SOCIALIST REPUBLIC OF VIETNAM
THE PEOPLE'S COMMITTEE OF HO CHI MINH CITY
MANAGEMENT AUTHORITY FOR URBAN RAILWAYS

SOCIALIST REPUBLIC OF VIETNAM
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT

FINAL REPORT

MARCH 2012

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO., LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO., LTD.

OPS
CR(5)
12-020

TABLE OF CONTENTS

－ ABBREVIATIONS TABLE －

ADB	Asian Development Bank
BTCS	Ben Thanh Central Station
C&C	Cut and Cover
CBD	Central Business District
BRT	Bus Rapid Transit
DFP	Department of Fire Fighting and Prevention
DOC	Department of Construction
DOF	Department of Finance
DONRE	Department of Natural Resources and Environment
DOSTE	Department of Natural Resources and Environment
DOT	Department of Transportation
DPA	Department of Planning and Architecture
DPI	Department of Planning and Investment
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EMoP	Environmental Monitoring Plan
EMP	Environmental Management Plan
EPC	Environmental Protection Commitments
ESC	Environmental Supervision Consultant
GDMH	General Department of Meteorology and Hydrology
HCMC	Ho Chi Minh City
HCM PC	The People's Committee of Ho Chi Minh City
HIDS	Ho Chi Minh City Institute for Development Studies
HOUTRANS	Ho Chi Minh City Transport Master Plan 2002～2004
IEE	Initial Environmental Examination
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt fur Wiederaufbau
LEP	Law on Environmental Protection
MARD	Ministry of Agriculture and Rural Development
MAUR	Management Authority for Urban Railways
MFA	Ministry of Foreign Affairs
MOCI	Ministry of Culture and Information, now is the Ministry of Culture, Sport and Tourism
MOF	Ministry of Fishery
MOH	Ministry of Health
MOI	Ministry of Industry
MONRE	Ministry of Natural Resources and Environment
MOST	Ministry of Sciences and Technologies

MOSTE	Ministry of Science, Technology and Environment
MOT	Ministry of Transportation
MOT	Ministry of Trade
MPI	Ministry of Planning and Investment
NEA	National Environment Agency
QCVN	national technical regulation
QCVN	national technical regulation
SEA	Strategic Environmental Assessment
STRASYA	STandard urban RAilway SYstem for Asia
TBM	Tunnel Boring Method
TCVN	Vietnamese Standard
UMRT	Urban Mass Rapid Transit
USM	Underground Shopping Mall
UNEP	United Nations Environment Programme
VNMB	Vietnam Marine Bureau
VEA	Vietnam Environment Administration
VEPA	Vietnam Environment Protection Agency

CHAPTER 1 INTRODUCTION

1.1 PURPOSE AND BACKGROUND OF THE SURVEY

1.1.1 Location of Object of the survey

Country : The Socialist Republic of Vietnam
Region : Ben Thanh Area, Ho Chi Minh City

Figure 1.1 Location map of object of the survey

1.1.2 Purpose and Background of Survey

1) Background

The vicinity of Ben Thanh Station (a metro terminus) on Line 1 of the Ho Chi Minh City Urban Mass Rapid Transit (hereinafter "UMRT"), which is currently under planning of construction with an ODA loan from Japan, has long been a major urban hub centering on a market and attracting many city people. With inner-city trunk roads and a bus terminal located in close proximity, it forms a major transport terminus into which Metro Lines 2, 3a, and 4 will link, according to plans for the future. Thus, the neighborhood has high concentrations of people and urban functions, serving as a core of the economy, tourism, history, culture, and commerce. Meanwhile, it is poorly served by roads and other infrastructure, leaving the surrounding area with problems such as traffic congestion. A major issue for the neighborhood is to improve the local infrastructure.

A particular problem is the structure of traffic intersections, such as the roundabouts constructed during the days of French rule, which are unable to deal with the current surge in vehicles and two-wheeled vehicles. Ensuring adequate separation between vehicles, two-wheeled vehicles, and pedestrians is also proving increasingly difficult. Thus the need for an improvement in transport infrastructure is evident and the neighborhood must deal with traffic-related issues including redevelopment of the road network, introduction of public transport to change travel behavior, and improvement of pedestrian spaces.

At the same time, demand is growing for infrastructure facilities associated with future metro station development, including a station plaza, access roads, and an underground pedestrian passageway. There are also calls to redevelop the bus terminal and other transport facilities. To provide visitors with a public space offering an enhanced standard of services and comfort, it is necessary to develop a quality urban space centering on the metro station and to consider the inclusion into this development project of commercial and other facilities financed using private capital.

2) Purpose

In consideration of above mentioned situation, the project which creates high-quality urban space centering around the metro station is to be performed. This project is intended to provide the city with a central interchange, improve the infrastructure (including construction of a station plaza) conducive to regeneration of the area, and establish commercial and other facilities using private finance. By increasing Ben Thanh Station’s ability to attract passengers, the resulting quality urban space will increase the number of UMRT users, which will eventually lead to more stable business operations for UMRT.

The purpose of the survey described here is to conduct an investigation to verify the adequacy, effectiveness, efficiency, and other aspects of the improvement project in which private capital is used for the purpose of project implementation.

The specific approach is to investigate the current state of the area and the issues facing it, and then to elucidate the infrastructure improvement needs. A schematic infrastructure improvement plan is to be formulated in line with the opinions of the Ho Chi Minh City administration and related Vietnamese personnel and the trends they have outlined. The project is assessed in full consideration of these findings. Further, based on the proposed improvement plan, the cost of the project is estimated and a project scheme (including the anhk division and cost sharing between the public and private sectors) developed. Finally, the efficiency and effectiveness of the project is assessed and, based on the results of a project risk study, an overall assessment is delivered.

1.1.3 Necessity of Project

1) Necessity of Infrastructure

There is rising expectation that redevelopment of the area around Ben Thanh Station will accompany metro development, with people urging large-scale regeneration of the area. In response, a statutory urban plan aimed at regenerating the station area is under development. (NIKKEN SEKKEI LTD. is performing this service named as “The Formulation of Urban Construction Detailed Planning on Scale of 1/2000 and Urban Architectural Management Regulation at Level 2 for The Existing Center of Ho Chi Minh City” ordered by the Management Authority of Construction Planning Project of Ho Chi Minh City.) This plan will prioritize improvements to the area and stipulate land use and building conditions, urban design, the use of underground space, station plaza improvements, etc. In addition, since Metro Line 1 is already under tender for a contractor, an urgent issue is the formulation of a development plan that integrates surface and subsurface usage in compliance with the statutory plan and the plans for Metro Line 1. Such a plan will greatly contribute to urban regeneration in the area.

In consideration of above mentioned situation, the project which creates high-quality urban space centering on the metro station is to be performed. This project is intended to provide the city with a central interchange, improve the infrastructure (including construction of a station plaza) conducive to regeneration of the area, and establish commercial and other facilities using private finance. By increasing Ben Thanh Station’s ability to attract passengers, the resulting quality urban space will increase the number of UMRT users, which will eventually lead to more stable business operations for UMRT.

2) Consistence with Vietnam Government’s Policies

In “The Socio-Economic Development Strategy (SEDS) from 2001 to 2010”, Vietnam government officially announced the vision that the economy will become an industrial country by 2020. It is very important to provide the sufficient infrastructure for the sustainable economic development in order to enhance the economic growth and promote the industrialization and the modernization. Especially, the economic loss is huge by the chronic traffic jam in the metropolis like Hanoi City and Ho Chi Minh City, so that the infrastructure development in the metropolis has first priority among the various developments in Vietnam.

Besides, from the viewpoint of the financial load reduction of the government the infrastructure development with the private finances is expected. Therefore the basic PPP infrastructure-related law came into effect in November 2010, which is however only Vietnam government trial efforts at enforcement.

3) Consistence with the Government of Japan’s Country Assistance Program

On the Japanese side, the government’s Country Assistance Program for Vietnam (July 2009) is promoting a PPP scheme that takes advantage of the expertise and technology of Japanese companies in the field of infrastructure development. In terms of project implementation, the scheme focuses on an improvement in the urban transport network as the core assistance in “urban railway, transportation and traffic, and communication network improvement”, which is categorized as a priority development area in the “promotion of economic growth and strengthening of international competitive ability.”

4) Japan's ODA for Railway Development in Ho Chi Minh City

The report "The Study on Urban Transport Master Plan and Feasibility Study in Ho Chi Minh Metropolitan Area (hereinafter HOUTRANS)" (2002-2004) produced by Japan International Cooperation Agency (hereinafter JICA) sets the target share of public transport at 45-50% for the city. This target has been adopted in the basic policy of the Ministry of Construction.

Currently, the Government of Japan is supporting in constructing Metro Line-1. JICA conducted HOUTRANS in 2002-2004, and 5 urban railway lines were proposed in Ho Chi Minh City. Based on HOUTRANS with some modifications of the alignments and added one new line, Ho Chi Minh City transport master plan was approved by the Prime Minister in 2007. Line-1 was selected for the pre-feasibility study project in HOUTRANS. Japan Bank for International Cooperation (JBIC, currently JICA) funded on the feasibility study (SAPROF) on the Line-1 in 2006, which was extended to Suoi Tien Bus Terminal. In 2007, the Vietnamese and Japanese governments agreed that the Government of Japan would provide Yen loan to invest in this project and the consultant service started in Feb 2008. This Line-1 has 19.7km long (2.2 km for underground, 17.2km for elevated, 0.3km for transition). For Line-1, it was decided by the Vietnamese Government to adopt "Standard Urban Railway System for Asia (hereinafter STRASYA)" which is a Japanese technical standard for urban railways defined by Ministry of Land, Infrastructure and Transport, Japan in 2007.

5) Other Donor Activities for Railway Development in Vietnam

Besides Line-1, Line-2 (Ben Thanh – Tham Luong) project is supported by the Government of Germany (KfW), Asian Development Bank (ADB) and European Investment Bank (EIB) among other 6 lines.

In Hanoi, the Government of Japan has committed in supporting in urban railways as well. Currently, there are two urban railways (Metro) under the support of the Government of Japan, Line-1 and Line-2, while there are 5 lines approved in the Master Plan in Hanoi, and Line-3 is under preparation of the support by the French Government. In case of Hanoi, JICA also supports the urban development surrounding the railway stations of aforesaid two metro lines by the technical assistance. However, this kind of technical assistance has not been conducted in Ho Chi Minh City.

As illustrated above, the cooperation on urban railways in Ho Chi Minh City as well as Hanoi is very important and competitive among developed countries which want to sell their advanced urban railway system strategically. In this regard, the support on Ben Thanh Central Station is very important from the view point of not only transport planning and railway network of Ho Chi Minh City but also the strategic promotion of Japanese railway and urban development system.

6) Necessity from Users' Viewpoints

Ben Thanh area, which has a high concentration of urban functions in the center of Ho Chi Minh City, is a major urban hub attracting many city people. In this area, the underground station of UMRT Line 1 is planned to be a central station receiving 4 UMRT Lines which are 1, 2, 3a, and 4. Ho Chi Minh City is planning to redevelop the road network and introduce public transport to change the travel behavior of its citizens. Therefore, in near future UMRT

Lines are expected to be the main traffic measures for city people to reach Ben Thanh area.

According to above mentioned viewpoints, the visitors to the underground development around Ben Thanh Central Station are estimated to be mainly city people who arrive at this area by UMRT Lines. Especially they are the commuters to this area and the shoppers visiting the underground development commercial facilities. In additional, as the underground bus terminal is planned around the station in the statutory urban plan, it is expected that this facility shall be visited by bus passengers and passengers transferring between UMRT and bus. Thus it is very important for city people coming to this area to be able to move from the UMRT station to the destination safely and comfortably. It is necessary that the station is connected to the surrounding area seamlessly and the visitors can move without the disturbance by motorbikes and automobiles on ground.

UMRT Line 1 is currently under construction planning funded by ODA loan from Japan and it is expected to commence construction soon. With the same timing, this project, which provides the station plazas and the passageway centering on the station and establishes commercial facilities, is intended to create a high-quality urban space for visitors' safety and comfort.

1.2 OUTLINE OF THE PROJECT

1.2.1 Scope of the Project

The services comprise an investigation of the area around Ben Thanh UMRT Station, Ho Chi Minh City, Vietnam.

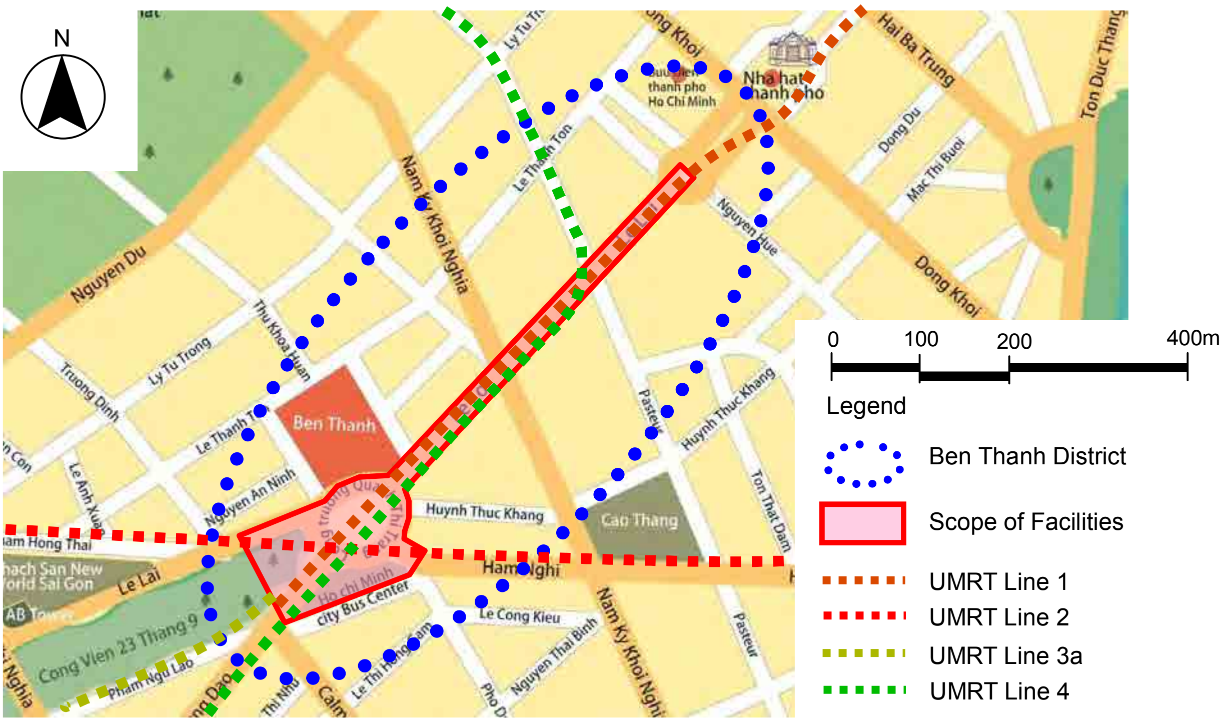


Figure 1.2 Map of project scope

1.2.2 Key Points of the Project

The key points of this project are as follows:

- The aim of the project is to establish a hub that acts as a nodal point in the transport network while developing the vicinity, taking the perspective of integrated regional development.
- While conforming with the Ho Chi Minh City master plan, the project also stresses integration between surface and subsurface development, aiming for comprehensive development that includes both above-ground and below-ground sections.
- An “underground traffic network system” will be developed, centering on the metro station and linking to underground parking and a bus terminal through connections to the underground shopping area and adjacent private buildings, thereby aiming at a comprehensive development of the entire area.

1) Formation of a central hub for Ho Chi Minh City (economy, tourism, history, culture, and commerce)

A public space will be created that integrates surface and subsurface developments centering on UMRT Line 1 Ben Thanh Station. Adjoining the public space, private-financed commercial and other facilities will be constructed to form an underground continuum with buildings in the neighborhood, thus establishing urban amenities offering greater convenience and more local connectivity. This quality public urban space, linked intimately with the neighborhood, will act as an urban core for economy, tourism, history, culture, and commerce.

2) Using private capital to establish a transport node around the metro station and an improved underground shopping area

Ben Thanh Station on UMRT Line 1 is to be a future junction with Lines 2, 3a, and 4. Inner-city trunk roads pass close by above it and there is a bus terminal in close vicinity, so the neighborhood acts as a major transport terminus. Taking advantage of these circumstances, the area is to be developed into a quality node in the urban transport network.

Work to improve public transport facilities, including the bus terminal and underground parking along with organic links between them such as an underground walkway, will be the responsibility of the public sector. Meanwhile, in the underground plaza and other areas, commercial premises will be constructed through private-sector initiative so as to create an underground space for visitors that offers improved amenity, fun, and comfort.

3) Coordination with surrounding developments and formulation of underground pedestrian network

The metro station, underground station plaza, and underground shopping area will be connected on a single level with the subsurface floors of adjacent buildings. As the nearby buildings are constructed, this will evolve into an underground pedestrian network connecting various transport amenities into a transport node. With its increased accessibility, the network will help to draw more visitors to the underground premises, which in turn will increase the profitability of the underground shopping area and other commercial activities. It will also add to the asset value of the nearby private properties because they also become more accessible. Thus, the project area will gain in importance as an urban core while at the same time contributing to improved local integration.

4) Use of underground space above metro section as public space

The underground plaza, passages, and shopping area will make use of the space above Ben Thanh Station and will be developed in conjunction with its construction. This will reduce the cost of each part as compared with developing it as an independent project, enhancing profitability for each project owner.

5) Integrated surface and subsurface development

To deliver a comfortable and usable underground space, it is essential to design the underground plaza and other subsurface spaces with open ceilings, hence providing integration with aboveground developments. Further, from the viewpoint of consistency with the statutory urban plan implemented by Ho Chi Minh City, the plan for development of the underground space must include improvements to surface roads.

1.2.3 Outline of the Project

This project is a infrastructure development to make the Ben Thanh area a high quality urban space as a traffic node involving the Ben Thanh Central station intersectionally receiving 4 lines of UMRT Line 1, 2, 3a, and 4. Considering the future UMRT lines in addition to Line 1 which has already been on the tendering stage, the smooth transfer from one line to another and the high connectivity of Ben Thanh station and other traffic facilities (bus terminal, taxi bay, and parking) will be ensured. Furthermore the underground passageways can be connected to the basement of surrounding new buildings. In this project the underground plaza and passageway will be constructed on the basement 1st floor, so the comfortable urban space in the center of Ho Chi Minh City can be created and the underground shopping mall will be formed with retail stores on the both sides of the passageway in approx. 500m underground space up to Opera House station.

Scale of Project	:	Area of basement 1st floor	:	52,000m2 (by estimation)
		(Including the underground shopping mall and a part of station facilities)		
		Length : approx. 780m		Width : approx. 44m & 140m
Depth of facilities	:	Level of basement 1st floor	:	approx. GL-9m
		Excavation level	:	approx. GL-12m

Figure 1.3 Overview of Ben Thanh Market and September 23rd Park

< PURPOSE OF PROJECT >

The project which creates high-quality urban space centering around the metro station is to be performed. This project is intended to provide the city with a central interchange, improve the infrastructure (including construction of a station plaza) conducive to regeneration of the area, and establish commercial and other facilities using private finance.

< OUTLINE OF PROJECT >

- The underground plaza and passageway will be constructed on the basement 1st floor as same floor as the paid concourse centering around Ben Thanh Central station. In addition the underground shopping mall will be formed arranging the retail stores on both side of the passageway.
- The development area is around Ben Thanh station area and beneath Le Loi street up to Opera House station.
- The on-ground in the development area is public road (Quach Thai Trang Rotary and Le Loi street) and a part of Sptenmber 23rd park.
- Ben Thanh Central station receives not only UMRT Line 1 but also Line 2, 3a, and 4.

< SCALE OF PROJECT >

Area of basement 1st floor :
52,000m^2 (by estimate)
(including the underground sopping mall and a part of station facilities)
Length : approx. 780m
Width : approx. 44m & 140m
Level of basement 1st floor :
approx. GL-9m
Excavation level :
approx. GL-12m

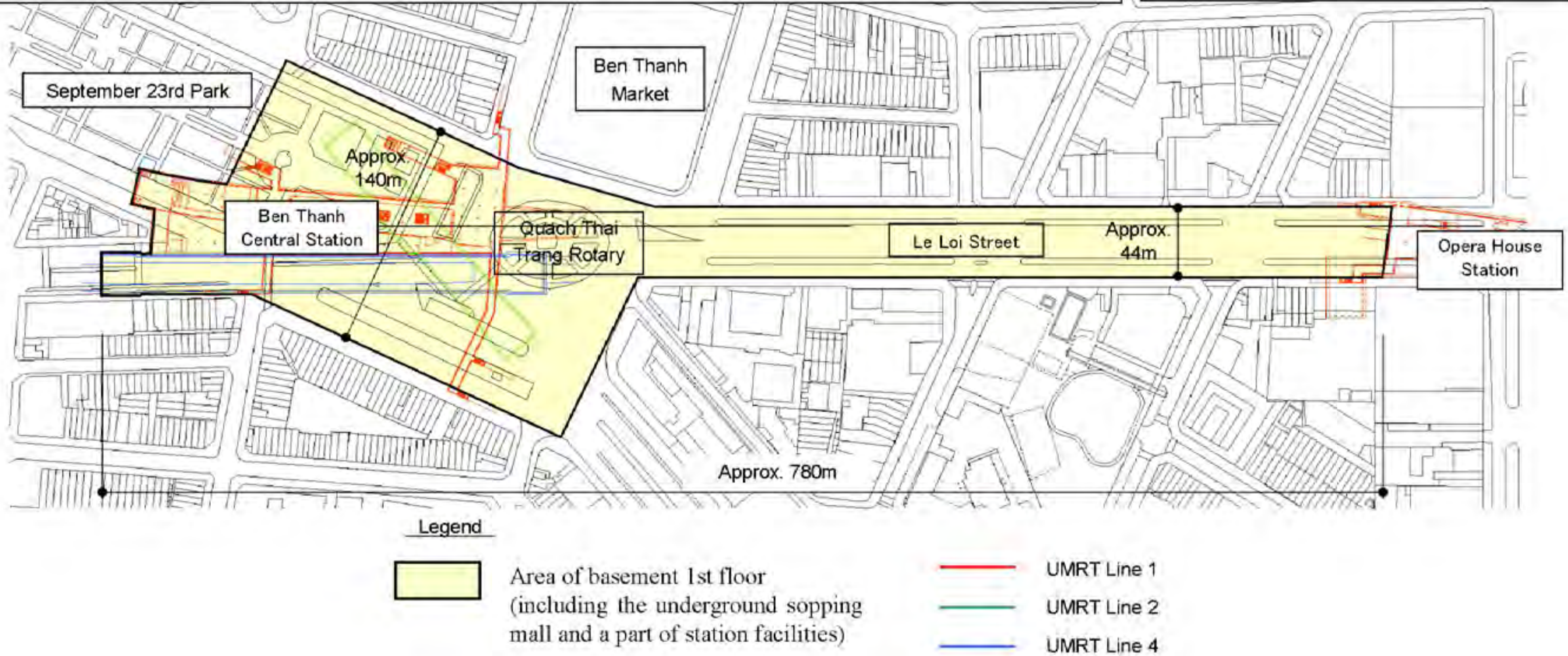


Figure 1.4 Outline of the project

1.3 SURVEY IMPLEMENTATION

1.3.1 Flowchart of the Survey

The survey is carried out according to the flowchart below.

＜Survey items＞	＜Survey details＞
(1) Investigation of current situation and strategies in project area	1) Investigation of current situation in the area and related projects 2) Investigation of relevant legal systems 3) Investigation of future strategies
(2) Collation of issues and understanding of project needs	1) Collation of issues related to the project area 2) Understanding of project needs
(3) Formulation of project improvement plan	1) Understanding of traffic volume forecasts 2) Study for improvement planning policy 3) Study for schematic facility design
(4) Consultations with concerned parties	1) Collation of agencies related to the project 2) Consultations with concerned parties
(5) Investigation of environmental and social considerations	1) Study for environmental relevant law system 2) Research on environmental and social impact
(6) Project cost estimation and study of technological issues	1) Study for construction methods and technological issues 2) Study for traffic measures during construction 3) Estimation of overall project cost 4) Summary of technological issues for construction
(7) Study and proposal for project implementation scheme	1) Study for division between public and private work 2) Study for project implementation program 3) Study for organization for project implementation 4) Study for schedule 5) Study and proposal for funding plan 6) Analysis of financial situation 7) Income and expenditure planning 8) Financial balance of the project
(8) Assessment of project feasibility	1) Study for project risks 2) Dealing with existing underground obstacles 3) Financial analysis and economic analysis 4) Survey of developers' investment intent 5) Overall assessment and proposal
(9) Study for project effects	

Figure 1.5 Flowchart of the survey

1.3.2 Organization of the Survey Implementation

The counter part of this survey is Management Authority for Urban Railways (MAUR). MAUR has the responsibility for the implementation of all UMRT lines. They take charge of the feasibility study, the design, and the construction. And they will also conduct the operation and the maintenance in the future.

This survey is advanced through the technical and business meetings with the Technical Unit Team which is organized by mainly staffs of Investment Preparation Project Management Unit and others in MAUR. In addition, regarding the important study content, the consensus with the Task Team for Ben Thanh Central Station Project is built through the conferences. This task team is organized in HCMC PC for the evaluation of the Preparatory Survey on Ben Thanh Central Station Project. The organization of this Task Team is shown below.

Table 1.1 Organization of the task team for Ben Thanh Central Station Project

	Department	Post
Chairman	MAUR（Management Authority for Urban Railways）	Vice Chairman
Member	DOC（Department of Construction）	Deputy Director
	DPA（Department of Planning and Architecture）	Deputy Director
	HIDS（Ho Chi Minh City Institute for Development Studies）	Vice Chairman
	DOF（Department of Finance）	Head of Investment and Repairment Office
	MAUR Investment Preparation Project Management Unit	Director
	DPI（Department of Planning and Investment）	Deputy Head of ODA Office
	DOT（Department of Transportation）	Expert of DOT

CHAPTER 2 CIRCUMSTANCES SURROUNDING THE PROJECT

2.1 SOCIOECONOMIC CIRCUMSTANCES

2.1.1 Socioeconomic Situation in Ho Chi Minh City

Ho Chi Minh City (formerly Saigon), known as the pearl of the East, is located in the southeast part of Vietnam. It borders Tay Ninh Province and Binh Duong Province on the north, Dong Nai Province and Ba Ria-Vung Tau Province on the east, and Long An Province and Tien Giang Province on the west and south. The city measures 2,095 km^2 in area and makes up 0.63% of the total land area of Vietnam.

Located in southern Vietnam's major economic zone, Ho Chi Minh City is a multifunctional city that drives the economic growth of both the surrounding region and the country as a whole. The city's economic growth rate was 12.6% in 2007, and its GDP was USD 14.2 billion, accounting for 20% of the total GDP of Vietnam. The value from its industrial products, exports and financial activities accounts for 1/3 of the country's total, and the city plays a major role in promoting economic growth in Vietnam. Moreover, Ho Chi Minh City is the largest industrial zone in Vietnam, with major industries that include textile manufacture, chemical manufacture, shipbuilding, machinery manufacture, rice flour milling, production of beer and other beverages, and sugar processing. Annual sales from industry in Ho Chi Minh City amount to USD 5.8 billion (2007 figures), accounting for 23% of the total nationwide. In recent years, there has been rapid growth in business, trade, finance, the telephone industry, transportation, the entertainment industry, the travel industry and other modern service industries, and these now amount to USD 74.3 billion (of which independent businesses account for USD 68.3 billion). The rapid growth of these service industries has helped to streamline of the economic structure.

Ho Chi Minh City also has the greatest population density of any city in Vietnam. In 2009, the city's population was 7,165,398. Of this figure, 5,884,241 lived in the 19 provinces within the city, while the remaining 1,281,157 live in the five suburban provinces (according to data from the Ho Chi Minh City Bureau of Statistics). By 2025, the residential population of the city is expected to reach 10 million (4 to 4.5 million in the old provinces, 2.8-2.9 in the six new provinces, and 2.6 in the suburban areas). Of this figure, the immigrant population is expected to account for 2.5 million people. As Vietnam's largest economic and financial center, Ho Chi Minh City has attracted many people from the surrounding regions of Vietnam in recent years. For this reason, the city's population has increased by 200,000 each year since 1999 (see Table 2.1-Table 2.4 and Fig. 2.1-Fig. 2.4).

Under integrated administration, Ho Chi Minh City seeks to become a cultural city that achieves harmony between economic growth and the preservation of its historical and cultural attributes, the environment and so on. Ho Chi Minh City aims to contribute to greater growth in southern Vietnam and in the country as a whole by becoming a center for industry, services, and scientific and technological research in Southeast Asia.

At the same time, however, there is increasing pollution of the urban environment, particularly as a result of the exhaust emitted from two-wheeled vehicles. The air pollution caused by increased traffic congestion is a barrier to many attractive investment activities and curtails the economic growth of the city. To achieve the goal of forming a cultural city, the problems of two-wheeled vehicular exhaust and traffic congestion must be resolved as quickly as possible.

Table2.1 Statistical Population of HCMC by 2009

	NUMBER OF DISTRICT	AREA (sq.km)	POPULATUIN (人)	DENSITY (人/sq.km)
Total	322	2,095.01	7,165,398	3,420
Urban Area	259	494.01	5,884,241	11,911
- Dist. 1	**10**	**7.73**	**186,483**	**24,125**
- Dist. 2	11	49.74	144,966	2,914
- Dist. 3	14	4.92	190,177	38,654
- Dist. 4	15	4.18	194,545	46,542
- Dist. 5	15	4.27	193,260	45,260
- Dist. 6	14	7.19	263,802	36,690
- Dist. 7	10	35.69	261,802	7,335
- Dist. 8	16	19.18	406,176	21,177
- Dist. 9	13	114.00	247,612	2,172
- Dist. 10	15	5.72	230,386	40,277
- Dist. 11	16	5.14	230,946	44,931
- Dist. 12	11	52.78	373,499	7,077
- Go Vap	16	19.74	535,188	27,112
- Tan Binh	15	22.38	416,225	18,598
- Tan Phu	11	16.06	395,188	24,607
- Binh Thanh	20	20.76	463,516	22,327
- Phu Nhuan	15	4.88	183,235	37,548
- Thu Duc	12	47.76	411,945	8,625
- Binh Tan	10	51.89	555,290	10,701
Rural Area	63	1,601.00	1,281,157	800
- Cu Chi	21	434.50	340,112	783
- Hoc Mon	12	109.18	344,054	3,151
- Binh Chanh	16	252.69	421,529	1,668
- Nha Be	7	100.41	102,488	1,020
- Can Gio	7	704.22	73,014	104

Source：Statistical Office in Ho Chi Minh City http://www.pso.hochiminhcity.gov.vn/

Table2.2 Demographic Statics of HCMC

	2005	2006	2007	2008	2009
1. Mean Population					
Total	6,230,926	6,483,033	6,725,864	6,945,854	7,165,398
Urban Area	5,232,947	5,436,405	5,627,664	5,778,354	5,884,241
Rural Area	997,979	1,046,628	1,098,200	1,167,500	1,281,157
2. Birthrate (‰)					
Total	15,71	14,78	14,97	14,35	14,33
Urban Area	15,34	14,40	14,65	13,92	13,91
Rural Area	17,68	16,73	16,62	16,44	16,43
3. Mortality (‰)					
Total	4,20	4,12	4,13	3,97	3,96
Urban Area	4,16	4,11	4,12	4,02	3,85
Rural Area	4,41	4,17	4,17	4,41	4,47
4. Population Growth Rate(‰)					
Total	11,51	10,66	10,84	10,38	10,37
Urban Area	11,18	10,29	10,53	9,91	10,06
Rural Area	13,27	12,56	12,45	12,03	11,96
5. Population Influs Rate (‰)	19,97	19,92	21,46	21,71	21,76

Source : Statistical Office in Ho Chi Minh City http://www.pso.hochiminhcity.gov.vn/

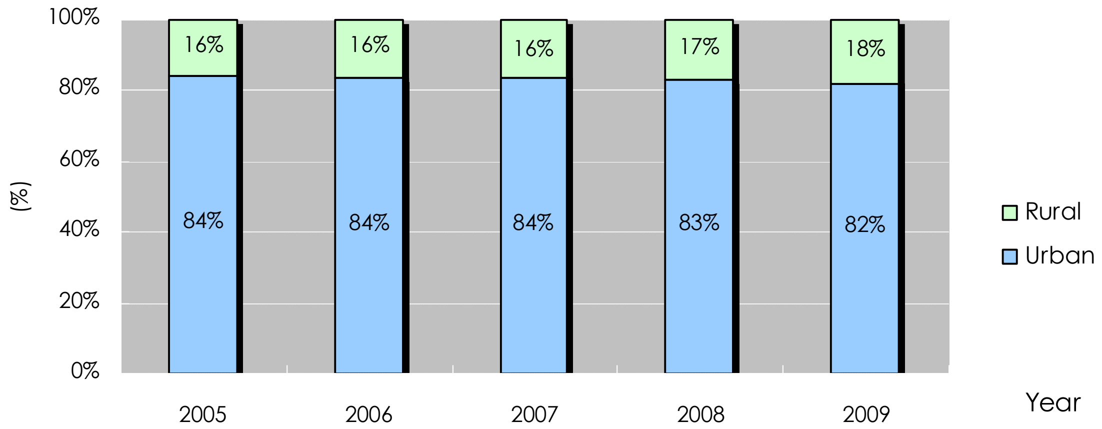


Figure2.1 Population Ratio

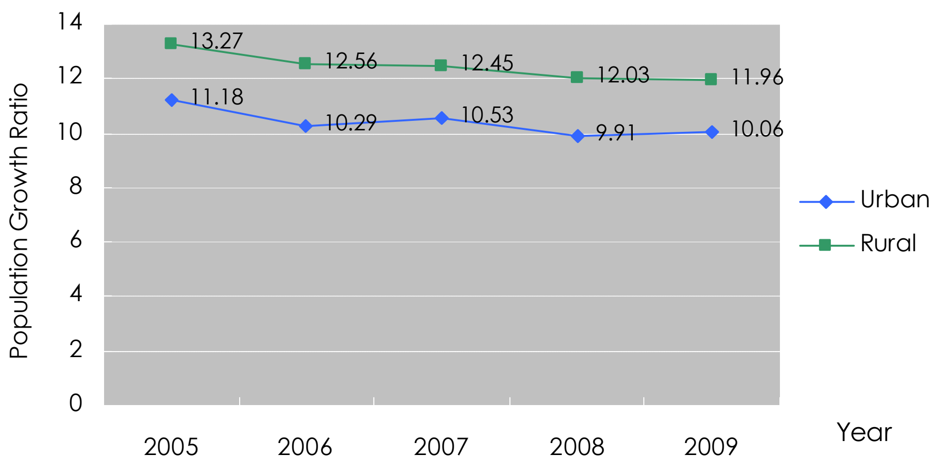


Figure2.2 Population Growth Ratio

Table2.3 Demographic Statics of HCMC

Year	Total	Investment			
		Domestic	Domestic Investment		Foreign
			Government managed	Non-government managed	
1995	100.0	84.0	60.7	23.4	16.0
2000	100.0	67.5	42.2	25.3	32.5
2001	100.0	67.2	39.1	28.1	32.8
2002	100.0	65.6	36.5	29.0	34.4
2003	100.0	66.0	32.6	33.4	34.0
2004	100.0	66.5	31.2	35.2	33.5
2005	100.0	65.2	29.1	36.1	34.8
2006	100.0	63.4	24.8	38.6	36.6
2007	100.0	63.1	18.8	44.2	36.9
2008	100.0	60.2	18.5	42.0	39.8
2009	100.0	61.4	17.1	44.4	38.6

Source : Statistical Office in Ho Chi Minh City http://www.pso.hochiminhcity.gov.vn/

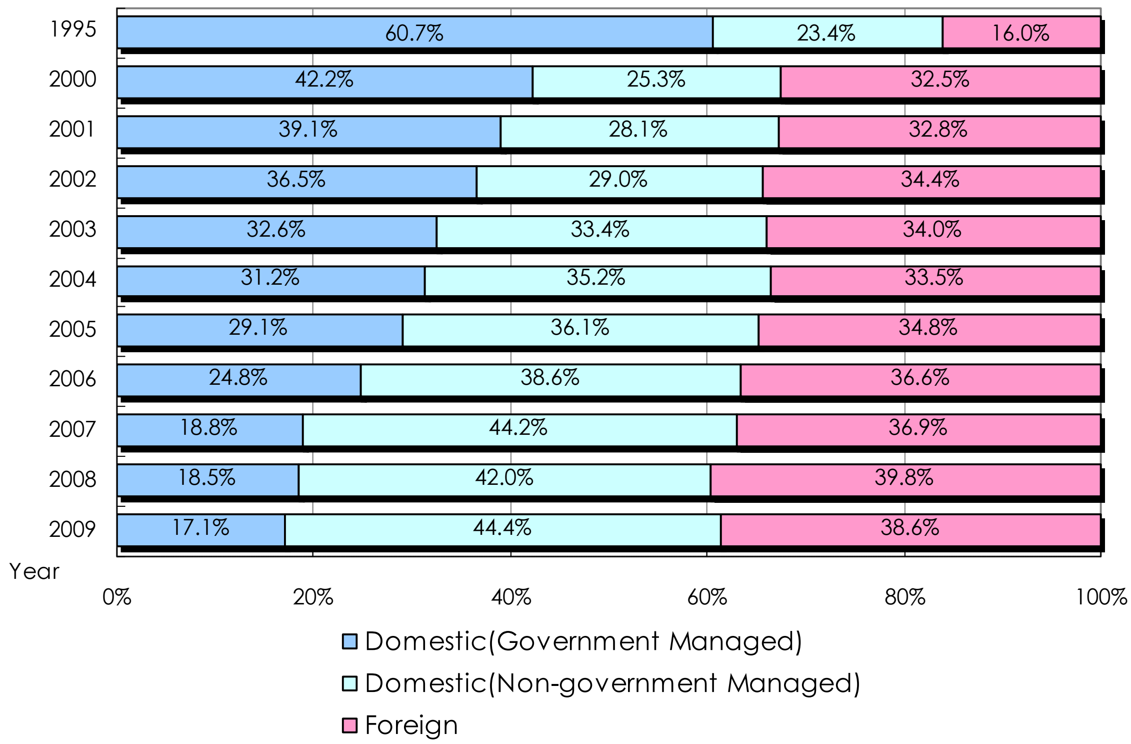


Figure2.3 Investment Ratio of Domestic and Foreign

Table2.4 Economic Indictor of Vietnamese Major Cities

	Unit	Whole Country	HàNội	HCM City	Hải Phòng	Đà Nẵng
- Population	1000person	86,025	6,472	7,168	1,842	890
- Working Population of State Sector	1000person	4,031	598	437	150	…
- GDP (1994 price)	1BillionVND	516,609	65,747	134,776	21,634	9,191
- GDP Growth Rate	%	5.3	6.7	8.5	7.6	10.7
- Contribution for the Treasury	1BillionVND	…	73,500	135,362	28,483	10,244
- Industrial Output（1994 price）	1BillionVND	696,577	91,540	181,904	38,482	11,179
- Investment Value （Current Price）	1BillionVND	708,800	109,348	143,504	27,408	15,333
- Outward Direct Investment	1MillionUSD	21,482	216	1,035	46	173
- Amount of Trade	1BillionVND	1,197,400	157,494	291,780	27,530	21,888
- Export Value	1MillionUSD	57,096	6,328	18,306	1,679	476
- Agricultural Output （1994 price）	1BillionVND	410,100	7,412	3,210	3,680	574
- Cereal Production	1000 tons	43,300	1,229	106	498	50
- Diffusion of Telephone	unit／100person	22.1	34	18	…	24
- High School Attendance Rate	／10 thousand	1,744	1,536	1,364	1,547	1,674

S Source：Statistical Office in Ho Chi Minh City http://www.pso.hochiminhcity.gov.vn/

Figure2.4 Economic Indictor of Vietnamese Major Cities

2.1.2 Socioeconomic Situation in Ben Thanh Commune

District 1 of Ho Chi Minh City is made up of ten communes (Phuong). The project site is located in one of these communes, Ben Thanh. Figure 2.5 shows a map of Ben Thanh and the location of the project site.

