5	Noise, vibration	B-	B±	B-	B±	[Construction stage] ・Levels of noise and vibration may increase due to construction works. [Operation stage] ・Level of noise and vibration may increase due to the bus operation. ・ However, noise level in total may decrease due to the decrease in private vehicles.
	6	Ground subsidence	D	D	D	D	[Construction stage / Operation stage] ・Construction of flyovers and depot with light structures on the solid land in the project area is

							expected not cause ground subsidence.
	7	Offensive odor	D	D	D	D	[Construction stage / Operation stage] ・Construction works and its maintenance do not generate offensive odor.
	8	Bottom sediment	D	D	D	D	[Construction stage / Operation stage] ・Large-scale soil reclamation or civil work is not required for construction of flyovers, depot, and bus stops. Therefore, the Project is expected not caused bottom sediment to the surrounding water bodies.
Natural environment	9	Protected areas	D	D	D	D	[Construction stage / Operation stage] ・There is not any protected areas such as national park observed in the project area.
	10	Eco-system	D	D	D	D	[Construction stage / Operation stage] ・The areas around the project site are already urbanized and occupied by many industrial zones and residential areas.
	11	Hydrological situation	D	D	D	D	[Construction stage / Operation stage] ・The construction and operation of the BRT system is expected not cause affect to the flow of rivers those are located far from the BRT route.
	12	Topography and geographical features	D	D	D	D	[Construction stage / Operation stage] ・The project areas is occupied mainly by fairly flat low hills. Impact to topography and geographical features around the depot and flyovers is not predicted.
Social environment	13	Involuntary resettlement	C-	D	D	D	[Pre-construction stage] ・The BRT Project requires land for the depot and the bus route. However, land for the depot had been acquired by Binh Duong PC during the 2003-2010 period, under the Binh Duong Industrial – Service and Residential Complex Development Project. Due diligence survey is required to ensure that the process of land acquisition for this land is conform with JICA Environmental Guidelines. ・Land required for the BRT route had been almost acquired under the Mp-Tv Road Construction Project, Pham Ngoc Thach Road Construction Project, etc. ・Construction of 8 flyovers and 13 bus stops along Mp-Tv Road is planned in Phase 1 (by 2018). However, there is no need to acquire additional land for these flyovers and bus stops, because they are planned within the ROW of Mp-Tv Road. [Operation stage] ・Requirement of additional land acquisition and resettlement is not expected during operation stage of the BRT bus.
	14	The poor	D	C+	D	C+	[Construction stage / Operation stage] ・The Project is expected not cause impact to the poor. ・The Project may help to improve accessibility of the poor, the elderly people, the handicapped persons, etc.
	15	Indigenous and ethnic people	D	D	D	D	[Construction stage / Operation stage] ・Indigenous and ethnic people are not observed residing around the project area.
	16	Local economy	C±	B+	B±	B+	[Construction stage] ・Residents and business activities near the construction

		such as employment and livelihood					sites may be affected by dust, noise, traffic jam, etc. temporarily during construction stage. ・Local residents may have opportunity to work as construction worker for the project. [Operation stage] ・Local economy and industry may be promptly developed due to the improved accessibility to Suoi Tien Terminal Station, New Eastern Bus Terminal, Cai Mep-Thi Vai International Port, Hi-Tech Park, HCMC University, Ben Thanh Business Center, etc. ・The Project may contribute to economic development of the areas around the bus stops
	17	Land use and utilization of local resources	B+	A+	B+	A+	[Construction stage / Operation Stage] ・There may be significant change in land use in the areas along Mp-Tv Road, especially in the areas around the bus stops, where agricultural land may change into residential land, urban land, commercial land, etc. ・The flyovers and the pedestrian bridge built at the bus stops may help local residents to across Mp-Tv Road in more easier and safer manner. ・Improvement of traffic condition may distribute to the efficient use of local resources.
	18	Water usage or water rights and rights of common	D	D	D	D	[Construction stage / Operation Stage] ・There is not any river or lakes in the project area. The project is expected not cause impact to the water usage of local residents.
	19	Existing social infrastructures and service	B-	B+	B-	B+	[Construction stage] ・Traffic jam may occur on the roads around the construction sites during construction. [Operation stage] ・The BRT buses may help improve local residents' accessibility to public facilities in large area.
	20	Social capitals, local organizations, such as authorities to make decisions	D	D	D	D	[Construction stage / Operation stage] ・Mp-Tv is a newly constructed road, and therefore the BRT project will not cause significant impact to the existing public transportation system of the locality.
	21	Misdistribution of benefit and damage	C-	C-	B-	B+	[Construction stage] ・Residents who reside near the construction sites may suffer more direct impact of land acquisition, dust, noise, traffic jam, etc. than residents who reside far from the construction sites. [Operation stage] ・Residents who reside right near the bus stops may earn more direct benefits (such as increased land price, reduction of travel time, etc.) from the project than residents who reside far from the bus stops.

	22	Local conflict of interests	D	D	D	D	[Construction stage / Operation stage] ・Conflict of interests between local residents/communes is not predicted by the Project.
	23	Cultural, historical heritage	C-	C-	B-	B-	[Construction stage / Operation stage] ・One national heritage relic (Phu Loi Prison) is found in the project area, but it is located 400 m far from the planned BRT route. ・Some sensitive spots (churches, pagodas, schools, etc.) are found within 500m from the planned BRT route. However, among these spots, Ham An Pagoda (Hiep Thanh Ward) and Doan Thi Diem Primary School (Binh An Ward) are located right near the BRT route and may be affected directly by the Project.
	24	Landscape	C-	D	D	D	[Construction stage/Operation stage] ・Negative impact to landscape is not predicted, due to no any scenic landscape is observed in the area along the BRT route.
	25	Gender	D	D	D	D	[Construction stage / Operation stage] ・Impact to gender that requires particular consideration is not expected.
	26	Children's right	D	C+	D	B+	[Construction stage] ・Impact to children's right that requires particular consideration is not expected. [Operation stage] ・The bus operation and the pedestrian bridge at the bus stop may help improve children's accessibility to other areas.
	27	Infectious diseases such as HIV/AIDS	C-	C-	D	D	[Construction stage] ・Risk of HIV/AIDS infection may increase among construction workers, amusement places around construction sites. [Operation stage] ・Rural communes along the BRT route may be quickly developed in term of economy, and will be easily communicated with other areas, and therefore, may face increased risk of infection.
	28	Working environment (including working safety)	C-	D	B-	D	[Construction stage] ・Dust and exhaust gas generated by construction works may cause negative affect to workers' health. ・Wastes from worker camps and construction office may worsen sanitary condition of the surrounding areas. [Operation stage] ・Impact to working environment that requires particular consideration is not expected.
Others	29	Accident	B-	B-	B-	B-	[Construction stage] ・There is risk of traffic accident on the roads around the construction sites. [Operation stage] ・Traffic accident may occur around the bus stops due to the inattention of both drivers and pedestrians.
	30	Transboundary	C-	B+	C-	B+	[Construction stage] ・Greenhouse gas (CO_2) will be generated by

		impacts, global warming					construction works. [Operation stage] • It is expected that total volume of greenhouse gas will be decreased, due to the decrease in motorbikes and other means of private transportation. • The BRT buses using compressed natural gas (CNG) as fuel will be introduced to the Project with aim to reduce green house gas.

Note A+/-: serious positive/negative impact is expected;
B+/-: positive/negative impact is expected to some extent;
C+/-: extent of impact is unknown, further study is needed;
D: limited impact/negligible impact, further study is not needed.
Source: JICA Study Team

3.10.11 Impact mitigation measures

Table 3.10.27 shows the recommended environmental management plan（EMP） for the impacts assessed as "A-", or "B-". The EMP includes the relevant recommended mitigation measures, organizations in charge of EMP implementation, organizations in charge of supervision the implementation of EMP, and financial sources.