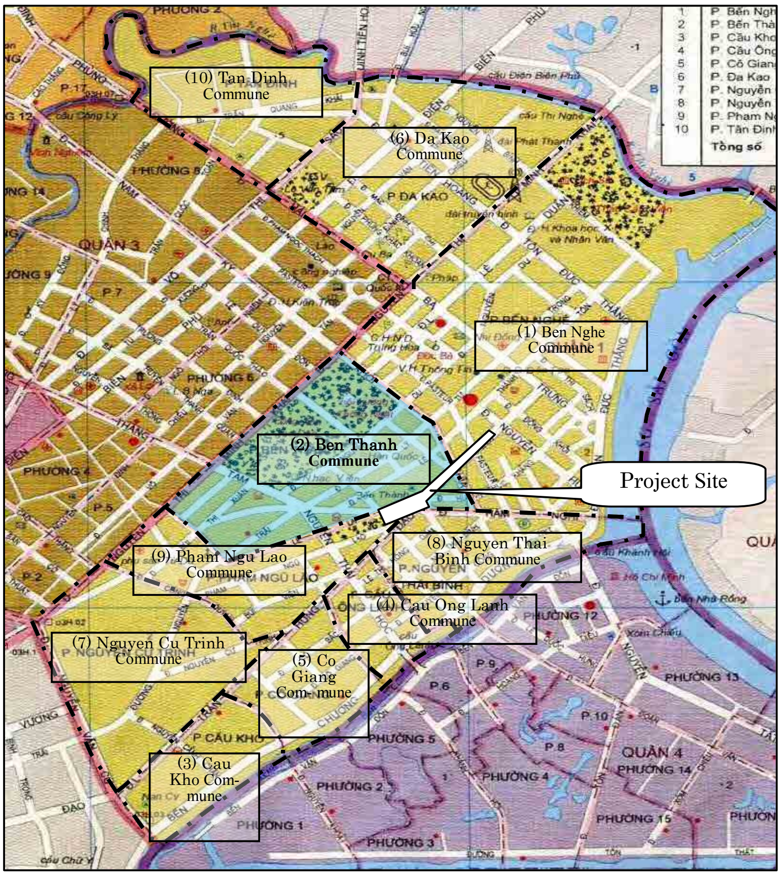


Figure 2.5 Map of Phuong Ben Thanh and location of project site

It has not yet been confirmed whether or not detailed survey data exists for the socioeconomic status of the area around the project site. However, the following overview of Ben Thanh commune is posted on the Ho Chi Minh City website.

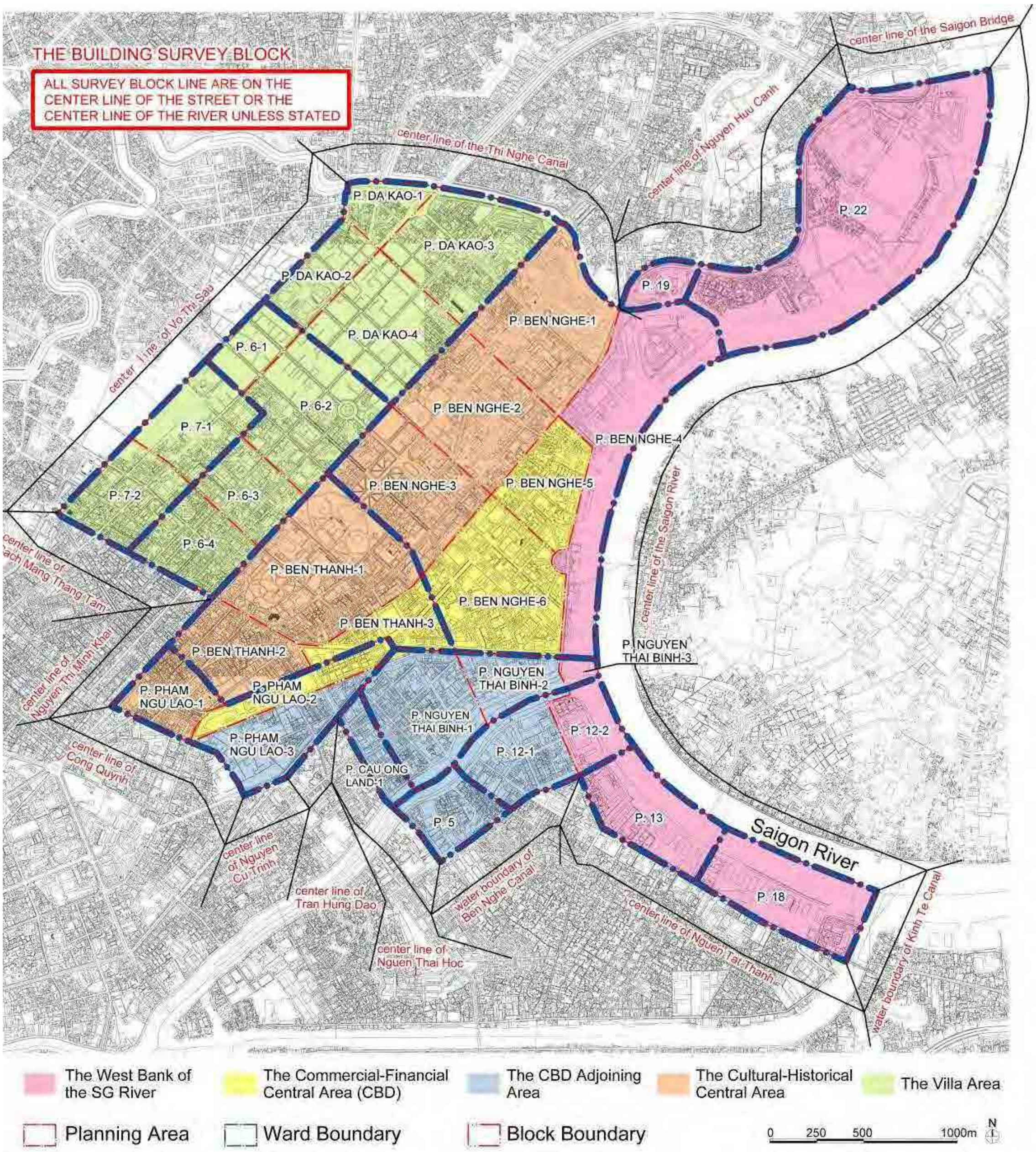
Overview of Phuong Ben Thanh

- Total area: 0.9297 km^2
- Population: 17,688 (population density 19,025 people / km^2)
- Working population: 10,967 (of which 6,580 are women)

2.2 CURRENT SITUATION IN THE REGION

2.2.1 Situation in Cities in the Region

According to the Ho Chi Minh City Department of Planning and Architecture (DPA), a "Study to Conduct Detailed Planning and Establish Architectural Guidelines for Central Ho Chi Minh City" is being conducted in the central business district in downtown Ho Chi Minh City, which includes the area around Ben Thanh Station. For this study, central Ho Chi Minh City has been divided into five areas (see Figure. 2.6) and a study is being conducted of land use, roads, building use, structural forms and so on in each area. Below is an overview of the current land use, traffic situation and buildings in central Ho Chi Minh City based on this study.



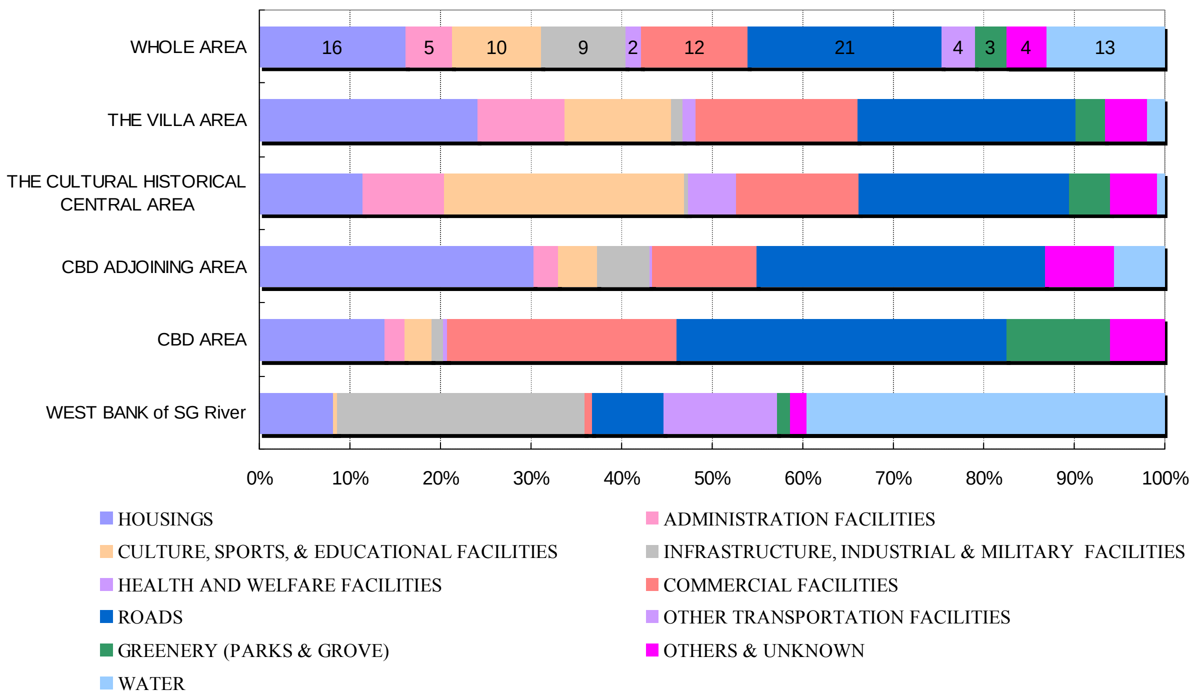
Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.6 Land Classification of the Existing Center of Ho Chi Minh City

1) Land use

Figure 2.7 shows the land use ratio in central Ho Chi Minh City. In the central business district, in which the project area is located, commercial establishments account for the largest proportion (25%) of land use. In addition to historical commercial establishments such as the Ben Thanh Market, commercial facilities are being planned one after another by means of large-scale redevelopment projects, so this proportion is expected to increase in the future. In addition, parks and other open spaces account for 10% of land use, and the high proportion of open spaces is also another characteristic of the area. The high proportion of open spaces is due to the presence within the area of the Twenty-Three September Park, which is used by the citizens of Ho Chi Minh City as an open space.

With regard to the commercial establishments and parks and other open spaces that characterize land use in the central business district, Figure. 2.8 and Table 2.5 show the location and area of the major facilities in the project area.



Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.7 Land Use Proportion of the Existing Center of Ho Chi Minh City

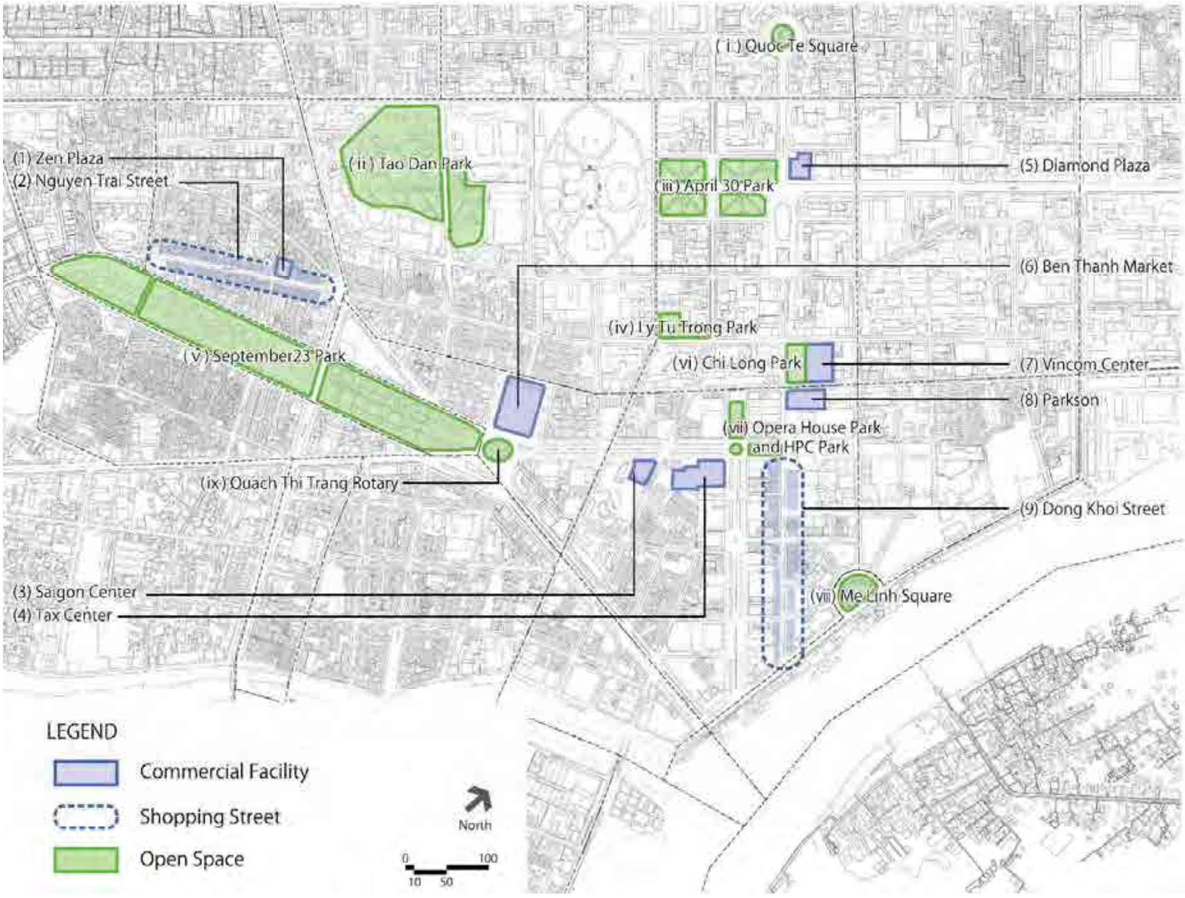


Figure 2.8 Major Commercial Facility and Open Space

Table 2.5 Area of Major Commercial Facility and Open Space

No	Commercial are name	area (m^2)	No	Open space name	area (m^2)
1	Zen Plaza	8,300	i	Quoc Te Square	2,500
2	Nguyen Trai Street	15,600	ii	Tao Dan Park	74,400
3	Saigon Center	10,800	iii	April 30 Park	35,300
4	Tax Center	16,900	iv	Ly Tu Trong Park	5,400
5	Diamond Plaza	14,700	v	September23 Park	112,500
6	Ben Thanh Market	14,400	vi	Chi Long Park	3,500
7	Vincom Center	37,700	vii	Opera House Park and HPC Park	5,900
8	Parkson	21,800	viii	Me Linh Square	11,400
9	Dong Khoi Street	25,100	ix	Quach Thi Trang Rotary	3,200

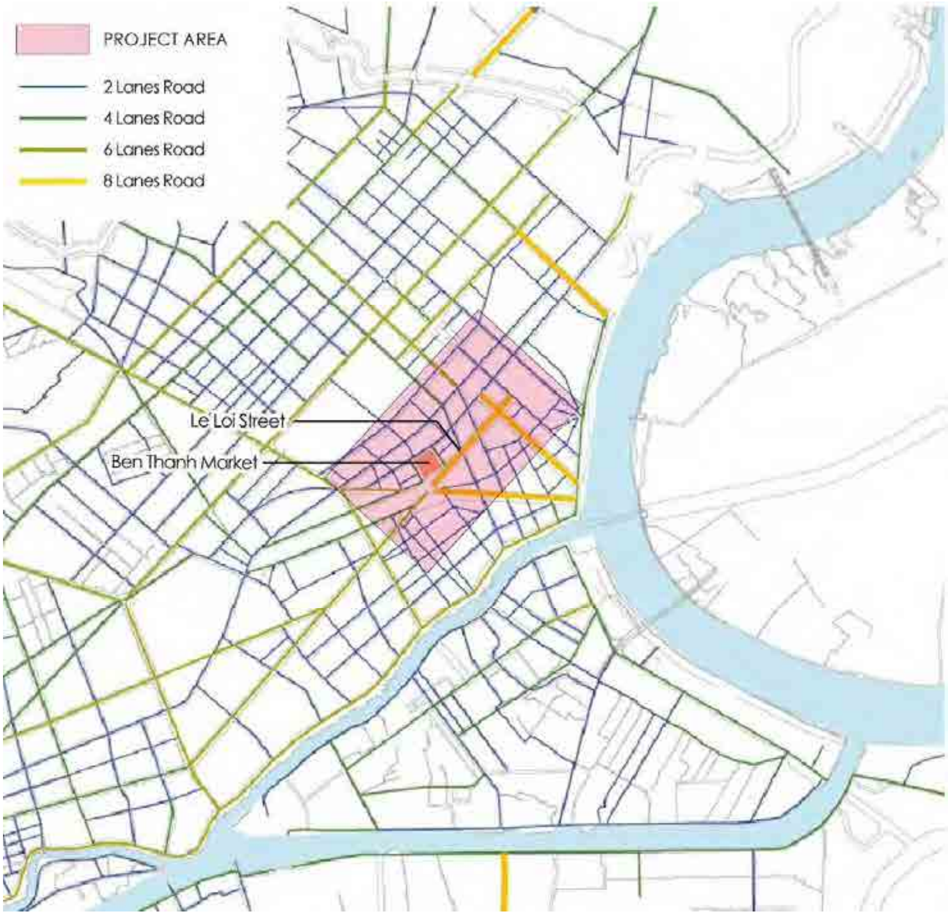
2) Traffic situation

(1) Roads

The total length of expressways and ordinary roads in Ho Chi Minh City is 3,000 km. These roads are not distributed evenly throughout the region. The road area per population of one million is 0.31 km^2 in Districts 1, 3, and 5, while it is 0.84 km^2 in District 2, 7, 9, and 12 and in the suburban areas, and 0.24 km^2 in the other districts. The road density in Ho Chi Minh City overall (2,095 km^2) is only 1.5-1.6%. (In industrialized countries, the road area needed for comfortable transit is said to be 10-15%)

With respect to road width, 14% of the roads are 12 meters or more; 51% are 7 to 12 meters, wide enough to accommodate small buses, and the remaining roads are 7 meters or less and are passable only by motorcycles and bicycles. The narrow roads are clogged with many vehicles, and many intersections do not fulfill their traffic functions adequately and are dangerous as a result.

Figure 2.9 shows a road map of central Ho Chi Minh City. The project area is located in the center of the city in which main streets such as Le Loi are located. Figure 2.10 shows a diagram of the current traffic flow in the project area. The following sections present an overview of each of the main roads in the project area.



Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.9 Road Capacity of the Existing Center of Ho Chi Minh City

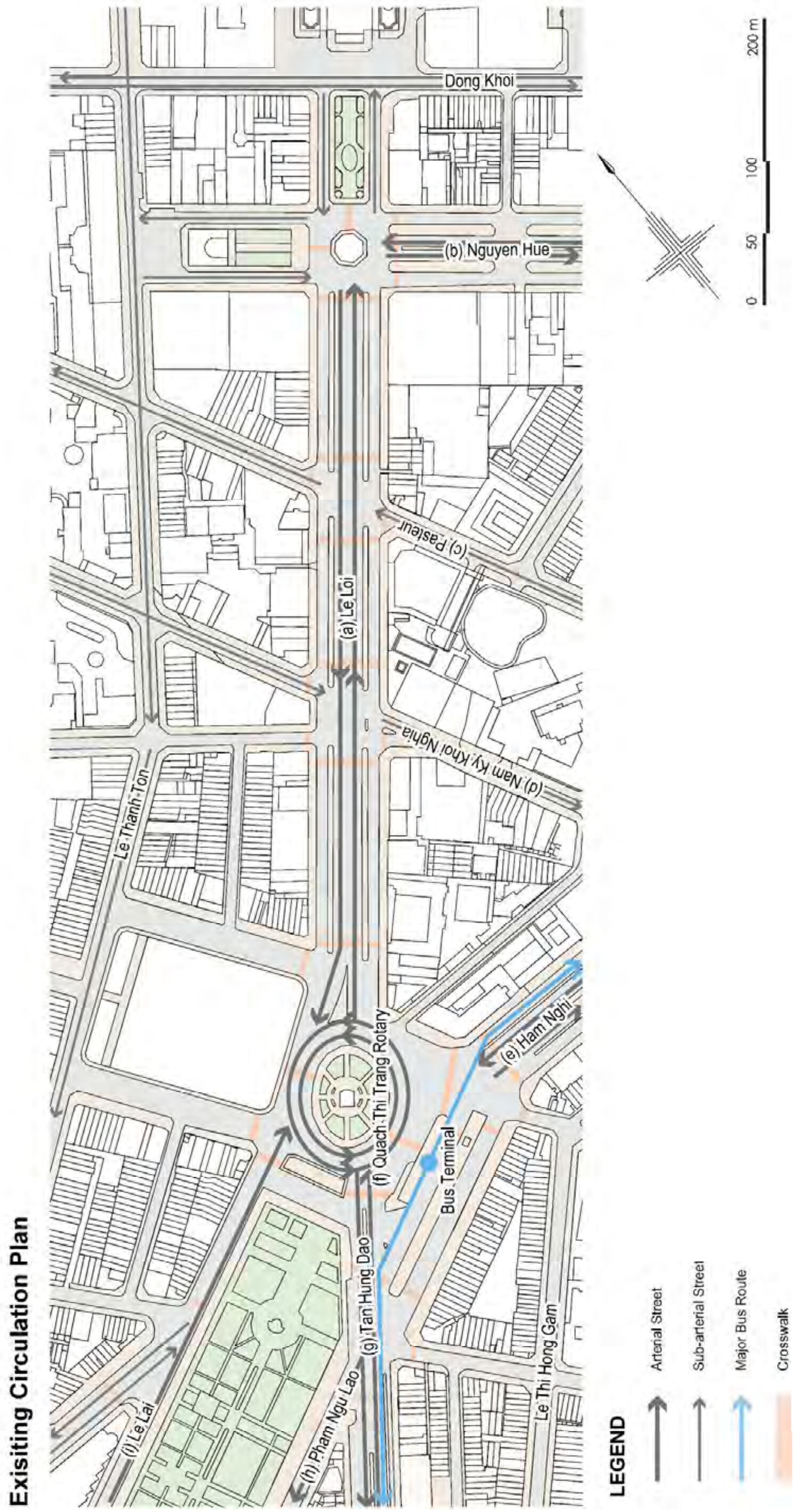


Figure2.10 Existing Circulation Plan

(a) Le Loi

Le Loi is located above the underground passageway that connects Ben Thanh Station (in the project area) and Opera House station. This is one of the oldest streets in Ho Chi Minh City, and at the same time it is also one of the city's main streets supporting municipal transport. Le Loi is also known as a commercial area. Throughout the city's history, four and five-story commercial establishments have lined up on both sides of the street, forming an arcade-like setting. The first floors of these buildings are used primarily as retail outlets, and the upper floors are used as residences. Most of these are of French colonial architecture, but since the beginning of the 21st century redevelopment projects have been conducted by means of large-scale land consolidation, with the result that the street environment and the urban scale of the surrounding area is being destroyed.

Le Loi has three lanes going in each direction, with motorcycle lanes on the sides and a median strip. As one of the three lanes is used as a parking lane, in actuality there are only two lanes for traffic in each direction. The sidewalks are comparatively wide at 6 meters. The motorcycle lanes on each side are extremely congested with large numbers of motorcycles, but the volume of traffic in the vehicle lanes in the center is not so great. Almost every intersection has traffic lights and crosswalks, making it comparatively easy for pedestrians to cross while observing the traffic rules. Figure 2.11 shows the current state of Le Loi

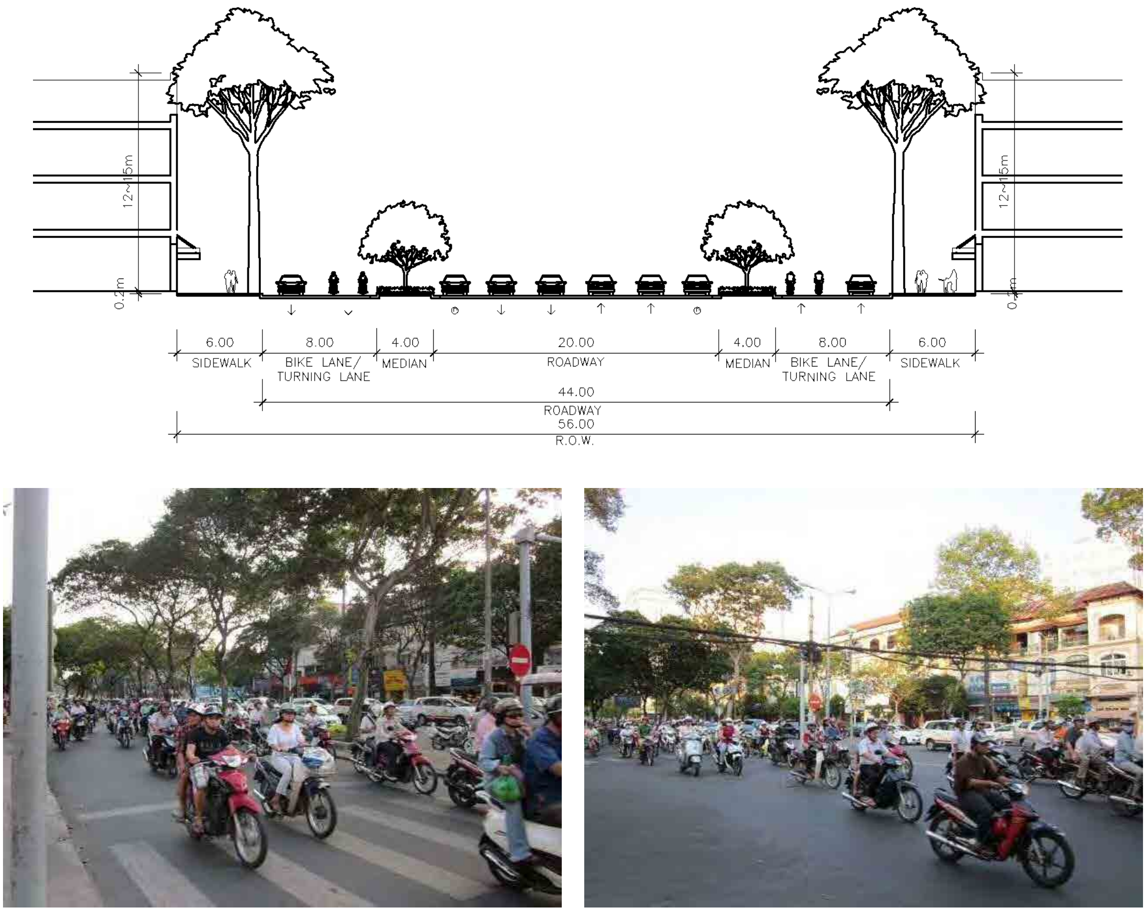


Figure2.11 Current State of Le Loi

(b) Nguyen Hue

Nguyen Hue is another of the historical main streets in the project area. It stretches from the Saigon River to the front of the People's Committee Building (Ho Chi Minh City Hall). Like Le Loi, it is one of the oldest streets in the city. Nguyen Hue is a street that was created by filling in a canal. In old photographs taken in Ho Chi Minh City, both sides of the canal are lined with low-rise retail shops. At present, due in part to its location in the center of the city, large-scale redevelopment is underway, and this redevelopment is changing the skyline in the area. The main use of the buildings on this street is mixed use that includes commercial establishments, residences, offices and so on. The first floor of each building is used mainly for retail outlets and restaurants that seek to attract pedestrians from Le Loi. As one gets closer to the riverbank, commercial activity diminishes and pedestrian traffic is reduced, as there is considerable traffic congestion at Ton Duc Thang (street).

Nguyen Hue has two lanes going in each direction, and there are comparatively wide motorcycle lanes on the sides and a median strip. As in the case of Le Loi, one of the lanes in each direction is used for parking. There is not as much traffic on Nguyen Hue as on Le Loi, with little motorcycle traffic in particular. The major intersections have traffic lights and crosswalks, enabling pedestrians to cross while observing the traffic rules. Figure 2.12 shows the current state of Nguyen Hue.

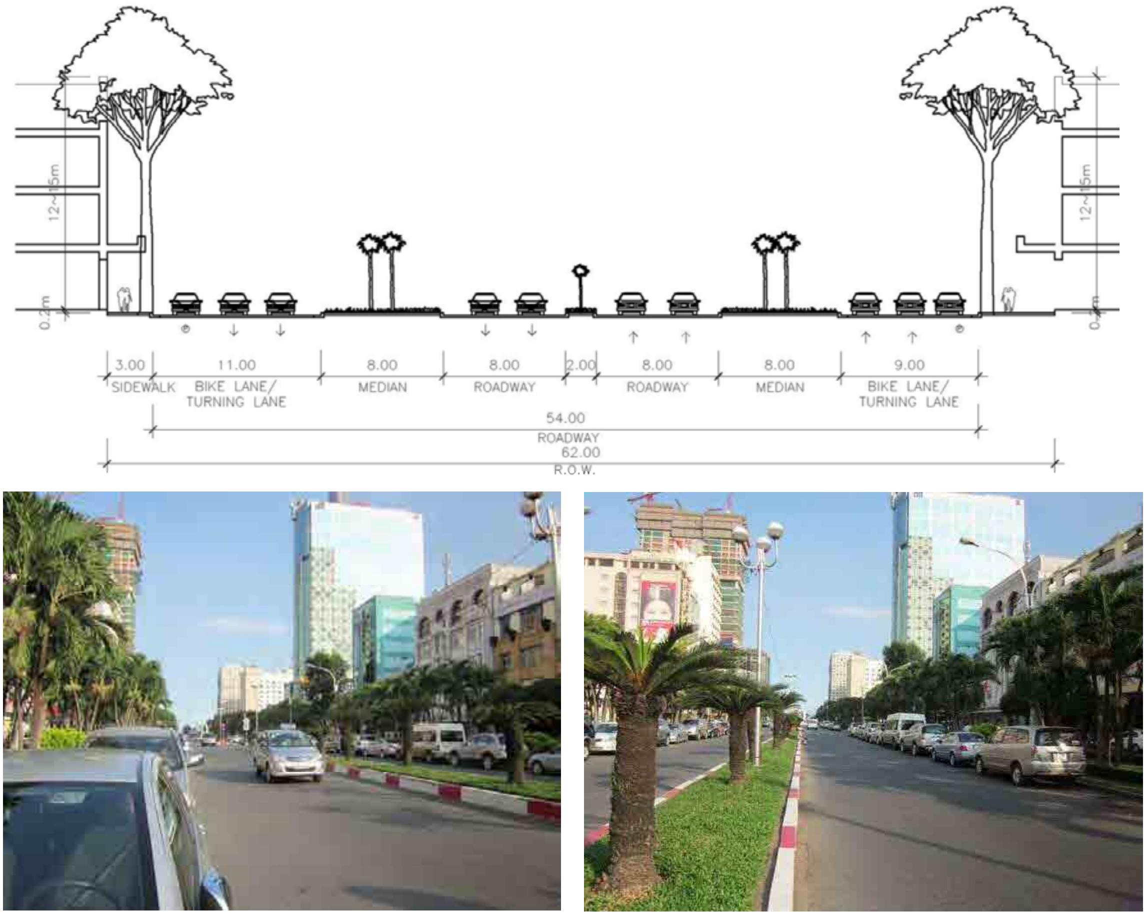


Figure2.12 Current State of Nguyen Hue

(c) Pasteur

Pasteur is a one-way street that goes straight to Le Loi. This street is said to have been completed in 1865 during the French Colonial period, making it the oldest street in Ho Chi Minh City. A canal was filled up to create the street, and at the time it was known by a different name. In 1955, it was given the name Pasteur. Beginning in1975, it was known by a different name (Nguyen Thi Minh Khai), but in 1991 it was once again given the name Pasteur by the Ho Chi Minh People's Committee, and the name is retained to this day.

The one-way flow of traffic goes from Le Loi to Le Thanh Ton (street). The street has two lanes, but as the road width is narrow, automobiles and motorcycles travel in the same lanes. The volume of traffic is particularly great in the section from the intersection with Le Loi going in the direction of Le Thanh Ton. Figure 2.13 shows the current state of Pasteur (street).

Figure2.13 Current State of Pasteur

(d) Nam Ky Khoi Nghia

Nam Ky Khoi Nghia is a one-way street with two lanes of traffic going in the opposite direction from Pasteur. As in the case of Pasteur, the road width is narrow and automobiles and motorcycles travel in the same lanes. The volume of traffic is particularly great in the section south of Le Loi beginning from the intersection with Le Thanh Ton. Figure 2.14 shows the current state of Nam Ky Khoi Nghia.

Figure2.14 Current State of Nam Ky Khoi Nghia

(e) Ham Nghi

Ham Nghi is one of the oldest main streets in the project area. It links Quach Thi Trang Plaza with Ton Duc Thang. The road is extremely wide (more than 50 meters), including six-meter-wide sidewalks on both sides. Along the road are historical buildings that include the customs office, the national railway building, and the maritime commerce building. As a result of the redevelopment that is currently underway by means of large-scale land consolidation, the road is now lined with new high-rise office buildings.

Although the volume of traffic is not as great as that on Le Loi, the road is crowded with many automobiles and motorcycles. The road has three lanes going in each direction, with comparatively wide motorcycle lanes on each side and a median strip. One of the major characteristics of this road is on-street parking for buses. Due to the lack of adequate parking spaces in the bus terminal in front of the Ben Thanh Roundabout, there is a line of many buses parked along Ham Nghi, and this is the cause of traffic jams. Figure 2.15 shows the current state of Ham Nghi.

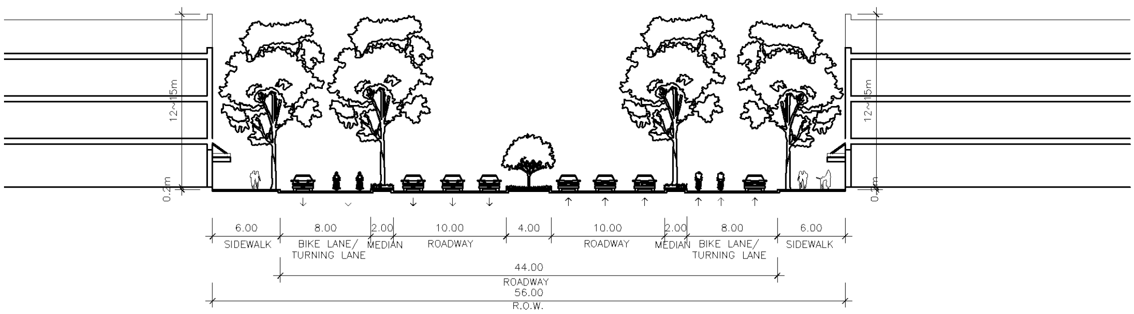


Figure2.15 Current State of Ham Nghi

(f) Quach Thi Trang Roundabout

The roundabout in front of the Ben Thanh Market is beloved by the citizens of Ho Chi Minh City. It is named after a young girl, Quach Thi Trang, who died at this location.

The roundabout previously bore a different name, but since 1963 when Quach Thi Trang was killed at this location, it has been called by this name. It is located in the center of the city where four main roads come together. The Quach Thi Trang Roundabout is always crowded with many automobiles and motorcycles. It has an extremely large number of motorcycles in particular during the hours of 5:00 p.m. to 7:00 p.m. when people are going home from work. There are crosswalks centering on the roundabout, but due to the large volume of traffic, it is difficult to cross safely. As a result, the pedestrian network is divided by the roundabout in both the north-south direction and the east-west direction. Figure 2.16 shows the current state of the Quach Thi Trang Roundabout.

Figure2.16 Current State of Quach Thi Trang Rotary

(g) Pham Ngu Lao

Pham Ngu Lao is a street adjacent to September 23rd Park. The sidewalk on the parking side is extremely wide (13 meters), enabling pedestrians to walk in comfort along the park. Conversely, the sidewalk on the other side of the street is lined with low-rise buildings. The first floor of these buildings is used as retail shops. Trees are planted along the sidewalks to provide shade in order to make it easy for pedestrians to walk in comfort.

The street is a one-way street with three lanes, one of which is used as parking space. The volume of traffic is great, and the number of parked taxis becomes more and more noticeable as one approaches the Ben Thanh Roundabout, and this impedes the smooth flow of traffic. Figure 2.17 shows the current state of Pham Ngu Lao.

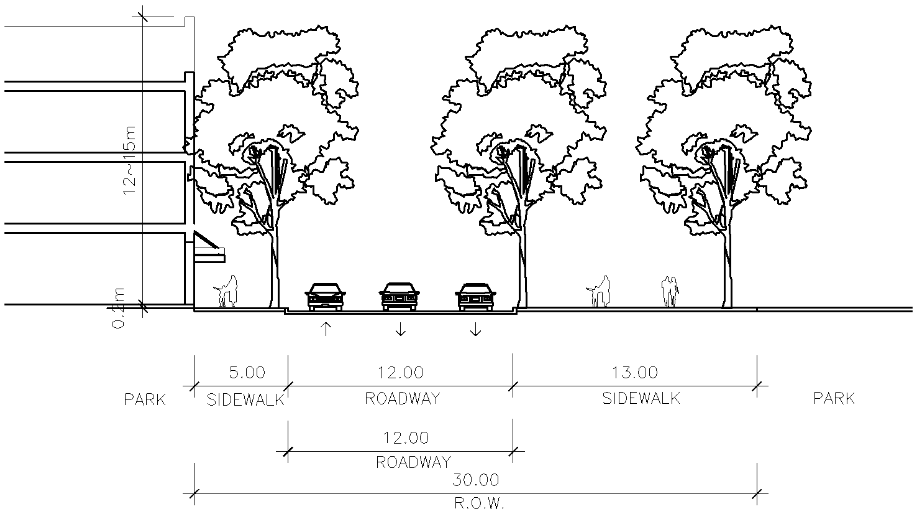


Figure2.17 Current State of Pham Ngu Lao

(h) Le Lai

Le Lai is a street that is adjacent to September 23rd Park. The sidewalk on the park side is wide (8.5 meters) and is lined with benches, and thus it is integrated with the park for recreation and relaxation by the city's residents. The sidewalk on the other side of the street is about five meters wide and is lined with small-scale commercial establishments that are not set back from the sidewalk. There are rows of motorcycles parked along the sidewalk, and in addition the sidewalk is in disrepair with many uneven places, so it is not a comfortable route for pedestrians to use.

The street is crowded with a large number of both automobiles and motorcycles. As there are no traffic lights, it is difficult for pedestrians to cross the street, and so the park is cut off from the surrounding pedestrian network. Figure 2.18 shows the current state of Le Lai.

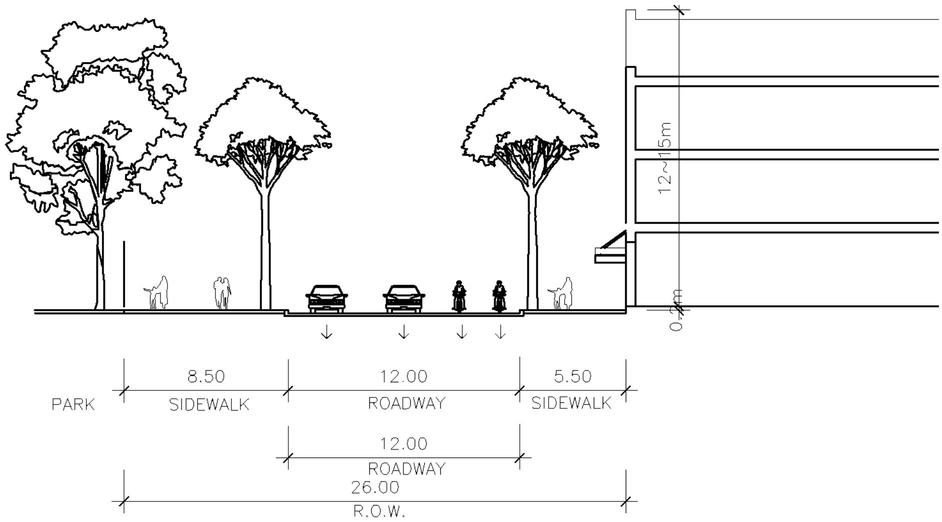


Figure2.18 Current State of Le Lai

(2) Railways

Ho Chi Minh City has only one railway line that leads to Saigon Station. This is a single-gauge railway line of 1,000 mm gauge track. The railway crosses roads on the same level, and this produces considerable traffic congestion. There is no railway line within the project area.

(3) Public buses

Currently, the Center for Executive and the Department of Transportation (DOT) are in charge of the management and operation of the bus system in Ho Chi Minh City. In 2007, there were 153 bus routes: 114 that receive government assistance, 36 that receive no government assistance, and three school bus routes.

The bus terminal is currently located on the east side of the roundabout and serves 30 bus routes. In FY 2011, the bus terminal is scheduled to be moved to one section of the September 23rd Park.

(4) Motorcycles and privately owned automobiles

The use of motorcycles by the residents of Ho Chi Minh City has increased rapidly along with the economic growth of the city. Compared to other cities in Asia, transport in Ho Chi Minh City is characterized by the use of motorcycles. In comparison to GDP and income, a large proportion of the population (492 out of 1,000) rides motorcycles (see Table 2.6). In 2007 alone, 300,000 vehicles were registered, and the total number of vehicles came to 3.6 million (3,096,000 two-wheeled vehicles, 202,000 privately owned automobiles and 399,000 other vehicles).

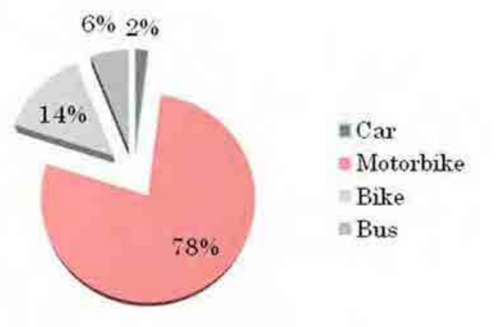
In 2000, the total number of vehicles in the city came to 1.7 million (131,000 automobiles and 1,569,000 two-wheeled vehicles), but this figure has now doubled. On average, 1,300 new two-wheeled vehicles and 100 new automobiles are registered each day. As these figures show, the number of vehicles in the city is increasing dramatically. In contrast, the speed of road, railway and other infrastructure construction is extremely slow.