Table 3.10.27 Environmental Management Plan（EMP）

Impact	Recommended impact mitigation measures	Implementing organizations	Supervision organizations	Financial sources
Construction stage				
1. Air pollution (B-)	1) Site inductions would be provided to make construction workers aware of air quality control practices and responsibilities. 2) Construction activities would be modified, reduced or controlled during high or unfavorable wind conditions if they would potentially increase off-site dust emissions. 3) Measures would be implemented to control dust emissions, such as the use of water carts, sprinklers, sprays and dust screens. The frequency of use would be modified in response to weather conditions. 4) Disturbed areas would be stabilized as soon as practicable to prevent or minimize windblown dust. 5) Controls, such as rumble grids or wheel wash facilities, would be implemented to minimize the tracking of dirt onto public roads. 6) Hardstand areas and surrounding public roads would be cleaned, as required. 7) Speed limits would be posted and observed by all construction vehicles on the construction site. 8) Haul trucks, plant and equipment would be switched off when not in operation for periods of greater than 15 minutes. 9) Construction plant, vehicles and machinery would be maintained in good working order and in accordance with manufacturers' specifications. 10) A formal dust observation program would be implemented during construction, involving daily reviews of weather forecasts, observations of meteorological conditions and on site dust generation.	Contractors	Binh Duong Province DOT / PMU / Construction Supervision Consultant	Project cost / contract cost

Impact	Recommended impact mitigation measures	Implementing organizations	Supervision organizations	Financial sources
	This would inform mitigation measures or alterations to construction activities to be implemented during unfavorable weather conditions (such as dry weather and strong winds).			
2. Wastes (B-)	1) No burning of debris, construction wastes or vegetation shall be allowed on-site. 2) Waste shall be segregated on-site to facilitate re-use, recycling, and collected and disposed by licensed companies. 3) Raw material requirements shall be planned at the outset of each construction activity to avoid excess material storage and wastage on-site. 4) Wastes shall be stored and handled in dedicated areas with bounded sides such a way as to avoid loss or leakage and subsequent pollution. 5) The Contractor shall segregate construction waste materials on-site to facilitate re-use, recycling and waste disposal practice in accordance with the best available technology. 6) Contractor shall liaise with the Municipal Environmental Company of Binh Duong Province to determine the appropriate location for reuse. 7) Waste oils, chemicals, paints and other such materials used for machinery maintenance and construction shall be collected and stored in bundled areas on-site for resale/re-use or managed disposal. 8) In locations remote from the site offices the Contractor shall provide latrine pits in suitable locations for the convenience of the construction workforce. 9) Sewage from site toilets, kitchens and similar, shall be discharged to a septic tank and soak-away system. Grease traps shall be installed where canteen waste is collected.	Contractors	Binh Duong Province DOT / PMU/ Construction Supervision Consultant	Project cost / contract cost
3. Noise, vibration (B-)	1) Construction Noise and Vibration Management Plan would be prepared and implemented, and would include the following: ・ Identification of nearby residences and other sensitive land uses. ・ Description of approved hours of work. ・ Description and identification of all construction activities, including work areas, equipment and duration. ・ Description of what work practices (generic and specific) would be applied to minimize noise and vibration. ・ A complaints handling process. ・ Noise and vibration monitoring procedures. ・ Overview of community consultation required for identified high impact works. 2) Induction and training would be provided to relevant staff and sub-contractors outlining their responsibilities with regard to noise. 3) A protocol would be developed to identify the need for and provision of respite measures for residential receivers. Respite measures may include the restriction to the hours of construction activities resulting in	Contractors	Binh Duong Province DOT / PMU/ Construction Supervision Consultant	Project cost / contract cost

Impact	Recommended impact mitigation measures	Implementing organizations	Supervision organizations	Financial sources
	impulsive or tonal noise (such as rock breaking, rock hammering, pile driving), or other appropriate measures agreed between the contractor and residential receiver. 4) Equipment would be regularly inspected and maintained to ensure it is in good working order. 5) Noisy equipment would be orientated away from residential receivers. 6) Where feasible and reasonable, the use of temporary noise hoardings would be considered where ancillary construction facilities are in proximity to sensitive receivers. 7) Noise monitoring would be conducted at the commencement of construction activities and periodically during the construction program.			
4. Local economy such as employment and livelihood (B-)	1) The contractors will be encouraged to employ project-affected residents and other local residents to work as construction worker. 2) Construction vehicle operation plan should be appropriately made, and routes for construction vehicles should be properly planned to mitigate impacts to local business activities. 3) For proper control of traffic or when/ where necessary, flagmen shall be assigned to direct the movement of traffic on access roads to the construction site. 4) In order to minimize disruption to traffic flows the construction site shall be enclosed with temporary fence to provide a visual barrier between the construction site and adjacent traffic. 5) In case of blocking traffic for transport of heavy equipment the contractor shall inform and co-operate with local authorities and people in advance to minimize impacts to local traffic and local people.	Contractors	Binh Duong Province DOT / PMU/ Construction Supervision Consultant	Project cost / contract cost
5. Existing social infrastructures and service (B-)	1) Construction vehicle operation plan should be appropriately made, and routes for construction vehicles should be properly planned to mitigate traffic jam on the local road network. 2) The relocation of electric cables, communication cables, water supply pipes, irrigation ditches, drainage gutters, etc. should be carefully planned and duly implemented so as these relocation works will not interrupt local residents' daily life activities and production activities for long time.	Contractors	Binh Duong Province DOT / PMU/ Construction Supervision Consultant	Project cost / contract cost
6. Misdistribution of benefit and damage (B-)	1) Measures described in Items 1. & 3. & 5. above shall be implemented to mitigate impacts of dust, noise, traffic jam, etc., to residents who riside near the construction sites.	Contractors	Binh Duong Province DOT / PMU/ Construction Supervision Consultant	Project cost / contract cost
7. Cultural, historical heritage (B-)	1) Measures described in Items 1. & 3. above shall be implemented to mitigate impacts of dust, noise, etc., to Ham An Pagoda and Doan Thi Diem Primary School.	Contractors	Binh Duong Province DOT / PMU/ Construction Supervision Consultant	Project cost / contract cost
8. Working environment	The following measures should be taken by the Contractor during construction phase:	Contractors	Binh Duong Province DOT / PMU/	Project cost / contract

Impact	Recommended impact mitigation measures	Implementing organizations	Supervision organizations	Financial sources
(including working safety) (B-)	1) Provide construction workers with sufficient personal protection equipment (PPE) such as hard hats, earpiece, safety shoes, and others; 2) Provide seminars on safety issues for local public, particularly for school students; 3) Install warning signs whereas the potential dangers are present; 4) Erect temporary fence around high risk areas to control public access and light them at night if that is on the regular roads used by the locals; 5) Assign construction staffs on or near places where construction vehicles are crowded to ensure safety.		Construction Supervision Consultant	cost
9. Accident (B-)	1) The location of the bus stops, pedestrian crossings, and other safety auxiliaries should be properly designed to ensure traffic safety for pedestrians, and mitigate impediment to local resident movement. 2) Construction vehicle operation plan should be appropriately made, and routes for construction vehicles should be properly planned to avoid concentration of machinery and vehicles in limited roads. 3) For proper control of traffic or when/ where necessary, flagmen shall be assigned to direct the movement of traffic on access roads to the construction site. 4) In order to minimize disruption to traffic flows the construction site shall be enclosed with temporary fence to provide a visual barrier between the construction site and adjacent traffic. 5) In case of blocking traffic for transport of heavy equipment the contractor shall inform and co-operate with local authorities and people in advance to minimize impacts to local traffic and local people. 6) Drivers of vehicles bringing equipment and materials should be properly trained to ensure that they observe the driving rules, driving routes, etc.	Contractors	Binh Duong Province DOT / PMU/ Construction Supervision Consultant	Project cost / contract cost
Operation stage				
10. Water pollution (B-)	1) Plan to treat wastewater and waste oil from the depot project should be prepared to mitigate negative impacts to the surrounding ditchs, ponds, etc. 2) Domestic wastewater from the depot shall be treated by septic tank. Based on the estimated volume of wastewater at the depot in 2040, the capacity of the septic tank shall be more than 48 m3. 3) Wastewater generated from car washing that contains organic substances, oil and suspended solids shall be collected and screened to extract out solid wastes, before moving to a stabilization tank. Then wastewater shall be stabilized before being discharged into a flotation tank, where oil and suspended solids are removed. Then it shall be discharged into a coagulation and sedimentation tank with supporting of coagulating chemicals. The wastewater needs to be disinfected before discharged to drainage system. 4) Rain water from the ground of the depot shall be directly discharged to local drainage system. Solid waste on the ground shall be regularly cleaned to	Depot Management Company (under contract with BRT Operator)	Binh Duong Province DOT / BRT Operator	BRT operation cost