Table2.6 Number of Motorbike Users per 1000 person

City	HCMC	Hanoi	Singapore	Bankok	Manila	Jakarta
Motorbike/1.000 thousand people	492	260	41	136	8	118

Source: Metro Line2 FS Final Report

Figure 2.19 shows the status of vehicle use by people in Ho Chi Minh City. Two-wheeled vehicles are used by 78% and automobile, by 14%. Nearly 94% use private means of transportation. The proportion that uses public transport is less than 10%. More than 90% of households own a vehicle, and of these nearly 53% of households own two or more vehicles.



Source: Metro Line2 FS Final Report

Figure2.19 Percentage of Transportation

Furthermore, automobile ownership by households was 1.6% in 2002, and this figure is expected to increase to 18.6% by 2020. This is expected to bring about great changes in the traffic situation in Ho Chi Minh City.

With regard to the current state of transit in Ho Chi Minh City, there are many traffic accidents and a considerable amount of traffic congestion. According to the Center for Management and Operation of Public Transportation, annual economic losses resulting from traffic congestion and traffic accidents caused by vehicle transit was USD 1.25 billion as of 2005, and this figure was predicted to be USD 5 billion in 2010.

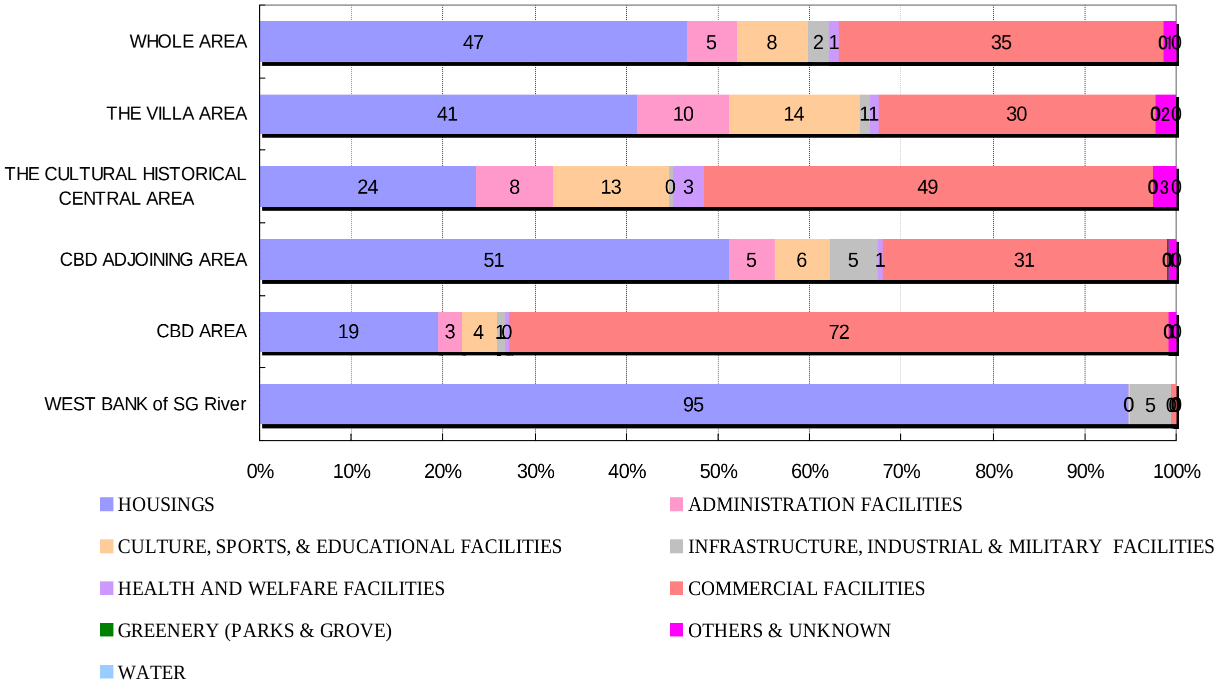
2) Building use

(1) Summary

Figure 2.20 shows the proportion of building use in central Ho Chi Minh City. In the central business district, in which the project area is located, nearly 72% of the buildings are used as retail shops. The commercial establishments can be generally divided into two types: small-scale historical buildings remaining from the French Colonial period, with integrated retail shops and residences, and high-rise buildings created through large-scale redevelopment.

Most of the commercial establishments that were built many years ago and remain to this day have first floor sections that are used as commercial establishments and upper floors that are used as residences. The commercial establishments are used for a variety of enterprises, including retailers (selling clothing, gifts, motorcycle’s helmets and so on) together with eating and drinking establishments. Many of the eating and drinking establishments use the area up through the sidewalk in front for customer seating. While this provides vitality to the urban environment, the seating and the rows of customer's motorcycles take up a great deal of the sidewalk area and inhibit pedestrian transit. This type of building is usually three to four stories in height and constructed in the French Colonial style, providing pedestrians with a human scale urban environment.

On the other hand, the skyscrapers constructed as a result of a number of redevelopment projects that have been underway through large-scale land consolidation are complexes that include commercial stores, offices and other functions. The Saigon Center on the south side of Le Loi, which was completed in 1997, is a skyscraper approximately 110 meters in height. The lower floors are devoted to commercial establishments, while the upper floors are used as office space. Redevelopment projects are being promoted successively, and the SJC Tower skyscraper, expected to be approximately 200 meters in height, is currently under construction in the area enclosed by the Le Loi, Nam Ky Khoi Nghia and Le Tranh Ton streets. Moreover, even in the Saigon Center area, there are plans to construct the Saigon Center II towers (88 floors and 66 floors) on an adjacent site, as well as to construct two 220-meter-high skyscraper buildings (the Benthanh Twins) on the south side of the Ben Thanh Roundabout. These types of redevelopment projects involving skyscraper construction are expected to increase, and as a result the urban scale, the skyline and the human scale urban environment are expected to undergo a dramatic transformation in the future.



Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.20 Building USE (GFA) Proportion

(2) Historical buildings and structures

Ho Chi Minh City has been called the Paris of the Orient. The cityscape and buildings of the city are strongly influenced by the French control of the country as part of French Indochina from 1887 through 1954. This influence created both the historical cityscape of rows of small-scale retail shops and the symbolic buildings of Ho Chi Minh City that were constructed in the French Colonial period such as the Ben Thanh Market and the Opera House (many of which are located in the project area). Here and there in the city there are also bronze statues of Ho Chi Minh and other revolutionaries and leaders of the Vietnamese Revolution. These are placed in front of important buildings in the city and at traffic intersections and so on, and they communicate the history of the city to the present day.

Figure 2.21 shows a layout diagram with the locations of the major historical buildings and structures located in the project area. An overview is presented below.

Figure2.21 Existing Architectural Resources

(a) Ben Thanh Market

The Ben Thanh Market is one of the most famous landmarks in Ho Chi Minh City. It is located in front of the roundabout at which four main roads intersect: Le Loi, Ham Nghi, Pham Ngu Lao and Le Lai (see Figure2.22). The market was constructed in 1914 by filling up marshland during expansion of the urban area. It was designed by the architects Brassard and Maupin, who designed many of the buildings in Indochina.

Figure2.22 Ben Thanh Market

The market has a symmetrical design centering on the clock tower. It is the symbol not only of Ho Chi Minh City but also of the whole of southern Vietnam. The market is surrounded by rows of many commercial establishments constructed during the French Colonial period, and it serves as a center for the activities of both residents and tourists.

(b) Opera House

The Opera House is a theater that was constructed in 1895. This building, located at the end of Le Loi, is carefully crafted in the Neoclassical style and has a mansard roof. Although it has been restored several times, the original building façade still remains to this day (see Figure2.23).

Figure2.23 Opera House

The days on which the building can be used as a theatre are restricted, and it is not possible to gain admittance every day. However, the area is bustling with many tourists who come to view it as one of the major historical buildings of Ho Chi Minh City.

(c) Statue of Ho Chi Minh in front of the Headquarters of the People's Committee

Ho Chi Minh, from whom the city gets its name, was the leader of the Vietnamese Revolution, a politician and the first president of what was then known as the Democratic Republic of Vietnam. This statue is located in the most famous location in the city, in front of the People's Committee Headquarters (see Figure2.24). Ho Chi Minh is depicted

Figure2.24 Statue of Ho Chi Minh

standing on a podium with his arms around a small girl, gazing at the Saigon River. The statue bears an inscription saying that Diep Minh Chau especially created the statue in 1990.

(d) Bust of Quach Thi Trang

At the roundabout in front of Ben Thanh Market, crowded with many automobiles and motorcycles, there is a bust of a young girl (see Figure2.25). Quach Thi Trang was a young girl who was shot dead by police in 1963 while participating together with 5,000 students in a protest demonstration against martial law in the Republic of Vietnam, held in the plaza in front of Ben Thanh Market. The bust was constructed in 1964 with contributions collected by student organizations as a symbol of the young girl's courage and patriotism. Following Vietnam's independence in 1975, the plaza was officially named after Quach Thi Trang by the Vietnamese government.

Figure2.25 Bust of Quach Thi Trang

(e) Equestrian Statue of General Tran Nguyen Han

Like the bust of Quach Thi Trang, the bronze status of General Tran Nguyen Han mounted on a horse is constructed on a tall podium in the center of the roundabout in front of Ben Thanh Market (see Figure2.26). When the Ming Dynasty invaded Vietnam in the 15th century, General Tran Nguyen Han commanded the forces serving King Le Loi that repelled the invasion. The bronze statue was built to commemorate his bravery and loyalty and his contributions to the establishment of the Kingdom of Vietnam.

Figure2.26 Statue of General Tran Nguyen Han

(3) Survey of surrounding buildings

In order to determine the buildings (see Figure2.27) that are expected to be affected in some way by the construction of the subway station and underground shopping mall as a result of this project, a study was conducted to determine the use, number of floors and structural form of the buildings in the area. The area was divided into a north area and a south area (separated by the underground shopping mall) and the buildings examined in the study were assigned numbers.

(a) Usage (See Figure2.28)

The most common usage for the buildings in the area was mixed usage (shops and residences). If the buildings devoted solely to commercial establishments (such as Ben Thanh Market) and the complexes with commercial establishments and offices and so on are included, almost all of the buildings are used for commercial establishments, and it is clear that this district is a center of commercial activity. Although the upper floors of the Saigon Center are used as office space, overall only a tiny number of buildings are used as offices.

(b) Number of floors (See Figure2.29)

Most of the mixed-use buildings with both shops and residences were constructed during the French Colonial period, and many are between four and six stories in height. These buildings are constructed in a continuous row along a single block, forming a historical cityscape. Currently the only large-scale building higher than 10 stories is the Saigon Center, but many redevelopment projects are in progress and the city skyline is expected to change dramatically in the future.

(c) Structural form (See Figure2.30)

Almost all of the buildings are of reinforced concrete or brick construction. The buildings in Ho Chi Minh City that include the Saigon Center and other skyscrapers currently under construction are characterized by reinforced concrete construction. There are very few buildings of steel construction.

Figure2.27 Plot Plan of Building Survey

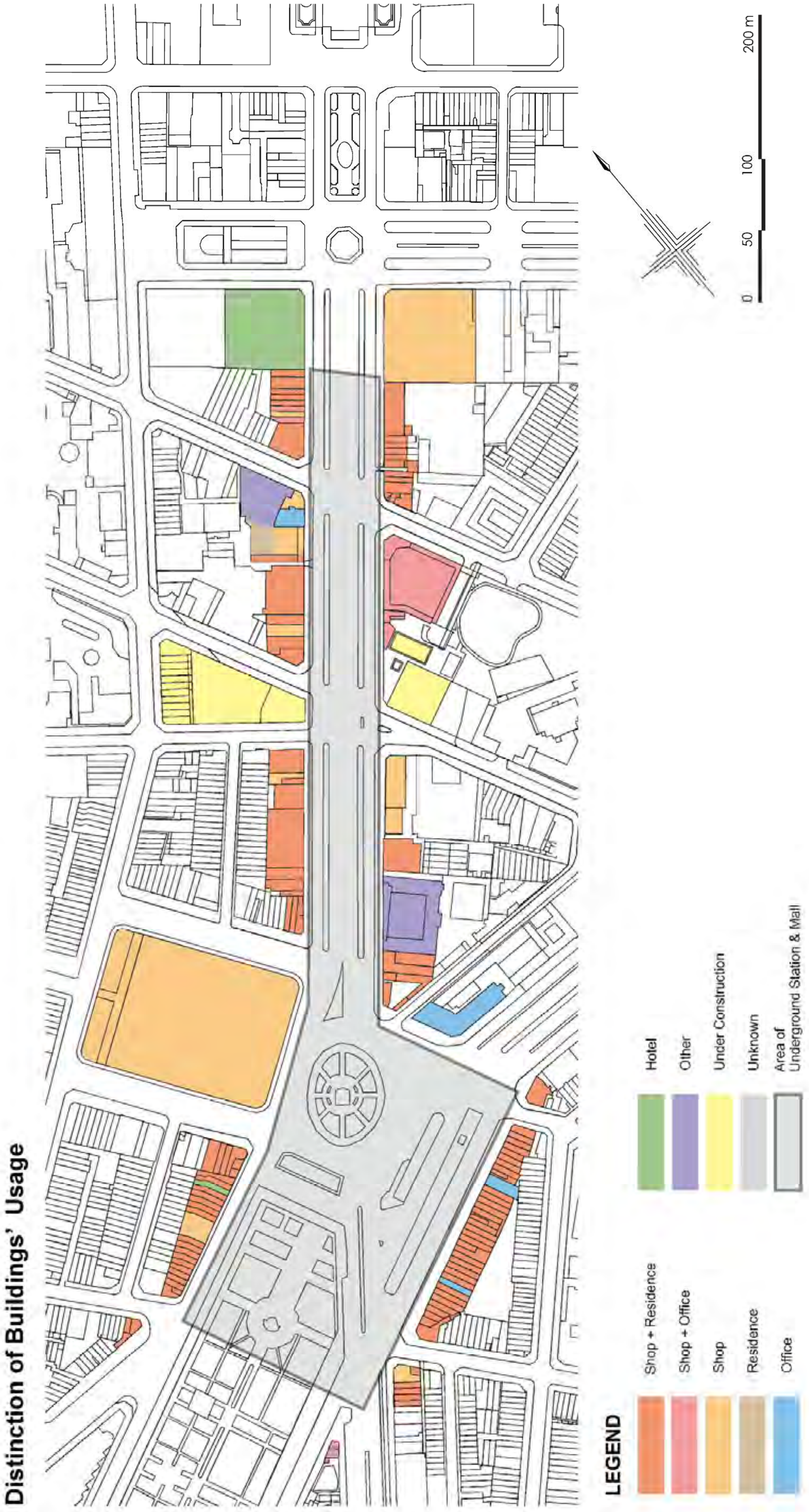


Figure2.28 Distinction of Buildings' Usage

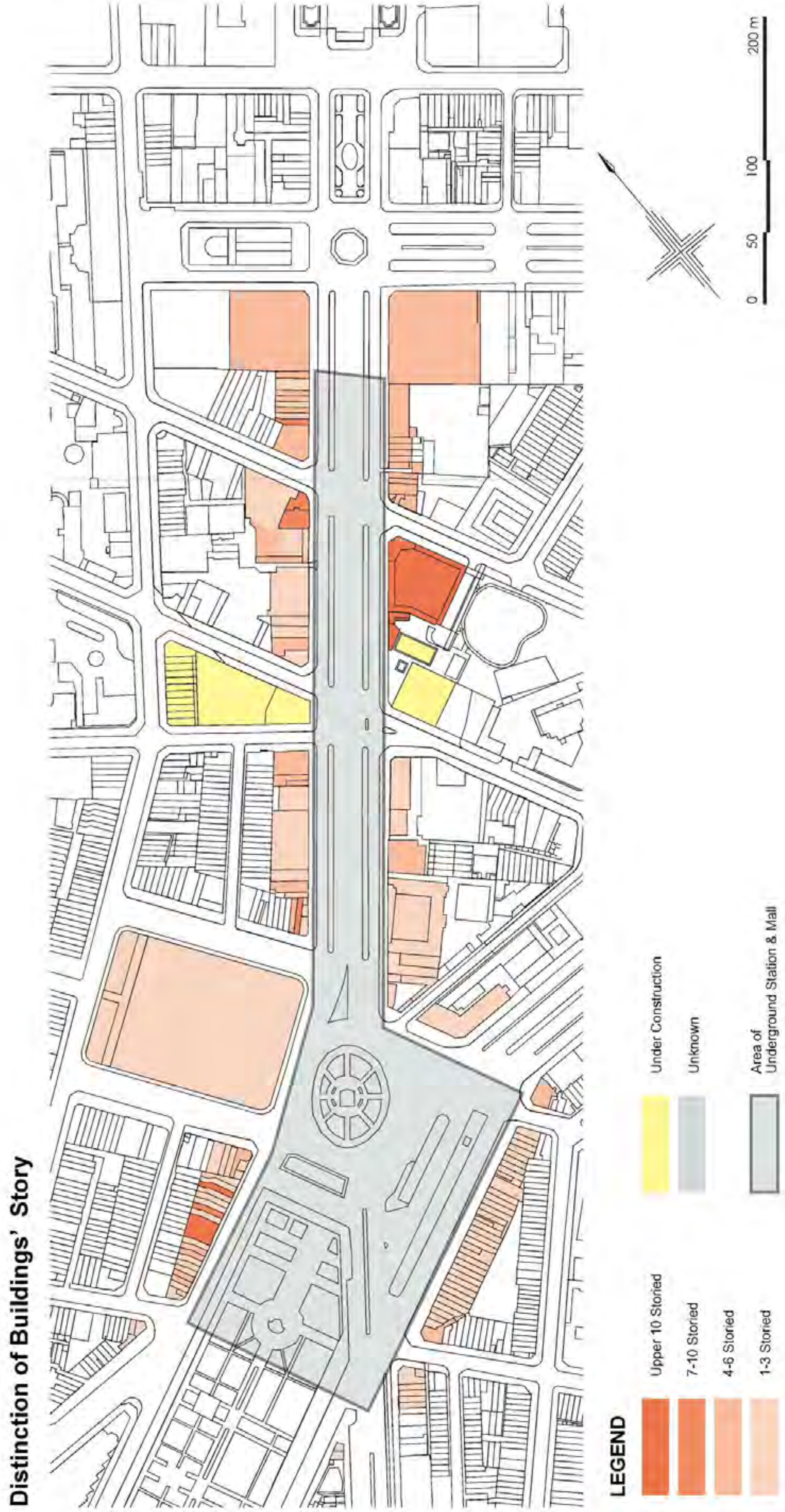


Figure2.29 Distinction of Buildings' Story

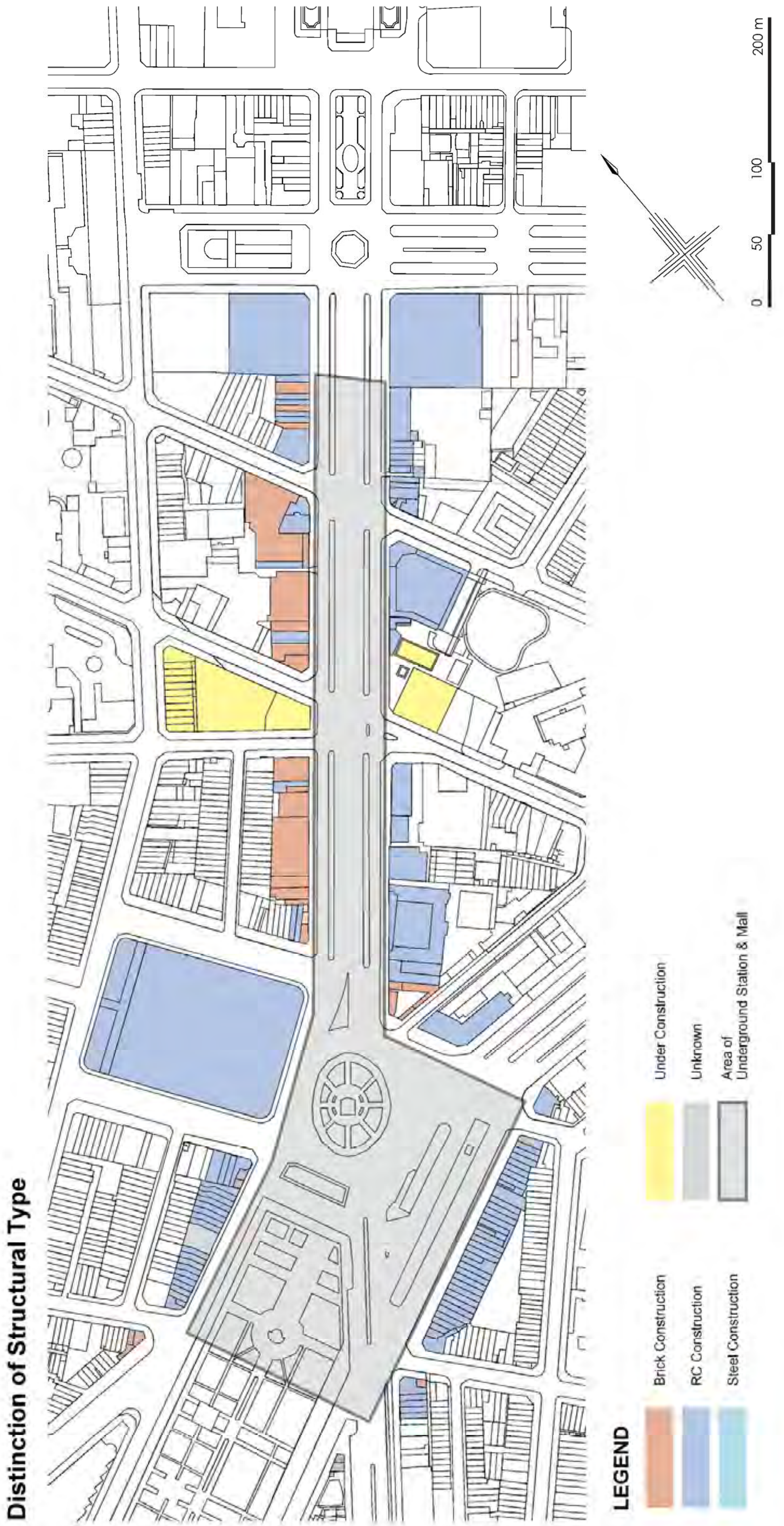


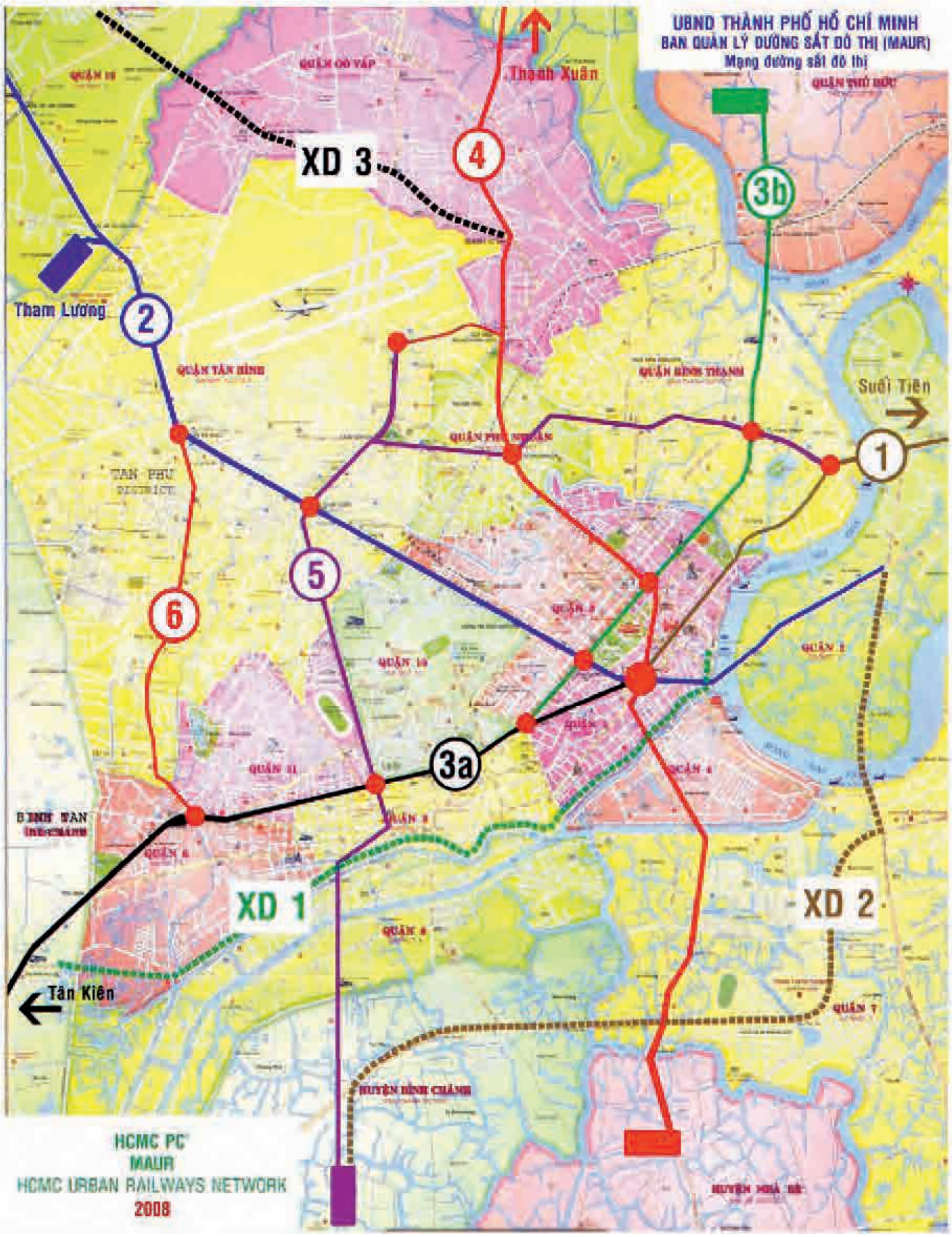
Figure2.30 Distinction of Structural Type

2.2.2 Railways and Underground Use

1) Overview of planning for Ho Chi Minh City Subway

Based on the municipal railway master plan approved by the prime minister in the decision No.6/2002/QD-TTg, planning is underway for a mixed transport network in Ho Chi Minh City that includes subway, streetcars, monorail and so on (see Figure2.31). The planning for these rail lines is expected to not only resolve the problems of increased traffic congestion, traffic accidents, degradation of the urban environment, etc..resulting from the rapid growth of the city, but also stimulate new growth in the areas along the rail lines and achieve the modernization specified in the city's master plan.

According to the announcement by the government, the completion year of the plan is 2025. However, at this point, none of the rail lines has begun service. The Table2.7 shows the state of progress in the planning of each rail line.



Source: Management Authority of Urban Railways (MAUR)

Figure2.31 Urban Railway Master Plan in HCMC

Table2.7 Progress of the Development of Urban Railway in HCMC

Line			Terminal Station		Length	Total Investment Cost (million USD)	Date of commencement and completion	Investment source	Implementation Progress
UMRT (Metro Line)	Line 1		Ben Thanh	Suoi Tien	19.7km Underground and elevated train	2,491	2007-2018	Already have doners ODA (Japan)	・Investment Project has been approved by HCM PC through the following Decisions 1453/QD-UBND (2007/04/06), 2721/QD-UBND (2008/06/26), 4480/QD-UBN (2011/09/21)
	Line 2	Stage-1	Ben Thanh	Tham Luong	11.3km Underground and elevated train	1,374	2010-2017	Already have doners Co-finance (KfW, ADB, EIB)	・Investment Project has been approved by HCM PC through the following Decisions 4474/QD-UBND (2010/10/11)
		Stage-2	Ben Thanh & Tham Luong	Thu Thiem & An Suong	8.7km Underground and elevated train	900	after 2014	Underpreparation for Investment ODA (Germany)	・MPI has submitted the project checklist of grant German ODA project to Prime Minister
	Line 3	3a	Ben Thanh	Tan Kien	16.2km Underground and elevated train	2,420 (expected)	2014-2020 (expected)	Underpreparation for Investment ODA	・HCM PC has submitted a proposal to MPI regarding the registration for Country Development Program of ADB 3354/UBND-DTMT (2011/07/08)
		3b	Cong Hoa Roundabout	Hiep Binh Phuoc	12.1km Underground and elevated train	1,866 (expected)	2013-2019 (expected)	Underpreparation for Investment ODA	・HCM PC has suggested MPI to support PC in submitting the proposal to JICA for JICA to consider a loan agreement 3440/UBND-DTMT (2011/07/12)
	Line 4		Ben Cat Bridige	Nguyen Van Linh	36.0km Underground and elevated train	2,500 (expected)	2014-2020 (expected)	Underpreparation for Investment ODA	・MAUR has signed a Memorandum with Italian – Thai Development Public Cooperation (Thailand) regarding the investment cooperation
	Line 5	Stage-1	Bay Hien Roundabout	Sai Gon Bridige	8.89km Underground and elevated train	1,180	2012-2018 (expected)	Already have doners ODA(Spain)	・PM has approved the check list of project
		Stage-2	District8	Bay Hien Roundabout	14.5km Underground and elevated train	1,120 (expected)	after 2013	Underpreparation for Investment ODA	・Preparatory Survey has been completed for whole line by Spanish consultant ・Local consultant is understudying the investment project implementation
	Line 6		Ba Queo	Phu Lam Roundabout	6.0km Underground and elevated train	1,280 (expected)	2014-2020 (expected)	Underpreparation for Investment ODA	・Spanish consultant has finished the feasibility study report ・Local consultant is understudying the investment project implementation which expects to be finished in 2011
Tram	Line XD1		Sai Gon	Western Bus Terminal	12.5km Streetcar	250 (expected)	after 2014	Underpreparation for Investment BOT, BT, PPP	・Procedures for selecting consultants for implementing investment project are on-going
Monorail	Line XD2		Nguyen Van Linh	District2	14.0km Elevated train	350 (expected)	after 2014	Underpreparation for Investment BOT, BT, PPP	・ Similar to Line 4, Italian-Thai Development Public Corporation is understudying the feasibility of BOT scheme ・In the case of Line XD2, Marubeni Corp. of Japan has completed the preparatory survey under PPP scheme
	Line XD3		Go Vap Roundabout	Quang Trung Software Park	8.5km Elevated train	200 (expected)	after 2014	Underpreparation for Investment BOT, BT, PPP	

Source: Management Authority of Urban Railways (MAUR)

(1) Line 1

Line 1 was the first railway line approved in Ho Chi Minh City. It is currently at the planning stage as a result of official development assistance (ODA) from Japan. The line is 19.7 km in length and connects Ben Thanh Station with Suoi Tien Station in the northeastern suburbs area of Ho Chi Minh City. The line will travel underground in the central area of Ho Chi Minh City covering 2.6 km that includes its starting point: Ben Thanh Station; in the remaining length of 17.1 km, train will travel elevated. The line will have three underground stations and 11 elevated stations, and a 27.4-hectare depot is planned for construction at Long Binh Ward (in the District 9). In terms of the state of planning, currently the Line 1 project is at the stage of receiving bids from construction companies.

(2) Line 2

Line 2 is the main line running east to west in the municipal railway network. Planning is currently progressing with the work divided into two phases. Phase 1 will be an 11.3 km section running between Ben Thanh Station and Tham Luong Station in the northwestern part of Ho Chi Minh City. Phase 2 will consist of two extensions from Ben Thanh to Thu Thiem and from Tham Luong to An Suong in the eastern and northwestern parts of the city, respectively. Ultimately, Line 2 will have a total length of 20.0 km. In the first phase of construction, all stations will be underground stations with the exception of Tan Binh Station, the terminus in the northwest part of the city for Phase 1.

Route planning is being co-financed by official development assistance from Germany in addition to the Asian Development Bank, the European Bank for Reconstruction and Development (EBRD) and KfW and the banking group of the German government. However, this project scope which has been approved by HCM PC does not include the Ben Thanh Station. In the case of second phase, the project checklist of grant German ODA project has been submitted by MPI to Prime Minister.

(3) Line 3

Project Line 3 is divided into following two projects. Line 3a is the extension project of Line 1, and Line 3b is planned to be running north to south. Line 3a is a 16.2 km route connecting Ben Thanh Station with Tan Kien Station in the southwest part of Ho Chi Minh City. The line is being planned to run southwest from Ben Thanh Station along Pham Ngu Lao (street) and Ben Thanh Station for Line 3a line will be a shared station with Line 1. HCM PC has submitted a proposal to MPI regarding the registration for Country Development Program of ADB

Line 3b is planned to branch off from Line 3a at Cong Hoa Roundabout station and lead to Hiep Binh Phuoc station in the north part of Ho Chi Minh City. The total length is 12.1 km. HCM PC has suggested MPI to support PC in submitting the proposal to JICA for JICA to consider a loan agreement on July, 2011.

(4) Line 4

In the municipal railway network, Line 4 is thought of as the main line running north to south. The initial planning called for a route with a total length of 24.0 km running from the Ben Cat Bridge to Nguyen Van Linh. However, changes to the plan are currently being debated, including the idea of extending the total length to 36.0 km to align it with urbanization in Ho Chi Minh City and the city's development policy. A 30-hectare depot is planned for construction in Thanh Xuan (in the 12th Commune), but in the event that the route is extended, two other depots will be needed, at the Port of Hiep Phuoc and in the metropolitan area (at Nha Be). MAUR has signed a Memorandum with Italian – Thai Development Public Cooperation (Thailand) regarding the investment cooperation. Currently, Italian – Thai Development Public Corporation has submitted the proposal for Line 4 Project to district level Departments and agencies on October, 2011.

(5) Line 5

Line 5 project is currently progressing with the work divided into two phases. Phase 1 is 9.0 km section running between Bay Hien Roundabout station and Saigon bridige. And prime minister has approved the check list of Spanish ODA project. Phase 2 is 14.5 km section running between district 8 and Bay Lam Roundabout station. Preparatory Survey has been completed for this section by Spanish consultant and local consultant is understudying the investment project implementation.

(6) Line 6

Line 6 is a 6.0 km route connecting Ba Queo station with Phu Lam Roundabout station. Spanish consultant has finished the feasibility study report and local consultant is understudying the investment project implementation which expects to be finished in 2011.

(7) Streetcars and monorail

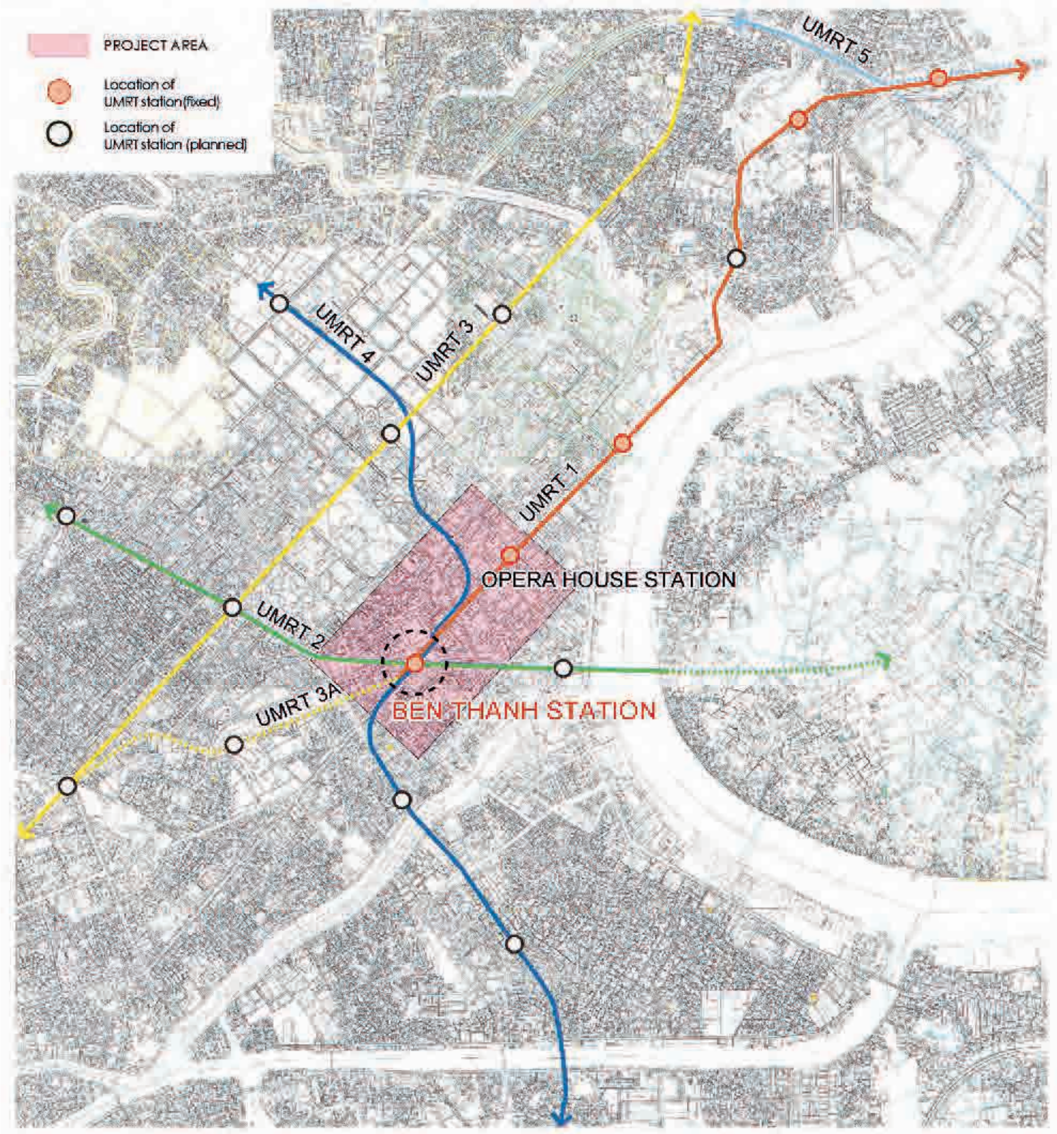
Streetcar Line XD1 is a 12.5 km route connecting river side of Saigon River with Bus terminal in the western side of the city. Procedures for selecting consultants for implementing investment project are now on-going.

In the case of two monorail lines, XD2 and XD3, similar to Line 4, Italian-Thai Development Public Corporation is understudying the feasibility of BOT scheme. And Marubeni Corp. of Japan has completed the preparatory survey under PPP scheme for Line XD2.

2) Overview of underground development in project area

Figure 2.32 shows the subway plan for central Ho Chi Minh City. Ben Thanh Station will be a transfer station for not only the UMRT Line 1, Line 2, Line 3a, and Line 4 but also for the light rail transit (LRT) and bus rapid transit (BRT) routes. Thus it plays a crucial role in the city's railway master plan.

Figure 2.33 shows the underground planning in the project area. Line 1 is planned to run northeast from Ben Thanh Station along Le Loi. The distance from the center of that station to the center of the next station, Opera House, will be 715 meters. Line 4 will go south along Pasteur (street) and will pass beneath the Line 1 tunnel and intersect Le Loi, from which point it will travel parallel to Line 1 on the southeast side of that line until it reaches Ben Thanh Station. Of the lines running into Ben Thanh Station, Line 2 will have the station constructed at the lowest depth. In addition to the railway planning, two bus underground terminals are planned for construction adjacent to Ben Thanh Station, making this station a center for municipal transit in Ho Chi Minh City.



Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure2.32 Urban Railways Network of the Existing Center of HCMC

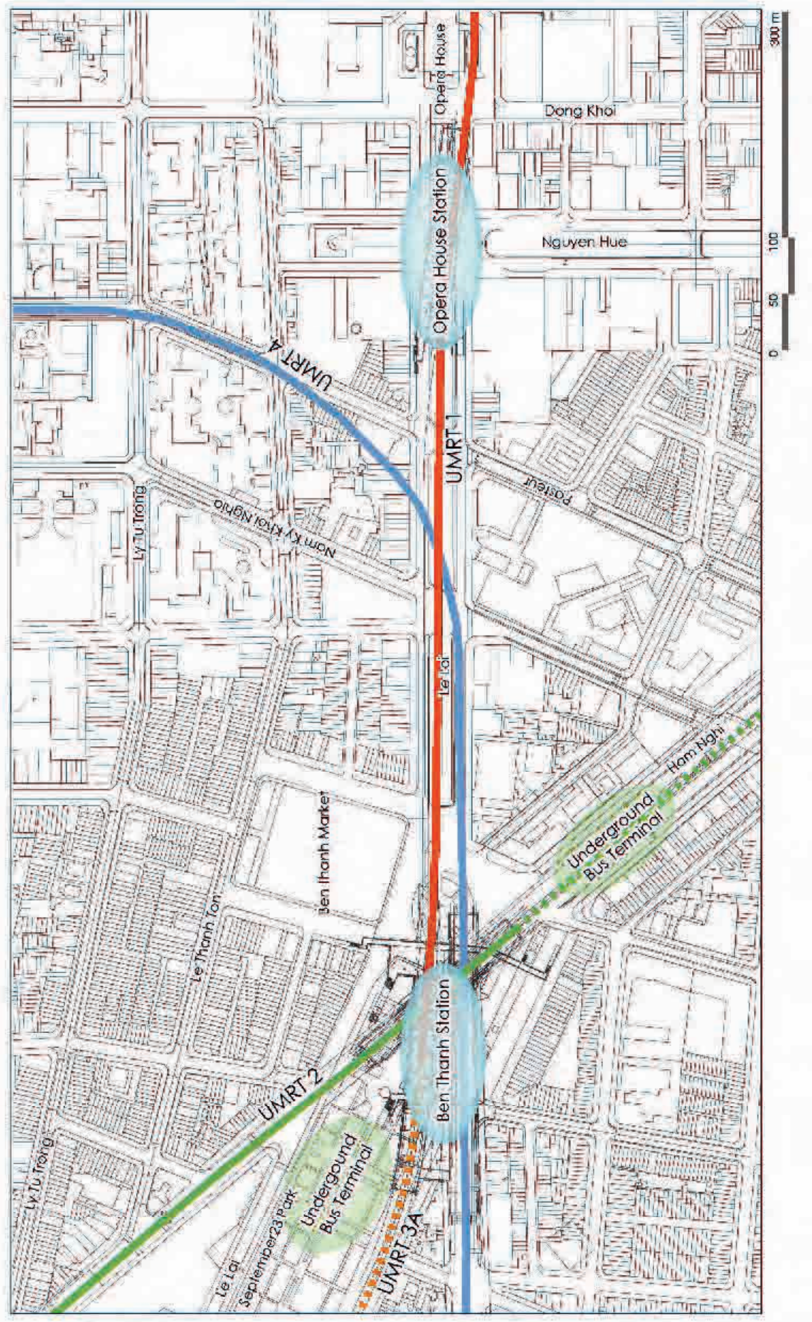


Figure2.33 Underground Development Plan

2) Overview of buried pipes in project area

Figures 2.34 and 2.35 show the current state of underground buried pipes in the project area. There are many buried pipes underground in the project area, including water pipes, sewer pipes, telephone cable and electrical cable conduits and so on. As a rule, it is the responsibility of Ho Chi Minh City to move these outside the site prior to the construction of underground stations and underground shopping malls. However, in the case of sewer pipes and other buried pipes that are difficult to move, the pipes need to be run around the site or hanging barriers must be put in place at the time that the underground station or underground shopping mall is constructed. See Section 3 in Chapter 4 regarding the study of buried pipes that must be conducted at the time of construction.

Figure2.34 Underground Facilities (1)

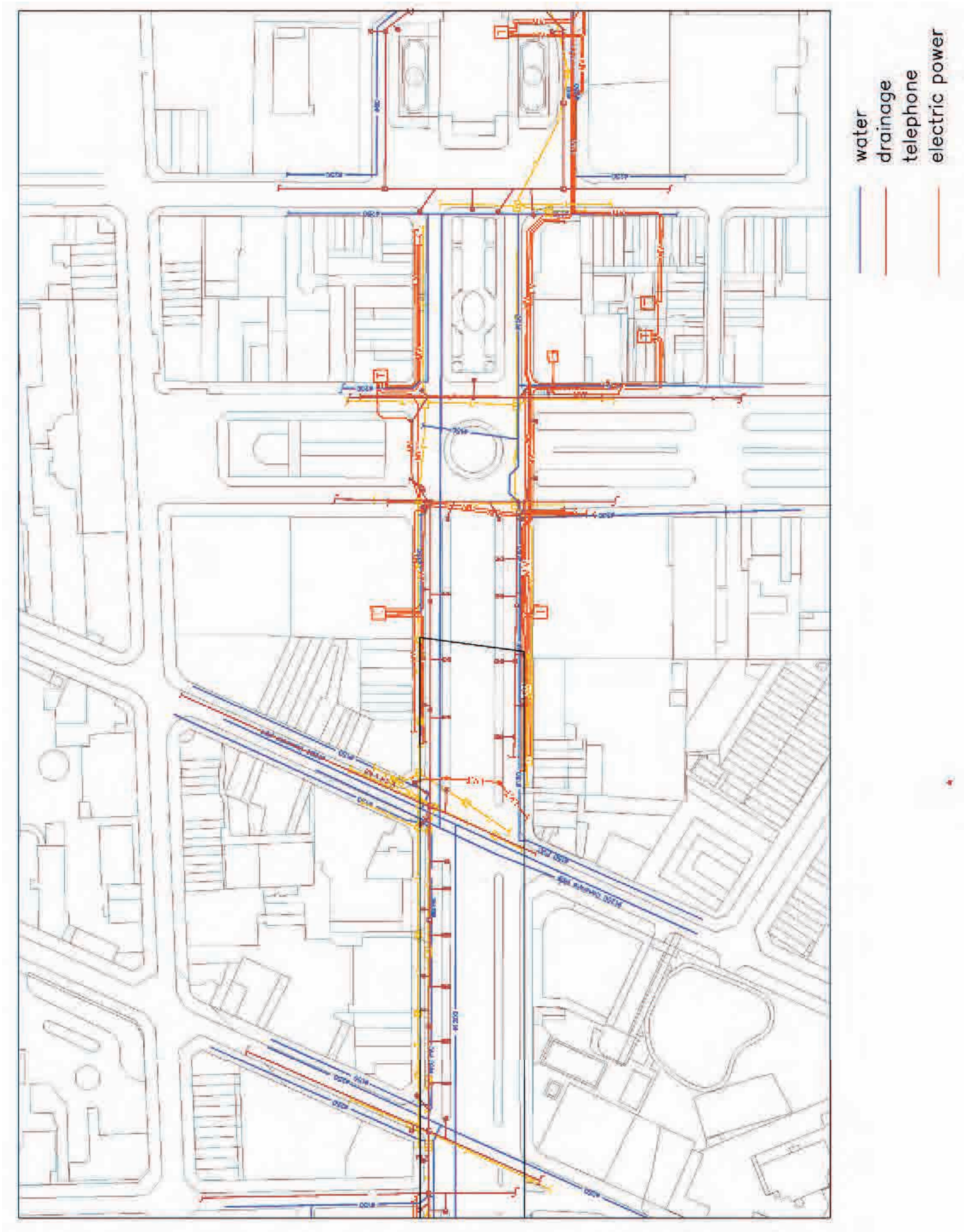
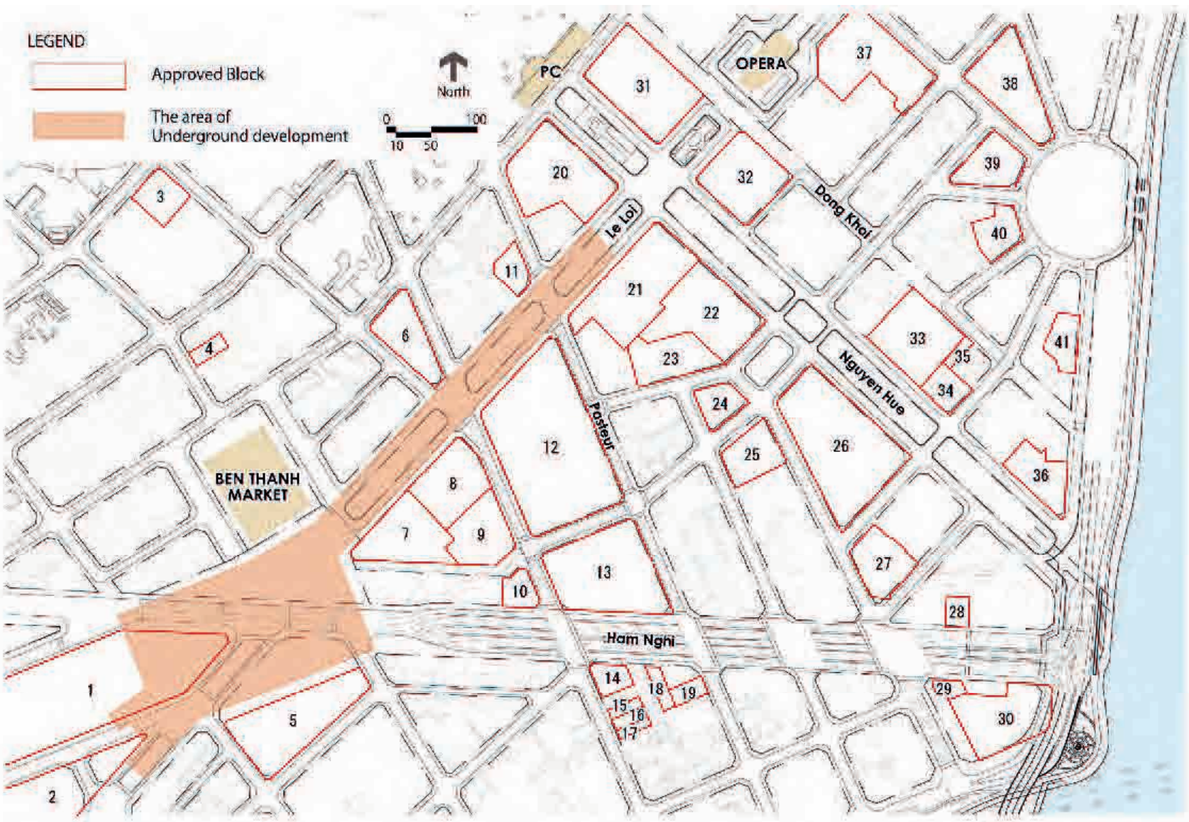


Figure2.35 Underground Facilities (2)

2.2.3 Development in the Surrounding Area

The area around Ben Thanh Station in the project site, centering on the Ben Thanh Market, is an important city center in which many residents gather. At the same time, it is also a transit terminal district at which main roads and bus terminals converge, and high-density development is already in progress. As the project area is in the center of Ho Chi Minh City, high-volume redevelopment projects are being pursued in many areas, and the project area is expected to become an even higher density area in the future. Figure 2.36 and Table 2.7 show the redevelopment projects in area around the project area. As Figure 2.36 shows, many redevelopment projects are planned in the area around the scope of the underground planning area. Moreover, compared to the redevelopment in the surrounding region, there are many skyscraper redevelopment projects with a height of 200 meters in the area adjacent to the scope of the underground planning area.

At ground level, it is difficult to create a comfortable pedestrian environment that links these redeveloped areas. Public underground passages are expected to be constructed in order to form a network of passages integrating these redeveloped areas.



Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure2.36 Approved Development of the Existing Center of HCMC

Table2.7 Approved Development of the Exisiting Center of HCMC (1)

NO	Name	Address	Landuse	Area (sqm)	FAR	BCR(%)			Setback	Height (m)	Story		Note
							podium	tower			(floor)	Note	
1	9/23 Park	Le Lai - Pham Ngu Lao - Quach Thi Trang - Nguyen Trai, Pham Ngu Lao Ward, Dist 1		28,400									
2		Tran Hung Dao - Pham Ngu Lao - Nguyen Thai Hoc, Pham Ngu Lao Ward, Dist 1		13,000	16		50	30		224	55		
3		39-39A Nguyen Trung Truc, Ben Thanh Ward, Dist 1		966.5	6.6	55			Nguyen Trung Truc (20m), Nguyen Du (20m): Podium 3m Tower 6-7m other boundaries: Podium 3m Tower 3m	50	10-12		Corner cut of intersection: 5m x 5m
4		26 Thu Khoa Huan, Ben Thanh Ward, Dist 1	Office	709.5	6.5	60			Thu Khoa Huan (20m): 6m Alley 24 Thu Khoa Huan (<12m): 2m adjoining boundaries: 2.5m	50	12		
5		Pham Ngu Lao - Le Thi Hong Gam - Calmette - Pho Duc Chinh, Nguyen Thai Binh Ward, Dist 1	Office, commercial, service, apartment	8,600	16		60	40		220	50-65		
6	SJC Tower	Le Loi - Nam Ky Khoi Nghia - Le Thanh Ton - Nguyen Trung Truc, Ben Nghe Ward, Dist 1	Office – Apartment for lease – Department store	3,805	15.75	62			Podium Le Loi: 10m Le Thanh Ton, Nam Ky Khoi Nghia, Nguyen Trung Truc: 5m	175	45	45 floors excluding 6 basements	Total floor area: 82,633 m2 including tower and podium (59,838 m2) + 6 basements (22,975 m2)
7	Saigon Hospital	117-121 Le Loi, Ben Nghe Ward, Dist 1	Luxury Hotel, Commercial, service and office	5,600	15		55	36	all boundaries: 4m (podium)	200	49		
8			Office, commercial and 5-star hotel	5,400	14-15		60-65	30-35		160-180	40-45		
9		61-71 Nam Ky Khoi Nghia, Ben Thanh Ward, Dist 1	Commercial, service and office	4,000	11		55	36	all boundaries: 4m (podium)	110	26		
10	Golden Saigon Plaza	130 Ham Nghi, Ben Thanh Ward, Dist 1		1,338	12	60			Ham Nghi (56m): Ground floor: 3m Upper floors: no setback Huynh Thuc Khang (20m), Nam Ky Khoi Nghia (20m): 3m 132 Ham Nghi: 6m	87.6	21		corner cut of intersection between Ham Nghi and Nam Ky Khoi Nghia: 9.5m x 9.5m corner cut of intersection between Huynh Thuc Khang and Nam Ky Koi Nghia: 7m x 7m
11		59 – 61 Pasteur, Ben Nghe Ward, Dist 1	department store, office for lease, cinema, hotel etc	around 902	9	75			Pasteur: Ground floor: minimum 4m. Floor 2 – 6: no setback Floor 7 or higher: 3m	56	12 – 14	excluding basements, terrace roof floor	
12	Saigon Center	Nam Ky Khoi Nghia - Le Loi - Pasteur - Huynh Thuc Khang, Ben Nghe Ward, Dist 1	Office – Apartment – Department store	19,706	12		65	30	Podium: no setback (ground floor: 3m)	192	48	112m with 28 floors (front building near Le Loi) 192m with 48 floors (back building near	
13		Huynh Thuc Khang - Pasteur - Ham Nghi - Nam Ky Khoi Nghia, Ben Nghe Ward, Dist 1		10,075	3.4	50.5			Huynh Thuc Khang (20m), Pasteur (20m): 3m existing 7-floor building: 10m	30.4	7	excluding basement, mezzanine, rooftop and technical floor on the roof	coverage area: 1,505 sqm corner cut of intersection: 3m x 3m
14		93-95 Ham Nghi, Nguyen Thai Binh Ward, Dist 1	Headquarter of IncomBank	1,187	14		75	50	Nam Ky Khoi Nghia (20m), Ham Nghi (56m): Podium: no setback (Ground floor 3m) Tower: 6m other boundaries: 3m	95	24 (tower) 6 (podium)		
15		70-72 Nam Ky Khoi Nghia, Nguyen Thai Binh Ward, Dist 1		641	6.5	55			Nam Ky Khoi Nghia (20m): 6m other boundaries: 2.5m	47.4	12		
16		66 - 66B - 68 Nam Ky Khoi Nghia, Nguyen Thai Binh Ward, Dist 1	Office – Apartment	582.2	6.5	55			Nam Ky Khoi Nghia (20m): 6m adjoining boundaries: no setback	55	14		
17	BIDV												
18		87A, 89/9-89/11-89/13-89/15 Ham Nghi, Nguyen Thai Binh, Dist 1	Office	883.5	9	75			Ham Nghi (56m): Floor 1-2: 3m Floor 3-10: no setback Floor 11-14: 5m 89A Ham Nghi: 2m alley: 1m rear site: 2m	51	14		
19		49 Pasteur, Nguyen Thai Binh Ward, Dist 1	Office	748	9	7			Pasteur (20m): Floor 1: minimum 3m Floor 2 -9: no setback Floor 10 -12: minimum 5m northwest boundary: no setback other boundaries: minimum 3m	51	12	including technical floors, rooftop floor and semi-basement floor	
20	Rex Hotel									32	8		
21	TAX	135 Nguyen Hue, 39-59 Le Loi, 122A-124 Pasteur, Ben Nghe Ward, Dist 1	Commercial, service, office and hotel	9,208.6	15	65			Pasteur: Podium (H=30m) 4m Le Loi: Tower 10m Nguyen Hue: Tower 50m northeast boundary: Podium (H=30m) 8-16m Tower setback from podium: minimum 6m	152	40	excluding basement	

Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Table2.7 Approved Development of the Exisiting Center of HCMC (2)

NO.	Name	Address	Landuse	Area (sqm)	FAR	BCR(%)			Setback	Height (m)	Story (floor)	Story Note	Note
							podium	tower					
22		TAX CENTER: 133 Nguyen Hue KIM DO HOTEL: 123-131 Nguyen Hue BIDV: 117 Nguyen Hue Ben Nghe Ward, Dist 1			15	40			Nguyen Hue: Podium (H=25m) 4m Tower 20m Ton That Thiep: Podium (H=25m) no setback Tower 4m adjoining boundaries: 6m, 6m	152 (tower) 25 (podium)	40 (tower) 6 (podium)		
23		18-64 Ton That Thiep, Ben Nghe Ward, Dist 1							Ton That Thiep St: Podium: no setback Tower: 4m northeast and northwest boundaries: 6m southwest boundary: 10m	108	30		
24		Ho Tung Mau - Huynh Thuc Khang - Ton That Dam - Ton That Thiep, Ben Nghe Ward, Dist 1			10	60				88	22		
25		Huynh Thuc Khang - Ton That Dam - Ho Tung Mau - 115-117 Ho Tung Mau, Ben Nghe, Dist 1	Department store – Hotel	3,055	around 12	65			Podium (5-storey): Ground floor: minimum 4m Storey 1 – 5: no setback from Huynh Thuc Khang (20m), Ton That Dam (20m), Ho Tung Mau (20m); For the land area behind the construction site: minimum 10m	88	22	excluding basements, mezzanines and technical floor podium (5 floors) + tower (17 floors)	
26		Nguyen Hue - Ngo Duc Ke - Ho Tung Mau - Huynh Thuc Khang, Ben Nghe Ward, Dist 1	Hotel, commercial and service	11,000	12 or 15	60			Nguyen Hue: Ground floor: 4m Tower: 20m other boundaries: Ground floor: 4m Tower: 10m	160	40		20% of land area shall be remained as local circulation and walkway
27	BITEXCO	45 Ngo Duc Ke, Ben Nghe Ward, Dist 1	Office, commercial, service, financial	2,874.22	15.8		55.3	30	all boundaries: 6m	270	61	60 floor, 1 ground floor	
28		12 Ham Nghi, Ben Nghe Ward, Dist 1		848	8.7	70			Ham Nghi (56m): Ground floor: 3m Upper floors: no setback other boundaries: 3m	51	12		
29		27-29 Ham Nghi, Nguyen Thai Binh Ward, Dist 1			9	70			Ham Nghi (56m): Ground floor: 3m Floor 2-14: no setback other boundaries: 3m	58	14		
30		34 Ton Duc Thang, Nguyen Thai Binh Ward, Dist 1	Office,commercial,apartment for rent	6,672.2	15	46			Ham Nghi: 21.5m Ton Duc Thang: 6m Ben Chuong Duong (combined with Khanh Hoi Bridge): 22m noth boundary: 6m southwest boundary: 5.2m	186	41	excluding 5 basement floors and 3 technical floors	
31	Eden area	Nguyen Hue - Le Thanh Ton - Dong Khoi - Le Loi, Ben Nghe Ward, Dist 1	Office, hotel and commercial	8,800	6	80			Nguyen Hue, Dong Khoi, Le Loi: Ground floor: 3m 1st floor-22m: no setback 22m-30m: 6m Le Thanh Ton St: Ground floor: 3m 1st floor-12m: no setback 12m-30m: 16m Le Than Ton for 40m distance from Nguyen Hue: Ground floor-22m: 10m Dong Khoi for 22m distance from Le Loi: Ground floor-30m: 3m Le Loi for 40m distance from Dong Khoi: Ground floor-30m: 3m	30			
32	Saigon Tourist	Le Loi - Nguyen Hue - Dong Khoi - Nguyen Thiep, Ben Nghe Ward, Dist 1	Department store, office, and hotel	6,000	6	80			Nguyen Hue (64m), Nguyen Thiep (10m), Le Loi (56m), Dong Khoi (20m): Ground floor: 3m 1st floor-22m: no setback 22m-30m: 6m Le Loi for 40m distance from Dong Khoi: Ground floor-30m: 3m Dong Khoi for 25m distance from Le Loi: Ground floor-30m: 3m	30	8		
33	Times Square	22-36 Nguyen Hue, 57-69F Dong Khoi, Ben Nghe Ward, Dist 1	Office, hotel, service apartment, commercial and service		16.4	68			Dong Khoi: Podium (H=24.9m) no setback Ground floor 5.5m Tower 12.5m Nguyen Hue St: Podium (H=24.9m) 5m Tower 5m southeast boundary: 4-7m northwest boundary: 4.5m-6.4m	163.8	39	excluding 3 basement floors, mezzanine and 3 technical floors	
34		14-20 Nguyen Hue, Ben Nghe Ward, Dist 1	Commercial and Office		15		70	40		180			
35		51-53 Dong Khoi, Ben Nghe Ward,	Commercial and		15		70	40		180			

Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Table2.7 Approved Development of the Exisiting Center of HCMC (3)

NO.	Name	Address	Landuse	Area (sqm)	FAR	BCR(%)			Setback	Height (m)	Story		Note
							podium	tower			(floor)	Note	
36		2A-4-6 Nguyen Hue, 27-30A Ton Duc Thang, Ben Nghe Ward, Dist 1		4,916	11.6	61.4			Ton Duc Thang (25m): no setback Nguyen Hue (64m): 5m other boundaries: 4.5m	110	30		
37	Park Hyatt	Lam Son - Hai Ba Trung - Dong Du, Ben Nghe Ward, Dist 1		8,180	13		70	55-60 (to floor 20) 25 (to floor 26)	Lam Son: to Floor 7: 4m to Floor 26: 30m Hai Ba Trung: Ground floor: 4m to Floor 7: no setback to Floor 20: 10m to Floor 26: 16m Dong Du: Ground floor: 4m to Floor 7: no setback to Floor 20: 10m to Floor 26: 65m other boundaries: 6m	104	26		
38	Sabeco Tower	2-4-6 Hai Ba Trung, Ben Nghe Ward, Dist 1		6,044	15	60			all boundaries: 4m	170	40		
39	Vietcombank Tower	5 Cong Truong Me Linh, Ben Nghe Ward, Dist 1	Office & commercial	3,232	16	67			From the right of way (Hai Ba Trung 20m, Mac Thi Buoi 20m, Phan Van Dat 20m): 4m	171	35		
40		11 Cong Me Linh, Ben Nghe Ward, Dist 1		2,208	12		60	35	Me Linh Square (26m), Phan Van Dat (20m), Ho Huan Nghiep (20m): Tower: 6m Podium of 4 floors: 3m other boundaries: 3m	124	30		
41		17-20 Ton Duc Thang, Ben Nghe Ward, Dist 1			10		70	45	Ton Duc Thang: Podium: no setback Tower: 3m Riverside Hotel: Ground floor and tower: 3m 1st floor-podium: no setback boundary with 18-19-20 Ton Duc Thang: no setback	75	16-18 (tower) 8 (podium)	Equivalent height to Renaissance Riverside Hotel (22 floors)	

Source: The Report on the Detailed Planning Study of the Existing Center, 2011

2.3 URBAN PLANNING OF HO CHI MINH CITY

As for the existing city center (930ha in total) including Ben Thanh Station and its vicinity, the Department of Planning and Architecture of Ho Chi Minh City is now under formulation of the legal detailed urban planning in the Study on the Formation of Urban Construction Detailed Planning on Scale of 1/2000 and Urban Architectural Management Regulation at Level 2 for the Existing Center of Ho Chi Minh City (hereinafter called the Detailed Planning Study of the Existing Center). The Detailed Planning Study of the Existing Center purposes to formulate zoning plans of 1/2000, and urban design plans of 1/500 for the area surrounded by Ham Nghi, Nguyen Hue and Le Loi Streets, and architectural guidelines. On November 2011, the Assessment Committee was organized to discuss the draft zoning plans and urban design plans, and the final coordinating process for the approval by the People's Committee of Ho Chi Minh City is being taken place as of November 2011. Based on what have been attained by the Detailed Planning Study of the Existing Center so far, urban planning of Ben Thanh Station and its vicinity is as outlined below, provided that part of the details is subject to change because it has not entered the administrative approval stage yet.

2.3.1 Principles of Area Development

1) The Existing City Center

The existing city center has the development principle that urban functions required for the core city of the Southern Vietnam are to be enhanced in harmony with the townscape valuably stocked during the French colonial era. Concretely,

(a) Urban functions: To reinforce pivotal functions for business, commerce, administration, culture and tourism in the Southern Vietnam.

(b) Transport: To form pedestrian priority zones by placing a special emphasis on public transport in order to hold back the present flood of motorcycles and cars.

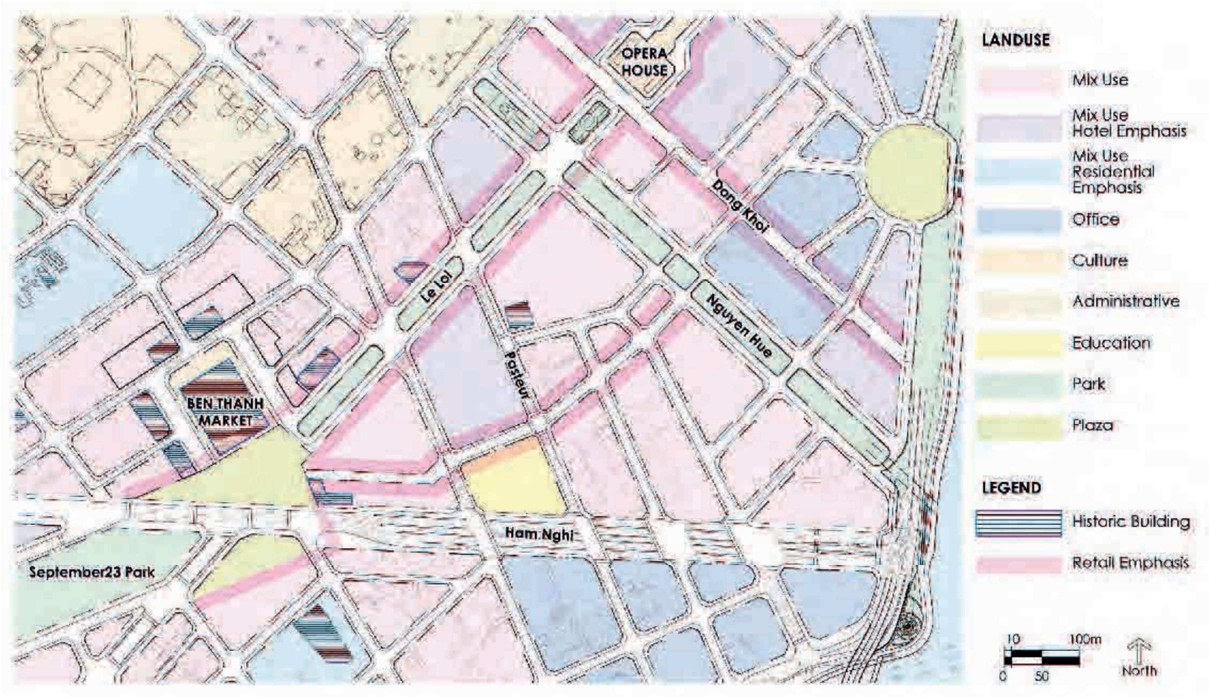
(c) Underground development: To form the network of underground urban space through construction of UMRT stations.

2) Vicinity of Ben Thanh Station

The area around Ben Thanh Station, which is positioned as part of the core of commerce, business and tourism in the existing city center, is planned to produce a mixture of the Ben Thanh Market and other historically valuable buildings and the redevelopment area with high-rise buildings together with a new public space comprising a pedestrianized market-front plaza and Le Loi Street as a transit mall.

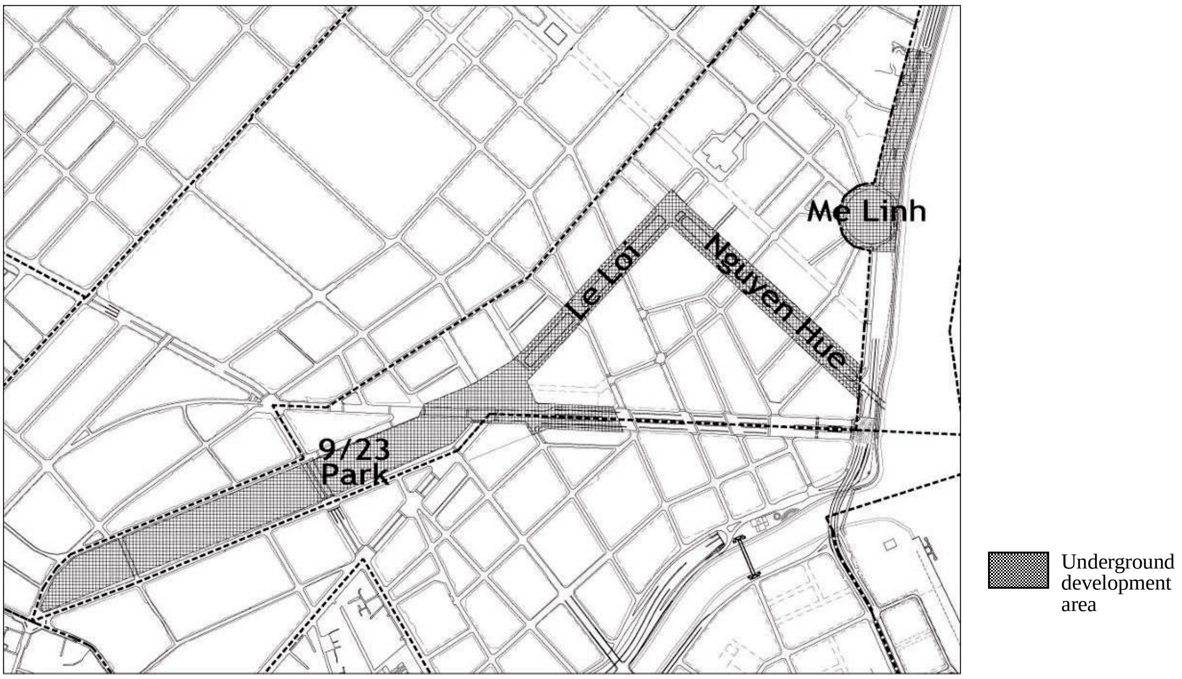
2.3.2 Land Use and Spatial Formation

Land use of the area around Ben Thanh Station is set up as mixed use with rather higher architectural indicators of FAR and height limitations, as shown in Figure 2.37. Therefore, this area will be redeveloped with many skyscrapers of large mass used for offices, shops, hotels, etc. The lower floors of buildings will be limited to commercial use so that Le Loi Street and the area around Ben Thanh Station can be provided with more vibrant dignity.



Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.37 Land Use Plan of the Existing Center of Ho Chi Minh City

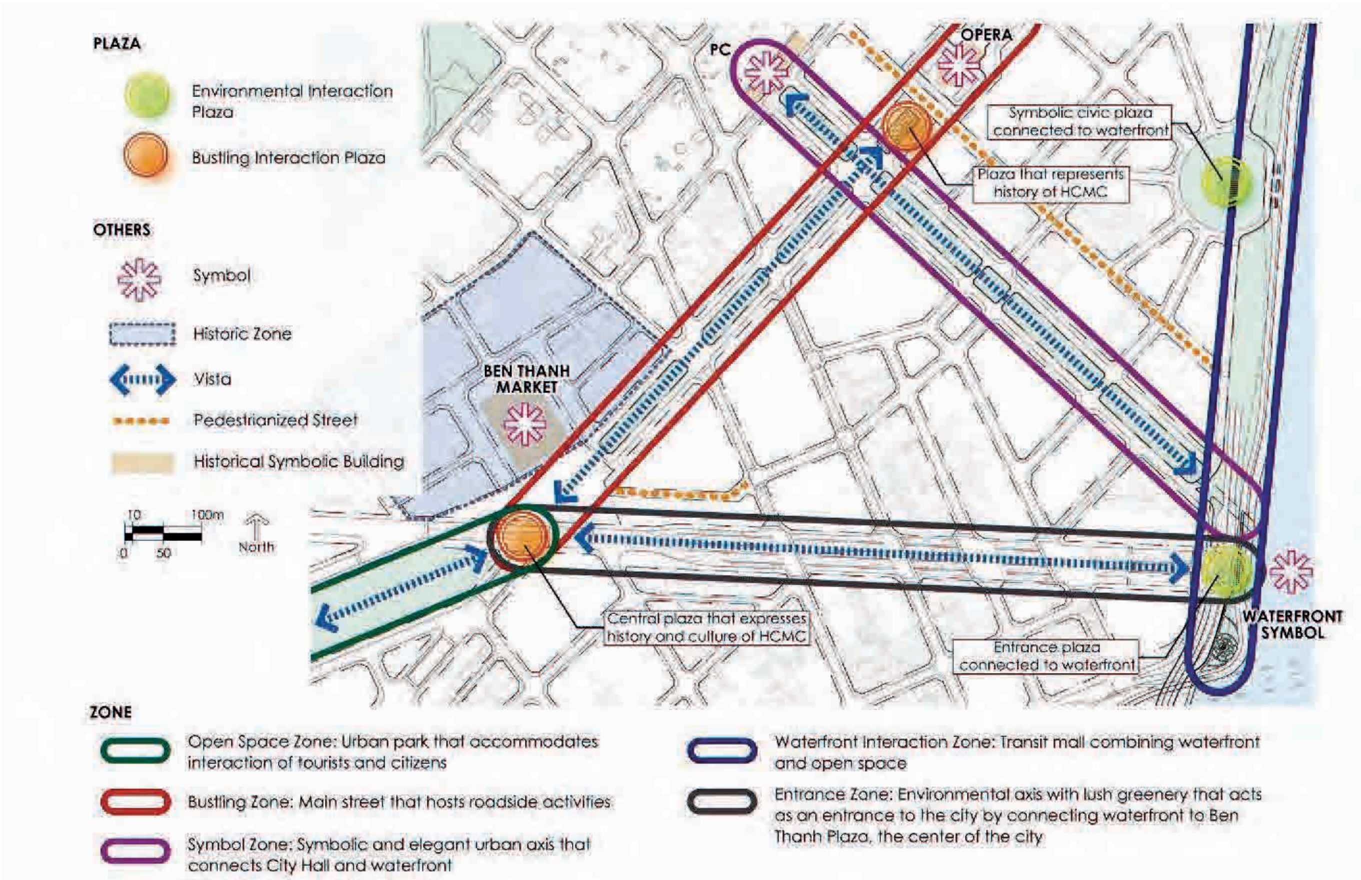


Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.38 Underground Development Plan of the Existing Center of Ho Chi Minh City

Underground urban space consisting of passages, shopping mall and car parking will be developed by using the occasion when Ben Thanh Station is constructed underground for two or more UMRT lines. Figure 2.38 shows the underground development plan of the existing city center. 9/23 Park, Nguyen Hue Street and Me Linh Plaza with a riverside park will have underground car parking and shopping malls and Le Loi Street, an underground shopping mall.

The linear area from Ben Thanh Station to Le Loi Street is planned to be filled densely with commercial and business functions as shown in Figure 2.38. Particularly, it is expected that more pedestrians will be able to enjoy higher urban amenity through re-arranged commercial or retail function. In this line, traffic of motorcycles and cars on the ground will be minimized so as to ensure safe and comfortable walk. As a result, Le Loi Street will be transformed to a transit mall limited to public transport, as stated in the next section of transport. In addition, the rotary in front of Ben Thanh Market will be pedestrianized and Opera House will have a plaza in front by pedestrianization of Dong Khoi Street. These plazas will become pedestrian and landscape nodes of the existing city center (See Figure 2.39).

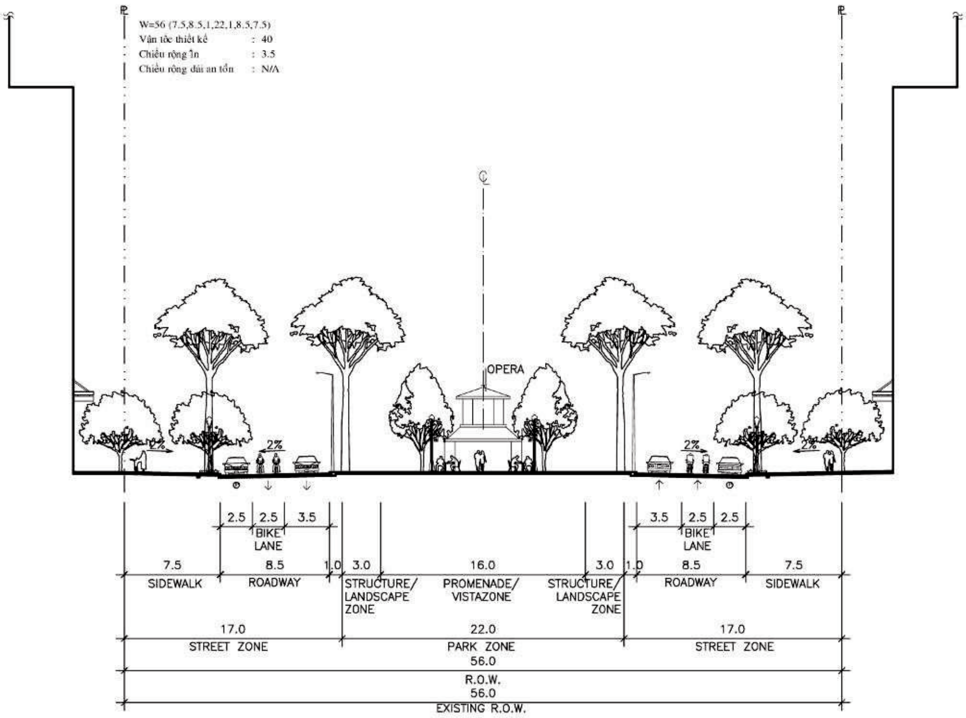


Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.39 Open Space and Landscape Plan of the Existing Center of Ho Chi Minh City

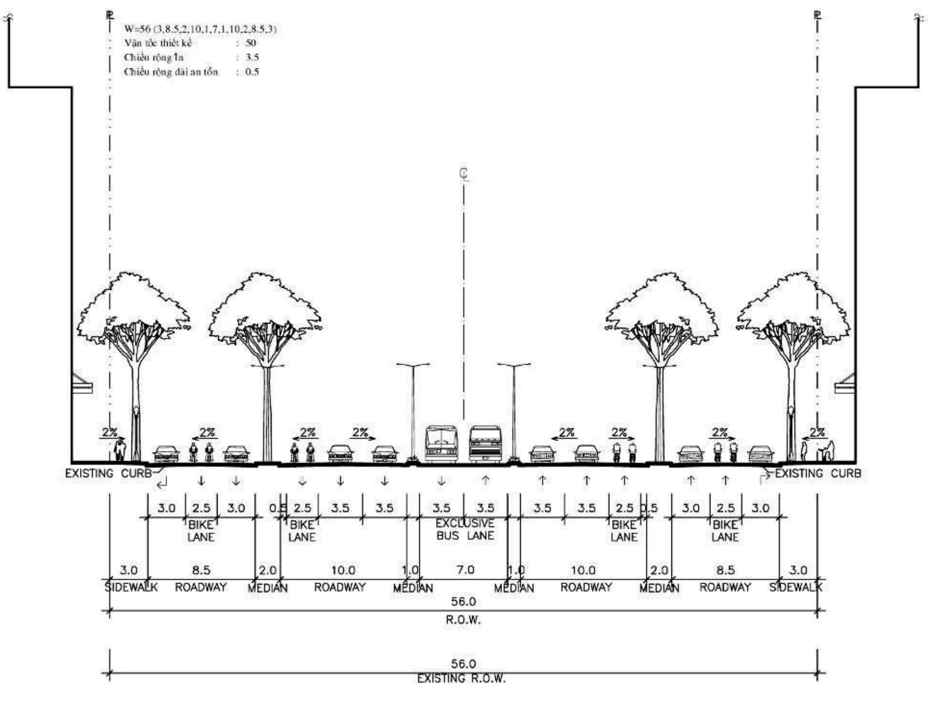
2.3.3 Transport

Roads/streets, public transport and pedestrian network around Ben Thanh Station are planned according to the above-mentioned development principles and land use. Principal streets of Le Loi, Han Nghi and Nguyen Hue will have the cross-sections as shown in Figures 2.40, 41 and 42. Particularly, Le Loi Street and Nguyen Hue Street will have a maximum width of sidewalk so as to form a pedestrian priority zone and serve as a transit mall with emphasis on public transport by reducing through-traffic and widening the median as green.