Impact	Recommended impact mitigation measures	Implementing organizations	Supervision organizations	Financial sources
	prevent pollutants from running into the drainage system and potentially cause water pollution.			
11. Wastes (B-)	1) Solid waste generated from the depot and bus stops should be properly collected and treated. 2) Hazardous wastes such as waste batteries, tires, oily waste, etc., generated from the operational and maintaining activities of BRT buses should be separated, collected, transferred and treated properly to avoid negative impacts on environment as well as public health.	Depot Management Company and BRT Operator	Binh Duong Province DOT / BRT Operator	BRT operation cost
12. Soil pollution (B-)	1) Measures described in Item 10 above should be duly implemented to prevent soil pollution caused by waste oil and polluted water from the depot.	Depot Management Company	Binh Duong Province DOT / BRT Operator	BRT operation cost
13. Noise, vibration (B-)	1) BRT buses should be regularly and properly maintained to keep the buses in good condition and reduce noise level at the sources (buses). 2) It needs to monitor the noise levels along the road, and take proper measures to mitigate impact of noise to the sensitive receptors, such as school, religious facility.	BRT Operator	Binh Duong Province DOT	BRT operation cost
14. Cultural, historical heritage (B-)	1) Regular monitoring of noise level near Ham An Pagoda (Hiep Thanh Ward) and Doan Thi Diem Primary School (Binh An Ward) should be conducted. Planting trees or installation of fences may be considered if the impact becomes seriously. 2) Examination of mitigation measures shall be consultated with affected people and local authorities where the excessive noise level is observed. 3) Use of horn shall be limited or prohibited at sensitive areas along the roads such as schools, pagodas.	BRT Operator	Binh Duong Province DOT	BRT operation cost
15. Accident (B-)	1) Bus drivers should be properly trained to ensure that they observe the driving rules, operate the bus in safety manner, etc.	BRT Operator	Binh Duong Province DOT	BRT operation cost

Source: JICA Study Team

3.10.12 Organizations revolving in the implementation of EMP

(1) Institutional organizations for implementation of EMP

The project executing agency assigned by the project owner is responsible for implementing the EMP throughout the project in order to avoid and mitigate impacts caused by the project to the extent possible. In order to realize the above mentioned EMP related activities, the Construction Supervision Consultant (CSC) who is employed by the project owner will supervise the EMP implementation and periodically organize environmental monitoring.

The contractors shall implement necessary preventive and mitigation measures to ensure environmental protection during pre-construction and construction phases. Details of organizations and their responsibilities are described in the following table.

Table 3.10.28 Roles and Responsibilities for Implementing the EMP

Organization	Responsibilities
The executing agency (Binh Duong Province	Prepare contractual requirements and ensure that contractors follow the EMP Ensure that construction contractors implement mitigation measures via environmental protection provisions in construction contracts