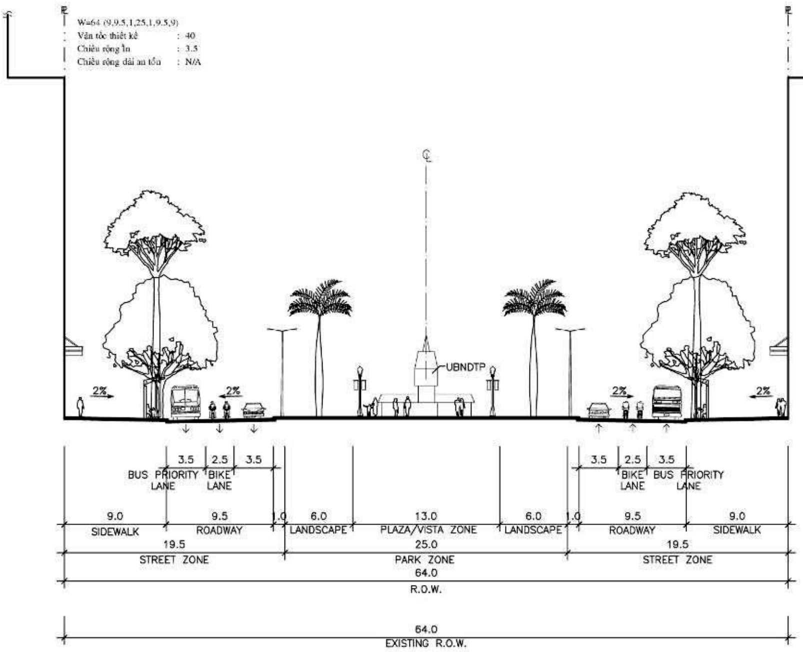
Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.40 Cross-section of Le Loi Street



Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.41 Cross-section of Ham Ghi Street



Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.42 Cross-section of Nguyen Hue Street

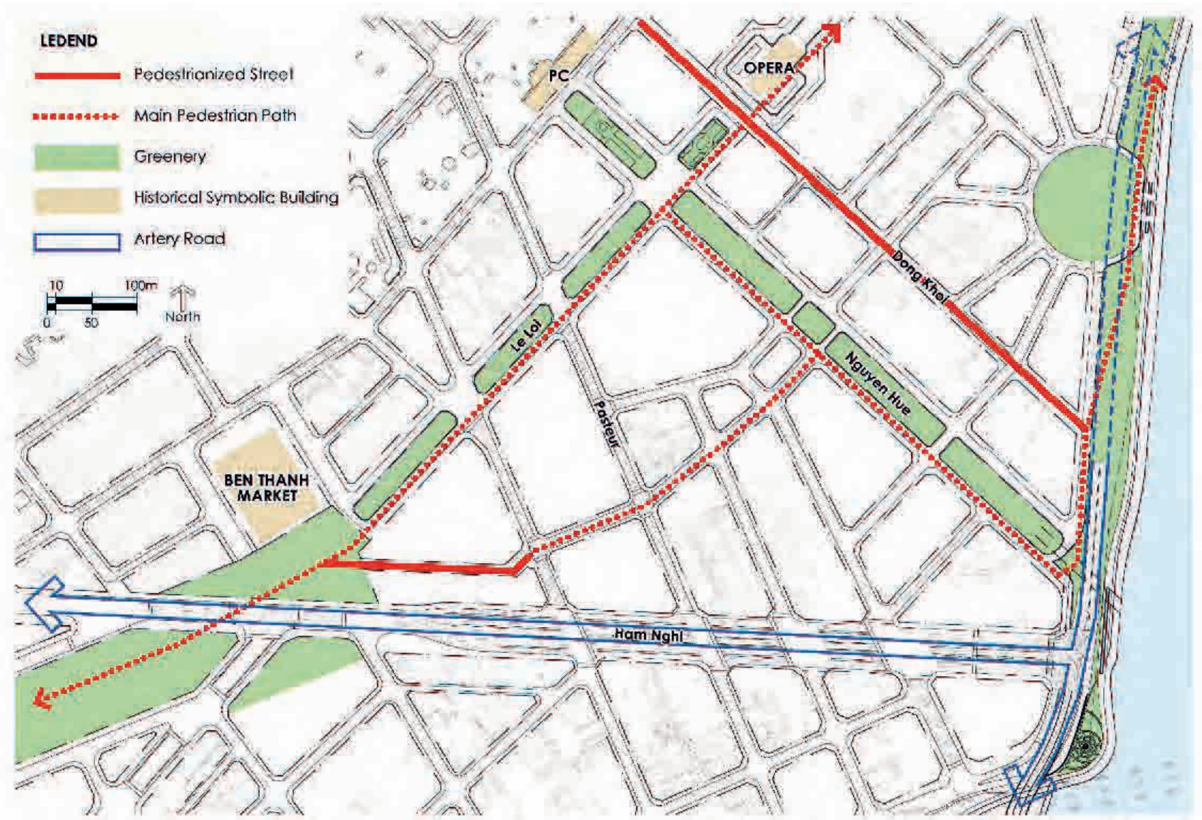
Figure 2.43 shows the public transport plan. Ben Thanh Station is a crucial traffic node to be used for four UMRT lines. Le Loi to Nguyen Hue Streets and Pasteur to Nam Ky Khoi Nghia Streets positioned as a transit mall will be used for bus services. Ham Nghi Street will receive an exclusive lane for BRT (Bus Rapid Transit) service which covers the southern area of the city. In lieu of the present one, a bus terminal will be newly constructed under 9/23 park and Ham Nghi Street.

Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.43 Public Transport Plan of the Existing Center of Ho Chi Minh City

Since the Ho Chi Minh City government has a policy to restrict *xe oms* (motorbike-style taxi) and *cyclos* (small light vehicle with two wheels like *rickshaw*) in the CBD area, the major access measures to the area surrounding Ben Thanh Central Station are busses, motorbikes and taxies. In a transport plan of this detailed planning study, therefore, accessibility to the CBD area by the UMRT and convenience of transfer between UMRT stations and busses and taxies are being examined as the important issues.

Figure 2.43 shows the principal pedestrian network around Ben Thanh Station. Le Loi Street and Nguyen Hue Street will be refurbished as pedestrian priority street and transit mall, and Huynh Thuc Khang Street (in part) and Dong Khoi Street will be pedestrianized. Consequently, an area surrounded by Le Loi Street, the Saigon River and Ham Nghi Street is intended to be designated as a pedestrian priority zone.



Source: The Report on the Detailed Planning Study of the Existing Center, 2011

Figure 2.44 Pedestrian Network Plan of the Existing Center of Ho Chi Minh City

To examine the above transport schemes in this detailed planning study, the traffic volumes and network simulation results obtained from “The Urban Transport Study for the Ho Chi Minh Metropolitan Area (called HOUTRANS)” were utilized, which was conducted during 2002 and 2004 funded by JICA and the data and information of which were updated by the latest planning conditions. In Ho Chi Minh City, the large-scale traffic study covering the entire city has not been conducted since HOUTRANS. The current transport master plan for Ho Chi Minh City approved by the Prime Minister was also formulated based on the HOUTRANS results.

2.4 RELATED LAWS AND REGULATIONS

2.4.1 PPP Related Laws and Regulations

1) BOT Law and PPP Regulation

Regarding legal framework about BOT/PPP schemes, Decree 78 was promulgated in 2007 and the BOT Law (Decree No.108/2009/ND-CP) has been in effect on January 15th, 2010. Furthermore, its detailed implementing regulation (Circular No.03-2011-TT-BKHDT) has been in effect on April 1st, 2011 which was followed by a minor revision of Decree No.108 done by Decree No.24 including four items such as preparation and assessment of feasibility study. In terms of PPP project, preparation of a legal framework has just been started by promulgating on November 9th, 2010, a Pilot PPP regulation (Decision No.71/2010/QD-TTg) as a Prime Minister Decision which is subordinated to Decree as legal action.

Nevertheless, there is no significant difference between the two in viewpoint that both are promulgated in order to facilitate private sector participation in provision of public services (infrastructure). The following are the distinguished difference of the newly created Pilot PPP regulation as compared to the BOT Law:

- One Stop Shopping: Integration of coordination process and entities: Concept of one stop shopping was adopted for coordination and adjustment of project/ concession conditions among the government agencies through inter-ministries committee mechanism chaired by MPI.
- Dead line is set for finalization of PPP contract within 30 business days from the selection of concessionaire
- Equity ratio by private investor must be over 30% of total project cost
- Amount of completion bond must be more than 2% of the total project cost
- Concessionaire must always be selected on the basis of competitive tender and the cost of preparing a feasibility study must be assumed by the government
- Overseas regulations may be adopted in case there is no appropriate rule in Vietnam
- Participation portion by the government must be less than 30% of the total project cost

2) Implementing Procedures stipulated in the BOT Law

In Decree No.108, authorized state agency in subject infrastructure sector (for example, MOT in case of expressway sector) is totally responsible for implementing procedures from project formulation to finalization of contract as illustrated in the following figure. At the time of FS approval, if the project cost exceeds over VND 1.5trillion, Prime Minister’s approval is necessary. MPI issues an investment certificate to either the investor or the project company. Implementing procedures are further detailed in Circular No.3.

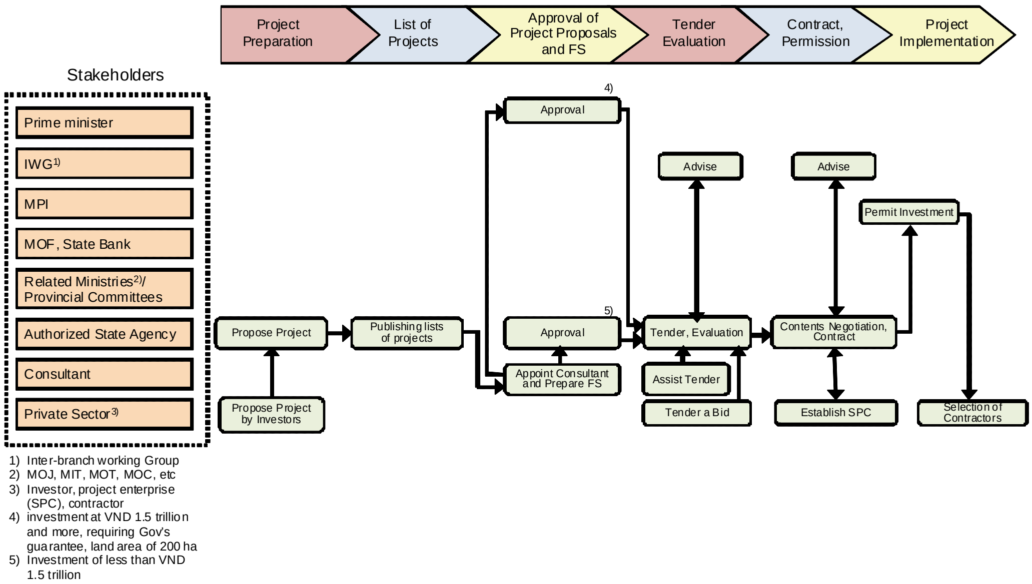


Figure 2.45 Implementing Procedure (Decree No. 108)

3) Implementing Procedures stipulated in the Pilot PPP Regulations

Preparation of PPP legal framework has just started in Vietnam and as previously mentioned Prime Minister Decision No.71 (the Pilot PPP Regulations) which is subordinated to Decree as legal action was promulgated in 2010. This Decision is positioned as Regulations for implementing Pilot PPP projects. This Decision No.71 basically follows the Decree No.108 in terms of procedures and contents as illustrated in the following figure and is composed of the following sections: i) General Provisions, ii) Public Participation, iii) Project Preparation, iv) Selection of Private Partners, v) Project Contract, vi) Investment Certificate and Project Implementation, vii) Financial Statement and Transfer of Project Work, viii) Incentives and Guarantee of Investments, xv) Organization of Implementation.

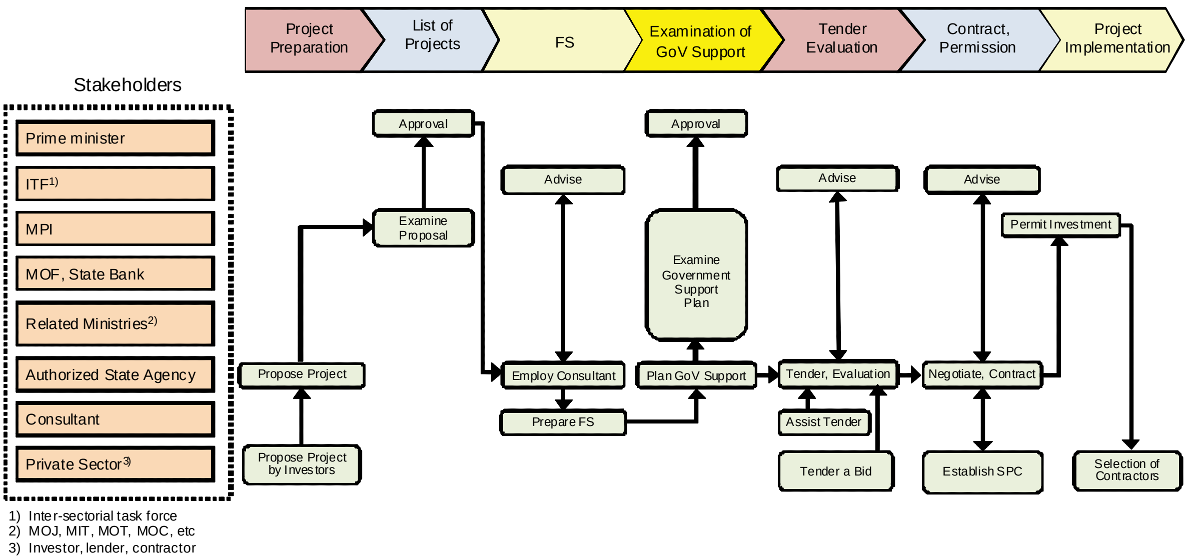


Figure 2.46 Implementing Procedure (Decision No. 71)

Decision No.71 gives MPI an initiative and leading role in implementing PPP project, for example MPI has authority to approve PPP project list before PM's approval for specific PPP project and advisory function of inter-sector task force which MPI is supposed to chair, on the procedures such as FS approval, selection of concessionaire and finalization of PPP contract. In the Decision, a new section for government support is created which clarifies the range of maximum government support to be within 30% of the total project cost. Decision No.71 has been effective from January 15th, 2011 and as being regulations for pilot PPP project, the Decision is supposed to be reviewed based on the result and experiences of the pilot PPP projects.

2.4.2 Related Laws and Regulations for Urban Development Project

1) Relates Laws and Regulations

The following are the related laws and regulation for implementing urban development project:

- Law on investment 2005 and its guiding documents
- Law on enterprise 2005 and its guiding documents
- Law on land 2003 as amended and its guiding documents
- Law on construction 2003 as amended and its guiding documents
- Law on urban planning and its guiding documents
- Law on real estate business and its guiding documents
- Decree No. 39/2010/ND-CP dated 7 April 2010 of the Government guiding on management of urban underground space ("Decree 39")

2) Proposed Implementing Procedure for PPP based Urban Development Project

Based on examination of the above listed laws and regulations, possible implementing procedures for PPP based urban development project is proposed in the following figure.

Considering the importance of this project, the first step to be required is for the potential concessionaire (a consortium composed of several investors) to obtain consent (Letter of Intent for In-principle Consent for Investigation) from both the Vietnamese Government (Prime Minister/Government Office) and the subject local government (People's Committee of Ho Chi Minh City), and on the basis of the consent, to implement a Pre F/S of the project.

Next step would be that the potential concessionaire summarizes the contents of the Pre FS and submit it to the above mentioned Governments as their proposal (General Proposal[1]) for obtaining a consent for implementing a F/S of the project (In-principle Approval/Acceptance of GOV/PC for the investors to make F/S).

After the implementation of the F/S, the procedure would be similar to those of large scale urban development project such as obtaining an investment certificate on the basis of the F/S, certificate of the land use right, although it is special land use right for the use of the underground space, and other necessary permits and approvals for development and construction, then to proceed to the start of construction.

[1] Tentative scope/scale of the Project, underground land to be used for the Project, capital level and structure, term of the Project and schedule for implementation, tentative technical and technological methods/solution for construction of project, proposed treatments for the Project, etc.

Regarding the acquisition and securing of the necessary rights and approvals for the use of the underground space, either the public side nor the private side have sufficient experiences thus far, therefore required procedures should be clarified in the investigation to be conducted from now on.

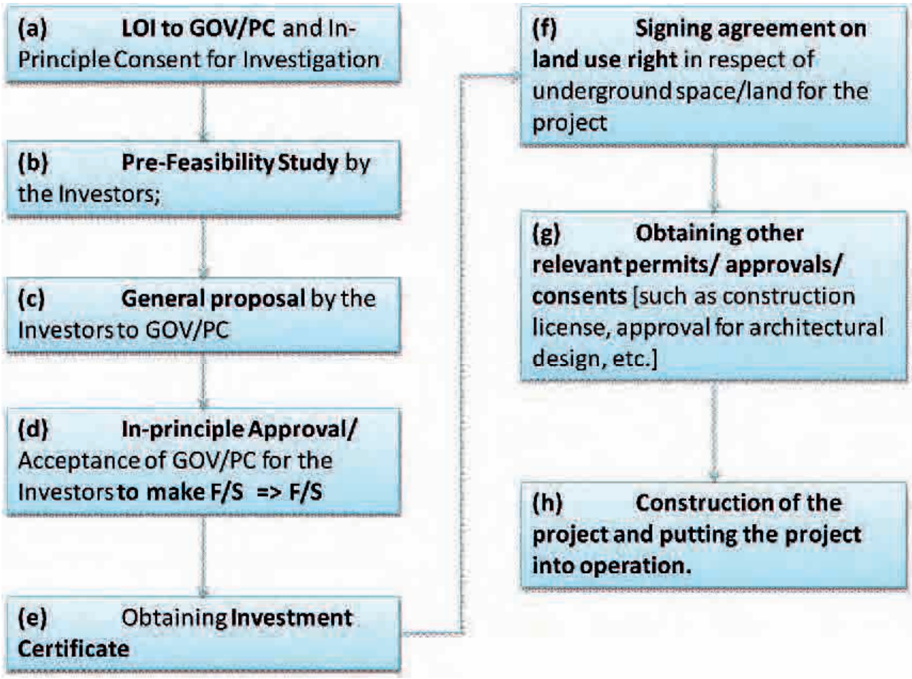


Figure 2.47 Proposed Implementing Procedure for PPP based Urban Development Project

2.4.3 Related Laws and Regulations for Underground Development

Regarding related laws and regulations for underground development, Decree No.39/2010/ND-CP "Decree on Management of Urban Underground Construction Space[2]" was promulgated on April 7th, 2010. Contents of this regulation are summarized as follows:

- Subject of regulation: As the subject of this regulation, underground railway transport facilities, underground parking and underground tunnels are clearly stipulated, however, treatment of commercial facilities are not defined clearly;
- Land use right: purpose of land use right is classified into Public Purpose and Business Purpose. However, what kind of usage is classified as public or business is not clearly stipulated. Details of how to set the level of land use fee is not stipulated either;
- Ownership of underground assets and facilities: Not clearly stipulated;

[2] Revised version of previous regulation "Decree No. 41/2007/ND-CP (First regulation regarding underground construction)

- Technical standards for underground construction: While Circular No.28/2009/TT-BXD, August 28 2009 promulgating the national construction code for urban works (Part 1.Subway; Part 2.Garage) exists, Decree No.39 allows adoption of foreign standards and rules when rules do not exist or are not sufficient domestically;
- Roles of local government PC: Local government PC plays an important role in Urban Planning, Urban Underground Development Planning, Land Use Planning, Approval of Land Use Right, Supervision of Underground Construction, Maintenance and Management of Facilities Developed Underground.

It is difficult to determine at a moment whether it is possible to set mortgage charge on immovable assets and facilities developed underground or not, as Decree No.39 does not clearly stipulate about the ownership right of those immovable assets and facilities (for example, how to approve land use right and how to issue land use certificate, etc). However, it is worthwhile to note that there is a legal opinion from a concerned local lawyer that setting mortgage charge on the immovable underground assets and facilities would work in similar manner as that of land use right on ground. Namely, if the land use right above the underground development is secured on the basis of leasing agreement, it is not possible to set mortgage charge on the immovable assets and facilities, while such land use right is based on permanent ownership (such as the land use right based on full payment of 50 year land use fee), it is assumed possible to set mortgage charge on the immovable assets and facilities developed underground.

2.4.4 Underground Construction Technology Standards

1) Construction technology standards in Vietnam

Table 2.8 shows the technical standards for the construction of buildings and other structures in Vietnam. With regard to the disaster planning standards for the buildings that are integrally related to this project, comparatively detailed regulations are contained in the Building Code of Vietnam-Volume 2 (issued in conjunction with Decision No. 439/BXD-CSXD, 25 Sep 1997), however, the content does not deal specifically with underground shopping malls.

As technical standards relating to underground structures, there is also the Vietnam Building Code for Urban Underground Structures (Part 1. The Underground/Part 2. The Parkings) (QCVN 08:2009/BXD, 14 Aug 2009). However, these standards are published by the Ministry of Construction (MOC) of Vietnam, and as there are some deficiencies with regard to the technical content and the procedures for publication, the standards are currently being revised, so at present they cannot be called useful technical standards.

Figure 2.8 Construction technology standards in Vietnam

Laws and Regulations	Number	Date
Construction Law	No. 16/2003/QH	26 Nov 2003
Decree on management of urban underground construction space	No.39/2010/ND-CP	7 Apr 2010
Circular on stipulating the application of foreign standards in construction activities in Vietnam	No. 40/2009/TT-BXD	09 Dec 2009
Building Code of Vietnam - Volume 1	Issued in conjunction with Decision No. 682/BXD-CSXD	14 Nov 1996
Building Code of Vietnam - Volume 2	Issued in conjunction with Decision No. 439/BXD-CSXD	25 Sep 1997
Building Code of Vietnam - Volume 3	Issued in conjunction with Decision No. 439/BXD-CSXD	25 Sep 1997
Vietnam Building Code on Regional and Urban Planning and Rural Residential Planning	Decision No.04/2008/QD-BXD	3 Apr 2008
Vietnam building standards design requirements for fire caution and prevention for houses and buildings	TCXDVN 2622	1995

2) Technical standards for municipal railway Line 1

In the related UMRT Line 1 project, the STandard urban RAilway SYstem for Asia (STRASYA) urban railway system prepared in 2007 by the Japanese Ministry of Land, Infrastructure, Transport and Tourism based on Japanese technical standards relating to urban railways is being used. STRASYA is a standard system for urban railways created based on Japanese railway technology and expertise. The introduction of this system is expected to enable highly safe, punctual, energy-efficient and low-maintenance railway operation.

With regard to disaster prevention planning for underground train stations, there are no disaster prevention standards in Vietnam. For this reason, following approval by the Ho Chi Minh City Fire Department of the disaster prevention plan based on Article 29 in the Ministerial Ordinance for Establishing Technical Standards Relating to Railways" established by Japan's Ministry of Land, Infrastructure, Transport and Tourism (MLITT Ministerial Ordinance No. 151, December 2001), this plan was used for the design of the UMRT Line 1 subway station.

3) Construction technology standards relating to underground shopping malls in Japan

Disaster planning for underground shopping malls in Japan is done primarily in accordance with the provisions of the Building Standards Law and its related laws and regulations and the Fire Defense Law and its related laws and regulations.

In the Building Standards Law, the provisions relating to underground shopping malls are established in Article 128, Section 3 of the Building Standards Law enforcement regulations. The standards for building equipment are established in the "Establishment of construction methods for emergency lighting equipment, smoke control equipment and drainage equipment constructed in underground passageways that connect to the structures in underground shopping malls" (Ministry of Construction Notification No. 1730). These documents will be used as the basis for the design of underground shopping malls as buildings, in accordance with the various regulations in the Building Standards Law and relevant laws and regulations. Moreover, although it was abolished in 2001, the "Basic Policy Relating to Underground Shopping Malls," which up to that time was the basic policy regarding safety in underground shopping malls, established detailed disaster technology standards relating to the construction of underground shopping malls. Some local governments, at their own discretion, continue to use this basic policy to regulate the safety of underground shopping malls. This is the policy used as a reference when studying disaster planning for underground shopping malls.

The Fire Defense Law and related laws and regulations establish standards for fire prevention management and firefighting equipment. According to the Fire Defense Law, underground shopping malls are defined as "stores, offices and other similar facilities constructed continuously along an underground passageway within an underground structure in an integrated manner with said passageway" (Fire Defense Law, Article 8, Section 2), and as fire prevention structures they are required to have firefighting equipment, etc. (Fire Defense Law, Article 17). The Fire Defense Law enforcement regulations contain the details of firefighting equipment, etc., and specify the equipment standards for fire extinguishers, sprinkler equipment and other fire extinguishing equipment, automatic fire alarm equipment and other alarm equipment, and guide lights and other evacuation equipment.

The regulations relating to underground shopping malls in the Building Standards Law (Article 128, Section 3) are as follows.

THE BUILDING STANDARD LAW ENFORCEMENT ORDER

(Underground Shopping Malls)

Article 128-3. All business establishments of underground shopping malls shall abut on underground passages as described in each of the following items for 2 m or more. Provided, that public lavatories, public telephone boxes and the like may abut on underground passages for less than 2 m:

(1) The walls, columns, floors, beams and floor slabs used shall have the fire-resistive performance specified by the Minister of Land, Infrastructure, Transport and Tourism.

(2) Underground passages shall be 5 m or more in width and 3 m or more in height to the ceiling and provided with no steps nor slope-way with a gradient exceeding 1/8.

(3) The interior ceiling and walls shall be finished with noncombustible materials and the beds thereof shall be made of noncombustible materials.

(4) Underground passages exceeding 60 m in length shall be provided with through stairs leading to the ground which are safe for evacuation and which conform to item (2) of the table of Article 23 paragraph 1 so that the travel distance from any part abutting on each business establishment to one of the said through stairs does not exceed 30 m.

(5) The end shall open onto a roadway at an entrance/exit not narrower than the width of the underground passage. Provided, that when it has two or more entrances/exits at the end, the total width of the entrances/exits shall be not narrower than that of the underground passage.

(6) Underground passages shall be provided with the lighting apparatus for emergency use, smoke exhaust assembly and drainage assembly which is constructed by a method specified by the Minister of Land, Infrastructure, Transport and Tourism.

2. In cases where business establishments of underground shopping malls abut on each other, the said business establishments shall be separated by floors and walls of fire-resistive construction and by specified opening protective assembly which is constructed as specified in Article 112 paragraph 14 item (2).

3. Each business establishment of underground shopping malls shall be separated from the underground passages concerned by floors and walls of fire-resistive construction and by specified opening protective assembly which is constructed as specified in Article 112 paragraph 14 item (2).

4. The travel distance from any part of the habitable rooms of each business establishment of underground shopping malls to one of the entrances/exits of the underground passages concerned (including passageways leading from any part of the habitable rooms directly to the ground) shall not exceed 30 m.

5. The provisions of Article 112 paragraphs 5 through 11, paragraphs 14 through 16, and Article 129-2-5 paragraph 1 item (7) (limited to the part pertaining to the provisions of Article 112 paragraph 15) shall apply mutatis mutandis to each business establishment of underground shopping malls. In this case, the phrase of “those parts of buildings

which are on the eleventh or higher floors thereof and have an aggregate of floor areas of each floor" in Article 112 paragraph 5 shall be replaced with "those parts of each business establishment of underground shopping malls which have an aggregate floor areas", the word of "buildings" in paragraphs 6 and 7 of the same Article with "each business establishment of underground shopping malls", the phrase of "those buildings whose principal building parts are of quasi-fire-resistive construction and have habitable rooms on basement levels or on the third or higher floors" in paragraph 9 of the same Article with "each business establishment of underground shopping malls" the phrase of "parts of buildings" in the said paragraph with "parts of each business establishment of underground shopping malls" and the phrase "quasi-fire-resistive construction" in the same paragraph with "fire-resistive construction," and the phrase "quasi-fire-resistive construction" in paragraph 10 of the same Article with "fire-resistive construction" and the phrase "quasi-fire-resistive construction which conforms to the technical criteria mentioned in Article 115-2-2 paragraph 1 item (1)" in Article 129-2-5 paragraph 1 item (7) with "fire-resistive construction."

6. Regarding the matters mentioned in the preceding paragraphs, local public organizations may change, by ordinances, the provisions of the said paragraphs, when such changes are deemed necessary due to relations to other structures or other circumstances.

4) Proposed applicable standards for this study

(1) Proposed applicable standards for Planning of Ben Thanh Central Station

Ben Thanh Central Station receives 4 UMRT Lines which are 1, 2, 3a, and 4. As the procedure of each project is different, the station's construction timing of each line shall be different. Nonetheless, Ben Thanh Central Station should be planned based on only one standard for the unified planning and design as a central station. On the other hand, the progress of UMRT Line 1 project is most expedited and the preliminary design has been already completed, Line 1's station shall presumably be constructed first. Therefore it is most suitable that the standards of UMRT Line 1 is adopted.

According to the above mentioned viewpoints, the following standards applied to UMRT Line 1 project are adopted as the standards for the planning of Ben Thanh Central Station:

- STandard urban RAilway SYstem for Asia (STRASYA) urban railway system
- Disaster plan standards based on Article 29 in "Ministerial Ordinance for Establishing Technical Standards Relating to Railways" established by Japan's Ministry of Land, Infrastructure, Transport and Tourism

(2) Proposed applicable standards for Planning of Underground Shopping Mall

No technical standards dealing specifically with disaster planning for underground shopping malls have been established in Vietnam. However, technical standards have been established for buildings. In Ho Chi Minh City, there are private sector buildings with underground floors that are used for commercial establishments, and these are thought to be in conformance with the construction technology standards of Vietnam. For this reason, the construction technology standards of Vietnam can be said to be the basis for disaster planning standards for underground shopping malls.

On the other hand, the underground shopping mall plan in this study that concerns primarily subway stations is a plan that is not limited to a single private sector building site but deals with wide-area development of public spaces beneath roads. Moreover, in comparison with private sector buildings, the users are expected to be many members of the general public including subway passengers, pedestrians traveling through underground passages and people accessing buses and other types of transport. As a result, a disaster plan that deals more specifically with underground shopping malls is needed for use in the event of a fire, one that considers how to prevent the spread of the fire and evacuate passengers. In this respect, it would be good to apply the construction technology standards for underground shopping malls prepared by Japan, a country that has a wealth of experience in the development of underground shopping malls and has technical standards developed especially for underground shopping malls.

Considering all of these factors, the technical standards for disaster plan planning used for this study were based on the construction standards in Vietnam, with Japanese construction technology standards used as specialized technical standards for underground shopping malls beneath roads to supplement areas of insufficiency. The major items applied as disaster planning standards were as follows.

Table 2.9 Comparison and Proposal for applicable standards

Item		Standards in Vietnam	Standards in Japan	Applicable standards
Fire Compart-ment	Area of Compart-ment (in general)	4,400 m^2 (with Fire-resistive construction and automatic fire extinguishing equipment)	3,000 m^2 (with Fire-resistive construction and automatic fire extinguishing equipment)	3,000 m^2 (with Fire-resistive construction and automatic fire extinguishing equipment)
	Between store and passage-ways	No specification	Stores to be separated from passageways	Stores to be separated from passageways
	Between store and store	No specification	Stores to be separated from adjacent stores	Stores to be separated from adjacent stores
Smoke Exhaust and Separation		Natural smoke ventilation or Smoke ventilation by fans and duct No specification for smoke separation	300 m^2 : Passageways 500 m^2 : Others Stores and Passageways: Smoke ventilation by fans and duct Underground Plaza: Natural smoke ventilation	300 m^2 : Passageways 500 m^2 : Others Stores and Passageways: Smoke ventilation by fans and duct Underground Plaza: Natural smoke ventilation
Underground Plaza (Safety Plaza for fire disaster)		No specification	Underground Plaza to be constructed with natural smoke ventilation, natural lighting, and more than two escape stairs	Underground Plaza to be constructed with natural smoke ventilation, natural lighting, and more than two escape stairs

Travel Distance	From any part to escape stairs	40 m	40 m (with Fire-resistive construction and noncombustible interior in stores)	40 m (with Fire-resistive construction and noncombustible interior in stores)
	to under-ground plaza	No specification	50 m (form any passageway part to underground plaza)	50 m (form any passageway part to underground plaza)
Escape Stairs	Width	more than 1.05 m	more than 1.5 m	more than 1.5 m
	End of USM	No specification (more than two escape stairs)	The end shall open onto a roadway at an exit not narrower than the width of the underground passage Underground Plaza to be constructed at the end with more than two escape stairs	The end shall open onto a roadway at an exit not narrower than the width of the underground passage Underground Plaza to be constructed at the end with more than two escape stairs
Fire Protection Equipment		・Emergency lighting ・Fire extinguisher ・Indoor fire hydrant systems ・Sprinkler systems ・Automatic fire alarm systems ・Emergency alarm systems ・Guiding lamps ・Smoke exhaust equipment ・sprinkler systems with FD connections ・FD indoor fire hydrant systems	・Emergency lighting ・Water drainage ・Fire extinguisher ・Indoor fire hydrant systems ・Sprinkler systems ・Water spray extinguishing systems ・Automatic fire alarm systems ・Gas leakage and fire alarm systems ・Emergency gas valve close device ・electric leakage and fire alarm devices ・Emergency alarm systems ・Guiding lamps ・Smoke exhaust equipment ・sprinkler systems with FD connections ・FD indoor fire hydrant systems ・Emergency power outlets ・Auxiliary facilities for radio communication systems	・Emergency lighting ・Water drainage ・Fire extinguisher ・Indoor fire hydrant systems ・Sprinkler systems ・Water spray extinguishing systems ・Automatic fire alarm systems ・Gas leakage and fire alarm systems ・Emergency gas valve close device ・electric leakage and fire alarm devices ・Emergency alarm systems ・Guiding lamps ・Smoke exhaust equipment ・sprinkler systems with FD connections ・FD indoor fire hydrant systems ・Emergency power outlets

Note) 1. The standards in Vietnam follow “Building Code of Vietnam - Volume 2” (Issued in conjunction with Decision No. 439/BXD-CSXD, 25 Sep 1997). In this case the building classification is assumed to be the commercial building, and the fire resistance level of the building is assumed to be Ⅰ.

2. The standards in Japan follow “The Building Standard Law”, “Fire Service Law”, and these relative laws and regulations. Further, "Basic Policy Relating to Underground Shopping Malls" (abolished in 2001) is referred to.

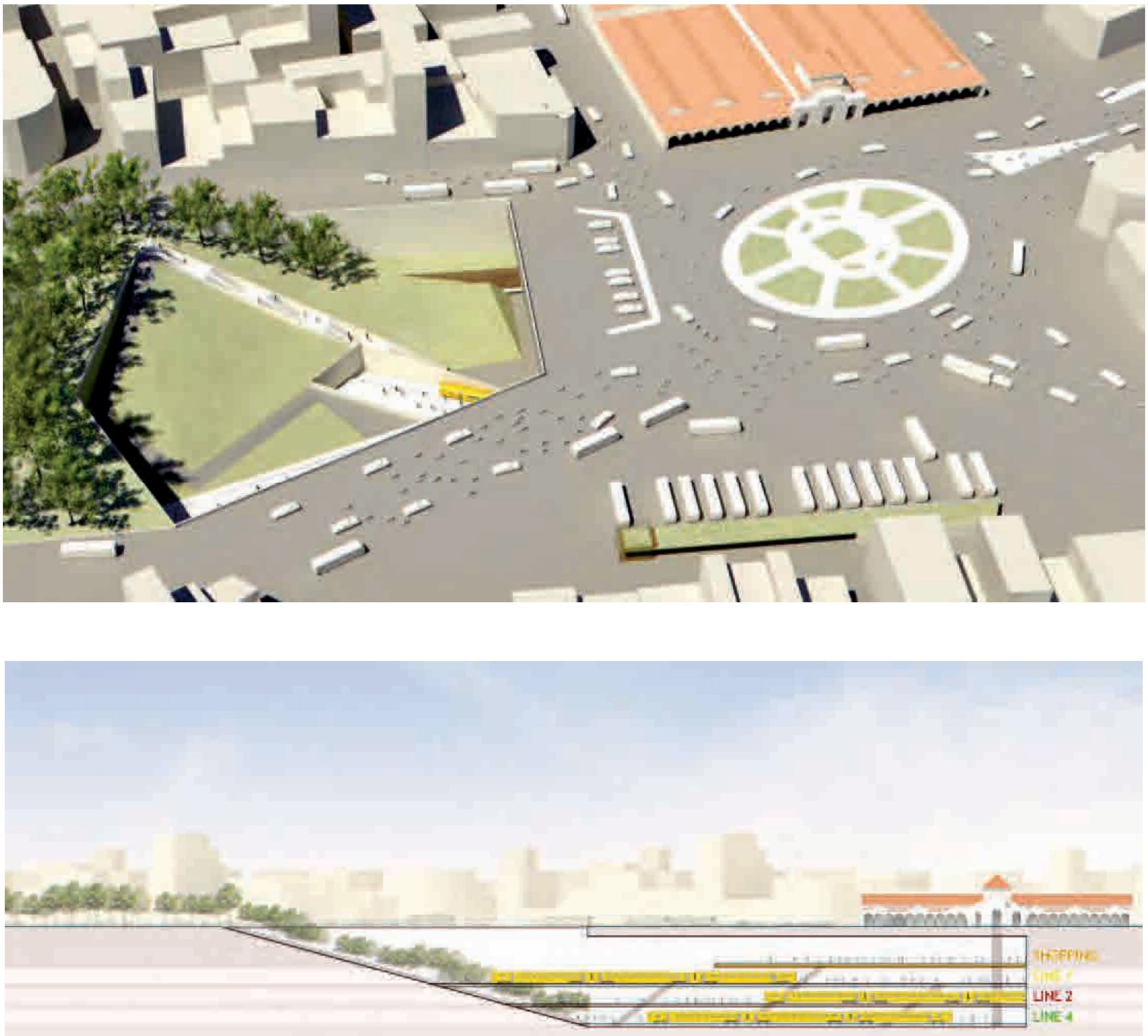
2.5 OTHER ACTIVITIES

2.5.1 Joint Ben Thanh Station proposal submitted by Belgium

An advance proposal for implementing a formal aid project was submitted in June 2009 by the government of Belgium through bilateral discussions. The content of this proposal was the planning of a joint Ben Thanh Station to serve UMRT Line 1, Line 2, and Line 4. Subsequently, however, there has been no movement toward starting the actual project.

The content of the proposal featured a large-scale atrium extending from the subway platforms to the ground level, forming the nucleus of an open space in order to create an open environment on the floors below ground level.

The content of the proposal was illustrated only through computer-designed image perspective drawings (see Figure2.48 and Figure2.49). Specific proposals for achieving the proposed space in the form of drawings and the like have not been provided.



Source: Department of Planning and Architecture

Figure2.48 Ben Thanh Station Proposal submitted by Belgium (1)

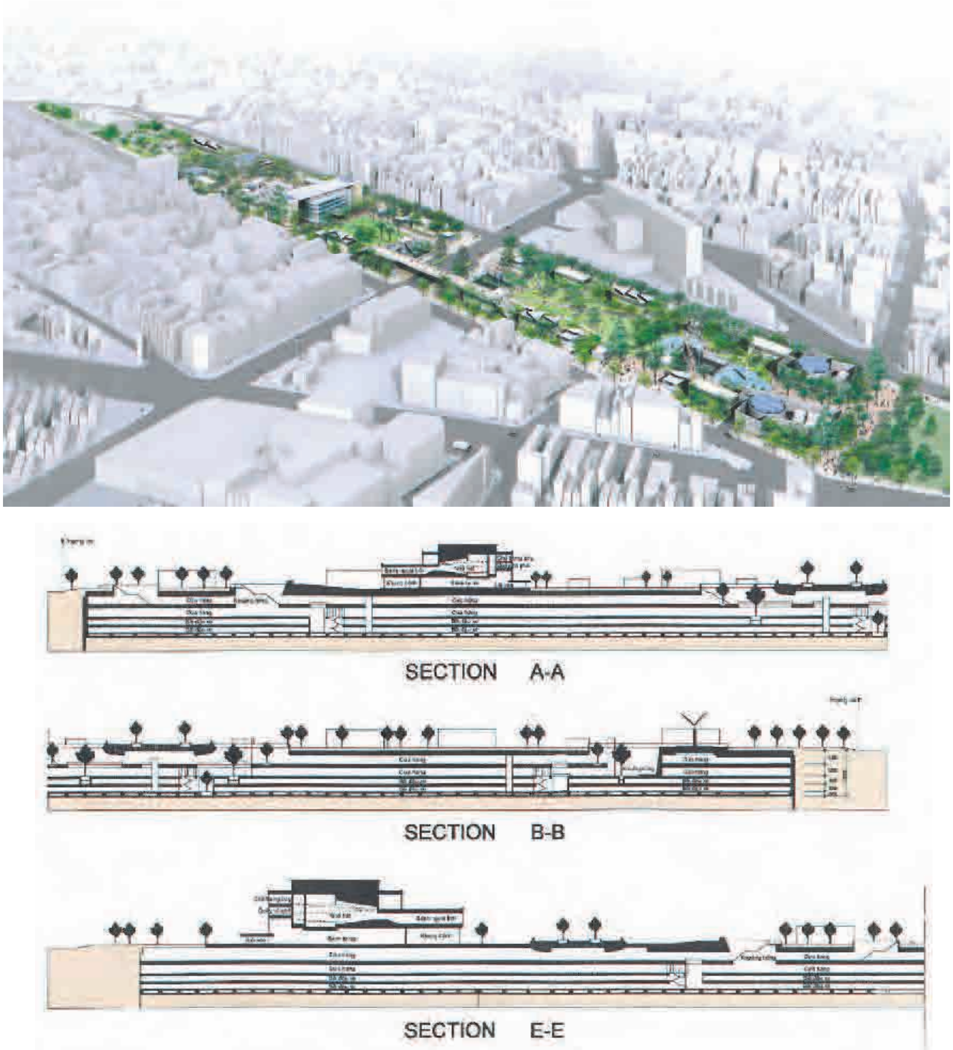
Source: Department of Planning and Architecture

Figure2.49 Ben Thanh Station Proposal submitted by Belgium (2)

2.5.2 23 September Park Proposal Submitted by Taiwan

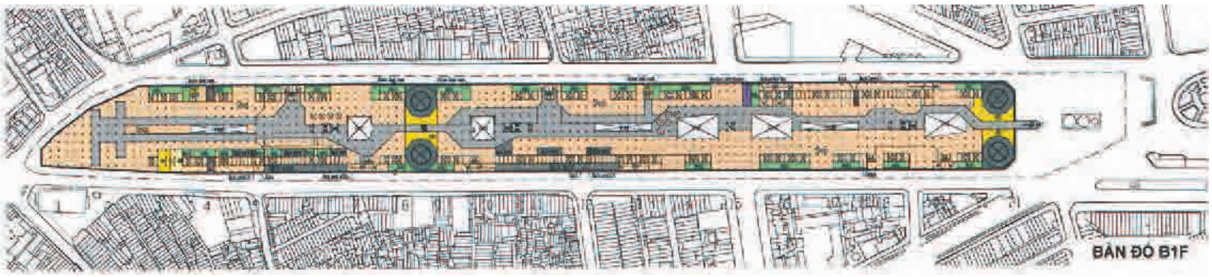
A Taiwanese investor has submitted a proposal for the Twenty-Three September Park. The content of the proposal involves park planning for the Twenty-Three September Park and the planning of an underground space. As the Department of Planning and Architecture (DPA) for Ho Chi Minh City has not approved the "Study for Detailed Planning and the Establishment of Guidelines for Central Ho Chi Minh City," the specific planning conditions have not been established and there has been no progress on the project.

The proposal involves the creation of a pedestrian network throughout the entire park, through the construction of pedestrian bridges over the roads that cut through the park at ground level (see Figure2.50). It also calls for the construction of a building with a height of approximately 20 meters in the center of the park. The plan calls for four underground floors, with commercial establishments on the first and second basement floors and parking on the third and fourth basement floors (see Figure2.51). The content of the proposal includes perspective views as well as drawings, equipment plans, environmental plans and other items.

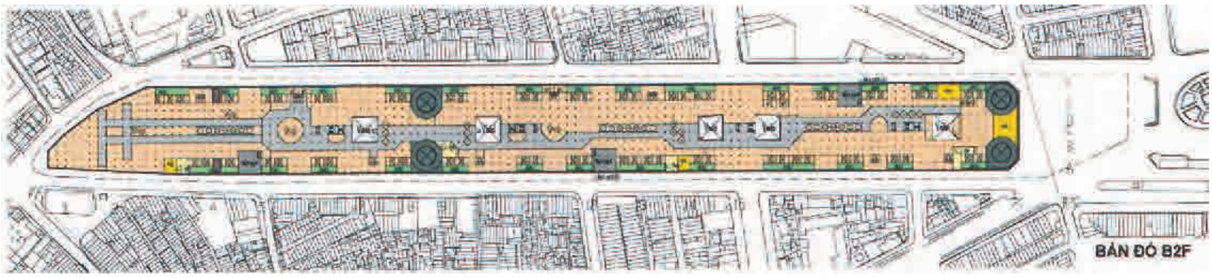


Source: Department of Planning and Architecture

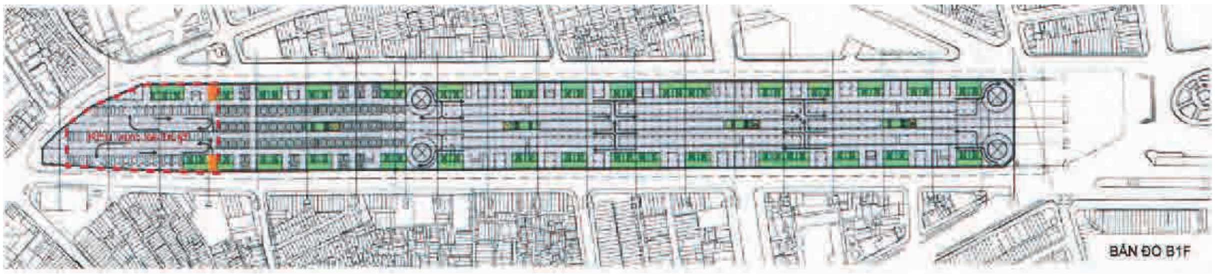
Figure2.50 23 September Park Proposal submitted by Taiwan (1)



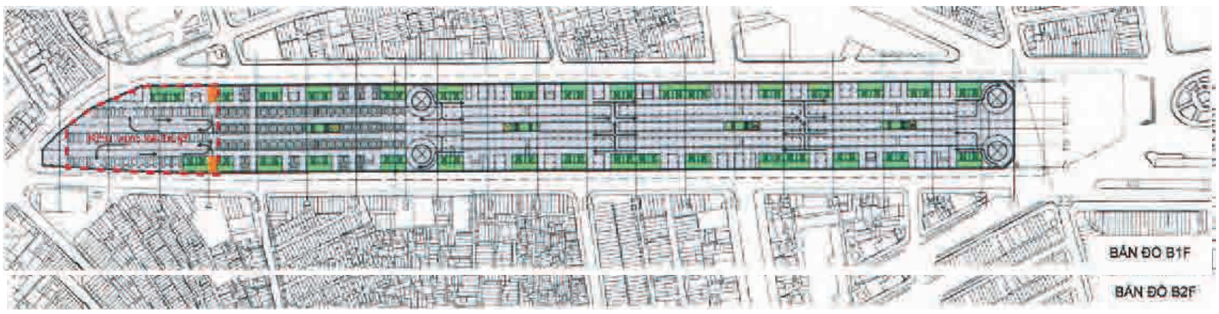
B1 Floor (Commercial Area)



B2 Floor (Commercial Area)



B3 Floor (Parking Area)



B4 Floor (Parking Area)

Source: Department of Planning and Architecture

Figure2.50 23 September Park Proposal submitted by Taiwan (2)

CHAPTER 3 CURRENT ISSUES AND SOLUTIONS OF THE PROJECT AREA

3.1 CURRENT ISSUES OF THE PROJECT AREA

The area around Ben Thanh Station has issues as itemized below.

1) Functional Enhancement as the CBD Core

Ho Chi Minh City is nationally required and internationally expected to heighten urban functions for serving as a central city for business, commerce, administration, culture and tourism in the Southern Vietnam and strengthen attractiveness for competing with big cities in Southeast Asia and other world cities. Since the area around Ben Thanh Station is located at the core of the CBD in which the said principal urban functions accumulate, the project area is destined to respond to higher functional requirements.

2) Appropriate Control for Development Pressure

The project area is the object of a lot of worldwide developers' or investors' attention. Proposals for high-density, high-rise buildings to be constructed in that area are taken into the concerned city authorities one after another. It is necessary to suitably control this sort of development needs so as to provide ordered townscape in harmony with the infrastructure facilities.

3) Disappearance of Historical Townscape

Under the aforesaid development pressure, many historical buildings around Ben Thanh Market and along Le Loi have disappeared from the public eye day by day.

4) Traffic Congestion and Air Pollution due to the Flood of Motorbikes and Cars

Roads in the CBD including the project area are filled with motorbikes and cars. So, traffic congestion and air pollution are at all times found. This results in damaging daily life and activities in the CBD and deteriorating the culturally and touristically attractive atmosphere.

5) Ineffective Road Network

In general, the road network, road cross-sections and roundabouts of the CBD including the project area are used almost originally as constructed during the French colonial era. This results in ineffective traffic treatment irrespective of the remarkably increasing motorbikes and cars.

6) Shortage of Parking Area

In addition to 4) and 5) above, the shortage of parking area causes cars to park on streets and motorbikes to park on streets and sidewalks, and it makes traffic congestion worse and reduces pedestrian space.

7) Rearrangement and Integration of Public Transport

Under the municipal policy of positively shifting to the public transport, construction of four lines of UMRT and relocation of the bus terminal are planned in the project area. However, these plans are carried out separately from each other, without unitary decision making.

8) Lack of Attractive Public Space giving Comfort to Citizens or Visitors

The project area to function as the core of CBD is densely built up with less orderly spatial arrangement. This results in lack of open or public space which citizens or visitors can use at ease or with comfort. Attractive urban space has to be produced on the basis of the historical, cultural and natural conditions characteristic of the city so that Ho Chi Minh City can rank with the world cities.

9) Lack of Pedestrian Space

A number of people visit the project area for shopping, tourism, business, etc. However, since part of road space is occupied by motorbikes and cars as stated already, there are few spaces where pedestrians can safely walk with comfort.

3.2 SOLUTIONS OF THE PROJECT AREA

3.2.1 Solutions of the Project Area

To solve the issues pointed out in Section 3.1, the following countermeasures have been worked out so far.

(a) Promulgation of detailed city planning and architectural design guideline for the city center (See Section 2.3) and urban management based thereon (Related to Issues 1), 2) and 3) in Section 3.1)

(b) Rearrangement of public transport including construction of four lines of UMRT, rearrangement of bus service lines, and arrangement of BRT (Bus Rapid Transit) service (Related to Issues 4))

(c) Rearrangement of roads in the CBD including reformation of Le Loi and Nguyen Hue to pedestrian priority street and transit mall and that of the roundabout in front of Ben Thanh Market to a pedestrian plaza (Related to Issues 4), 5), 8) and 9))

(d) Construction of underground car parking (See Section 2.3) in Nguyen Hue, 9/23 Park and the riverside park (Related to Issues 6))

These countermeasures will be able to achieve more integrated effects by implementing the following complementary solutions.

1) Construction of Overall Underground Terminal to ensure Smooth Connection of Public Transport (Related to Issue 7) in Section 3.1)

UMRT stations and bus/BRT terminals are to be constructed in the project area. An overall terminal has to be constructed mainly on the underground level to ensure the public transport passengers' smooth travel.

2) Creation of Attractive Underground Space (Related to Issue 8))

The project area is in the densely built-up CBD and anticipated to face more massive redevelopment in future. In consideration of the said future development tendency, it is necessary to create new urban space for peoples' comfort and enjoyment. Underground space is effective not only in drastic underground development at the densely built-up area, but in birth of physically comfortable space resisting the local hot and wet climate.

3) Formation of Underground Pedestrian Network connecting New Buildings and Traffic Nodes (Related to Issue 9))

Comfortable underground pedestrian network can be formed by constructing a public passage under arterial roads instead of an on-ground sidewalk which is difficult to construct with sufficient space at present. This underground pedestrian network can be directly connected to new business or commercial buildings adjacent to there, traffic nodes or several tourist spots.

These three complementary solutions are considered equivalent to the principal requirements for the Ben Thanh Central Station Project. Figure 3.1 shows interrelation of the current issues and solutions of the project area stated in Sections 3.1 and 3.2, including the requirements for the Ben Thanh Central Station Project.

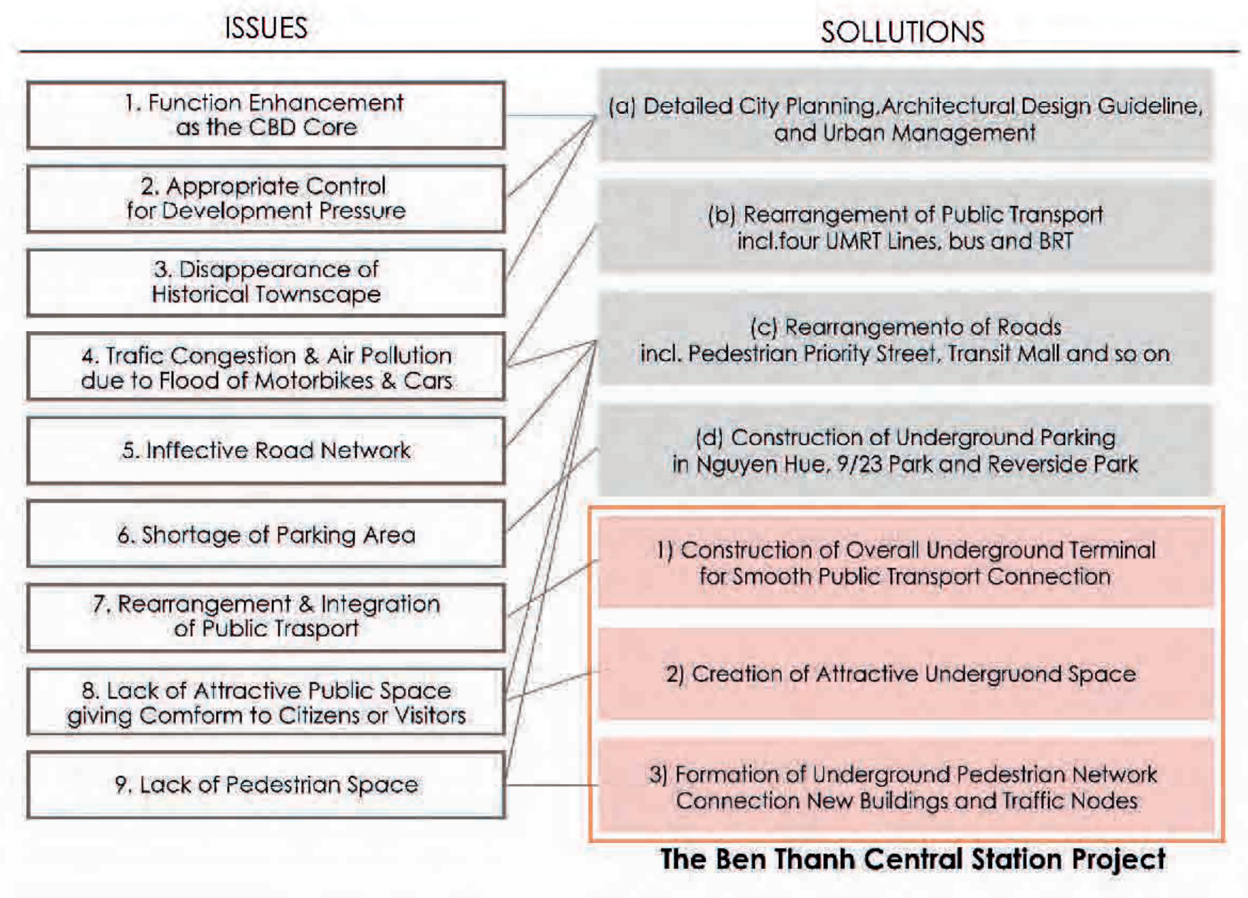


Figure 3.1 Issues and Solutions of the Project Area

3.2.2 Project Effect and the Impact on City Competitiveness

As shown in Section 3.1 and 3.2, specific countermeasures against current issues are revealed. The implementation of Ben Thanh Central Station Project based on these countermeasures is expected to bring various project effects in Ho Chi Minh City. In this section, these project effects and impacts on the improvement of the city competitiveness of Ho Chi Minh City are studied and introduced. These project effects corresponded to each countermeasure are itemized below. On the other hand, the effectiveness indicators for the evaluation of the project effect are mentioned in Chapter 8.

1) Construction of Overall Underground Terminal to ensure Smooth Connection of Public Transport

Smooth transfer between UMRT station and the bus terminal will enhance the convenience of these public transportation. Therefore, the construction of overall underground terminal will result in increasing the number of passenger of the public transportation including UMRT.

2) Creation of Attractive Underground Space

The comfortable underground space will attract many visitors for this area since it protects visitors from a sudden shower or muggy weather. Therefore, the creation of the attractive underground space will result in vitalization of the economic activities and passenger increase of public transportation.

Moreover, the project site will become the core area of Vietnamese cultural in collaboration to Ben Thanh Market which has been a symbol of Ho Chi Minh City for a long time. Consequently, the attractive urban space will contribute to the cultural interaction.

3) Formation of Underground Pedestrian Network connecting New Buildings and Traffic Nodes

The number of passenger of public transportation is expected to increase because of high accessibility from the underground terminal to surrounding buildings. In addition, expanded underground network will enhance the circulation of visitors and the economic activities in the project area.

Moreover, this high accessibility is expected to increase users of surrounding buildings and raise the value of these assets.

Accordingly, formation of the underground pedestrian network will contribute to improve the business environment in the center area of Ho Chi Minh City.

These project effects mentioned above will affect the improvement of city competitiveness of Ho Chi Minh City. Regarding the global city competitiveness, some institutes have published the ranking of global cities. According to the Global Power City Index published by The Institute for Urban Strategies, this ranking is estimated based on six overall categories with 69 individual indicators. These categories and indicators are shown in Table 3.1.

Table 3.1 Function and Indicator for Comprehensive Ranking

Function	Indicator Group	Number of Indicator
Economy	Market Attractiveness Economic Vitality Business Environment Regulations and Risks	14
Research & Development	Research Background Readiness for Accepting & Supporting Researchers Research Achievement	8
Cultural Interaction	Trendsetting Potential Accommodation Environment Resources of Attaching Visitors Shopping & Dining Volume of Interaction	16
Livability	Working Environment Cost of Living Security and Safety Life Support Functions	16
Environment	Ecology Pollution Natural Environment	10
Accessibility	Infrastructure of Int'l Transportation Infrastructure of Inner-city Transportation	8

Source: Global Power City Index 2011

Institute for Urban Strategies at the Mori Memorial Foundation, October 2011

Figure 3.2 shows interrelation of the project effects and functions stated in Table3.1. As shown in this figure, project effects are supposed to affect on many functions of city competitiveness. Thus, the city competitiveness of Ho Chi Minh City will be enhanced obviously. In particular, Ben Thanh Central Station Project will contribute to directly "Function.1: Economy" and "Function.6: Accessibility". These effects are estimated to be significant. Furthermore, the indirect contribution for "Function.3: Cultural Interaction", "Function.4: Livability " and "Function. 5: Environment " will be expected also.

Besides, Ho Chi Minh City is the largest commercial city in Vietnam and this project will be conducted in the center area of this city. This high potentiality will emphasize these project effects much more.

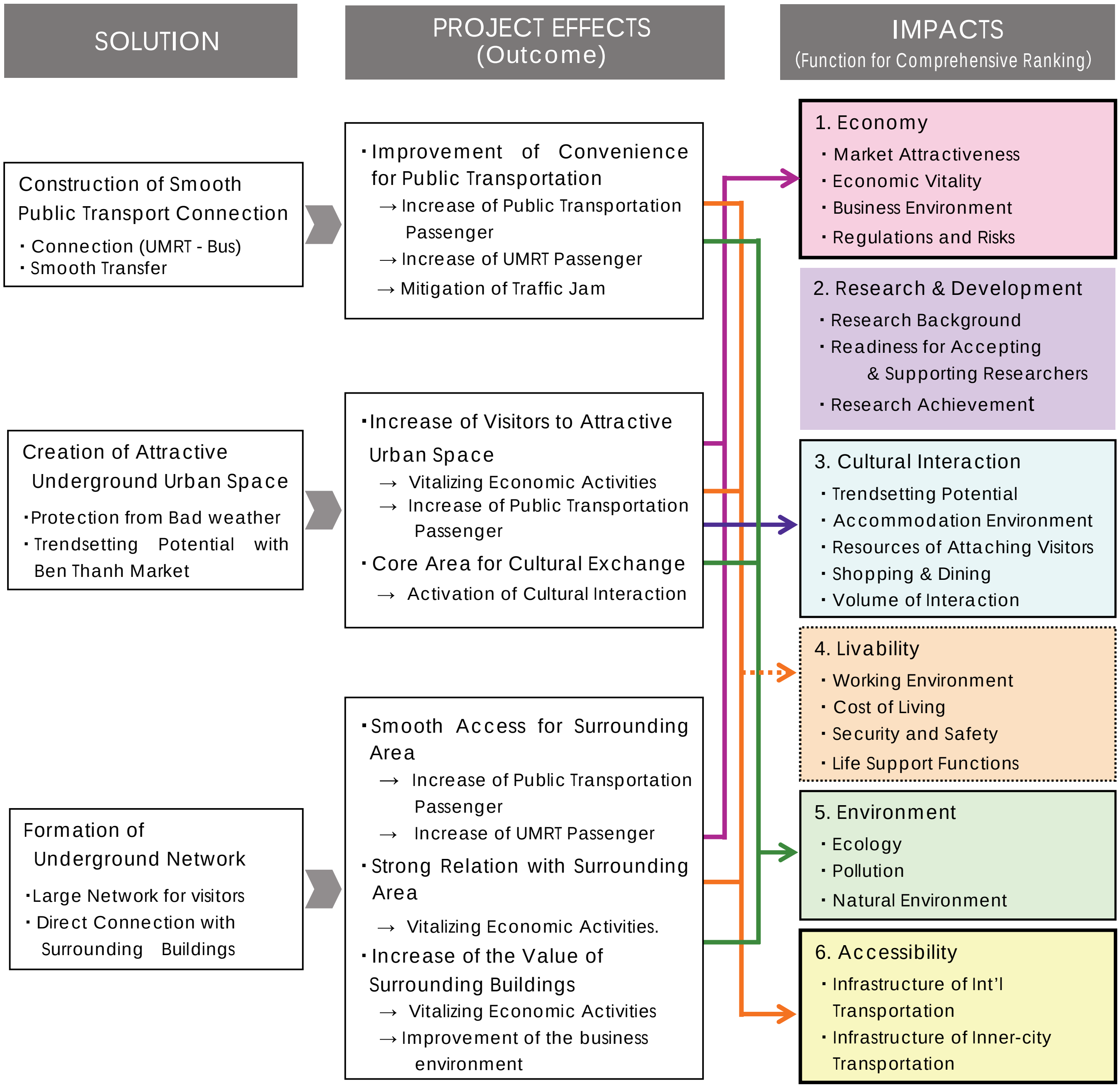


Figure 3.2 Project Effects and Impacts

CHAPTER 4 FORMATION OF PROJECT PLAN

In this chapter, the development plan of this project is formed considering the necessity of the infrastructure in the center of Ho Chi Minh City due to the construction of UMRT Line 1. This project plan is based on the following three points as described in "Chapter 3 the Current Issues and Solutions of the Project Area”. The schematic design of Ben Thanh Central Station Project is performed through the study on the planning policy and the basic layout of the underground facilities.

- Construction of Overall Underground Terminal to ensure Smooth Connection of Public Transport
- Creation of an Attractive Underground Space
- Formation of Underground Pedestrian Network connecting New Buildings and Traffic Nodes

In the study, at first the volume of the future pedestrian flows in Ben Thanh will be estimated in consideration of the operation of UMRT Lines and the urban development on surrounding private ground. Based on the number and ratio of the future pedestrians by each direction, the planning policy is established to serve as the main frame of this project. According to this planning policy, the schematic design for the underground facilities (the metro station, underground plazas, underground passageways, retail stores, and so on) is performed. After the study for construction methods and technical issues, the construction cost will be estimated.

4.1 DEMAND FORECAST ON UNDERGROUND FACILITIES

4.1.1 Methodology

On the underground development area on this survey, there are two aspects: as a comprehensive underground station and a underground commercial mall. Approach of demand forecasts on these two aspects are totally different, therefore the estimates for number of users are conducted by summing up the results of the ones of these two aspects.

Figure 4.1 shows the flow chart of demand forecasting on underground facilities on this survey.

For users of underground stations including transferring passengers, the demand forecasting system which has been used for several projects including HCMC Line-1 and the detail of this will be described in the next section. The target year of developing infrastructure of this survey is set to 2050, therefore, long time assumption is set based on the demand forecasting system on Line-1.

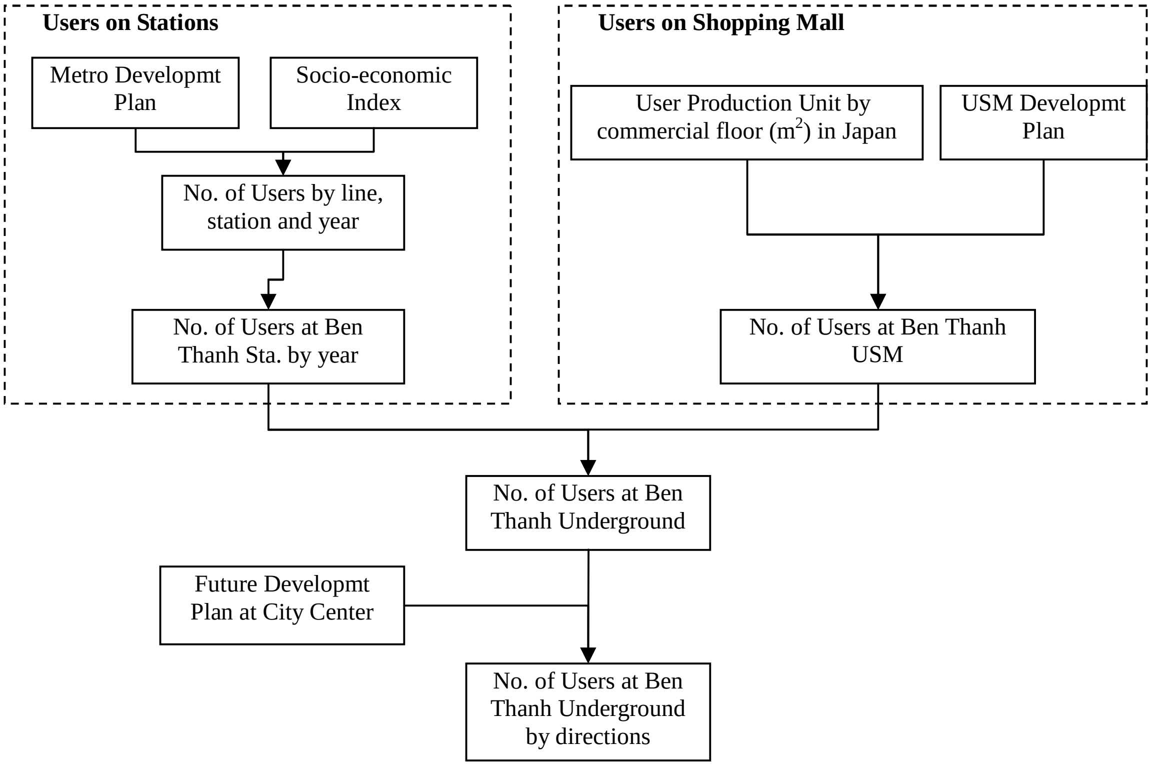


Figure 4.1 Flow Chart for Estimating Number of users at Ben Thanh Underground

4.1.2 Number of Users at Ben Thanh Station

1) Methodology

This demand forecasting system in this survey is to estimate the future demand of passengers of each urban railway line by assuming future socio-economic status including population by area, alignment and location of the stations of lines as well as the service level of urban lines based on the current transport behaviors of the citizen in HCMC.

4 steps method which is a conventional methodology for traffic demand forecasting is used for this. This method is composing by 4 components, namely “generation/attraction”, “distribution”, “modal share” and “traffic assignment”. The conceptual flowchart is shown in Figure 4.2. “Future population by wards” and “future development plan by urban railway lines” are the inputs specifically, the outputs are traffic volume (number of passengers) of each road and urban railway line. The parameters to estimated as each 4 step is also needed.

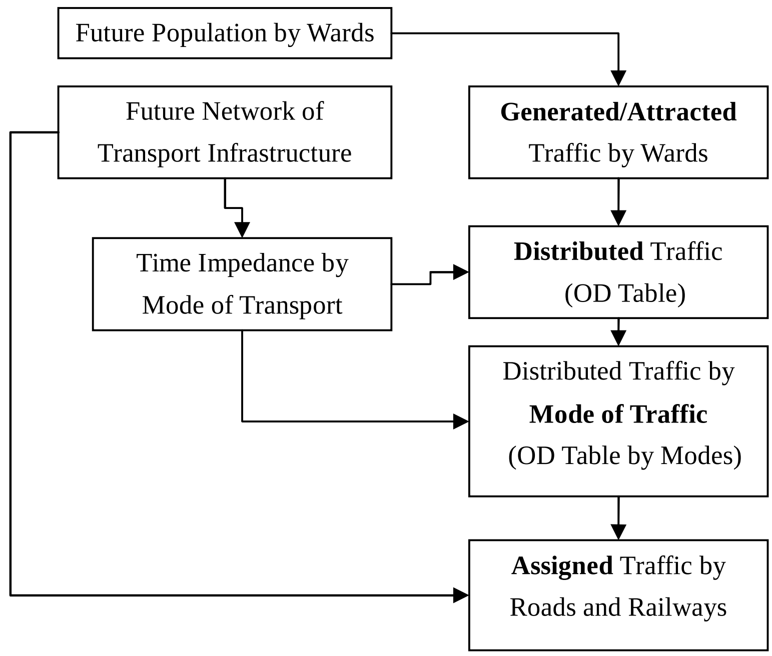


Figure 4.2 Flowchart for Demand Forecasting on Users of Urban Railway

In this survey, it is used that the result of population estimation (day time and night time) by wards of the study entitled ”Amendment of Urban Master Plan in HCMC for 2025” done by Ho Chi Minh City People’s Committee subcontracting to Nikken Sekkei in 2007. Parameters for estimation are from JICA Study entitled “Ho Chi Minh City Transport Master Plan (HOUTRANS)” in 2004.

Moreover, other assumptions for estimation are as follows:

- Modal share of public transport including buses is estimated as 16% in 2020. The political target of this modal share by the government is 30% in 2010 and 50% in 2020, however, this target seems too ambitious considering current modal share of public transport is about 8%. Therefore the modal share of 50% in 2020 is regarded too high.
- On the other hand, the value of 16% with completion of 6 lines of urban transport in 2020 seems feasible considering the modal share for public transport has reached 4 times in less than 10 years.
- All 6 urban railways are assumed to complete in 2020.
- The fare in 2020 is set to 5,000 VND plus 500VND/km (year 2006 price)

The demand in 2050 which is used for design target of infrastructure is estimated by assuming long term socio economic condition. It is hard to estimate this because there is no future population by wards and future transport network in such long term, however the demand is forecasted based on the demand of 2020 by assuming long term socio-economic status as shown in Table 4.1.

Table 4.1 Assumed Socio-Economic Status in 2050

	2020	2050
Population in HCMC (Million)	9.0	13.5
Modal Share of Public Transport (%)	16.0	30.0
Trip Demand on Public Transport (Mil/day)	6.88	19.35

2) Result of Estimation of Ben Thanh Station Users

Table 4.2 shows the result of numbers of estimated daily users of Ben Thanh Station in 2025 and 2050. It is estimated that there would be 50,500 and 73,600 passengers daily who will go in/out fro Ben Thanh Station in 2025 and 2050 respectively.

Table 4.2 Result of Estimated Number of Users at Ben Thanh Station

(Pax/day)

		2025	2050
Transfer	Line 1 <> Line 2	59,400	126,500
	Line 1 <> Line 4	38,300	50,100
	Line 2 <> Line 4	21,300	28,800
Station <> Outside		50,500	73,600
Total		169,500	279,000

4.1.3 Number of Users at Ben Thanh Shopping Mall

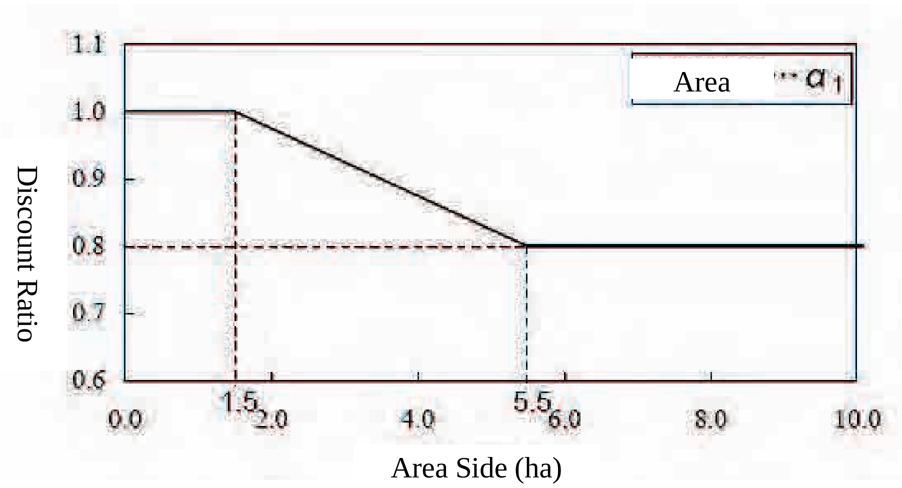
1) Methodology

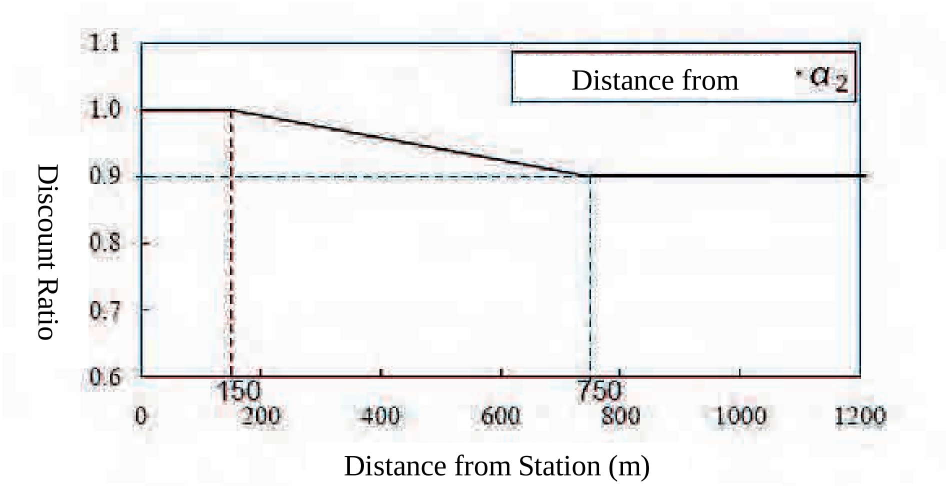
Next, the estimation of number of users at the planned underground shopping mall is conducted. The production unit for number of users of shopping mall in city center, illustrating "Transport Planning Manual for Large Developments" issued by Ministry of Land, Infrastructure, Transport and Tourism, Japan, is used Ben Thanh area can be regarded as the most congested city center area categorized in the Japanese manual, the production units on this category is shown in Table 4.3.

Table 4.3 User Production Unit for Commercial Facilities in Japan

	Production Unit (pax/ha/day)
Weekday	20,600
Weekend	21,800

Source: "Transport Planning Manual for Large Developments", MLITT





Source: "Transport Planning Manual for Large Developments", MLITT

Figure 4.3 Adjustment of Production Unit by Size of Commercial Area and Distance from Station in Japan

Figure 4.3 shows the idea of adjustment of production unit. From the experiences, discount rate are defined by size of commercial area and distance from station. This production unit and discount rate are used for this survey as a matured urbanization in 2050. For the estimation of 2025, it is assumed that 60% of the demand of 2050 based on the result of demand forecasting on railway users.

2) Result of Estimation of Ben Thanh Shopping Mall Users

The commercial development area size under planning in this survey is shown in Table 4.4. According to this, the commercial area is planned as 1.93ha, therefore discount rate of 95%, without the one from distance from railway station, will be adopted based on the Figure 4.3.

Table 4.4 Planned Development Area for Ben Thanh Underground Shopping Mall (m^2)

	Area for Mall	Area for Aisle
Beneath of Ben Thanh Roundabout	10,789	11,470
Beneath of Le Loi Street	8,588	9,000
Total	19,377	20,470

Table 4.5 shows the result of estimation of daily users of Ben Thanh Underground Shopping Mall in 2025 and 2050. It is estimated that there would be 22,800 weekday and 25,500 weekend users in 2025 and 37,900 weekday and 42,400 weekend users in 2050 respectively.

Table 4.5 Result of Estimated Number of Users at Ben Thanh Underground Shopping Mall

(pax/day)

	2025		2050	
	Weekday	Weekend	Weekday	Weekend
Beneath of Ben Thanh Roundabout	12,700	14,300	21,100	23,800
Beneath of Le Loi Street	10,100	11,200	16,800	18,600
Total	22,800	25,500	37,900	42,400

The results at 4.1.2 and 4.1.3 can be summarized at Table 4.6.

Table 4.5 Result of Estimated Number of Users at Ben Thanh Underground Facilities

(pax/day)

	2025		2050	
	Weekday	Weekend	Weekday	Weekend
Beneath of Ben Thanh Roundabout (including Station)	63,200	54,700	94,700	82,700
Beneath of Le Loi Street	10,100	11,200	16,800	18,600
Total	73,300	65,900	11,500	101,300

Note: The weekend railway users are assumed as 80% of weekdays.

Based on this result, the weekday users is estimated more than the weekend users, therefore the estimated number of weekday users is used for designing purpose.

4.1.4 Number of Users of Underground Facilities by Directions

1) Methodology

In this section, the number of users of Ben Thanh Underground Facilities by directions are estimated for the purpose of designing entrances. The formula is shown below.

$$T_{ij} = P_{ij} * N_i$$

$$P_{ij} = \frac{\exp \frac{V_j^{\beta}}{d_{ij}^{\alpha}}}{\sum_{ij} \exp \frac{V_j^{\beta}}{d_{ij}^{\alpha}}}$$

Where

T_{ij}: Traffic volume between underground area *i* and city block *j* on ground (pax/day)

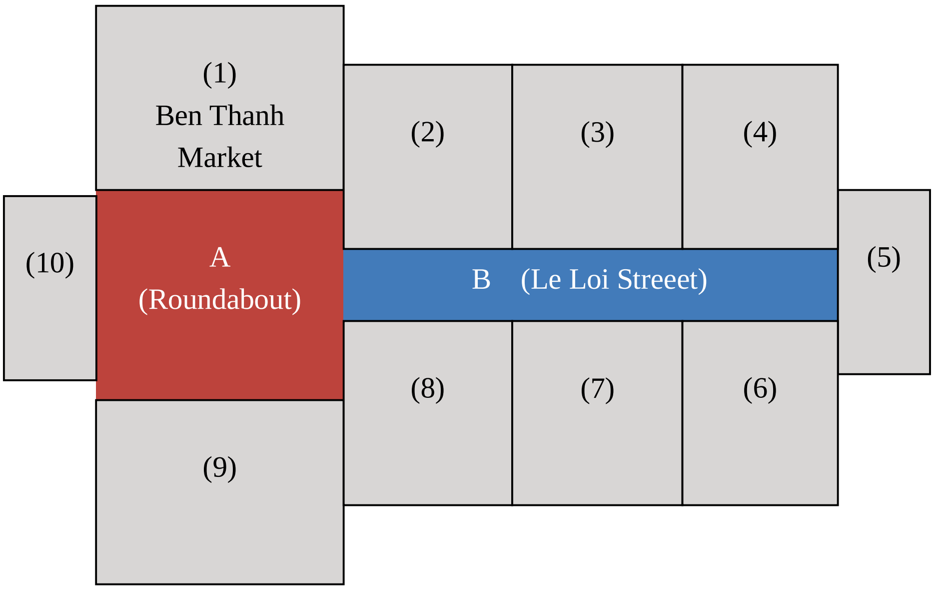
P_{ij}: Possibility to go to/from city block *j* for users of underground area *i*

d_{ij}^{α}: Distance between underground area *i* and city block *j* on ground (m)

V_j^{β}: Development Volume of city block *j* on ground (Commercial area, m^2)

α, β: Parameters, set to α=-0.001、 β=0.01

The development volume is obtained from “Detailed Master Plan and Development Guidelines for the Central Area of HCMC” currently been conducting by Nikken Sekkei. Figure 4.4 shows the result.



Block	Area (m^2)	Block	Area (m^2)
(1)	250,000	(6)	255,000
(2)	126,000	(7)	231,000
(3)	123,000	(8)	256,000
(4)	105,000	(9)	246,000
(5)	203,000	(10)	320,000

Source: "Detailed Master Plan and Development Guidelines for the Central Area of HCMC", Nikken Sekkei

Figure 4.4Planned Development Volume of City Block on ground at Ben Thanh Area

2) Result of Estimation of Ben Thanh Underground Facilities by Directions

Table 4.6 shows the result of the estimated daily users of Ben Thanh Underground Facilities by directions. Figure 4.5 illustrates those. This result says that it needs higher capacity of entrances in Ben Thanh roundabout side than Le Loi side.