Organization	Responsibilities
DOT / PMU)	Provide DONRE and JICA monitoring reports related to EMP implementation Inform local authorities and communities on status of the project and EMP implementation Coordinate with relevant parties in solving complaints from local people and authorities
Design Consultants	Conduct design for the structures (flyovers, bus stations, depot, etc.) with consideration of proper drainage system, plants and green areas for noise and dust reduction, safety for passengers
Construction Supervision Consultant (CSC)	Conduct environmental monitoring for three phases of the project Recommend additional mitigation measures during the construction stage, if necessary Conduct monitoring of the contractor's environmental performance with regard to implementation of EMP provisions and prepare quarterly monitoring reports Undertake regular spot inspections to ensure that the contractor is following the EMP, and advise the Project Director in case of any failures in the implementation Coordinate activities with the contractor and the executing agency
Contractors	Implement environmental mitigation and preventive measures as described in the EIA report as well as additional measures as necessary or as required by the executing agency or CSC Undertake regular site inspections to ensure best practices are used Document and address comments or complaints from the local residents.
BRT Operator (in operation phase)	Operate and maintain properly the structures in operation phase Ensure environmental protection measures such as measures for controlling wastewater quality at the depot, traffic management, etc.

Source: JICA Study Team

3.10.13 Environmental Monitoring Program (EMoP)

The following table shows the preliminarily proposed environmental monitoring plan.

Table 3.10.29 Environmental monitoring plan (EMoP)

No	Item Monitoring	Construction Stage	Operation Stage
1	Air pollution	1) Monitoring location 10 sites as described in the note below 2) Monitoring frequency Every 3 months, during construction period 3) Monitoring method TSP, CO, NO_2, SO_2, PM10, microclimate parameters Every 2hours in 16 hours from 6 a.m. to 10 p.m. Compared to criteria in QCVN 05:2009/BTNMT, QCVN 05:2013/BTNMT	1) Monitoring location 10 sites as described in the note below 2) Monitoring frequency Every 6 months, during 2 years 3) Monitoring method TSP, CO, NO_2, SO_2, PM10, microclimate parameters Every 2hours in 24 hours Compared to criteria in QCVN 05:2009/BTNMT, QCVN 05:2013/BTNMT
2	Water pollution (wastewater)	--	1) Monitoring location 1 site near the bus depot 2) Monitoring frequency Every 6 months, during 2 years 3) Monitoring method Temperature, pH, DO, SS, BOD5, COD, Coliform, oil content

No	Item Monitoring	Construction Stage	Operation Stage
			Compared to criteria in : a) QCVN 14 : 2008/BTNMT (National technical regulation on domestic wastewater) b) QCVN 29:2010/BTNMT (National Technical Regulation On the Effluent of Petroleum Terminal and Stations)
3	Wastes	1) Monitoring location At the waste storages around the construction sites, and at the waste dumping sites 2) Monitoring frequency Regular monitoring by CSC 3) Monitoring parameters The generated volume of wastes (waste soil and rock; demolition materials, domestic wastes, office wastes, etc.); The storage, collection, transportation and disposal of wastes Environmental conditions of the waste dumping sites	1) Monitoring location At the waste storages in the bus depot, and around the bus stops 2) Monitoring frequency Periodic monitoring by BRT Operator 3) Monitoring parameters The generated volume of wastes (domestic wastes, office wastes, etc.); The storage, collection, transportation and disposal of wastes
4	Soil pollution	--	Similar to '2. Water pollution'
5	Noise, vibration	1) Monitoring location 10 sites as described in the note below 2) Monitoring frequency Every 3 months, during construction period 3) Monitoring method Noise (Leq), Vibration (Laeq) Continuous 24 hours, every 2 hours/ time	1) Monitoring location 10 sites as described in the note below 2) Monitoring frequency Every 6 months, during 2 years 3) Monitoring method Noise (Leq), Vibration (Laeq) Continuous 24 hours, every 2 hours/ time
6	Local economy	1) Monitoring location Sampled business entities around the bus stops and flyovers 2) Monitoring frequency Every 3 months during the construction period 3) Monitoring method Interview based on monitoring format.	--
7	Existing social infrastructure and service	1) Monitoring location Relocation sites of electric cables, communication cables, water supply pipes, irrigation ditches, drainage gutters, etc. 2) Monitoring frequency Regular monitoring by PMU during the pre-construction phase 3) Monitoring method Conduct on-site observation on the relocation works.	--
8	Misdistribution of benefits and damage	1) Monitoring location Sampled households and business entities around the bus stops and flyovers 2) Monitoring frequency Every 3 months during the construction period 3) Monitoring method Interview based on monitoring format.	--
9	Cultural, historical heritage	--	1) Monitoring location Ham An Pagoda and Doan Thi Diem Primary School

No	Item Monitoring	Construction Stage	Operation Stage
			2) Monitoring frequency Periodic monitoring by BRT Operator 3) Monitoring method Interview based on monitoring format.
10	Infectious diseases such as HIV/AIDS	--	1) Monitoring location All commune health care stations along the BRT route. 2) Monitoring frequency Periodic monitoring by BRT Operator 3) Monitoring method Interview based on monitoring format.
11	Working environment	1) Monitoring location All construction sites and worker camps 2) Monitoring frequency Regular monitoring by CSC 3) Monitoring method Check reports on construction site management prepared by contractors Conduct on-site observation at the construction sites	--
12	Accidents	1) Monitoring location All construction sites 2) Monitoring frequency Regular monitoring by CSC 3) Monitoring method Check reports on working safety management prepared by contractors Conduct on-site observation around the construction sites	1) Monitoring location Traffic signs, signals, safety facilities, etc., along the BRT route 2) Monitoring frequency Periodic monitoring by BRT Operator 3) Monitoring method Check complaints raised by local residents Conduct on-site observation to check the conditions and performance of the traffic safety auxiliaries.

Note: Location of monitoring sites for air pollution, noise, and vibration.
Site 1: km00+000 MP-TV (starting point of My Phuoc –Tan Van Road)
Site 2: km02+000 – Near Doan Thi Diem Elementary School
Site 3: km07+000 –Near Tan Ninh Pagoda
Site 4: km07+471 – Nguyen Thi Minh Khai intersection
Site 5: km10+600 – Near An Phu Intersection
Site 6: km11+950 – An Phu 16
Site 7: km14+650 – Near DT746 Intersection
Site 8: km17+870 – Near DT743 Intersection
Site 9: km20+630 – Near Hoa An Pagoda
Site 10: Near BRT Depot in Binh Duong New City
Source: JICA Study Team

3.10.14 Predicted environmental cost

(1) Cost for implementing the environmental management plan (EMP)

The following table shows the predicted cost for implementing mitigation measures during construction phase (i.e. construction of the depot and 7 flyovers).

Table 3.10.30 Cost for implementing mitigation measures during construction phase

No.	Item	Implementation responsibility	Unit price (VND)	Number	Total cost	
					(Mil. VND)	(USD)
1	Temporary barriers to minimize noise and dust during construction	Contractor	100,000,000	9 (1 set/ construction site)	900	41,341
2	Wastewater treatment	Contractor	150,000,000	9 (1 system/ construction site)	1,350	62,012
3	Mobile hygiene toilets	Contractor	20,000,000	1 (2 toilets/ 8 construction site)	360	16,537
4	Bins for collect garbage, oil and grease	Contractor	5,000,000	9 (1 set/ construction site)	45	2,067
5	Training on occupational health and safety	Contractor	20,000,000	9 (1 time/ construction site)	180	8,268
	Total cost				2,835	130,225

Note: exchange rate is USD 1 = VND 21,770 (Vietcombank on 2015 July 02)
Note: Cost items must be reviewed in detail at the stage of detailed design
Source: JICA Study Team

(2) Total cost for implementing the environmental management plan (EMP) and the environmental monitoring program (EMoP)

The total cost for implementation of EMP and EMoP is presented in the following table (Detailed calculation is described in the EIA Report which is separately prepared in this Study).