Table 4.6 Estimated Daily Users of Ben Thanh Underground Facilities by directions

(2025, 000 pax/day)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	total
A	9.2	2.4	1.9	1.4	3.2	6.3	6.1	8.5	8.4	15.7	63.2
B	1.2	0.4	0.4	0.3	0.8	1.5	1.3	1.5	1.0	1.8	10.1
total	10.4	2.8	2.3	1.7	4.0	7.8	7.4	10.0	9.4	17.5	73.3

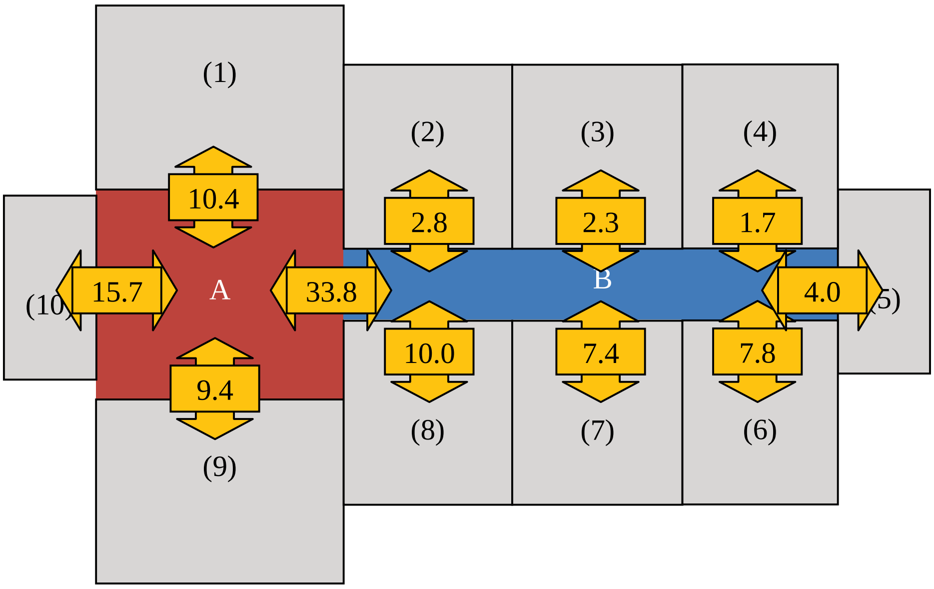
Note: A-B, (1)-(10) are corresponding the ones in Figure 4.4.

(2050, 000 pax/day)

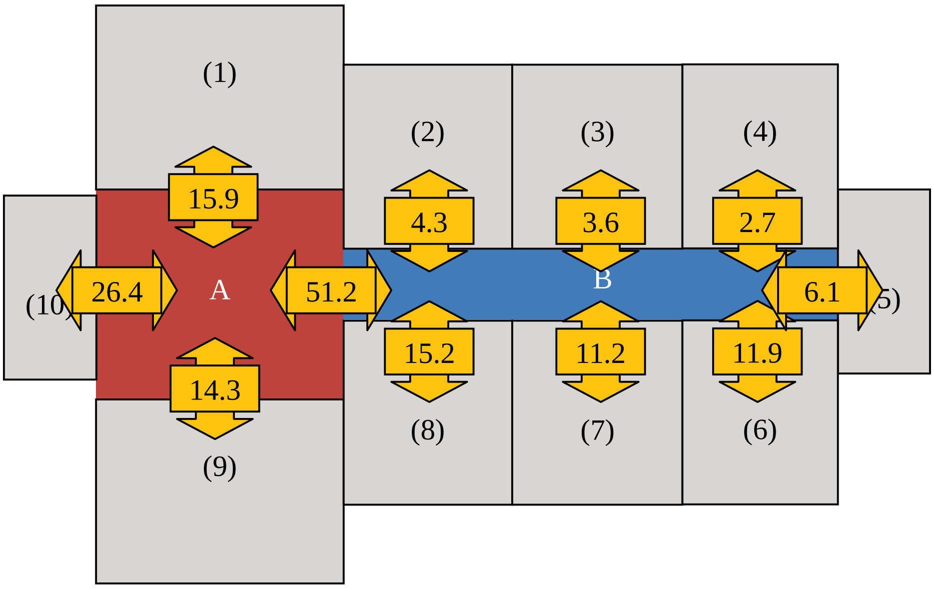
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	total
A	13.9	3.6	2.9	2.1	4.8	9.4	9.1	12.8	12.7	23.5	94.8
B	2.0	0.7	0.7	0.6	1.3	2.5	2.1	2.4	1.6	2.9	16.8
total	15.9	4.3	3.6	2.7	6.1	11.9	11.2	15.2	14.3	26.4	111.6

Note: A-B, (1)-(10) are corresponding the ones in Figure 4.4.

2025



2050



(000 pax/day)

Figure 4.5 Estimated Daily Users of Ben Thanh Underground Facilities by directions

4.2 PLANNING POLICY OF THE PROJECT

The planning policy of Ben Thanh Central Station Project is established in consideration with UMRT Central Station for Line 1, 2, 3a, and 4 and the urban development on the surrounding private ground. The policy is based on the following three points described as the necessity of the infrastructure in the center of Ho Chi Minh City

- Construction of Overall Underground Terminal to ensure Smooth Connection of Public Transport
- Creation of an Attractive Underground Space
- Formation of Underground Pedestrian Network connecting New Buildings and Traffic Nodes

As for “Construction of Overall Underground Terminal to ensure Smooth Connection of Public Transport”, the planning of the passageway layout and the pedestrian flow line is very important to ensure the smooth travel between Ben Thanh Central Station and other public traffic facilities like bus terminal. In this case the whole planning of Ben Thanh Central station with 3 platforms of 4 UMRT Lines is performed in consideration with the smooth transfer from one line to another. Therefore the planning policy of Ben Thanh Central Station is also established.

With regard to “Creation of Attractive Underground Space”, points of the planning are the clear layout of underground pedestrian passageways and the planning of the urban open space where everyone can take a rest and relax. In the underground space people can not understand easily the direction just like in the labyrinth without clear layout of passageways, so it is easy to lose the way. Therefore, the passageways should be arranged in composition with the main line and subsidiary lines for people to understand their location easily. In addition, the underground plazas with large atriums giving underground space natural sunlight are constructed and this makes the underground pedestrian urban space attractive and comfortable. In this manner, underground plazas help people to understand their location in underground space. Furthermore the passageways furnished with retail stores on both sides will become vibrant urban space and it is fun to walk in the underground urban space.

For “Formation of Underground Pedestrian Network connecting New Buildings and Traffic Nodes”, the pedestrian passageways should be arranged to ensure high accessibility to not only public traffic facilities but also surrounding new buildings. This higher connectivity forms the larger pedestrian underground network and makes moving to surrounding area easy and comfortable, so it becomes basic for the interactive evolution. The asset value of private buildings with high accessibility from the public traffic facilities rises, and the passenger increase because visitors to the buildings use public traffic means. In addition, visitors to Ben Thanh area walk around this area through underground pedestrian network and bring the bustle to the underground urban space

The planning policy of Ben Thanh Central Station Project is established in consideration with above mentioned matters.

4.2.1 Planning Conditions

In planning Ben Thanh Central Station and Underground Shopping Mall (USM), the planning conditions agreed with Management Authority of Urban Railways (MAUR) is shown below.

Furthermore, some conditions may be change due to the progress of the UMRT Line1. Therefore, in case the planning condition is modified, the review in the design works on the next stage should be necessary.

1) Over Planning

- JCA Study Team follows the Ho Chi Minh city plan for the planning of this project regarding the layout of underground facilities (pedestrian passageway, plaza, shopping mall, and so on) and surface structures (stairways, ventilation shaft, and so on) in principle.
- As for the design of the Ben Thanh central station including future metro lines, all station functions and facilities of UMRT Line-1, 2, 3a, and 4 shall be located together in the Central Station.
- Regarding the underground development including 4 UMRT Lines and underground shopping mall, some options for the development sequence should be considered. Consequently, the comparison study on development sequence is performed. In this comparison study, the development of the Line 1 project, which is the most expedited and whose preliminary design has been already completed, should have the first priority for development.
- The facility room such as electrical room, mechanical room, emergency generator room, and disaster prevention room shall be provided in the Ben Thanh Central Station individually for each metro station (UMRT Line 1, 2, 3a, and 4) and underground development.
- Current bus terminals in the South side of the Quach Thi Trang rotary in front of Ben Thanh market will be moved to the West side of September 23rd park before construction.
- Existing underground utilities such as water pipe, electrical cables, etc shall be moved to the area that they will not influent the construction of this project in advance to the construction.
- Basically Vietnam building disaster standards are adopted for disaster prevention plan of underground development. However Japan disaster standards are adopted for the matters which Vietnam standards

2) Metro Planning

- There are no disaster plan standards in Vietnam. For this reason, following approval by the Ho Chi Minh City Fire Department of the disaster plan based on Article 29 in the Ministerial Ordinance for Establishing Technical Standards Relating to Railways" established by Japan's Ministry of Land, Infrastructure, Transport and Tourism (MLITT Ministerial Ordinance No.151, December 2001), this plan was used for the design of the Ben Thanh Central Station.
- The ticket gate shall be integrated for each metro line (UMRT 1, 2, 3a, and 4).

(1) Line1

- In principle, JICA Study Team follows the latest design of UMRT Line-1 provided by MAUR.
- However, JICA Study Team shall review and propose some modifications on the following points:

  i) Type of the tunnel structure between Ben Thanh and Opera House stations

  With consideration to the impact of the construction of underground shopping mall and Line-4 to Line-1 tunnel, bored tunnel applied between Ben Thanh and Opera House stations could be modified to cut and cover tunnel.

  ii) Facility layout at Ben Thanh station

  With consideration to the more efficient and economical air conditioning and tunnel ventilation at Ben Thanh Central Station, the facility layout of Line-1 could be reviewed and modified.

  In addition to the above two points, in order to optimize the terminal station with the consideration to the more efficient transfer and attractive underground space, the station planning could be revised.

(2) Line2

- The horizontal alignment shown in the received drawings shall be unchanged.
- However, the location of scissors crossing shall be clarified and reviewed.
- The vertical alignment shall be reviewed according to the vertical alignment of Line-4 and Ben Thanh station layout.

(3) Line3a

- UMRT Line-3a to be considered as the extension of Line-1, so the stations of Line-3a is the same as Line-1.

(4) Line4

- The horizontal alignment shown in the received drawings shall be unchanged except for the reverse curve located near Ben Thanh station.
- The vertical alignment shall be reviewed according to the tunnel structure of Line-1 and Line-4 especially at the crossing section of these two lines.
- The location of the platform of Line-4 shall be adjusted according to the reviewed vertical alignment.
- The station for Line 4 shall not be a terminal station, so the scissors crossing shall not be located in Ben Thanh station.

4.2.2 Planning Policy of the Project

The basic planning policy of Ben Thanh Central Station Project is established according to the planning conditions described in "4.2.1 Planning Conditions".

In the beginning, the planning policy for the improvement in Ben Thanh area including on-ground and underground is established. The points of the planning based on the necessity of the infrastructure are concretely set as the whole planning policy.

Next, the policy of the planning on the basement 1st floor is established – the underground shopping mall - which is the main part of underground development in this project. This planning policy for the underground shopping mall is studied in consideration with the affect to UMRT Line 1, especially the affect to the procedure for Line 1 construction.

The planning policy for Ben Thanh Central Station is established as the main underground facility in this project.

1) Whole Planning Policy

The whole planning policy for the improvement in Ben Thanh area including on-ground and underground is established as Ben Thanh Central Station Project. The project improvement area is decided in consideration with the location of UMRT facilities like Ben Thanh station and Opera House station, and the bus terminal planned in the Urban Planning of Ho Chi Minh City. The points of the planning based on the necessity of the infrastructure are concretely set as the whole planning policy.

(1) Project Improvement Area

The project improvement area is decided in this section. As the basal condition, the scope of this project is set around the vicinity of Ben Thanh station up to Opera House station. In this area, the urban issues appear due to the construction of UMRT Line 1, and the underground development of the existing center of Ho Chi Minh City is planned in the Urban Plannig of Ho Chi Minh City.

In this scope of the project the project improvement area is decided in consideration with the connectivity to the public traffic facilities and the private buildings based on the underground development area in the Urban Plannig of Ho Chi Minh City. The range of the project improvement area is only beneath the public street, not including the private on-ground, because of the public urban space improvement. The private urban development by the developer with the right is expected on the private on-ground, and that development will be connected with this project. As for the setting of this project improvement area the relative and/or critical facilities are mentioned in the below table.

Table 4.8 Relative Facilities on Setting of Project Improvement Area

Items	Relative Facilities
Traffic Facilities to be connected	• UMRT Ben Thanh Central Station • UMRT Opera House Station • Bus Terminal (beneath September 23rd Park) • BRT Terminal (beneath Ham Nghi Street) • Taxi Bay on-ground
Private Buildings To be connected	• Urban Development around Quach Thai Trang Rotary • Urban Development along Le Loi Street
Underground Development Area in the Urban Planning of Ho Chi Minh City	• Underground beneath September 23rd Park • Underground beneath Quach Thi Trang Rotary • Underground beneath Ham Nghi Street • Underground beneath Le Loi Street • Underground beneath Nguyen Hue Street
Underground Space beneath the Public Street	• Quach Thi Trang Rotary • Le Loi Street • September 23rd Park

The range of the project improvement is roughly divided to two areas. One is the surrounding area of Ben Thanh station, and the other is Le Loi Street area. They are defined as following and the project improvement area is shown in Figure 4.6.

① Ben Thanh Station Area

(Underground Space surrounding UMRT Ben Thanh Station beneath Quach Thi Trang Rotary and a part of September 23rd Park)

- South-east side : The range including current bus terminal on Quach Thi Trang Rotary considering the connectivity with the private buildings
- South-west side : The range up to bus terminal beneath September 23rd Park planned in the Urban Planning of Ho Chi Minh City (not including bus terminal)
- North-west side : The range in front of Ben Thanh Market
- North-east side : The range beneath Quach Thi Trang Rotary considering the connectivity with the private buildings and the range up to BRT terminal beneath Ham Nghi Street

② Le Loi Street Area

(Underground Space up to Opera House Station beneath Le Loi Street)

- South-east side : The range beneath Le Loi Street considering the connectivity with the private buildings
- South-west side : to be connected with Ben Thanh Station Area
- North-west side : The range beneath Le Loi Street considering the connectivity with the private buildings
- North-east side : The range beneath Le Loi Street up to Opera House Station

In this project improvement area, the location of the public traffic facilities and the relative facilities to be connected with this project is shown in Figure4.7.

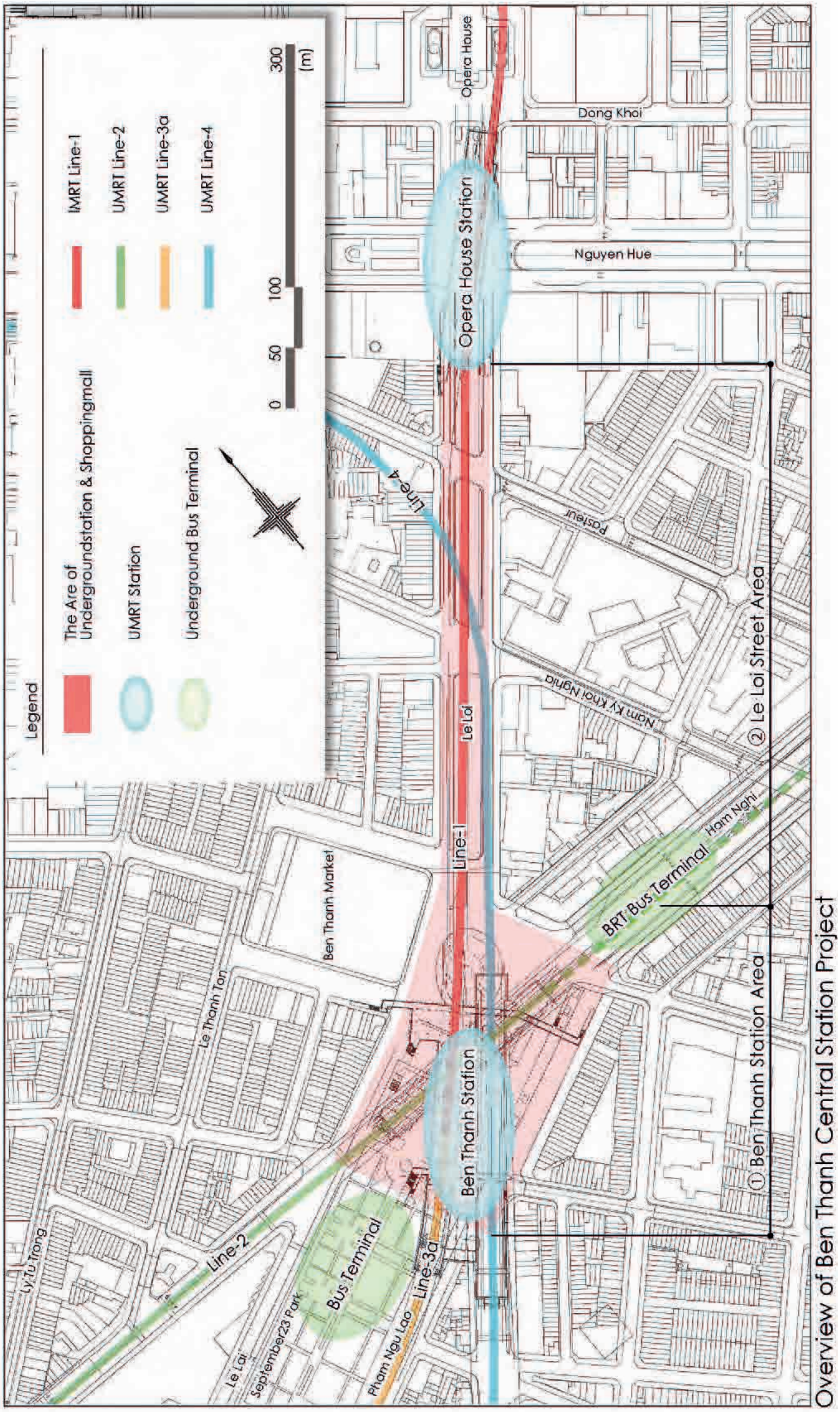


Figure 4.6 Project Improvement Area

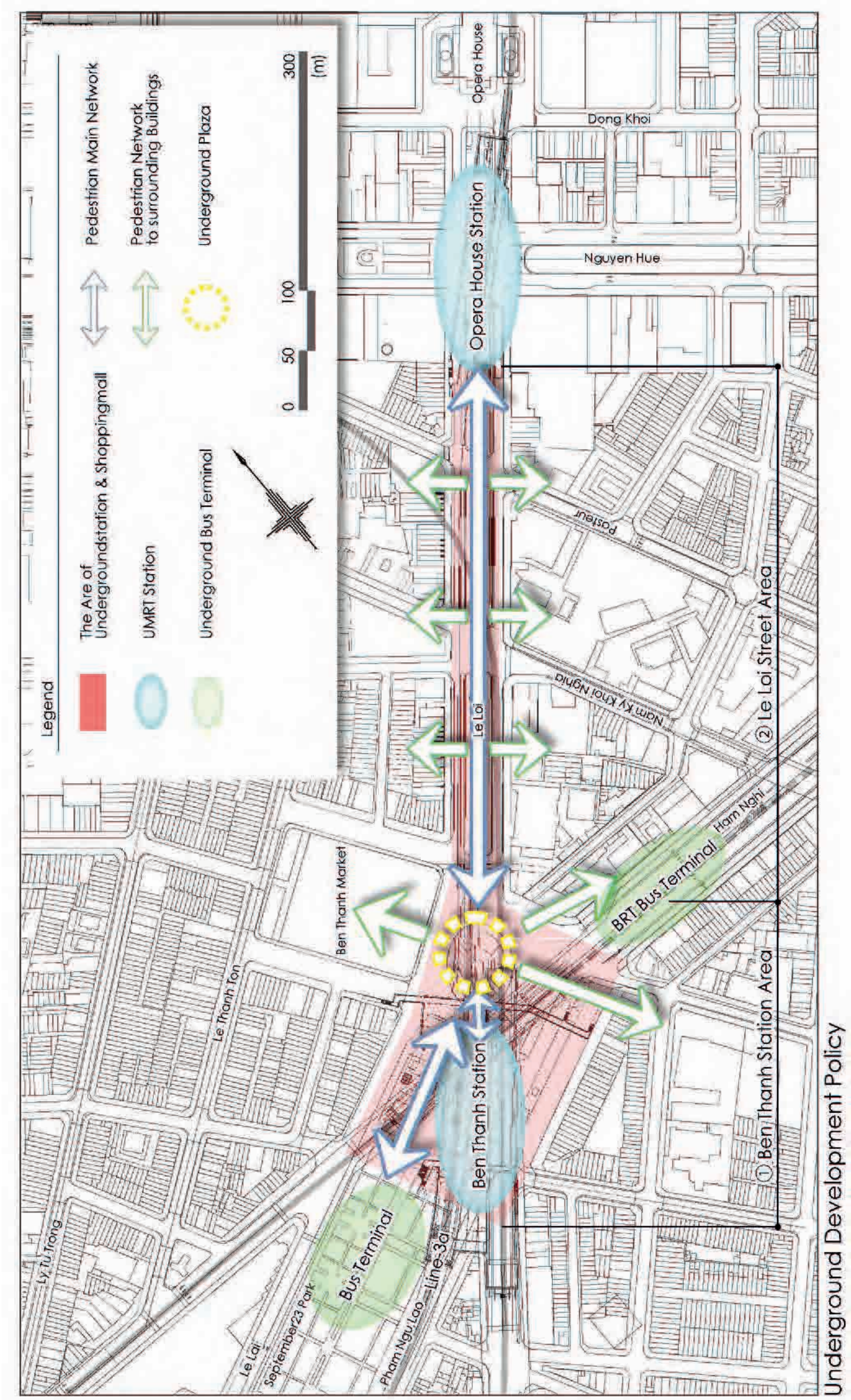


Figure4.7 Relative Facilities to be connected with this Project

(2) Whole Planning Policy

a) Whole Planning Policy

The planning policy for the improvement in Ben Thanh area is studied including on-ground and underground. The points of the planning based on the necessity of the infrastructure are concretely set as the whole planning policy in the project improvement area. The whole planning policy is described as following, and shown in Figure 4.8.

- Construction of Overall Underground Terminal to ensure Smooth Connection for Public Transport
  - Higher connectivity of Ben Thanh Central Station to bus terminal and BRT terminal
  - Simple layout of underground passageways to travel comfortably between public traffic facilities
  - Whole planning of Ben Thanh Central Station with 3 platforms of 4 UMRT lines to ensure the smooth transfer from one line to another

- Creation of Attractive Underground Urban Space
  - Underground urban space with open space is for passengers to take a rest and relax
  - Clear layout of underground passageways in composition with main line and subsidiary lines
  - Underground plazas with large atriums is to give underground space natural sunlight
  - The passageway with retail stores on both sides is to make underground urban space vibrant and joyful

- Formation of Underground Pedestrian Network connecting New Buildings and Traffic Nodes
  - High accessibility to surrounding new private buildings through simple layout of underground passageway
  - Underground pedestrian network to make the move to surrounding area easy and comfortable

The policy of on-ground planning is shown in Figure4.9 in consideration with the whole planning policy of the underground urban space.

b) Structural Concept

In planning the underground development, it is necessary to set up an underground space in such place as can be used by a certain amount of people. Horizontally, the underground space will be located under Le Loi from Ben Thanh Station to Opera House Station, taking into account the circulation of passengers from/to UMRT stations and the connection with basement floors of new buildings to be constructed adjacent to Le Loi. Vertically, the underground space will be placed between the ground level and the top of UMRT structure.

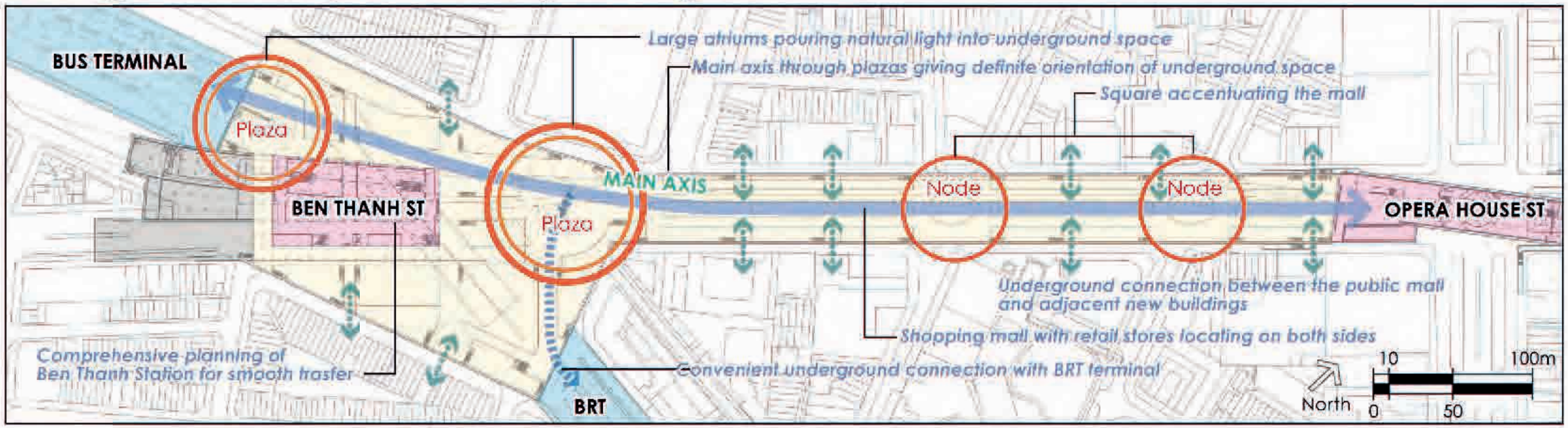
The underground space will be planned in conformity with the detailed city planning and architectural design guideline for the city center which is currently studied by the Department of Planning and Architecture as stated in Section 2.3. Concretely, Le Loi is planned to be reconstructed into a transit mall with priority to pedestrians by formation of historical streetscape securing the vista into Opera House; the roundabout in front of Ben Thanh Market is to be reformed into a pedestrianized plaza surrounded by Ben Thanh market and other historical buildings. The project's underground space will be provided with plazas as well as stairs, elevators and other facilities for raising and lowering people, so as to enable the underground space to be functionally integrated with the aforesaid on-ground transit mall and pedestrianized plaza.

In particular, the front of Ben Thanh Market will have a large atrium connecting the underground plaza with the on-ground pedestrianized plaza so that sufficient natural sunlight can pour into the underground space to make amazing impressions on underground people. In the detailed planning of the city center under study, a bus terminal is to be constructed under 9/23 Park. At the entrance into the bus terminal, an atrium will be provided to connect the on-ground park with the underground terminal space. This atrium will be constructed as unique space where people on the ground can look over passengers moving in Ben Thanh Station. These atria above the ground will have a cylindrical structure made of transparent, thermal-insulated materials.

Underground passages will be composed of the main line circulating from Opera House Station to the underground bus terminal through Ben Thanh Station and the subsidiary lines which connect with the BRT (Bus Rapid Transit) terminal to be constructed under Ham Nghi in the city center detailed planning and with basement floors of buildings to be newly constructed along Le Loi. The aforesaid two atria will be located on the main line in such a manner that a naturally lit plaza can produce attractive underground space and give the main line a direction definite irrespective of underground location. In addition, the underground passage will be constructed as a shopping mall furnished with retail stores on both sides. It is expected that this thermally insulated underground passage or mall will become vibrant urban space with comfortable indoor conditions not affected by the local hot climate.

Ben Thanh Station intersectionally receiving 4 lines of UMRT is to be so constructed that transfer from one line to another line can be facilitated. Higher connectivity of UMRT with the bus terminal and the BRT terminal will be ensured through the underground passage. Also, Ben Thanh Station is to have a linear well through which passengers can look down from the concourse at a moving UMRT train. This will contribute to making the underground space more attractive.

Underground Development Conceptual Diagram



Construction of Overall Underground Traffic Terminal

- Comprehensive planning of Ben Thanh Station comprising 3 platform for 4 UMRT lines will ensure smooth transfer from one line to another.
- Ben Thanh Station planned as an overall underground traffic terminal will facilitate transfer of public transport of UMRT, bus and BRT.
- Integrated underground development of Ben Thanh Station and its vicinity will enable general people as well as passengers to enjoy and use innovative urban space.

Creation of Attractive Underground Space

- While Le Loi, the roundabout in front of Ben Thanh Market, etc. are reformed, attractive space will be created them together with the underground pedestrian network appropriately connected to the ground level.
- Two large atria will be constructed between the on-ground plaza and the underground plaza so as to enable natural light to pour into the underground space.
- The underground space on the main axis will be formed as a shopping mall with retail stores on both sides so as to become vibrant urban space with comfortable indoor conditions.

Ben Thanh Station acting in the Underground Urban Space

- Ben Thanh station will have a linner well between the pedestrian level and the platform level, which will enable persons on the pedestrian level to look down at a moving UMRT train.

Figure4.8 Underground Planning Conceptual Diagram

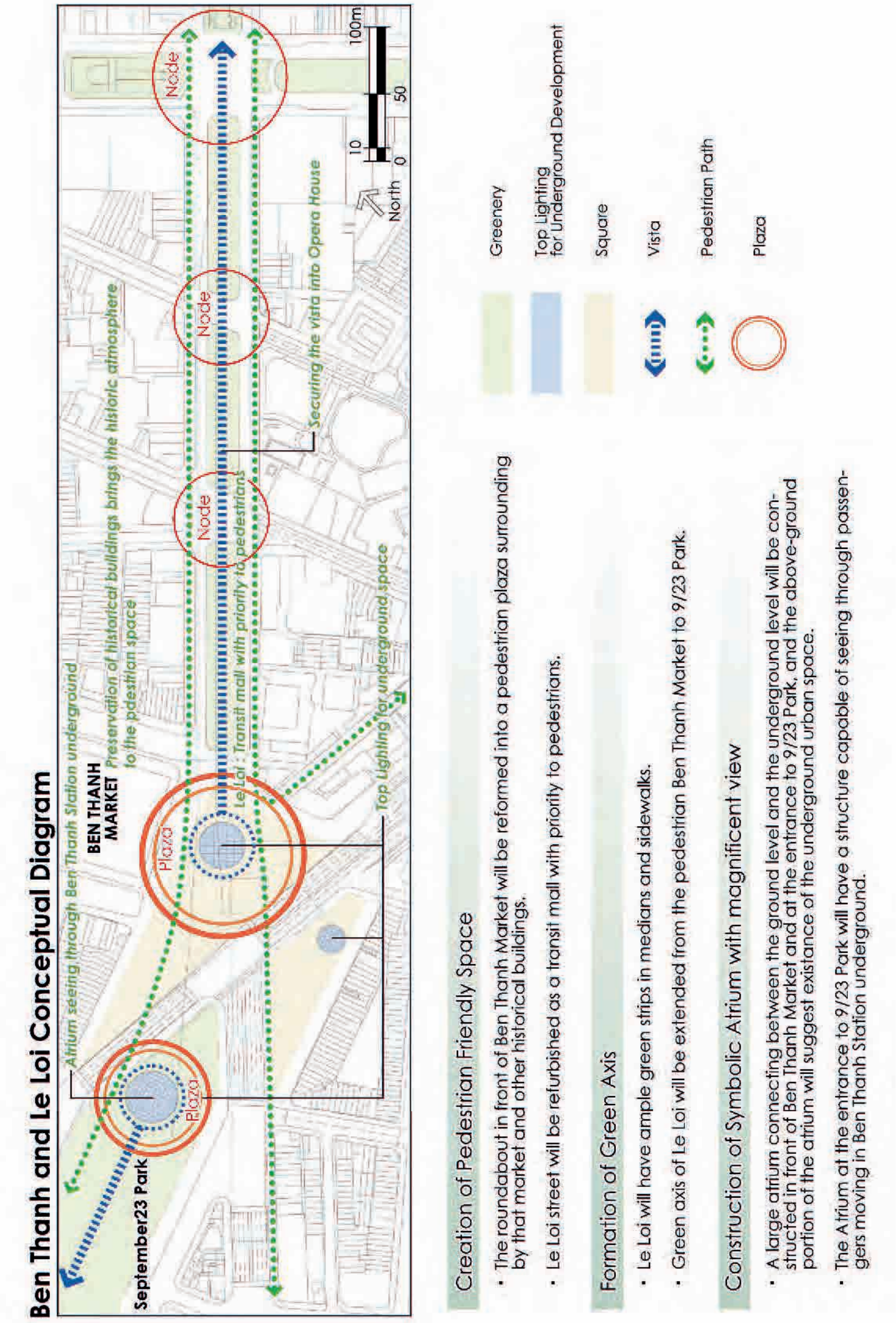


Figure4.9 Ground Planning Conceptual Diagram

2) Proposal of Underground Space Design

In the design of the underground facilities on the basement 1st floor, not only UMRT Line 1 project planning but also Line 2 and 4 project planning should be considered and some arrangement among these project planning is necessary. Especially UMRT Line 1 project has been already on the tendering stage for the design and the construction, so it is necessary to study the impact on Line 1 carefully. In this case, not only the design change of Line 1 but also the affect to the tendering procedure and the construction schedule should be studied. The planning policy with the large influence to the design of underground development is clarified through the comparative study.

(1) Underground Development in Ben Thanh Station Area

The arrangement and adjustment among the planning of UMRT Line 1, 2, and 4 at Ben Thanh Central Station is necessary for the design of the underground development in the Ben Thanh station area. These UMRT projects proceed individually, and the project progress is much different among the projects. UMRT Line 1 is on the tendering stage for the design and the construction. For the UMRT Line 2 the feasibility study has been just finished. UMRT Line 4 is on the stage that the initial feasibility study has been reported. And the feasibility study for the underground shopping mall is now performing in this survey. In those planning there is some uncertain element, and the timing of the construction and the operation for these projects is not clear at this moment.

However the design of the underground development depends on the construction sequence and timing of relative projects in the planning of the underground development in the Ben Thanh station area. In case that the underground shopping mall is constructed simultaneously with the station construction for the UMRT projects at Ben Thanh Central Station, the design will be made most reasonable and suitable as a central station for the smooth transfer and high accessibility to each platform. On the other hand, in case of the separate construction of all projects, the underground development has to be designed and enlarged step by step corresponding to the planning of the previous project. This process affects not only the whole project plan but also the construction method, so the construction cost will increase.

Therefore the comparison between two design methods on the underground development in the Ben Thanh station area is studied. One is the Independent Design which each project is designed separately corresponding to the procedure of each project, and the other is the Integrated Design which the overall design through the rearrangement and the adjustment of each project planning is performed. In case of the Independent Design, the UMRT Line 1 design is considered unchangeable because the preliminary design for Line 1 has been completed.

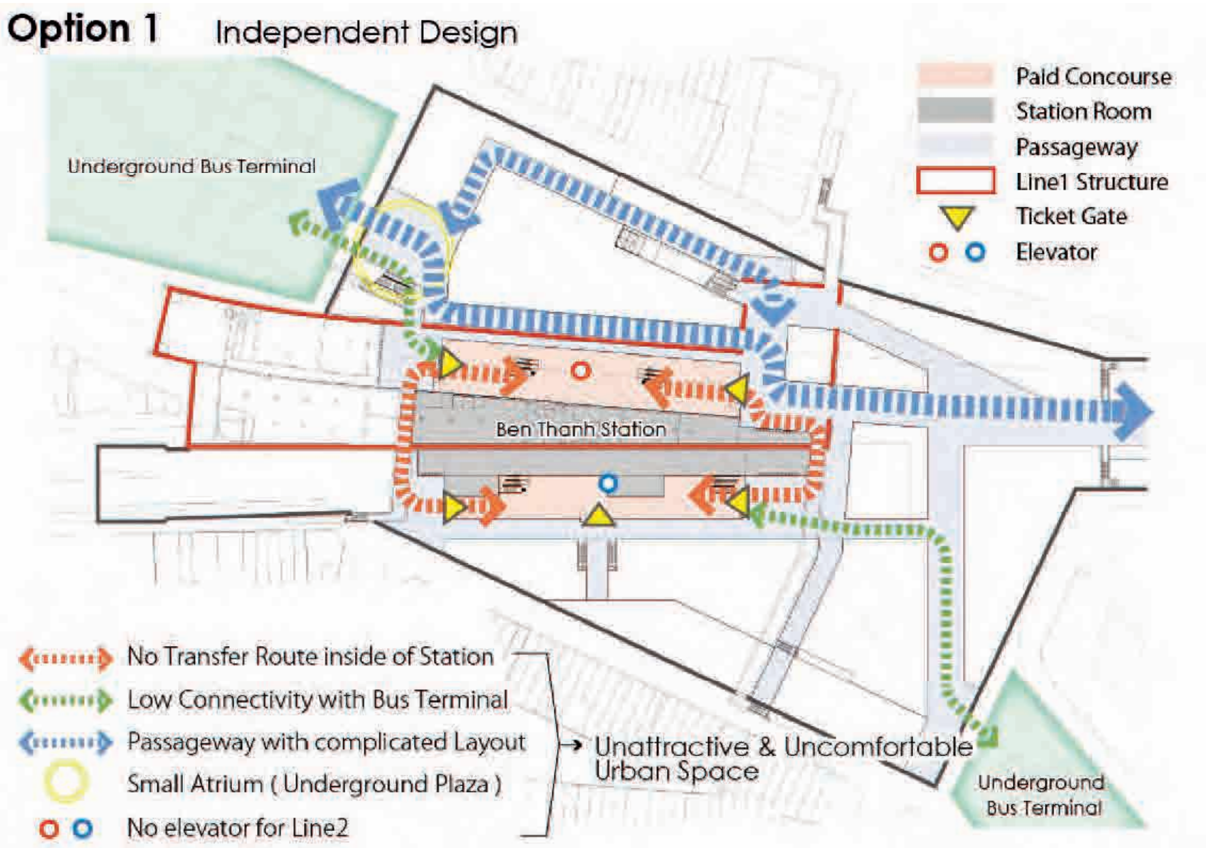
Figure 4.10 Relative project in Ben Thanh station area

The comparison options are mentioned below, and the comparison table is shown in.

Option 1 : Independent Design (Each project is designed separately)
Option 2 : Integrated Design (All projects are designed as one whole project)

The most important point on the comparison study between the aforesaid two options is the convenience of the transfer between one platform to the another as a central station. The comparison on the transfer route among three platforms and the study on the location of elevator directly reaching each platform from the paid concourse is performed. On the other hand, from the viewpoint of the urban planning for the center of Ho Chi Minh City, the comparison on the creation of the attractive and comfortable underground space and the connection to the public transportation such as the underground bus terminal is also studied. Furthermore, the impact on the UMRT Line 1 project that has already been completed the preliminary design is taken into consideration.

The summary of two options is shown in Figure4.11 and Figure4.12, and the comparison table is shown in Table4.9.