Table 3.10.31 Cost for implementation of EMP and mitigation measures

No.	Item	Implementation responsibility	Total cost	
			(VND)	(USD)
1	Environmental monitoring program	Project executing agency/PSC	1,245,400,000	57,207
1.1	Pre-construction phase	Project executing agency/PSC	119,800,000	5,503
1.2	Construction phase	Project executing agency/PSC	736,800,000	33,845
1.3	Operation phase	Project executing agency/PSC	388,800,000	17,859
2	Cost for implementation of mitigation measures in construction phase	Contractor	2,835,000,000	130,225
	Total cost		4,080,400,000	187,432

Note: exchange rate is USD 1 = VND 21,770 (Vietcombank on 2015 July 02)
Note: Cost items must be reviewed in detail at the stage of detailed design
Source: JICA Study Team

3.11 Consensus Building

3.11.1 Meeting with Counterparts

JICA Study team has regular meetings with counterparts of local government organizations, Binh Duong Province and HCMC, and their public corporations, BECAMEX IDC and SAMCO. Items of The BRT Project have been discussed mainly with Binh Duong Province and BECAMEX IDC, because most of the project area is under their jurisdiction. And major issues and context has been discussed with HCMC side. We have had a kick-off meeting at first to explain the contents of Inception Report, and had monthly meetings six times till now to discuss major issues of the project. Following table shows agenda of each meeting about the BRT project with Binh Duong Province. As to meetings with HCMC, see Chapter 2.10.

Table 3.11.1 Meeting with Binh Duong Province

	Date	Attendance (Organization of Binh Duong Province)	Major agenda
Kick off Meeting	28th Feb. 2014	DOT, BECAMEX IDC, DPI, DOC, Thu Dau Mot, Thuan An, Di An	・ICR contents ・Holding monthly meeting
1st Monthly Meeting	27th Mar. 2014	DOT, BECAMEX IDC, DPI, DOC, Thu Dau Mot, Thu An, Di AN, DONRE	・Traffic Survey ・Data request
2nd Monthly Meeting	28th Apr. 2014	DOT, BECAMEX IDC, DPI, DOC, Thu Dau Mot, Thuan An, Di An	・BRT route ・Traffic survey
3rd Monthly Meeting	29th May. 2014	DOT, BECAMEX IDC, DOC, Thu Dau Mot, Thu An, Di AN, DONRE	・BRT Route and speed ・BRT Cross section ・Demand forecast ・Facility plan
4th Monthly Meeting	24th Jun. 2014	DOT, BECAMEX IDC, DPI, DOC, Thu Dau Mot, Thu An, Di AN, DONRE	・BRT Cross section ・Facility Plan
5th Monthly Meeting	29th Jul. 2014	DOT, BECAMEX IDC, DPI, DOC, Thu Dau Mot, Thu An, Di AN	・Facility Plan ・Vehicle and system plan ・Business plan
6th Monthly Meeting	5th Sep. 2014	DOT, BECAMEX IDC, DPI, DOC, Thu Dau Mot, Thu An, Di AN, DONRE	・BRT route (restudy) ・Business plan ・EIA
1st Steering Committee	14th Nov. 2014	PC, DOT, BECAMEX IDC, DPI, DOC, Thu Dau Mot, Thu An, Di AN, DONRE	・BRT basic concept ・O&M plan ・Business plan
7th Monthly Meeting	10th Feb. 2015	DOT, Becamex Tokyu Bus, DOC, Thu Dau Mot, Thu An, DONRE	・Urban development plan with BRT development ・Demand forecast ・Business plan
2nd Steering Committee Meeting	2nd Dec. 2015	PC, DOT, DOF, DPI, BECAMEX IDC, DOC, Thu Dau Mot, Thu An, Di AN, DONRE	・Explanation and Approval of DFR ・Issues for the BRT implementation

Source: JICA Study Team

Source: JICA Study Team

Photo Meeting with Binh Duong Province (Left:Kick off Meeting, Right: 2nd Steering Committee)

3.11.2 Agreement and Issue

Table 3.11.2 Issues to be discussed regarding the BRT project.

No.	Issue	Handled by
1.	Whole section opening of Mp-Tv Rd.	BECAMEX IDC
2.	Project implementation schedule and future actions	
	Conduct local FS and get approval of investment plan from Vietnamese central government	BD DOT
	EIA approval procedure based on EIA draft prepared by JICA Study Team:	BD DOT
	Explanation to MPI and MOF	BD PC, BD DOT
3.	Development of BRT related projects	BD DOT HCM DOT

Source: JICA Study Team