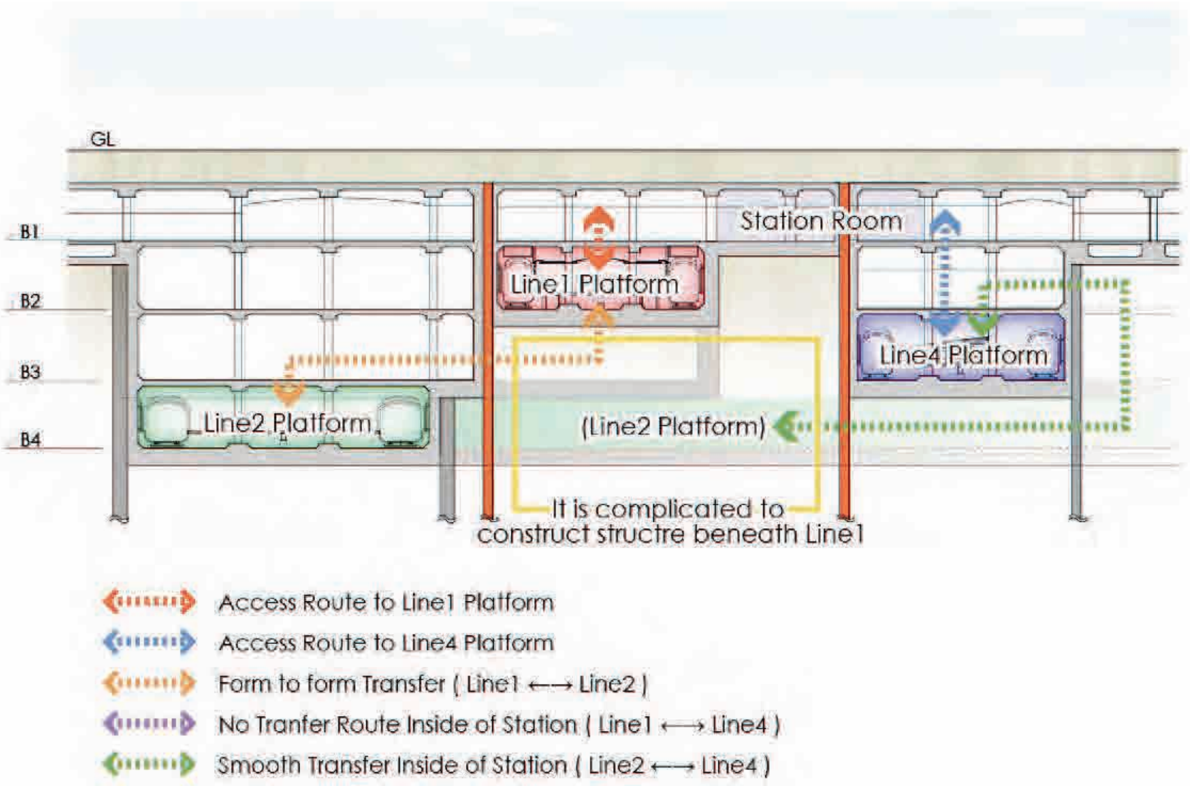
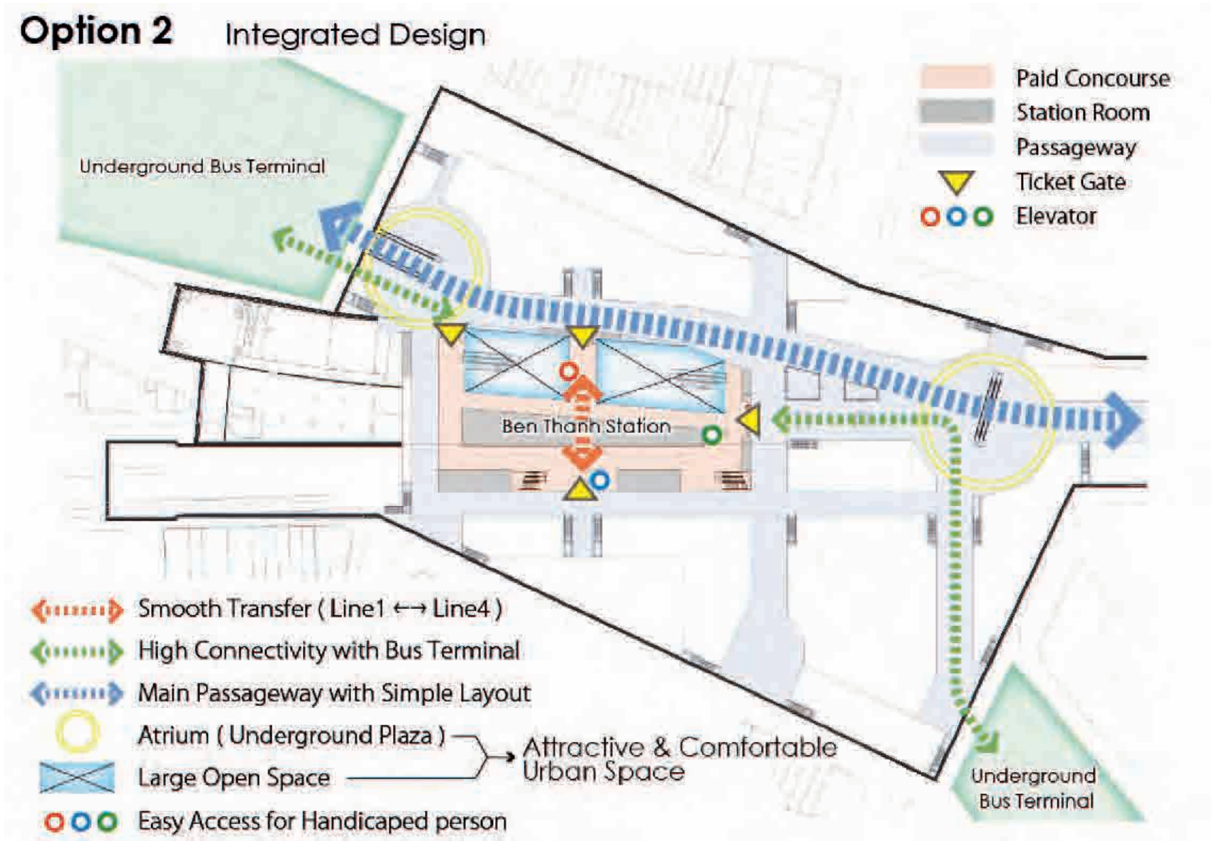


Figure4.11 Independent Design for central station planning



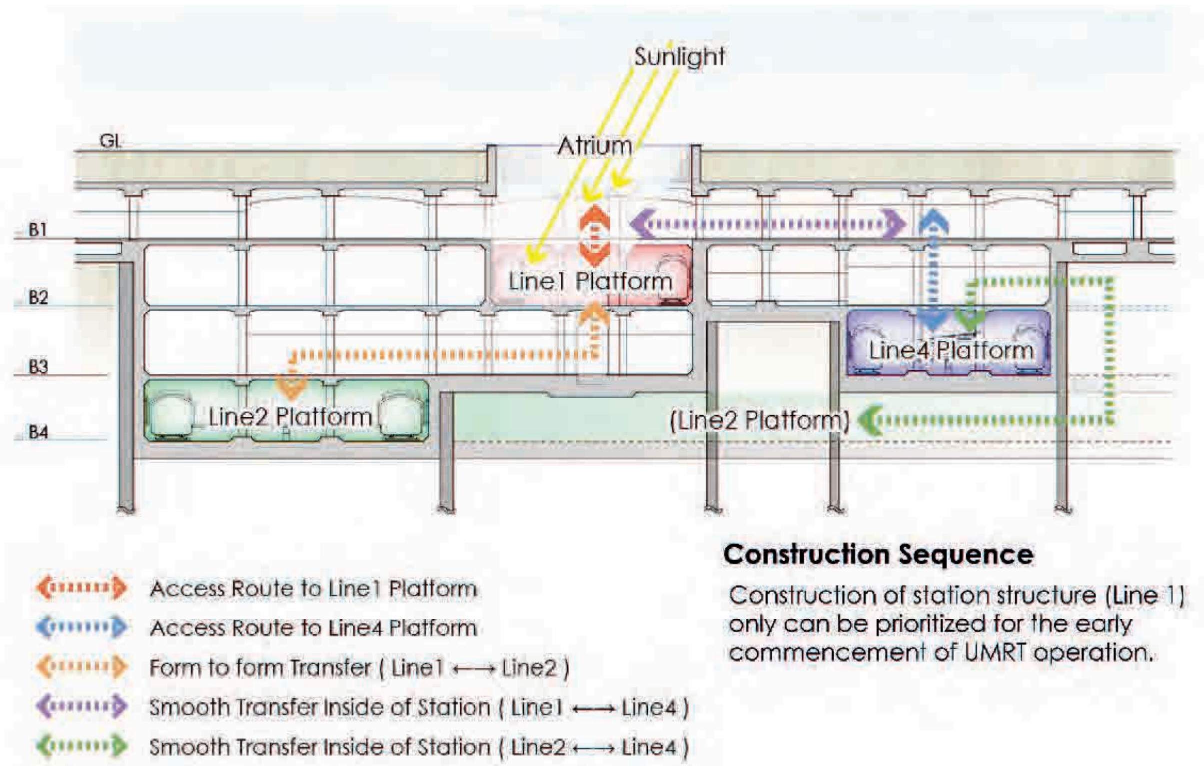
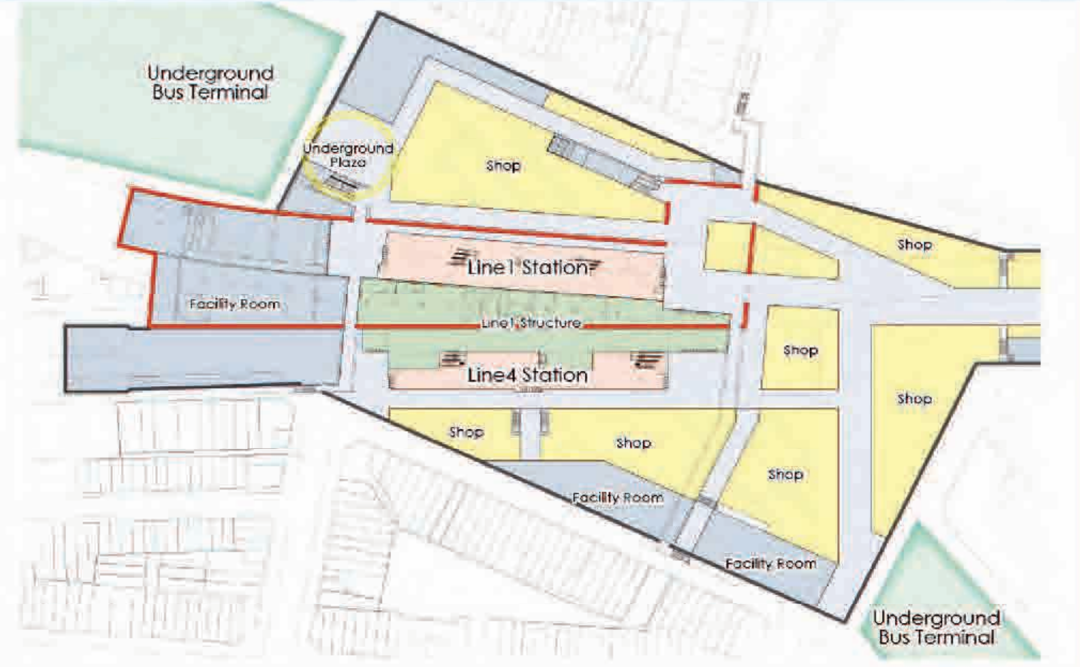
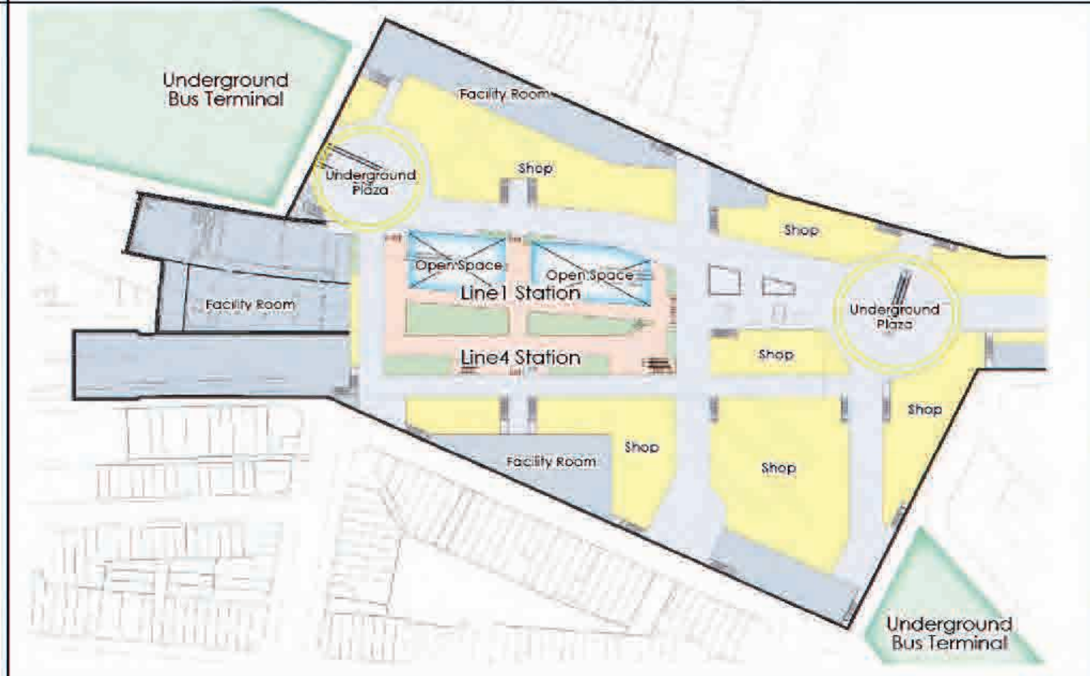


Figure4.12 Integrated Design for central station planning

Table 4.9 Comparative study for the planning policy of the underground development in Ben Thanh Station area

			Option 1		Option 2	
1	Outline of the Alternative	Planning Concept	Each facility for Line 1, Line 2, Line 4, and USM is designed and constructed separately.		Designing all facilities for Line 1, Line 2, Line 4, amd USM on the whole, the structure is constructed simultaneously.	
		Construction Sequence	(1) Line 1 → (2) USM → (3) Line 2 → (4) Line 4		(1) Line 1 + USM + Line 2 + Line 4 (Only concrete structure is constructed for Line 2 and Line 4 station)	
2	B1 Floor Plan					
3	Planning of Central Station		* The concourse of Line 4 is devided from the Line 1 concourse, so the connectivity is very bad for the passenger to transfer between Line 1 and Line 4. * There is no elevator from the concourse on B1 floor to the platform of Line 2 directly.	C	* The passenger can easily transfer between Line 1 and Line 4 through the concourse on B1 floor. * All platforms for Line 1, Line 2, and Line 4 can be approached for the handicapped person using the elevator from the concourse on B1 floor directly.	A
4	Impact on Line 1	During Tender Procedure	* In principle no design change is required for Line1 from Tender Drawings. (The openig on the wall for the future connectivity with USM should be taken into consideration on Line 1 design)	A	* The big design chage is indispensable, so the current tender procedure should be revised. * It could be proposed that Ben Thanh Central Station Project including the USM is devided from Line 1 Project.	B
		During Operation Period	* Line 1 can be operated in advance of Line 2, Line 4, and USM. * Monitering of the impact on the Line 1 structure is necessary especially during Line 2 construction.	B	* The schedule of completion of Ben Thanh station for Line 1 may be delayed. (Even if Ben Thanh station can not be constructed at the same time as the other part of Line 1, the passanger can approach the center of HCMC when Line 1 is operated up to Opera House station.)	B
5	Urban Planning	Plan of Plaza and Passageway	* Due to the structure of Line 1, the arrangement of the underground plaza and passageway is very complicated like a labyrinth. * It is difficult for people to understand the point where they are located on B1 floor, so it is hard to move from one place to another in the USM.	C	* The underground plaza and the passageway can be arranged simply in the direction along Le Loi street and the crossing direction. * People could easily understand the point where they are located on B1 floor, and there is no stress and no inconvenience to move to the destination.	A
		Attractive Urban Space Development	* Since it is difficult to arrange the effective large underground plaza which has the open space up to aboveground in order to bring the light, the attractive urban space can not be created.	C	* The underground plaza can be arranged effectively as the urban core, and it provids the large open space up to aboveground and brings the light to B1 floor. Therefore the attractive and comfortable underground urban space would be developed.	A
		Connectivity with Bus Terminal	* The accessibility from the metro station to the adjacent bus terminal is bad because of the complicated arrengement of the passageway.	C	* People can easily approach the adjacent bus terminal from the central station because of the simple arrangement of the passageway.	A
6	Construction Workability		* The construction of Line 2 is very difficult because the construction has to be done beneath the Line 1 concrete structure.	C	* Since all concrete structure is constructed simultaneously, the construction is not so difficult.	A
7	Comprehensive Evaluation		**Not Recommended** + Major advantages of Option 1 are as follows; Basically no design change is required for Line 1 - Major disadvantages of Option 1 are as follows; The concourse of Line 4 is devided from the Line 1 concourse, so the connectivity between Line 1 and Line 4 is bad. The arrangement of the plaza and passageway is very complicated and it is hard to move from one place to another (ex. from metro station to bus terminal).	**B**	**Recommendation of JICA Study Team** + Major advantages of Option 2 are as follows; Major disadvantages of Option 1 are resolved. + Major disadvantages of Option 2 are as follows; The current tender procedure should be revised and Ben Thanh Station to be devided from Line 1 Project.	**A**

Note
USM : Underground Shopping Mall

"A" : EXELENT
"B" : GOOD
"C" : BAD

As shown in the comparison table, in case of the Option 1 (Independent Design) the transfer from one line to another is not smooth as a central station, so Ben Thanh Central Station becomes inconvenience and uncomfortable for the passengers. That is since the previous project design does not consider the other following project planning. In addition, because the UMRT Line 1 structure is completed prior to the other projects and the shape of the other project structure should be adjusted to the Line 1 structure shape, the layout of the underground pedestrian passageways is made unclear like the labyrinth. The pedestrian in the underground passageways can not understand how to walk to the destination, so it is easy to lose the way. Further, regarding the construction because the UMRT Line 2 structure should be constructed beneath the Line 1 structure, the Line 2 construction becomes difficult and high risky, and the construction period is extended, so the construction cost increases. Therefore, Option 1 (Independent Design) has much disadvantage. The advantage is only no impact for the current procedure of UMRT Line 1 project.

On the other hand, in case of the Option 2 (Integrated Design), the high connectivity among three UMRT platforms is ensured to make the transfer from one line to another smooth as a central station, so Ben Thanh Central Station becomes convenience and comfortable for the passengers. In addition, through the clear layout of the underground pedestrian passageways the high accessibility to the public traffic facilities like the bus terminal is ensured, so it is easy for the underground pedestrian to move to the destination comfortably. Further, as the large atrium is planned above the Line 1 platform, the attractive urban space which is suitable for the center of Ho Chi Minh City can be created. Regarding the construction, the standard construction sequence can be performed because of the simultaneous construction of the whole structure, so the construction cost becomes reasonable. Therefore in Option 2 (Integrated Design), the comfortable and attractive underground urban space can be created in the center of Ho Chi Minh City. However, Option 2 has two points of disadvantage. One is that the design change is necessary for the Line 1 project of which the preliminary design has already been completed, and the other is that the tendering procedure of the Line 1 project should be revised.

Through this comparative study, Option 2 (Integrated Design) is strongly recommended. As a result of consultation with HCMC people's committee, the implementation of Integrated Design for Ben Thanh Central Station has been officially determined. In addition, Ho Chi Minh City expresses that the commercial operation of Line 1 is expected to start as early as possible.

(2) Underground Development in Le Loi Street Area

The arrangement and adjustment between the UMRT Line 1 tunnel and the underground shopping mall structure is necessary for the design of the underground development in the Le Loi street area. In addition the UMRT Line 4 tunnel should be considered. That is because the Line 4 tunnel is located in parallel to the Line 1 tunnel near Ben Thanh Station and passes beneath the Line 1 tunnel at the cross point in the middle between Ben Thanh Station and Opera House Station and goes to the Pasteur street.

The shield tunnel is adopted in the current UMRT Line 1 design for a part of tunnel section beneath Le Loi Street. However, in this shield tunnel section the tunnel structure interferes with the underground shopping mall structure, so the underground shopping mall can not be constructed above the Line 1 tunnel and the area of the underground development decreases. On the other hand, in case that the tunnel structure is changed from the shield tunnel to the cut and cover tunnel, the underground shopping mall can be constructed above the Line 1 tunnel. Therefore the area of the underground development expands and the underground shopping mall can be connected with the basement of surrounding buildings. Thus the attractive and comfortable underground urban space can be created to contribute to the economic growth in Ben Thanh area.

UMRT Line 4 tunnel is planned as the shield tunnel. However, Line 4 tunnel does not interfere with the underground shopping mall structure because the location of this tunnel is deeper than the Line 1 tunnel. The Line 4's tunnel has no issue for the relation with the Line 1 tunnel in the parallel section since there is enough distance between Line 1 and Line 4 tunnels. On the other hand, at the cross section between Line 1's and Line 4's tunnels the necessary distance between two tunnels should be kept and the solution of construction method like the soil improvement should be performed corresponding to the construction method of each tunnel.

In consideration with the above mentioned, the underground planning policy in the Le Loi street area is studied. The current plan of the relative projects is shown in Figure 4.11.

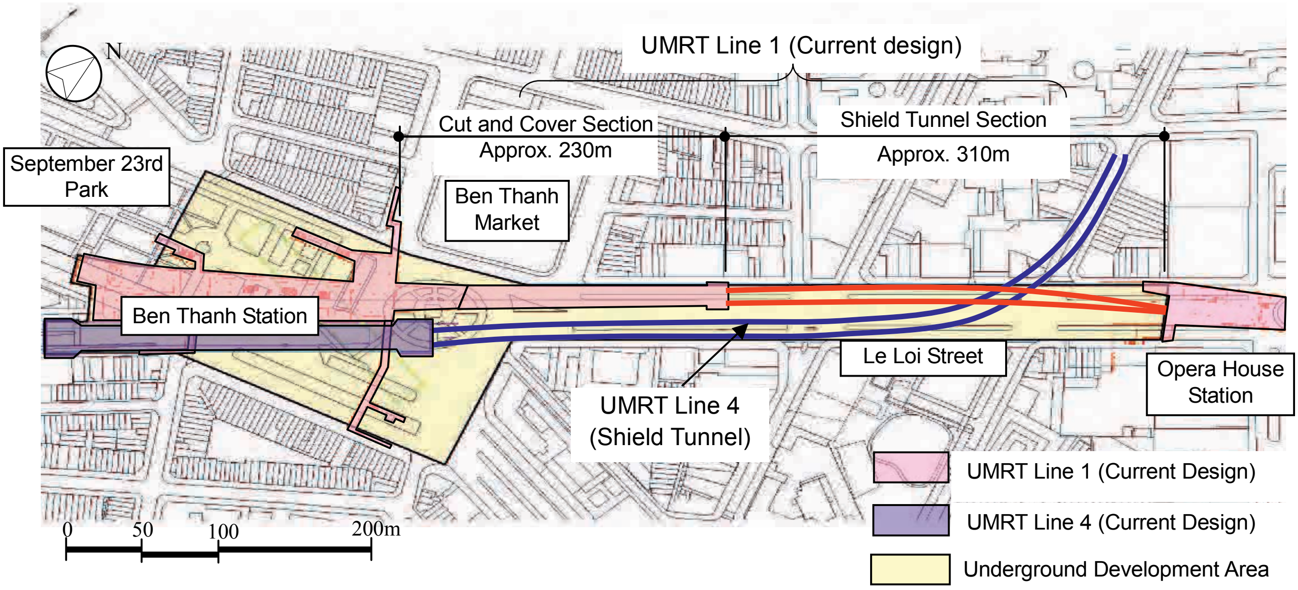


Figure 4.11 Relative project in Le Loi street area

Based on the current planning of each project, the comparison between two construction methods on the underground development in the Le Loi street area is studied. One is that the current design of UMRT Line 1 tunnel is not changed and the area of the underground development decreases, and the other is that the Line 1 tunnel structure is changed from the shield tunnel to the cut and cover tunnel and the area of the underground development expands. In addition the cut and cover tunnel for Line 1 has two options. One is that the Line 1 tunnel and the underground shopping mall are constructed simultaneously, and the other is that the Line 1 tunnel is constructed prior to the underground shopping mall. This is because the difference of the project procedure between Line 1 and the underground development should be studied in the comparison. The underground development is under the feasibility study as a PPP project. However, the Line 1 project is on the tendering stage of the design and construction, so the Line 1 project is prior to the underground development. Thus, the comparative study is performed among the following three options.

Option 1 : Shield tunnel for Line 1
(No design change for Line 1 tunnel)

Option 3 : Cut and cover tunnel for Line 1
(Design change for Line 1 tunnel and simultaneous construction of Line 1 tunnel and underground shopping mall)

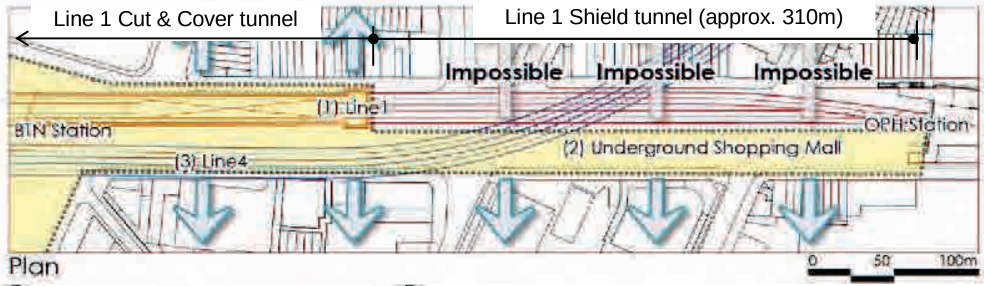
Option 3-1 : Cut and cover tunnel for Line 1
(Design change for Line 1 tunnel and construction of Line 1 tunnel prior to underground shopping mall)

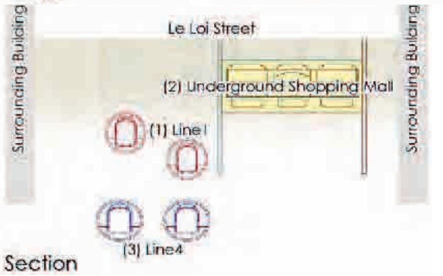
In the initial study for the construction method in the Le Loi street area, the comparative study of Option 2 is performed. Option 2 is that the both construction method of Line 1 and Line 4 tunnels is changed to cut and cover method. However, the result of the initial study shows that the impact on the Line 1 project is too large and the increase of the construction cost is so high because of very deep excavation. Therefore, Option 2 is omitted in the detail comparative study.

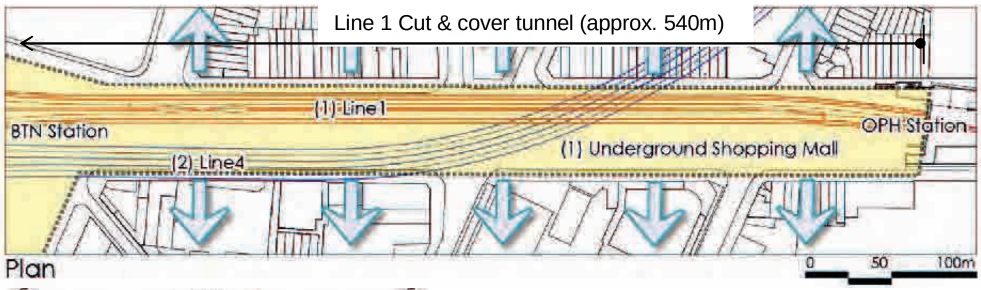
The comparison items in the comparative study among these three options take up the impact on the Line 1 and Line 4 projects as basic items. The main viewpoints are the influence to the project implementation schedule and the affect to the construction cost. In addition, because the area of the underground development is different among the options, the comparison items also take up the influence to the urban planning and the affect to the investment efficiency of the private sector for the underground shopping mall. In these items, the viewpoints of the urban planning are the connectivity with the surrounding private buildings and the creation of the attractive and comfortable urban space for the future. And the investment efficiency is evaluated according to the internal rate of return and the net present value of the cash flow in the private sector.

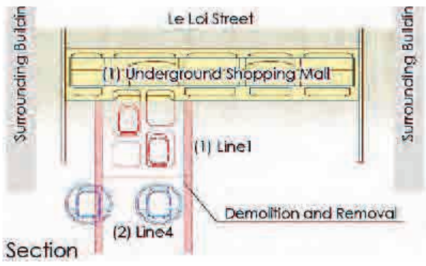
The outline of the three options is shown in Table 4.10, and the comparison table is shown in Table 4.11.

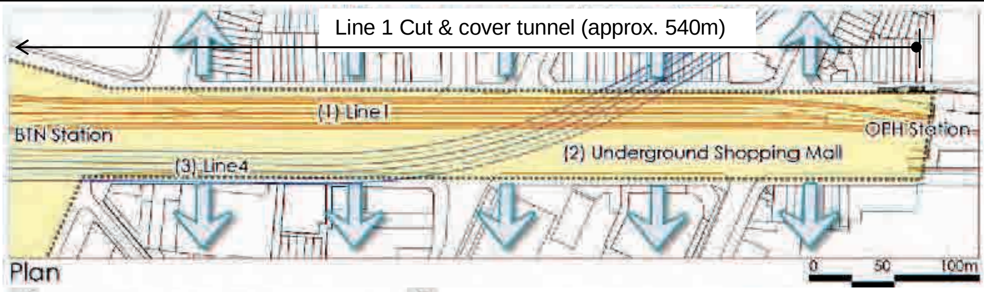
Table 4.10 Construction method of underground shopping mall and Line 1 tunnel beneath Le Loi Street

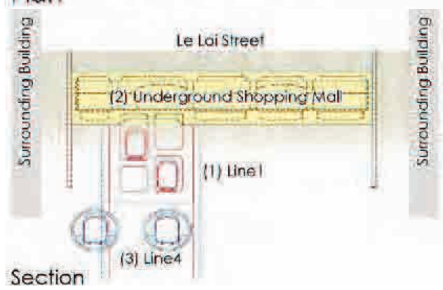
<table>
<tr><th></th><th>Outline of option</th></tr>
<tr><td>Option 1</td><td>



・Construction Method Line 1: Shield Tunnel
Line 4: Shield Tunnel
USM : Cut & Cover Tunnel
・Construction : Sequence ①Line 1 ②USM ③Line 4
・No design change for Line 1 tunnel
・The area of USM becomes small</td></tr>
<tr><td>Option 3</td><td>

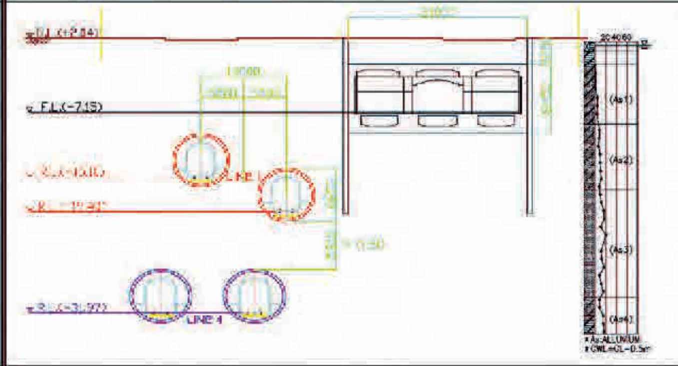
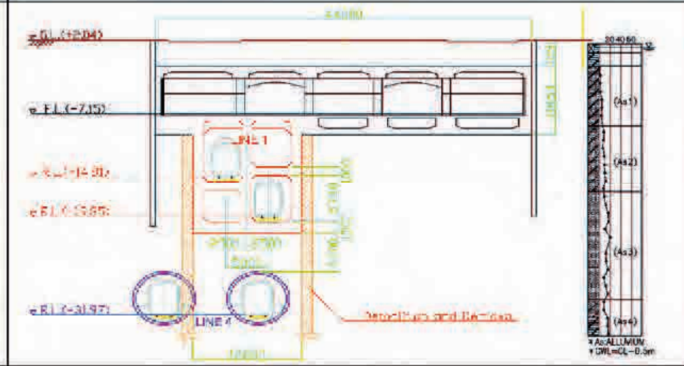
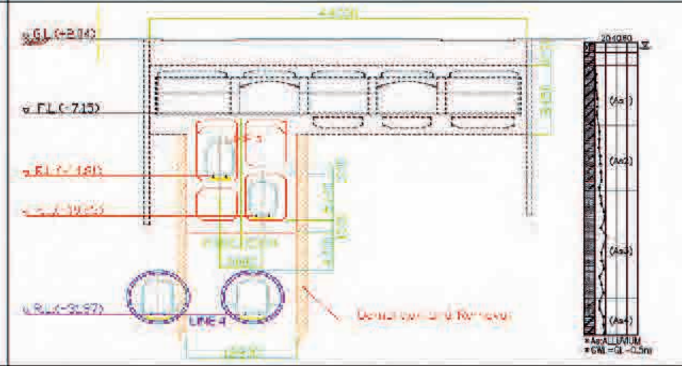


・Construction Method Line 1: Cut & Cover Tunnel
Line 4: Shield Tunnel
USM : Cut & Cover Tunnel
・Construction : Sequence ①Line 1 & USM ②Line 4 (simultaneously)
・Design change for Line 1 tunnel
・The area of USM becomes large</td></tr>
<tr><td>Option 3-1</td><td>



・Construction Method Line 1: Cut & Cover Tunnel
Line 4: Shield Tunnel
USM : Cut & Cover Tunnel
・Construction : Sequence ①Line 1 ②USM ③Line 4
・Design change for Line 1 tunnel
・The area of USM becomes large</td></tr>
</table>

Table 4.11 Comparative study for the planning policy of the underground development in Le Loi Street area

No.	Item	Sub-item	Option 1		Option 3		Option 3-1	
1	Outline of the Alternative	Type of Tunnel	* Line 1 : TBM * Line 4 : TBM		* Line 1 : C&C * Line 4 : TBM		* Line 1 : C&C * Line 4 : TBM	
		Construction Sequence	(1) Line 1 → (2) USM → (3) Line 4		(1) Line 1 & USM → (2) Line 4		(1) Line 1 → (2) USM → (3) Line 4	
		Other Conditions	* No design change is required for Line1 from Tender Drawings * Development area of USM is restricted		* No restriction is required for USM project		* No restriction is required for USM project	
2	Cross Section	(KM0+436 of Line 1)						
3	Rail Level at Cross Section	Line 1	-19.40		-19.85		-19.85	
		Line 4	-31.97		-31.97		-31.97	
4	Impact on Line 1	During Construction Period (including Tender Procedure)	* No preparatory work for USM and Line 4 is required	A	* The revision of the tender document is required. (The necessity of the revision of Preliminary Design of Line 1 Project is to be clarified) * Diaphragm wall has to be demolished and removed during the construction period of Line 1.	B	Same as Option 3	B
		Necessary Time for Construction	* No delay for Line 1 construction	A	* Line 1 construction to be postponed for approx. 4 years until PPP project will be approved	C	* Approx. 6 months for the approval and the design change of Line 1 Project would be necessary. (The arrangement of tender schedule will be required.)	B
		During Operation Period	* Line 1 tunnels will be affected by the construction of Line 4 tunnels which underpass the Line 1 tunnels with minimum of half diameter of the shield tunnel	B	* No impact on the Line 1 tunnels is expected from USM projects	A	Same as Option 3	A
5	Line 4 Construction	During Design Period	* The alignment of Line 4 can be revised after the construction of Line 1	B	* The horizontal alignment of Line 4 has to be fixed by the detailed design of Line 1	B	Same as Option 3	B
		During Construction Period	* Monitoring of the impact on Line 1 tunnel is necessary	B	* Monitoring of the impact on Line 1 tunnel is necessary	B	Same as Option 3	B
6	Urban Planning	Developing area of USM	approx. 18 500 m^2	C	approx. 25 500 m^2	A	Same as Option 3	A
		Construction of Passageway connecting USM with Surrounding Buildings	* The construction of the passageways which connect between the USM and buildings on the northwest side of Le Loi Street would be difficult. This is because the embedment of the retaining wall for the passageways would be hindered by the shield tunnel of Line 1, which causes the boiling destruction at the excavation bottom and the large deformation of the retaining wall.	C	* The underground passageways connecting the USM and buildings along Le Loi Street would be safely constructed because the embedment of the retaining wall could be sufficiently secured.	A	Same as Option 3	A
		Attractive Urban Space Development	* Since the connection between the USM and buildings on the northwest side of Le Loi Street wouldn't be secured, attractive and comfortable underground spaces wouldn't be developed.	C	* Since there is no restriction to connect the USM and buildings along Le Loi Street to be caused by the underground rail structure, developing attractive and comfortable underground spaces is expected.	A	Same as Option 3	A
7	Investment Efficiency for USM		* The investment efficiency for USM is marginal for private sector investment as the equity internal rate of return is 16% with NPV of private sector net cash flow is estimated at 1.9 times of initial equity investment. * The rentable ratio for the store in USM, which is the ratio of shop area to USM area, becomes considerably smaller.	C	* The investment efficiency for USM is sufficient for private sector investment as the equity internal rate of return is nearly 20% with NPV of private sector net cash flow is estimated at 2.6 times of initial equity investment. * The rentable ratio for the store in USM, which is the ratio of shop area to USM area, becomes considerably larger.	A	Same as Option 3	A
8	Construction cost performance	UMRT (CP-1) Construction	100 *	A	106 *	A	106 *	A
		USM Construction	100 *	-	114 *	-	114 *	-
		UMRT and USM Construction	100 *	-	109 *	-	109 *	-
9	Comprehensive Evaluation		**Not Recommended** + Major advantages of Option 1 are as follows; No design change is required for Line 1 Alignment of Line 4 can be reviewed and modified in the future - Major disadvantages of Option 1 are as follows; The developing area for USM has to be reduced for approx. 7000 sq.m The attractive and comfortable underground space wouldn't be developed The investment efficiency for USM would not be so good	**B**	**Recommendation of JICA Study Team in case of PPP project approval in early stage** + Major advantages of Option 3 are as follows; Major disadvantages of Options 1 and 2 are resolved or mitigated + Remaining major disadvantages of 3 are as follows; Only the horizontal alignment of Line 4 has to be fixed in the detailed design of Line 1	**B**	**Recommendation of JICA Study Team** + Major advantages of Option 3-1 are as follows; Major disadvantages of Options 1 and 2 are resolved or mitigated + Remaining major disadvantages of 3-1 are as follows; Only the horizontal alignment of Line 4 has to be fixed in the detailed design of Line 1	**A**

Note
TBM : Tunnel Boring Method
C&C : Cut and Cover
USM : Underground Shopping Mall

* Construction cost performance
1. Assuming construction cost of Option 1 is 100.
2. The cost of UMRT (CP-1) is the Construction Cost of Package 1 (Underground Section), HCMC Urban Railway Construction Project, Line 1.

"A" : EXCELLENT
"B" : GOOD
"C" : BAD

As shown in Table 4.11, in case of Option 1 (Shield tunnel for Line 1), the underground shopping mall can not be constructed above the Line 1 tunnel due to the interference with the Line 1 tunnel. Therefore the connectivity of the underground development with the new private buildings on the northwest side of Le Loi Street can not be ensured, and the formation of the underground pedestrian network can be insufficient in the future. The area for the pedestrian walking around becomes small, and the comfortable and attractive urban space can not be created. Further, it is estimated that the investment efficiency for the underground shopping mall in the private sector is not so good due to the small area of underground shopping mall. On the other hand, the impact on the UMRT Line project is small because of no design change for the Line 1 tunnel. It is not necessary to change the current documents for the tender of the design and construction, and there is no influence to the tendering procedure. When the UMRT Line 1 project has to be advanced in top priority, Option 1 is the best solution. However, because the future urban development is restricted, Option 1 is not recommendable.

In case of Option 3 and Option 3-1 (Cut and cover tunnel for Line 1), the underground shopping mall can be constructed above the Line 1 tunnel due to the design change of the Line 1 tunnel to the cut and cover tunnel. Since the underground development can be connected with the new private buildings along Le Loi Street, the underground pedestrian network can be formed sufficiently in the future. It is comfortable and convenient for the pedestrian to access to the adjacent facilities like the traffic facilities and/or the surrounding buildings, so the pedestrian is expected to walk around in the wider area. Therefore the attractive underground urban space can be created. On the other hand, according to the design change to the cut and cover tunnel in the shield tunnel section (the length: approx. 310m) between Ben Thanh Station and Opera House Station, it is estimated that the construction cost increases. For the construction cost of Line 1 underground section (CP-1), when the construction cost of Option 1 is 100, the one of Option3 and Option3-1 is 106, so 6% increase of the construction cost is estimated. Further, there is some affect on the schedule of the UMRT Line 1 project. The difference between Option 3 and Option 3-1 is the size of the influence to the schedule of the Line 1 project.

In Option 3 the underground shopping mall is constructed simultaneously with the UMRT Line 1's tunnel. In this case for the construction of the underground shopping mall which is expected to be developed as a PPP project, the project approval is necessary. However, the period of the project approval as a PPP project is assumed to be 3 or 4 years. Therefore, to construct the underground shopping mall simultaneously with the Line 1 tunnel, UMRT Line 1 should be extended since the construction of the underground shopping mall as a PPP project is approved. The UMRT Line 1 project is assumed to be a considerably late.

In Option 3-1 the UMRT Line 1 tunnel is constructed prior to the underground shopping mall. In this case the construction of the Line 1 tunnel does not have to extend until the project approval of the underground shopping mall as a PPP project. However, it is necessary to revise slightly the tendering documents and the process due to the design change of Line 1's tunnel. As for this revision process, however, the procedure in Ho Chi Minh City is not clear at the moment, the period of the revision work and the approval is assumed to be approximately from 3 to 5 months.

Through above mentioned comparative study, Option 3-1 is recommended as the best solution for the urban development in the center of Ho Chi Minh City considering the future, even though there is some impact on the UMRT Line 1 cost and schedule. This proposal has been approved in the consultation with the Task Team for Ben Thanh Central Station Project

3) Construction Sequence

(1) Unified Construction and Phased Construction

In the integrated design for the Ben Thanh Central station including the underground shopping mall, there is a large difference for the progress among 4 UMRT lines and underground shopping mall. Consequently, some options for the construction sequence can be considered. Therefore, the option study for the construction sequence of 4 UMRT Lines and underground shopping mall should be performed. The items to be studied are the timing of commercial operation of Line 1, the workability of construction, the influence on urban environment (such as traffic diversion during the construction period) and construction cost. According to the viewpoints of these items, the following two options can be considered for the construction sequence.

Option 1 : Unified Construction (3 UMRT Stations and Underground Shopping Mall are constructed at the same time)

Option 3 : Phased Construction (Preceding the construction of Line 1 for early commercial operation)

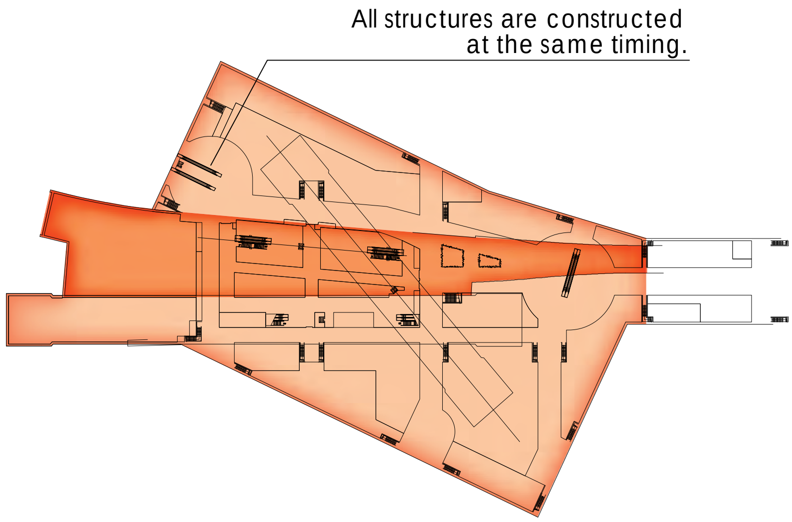
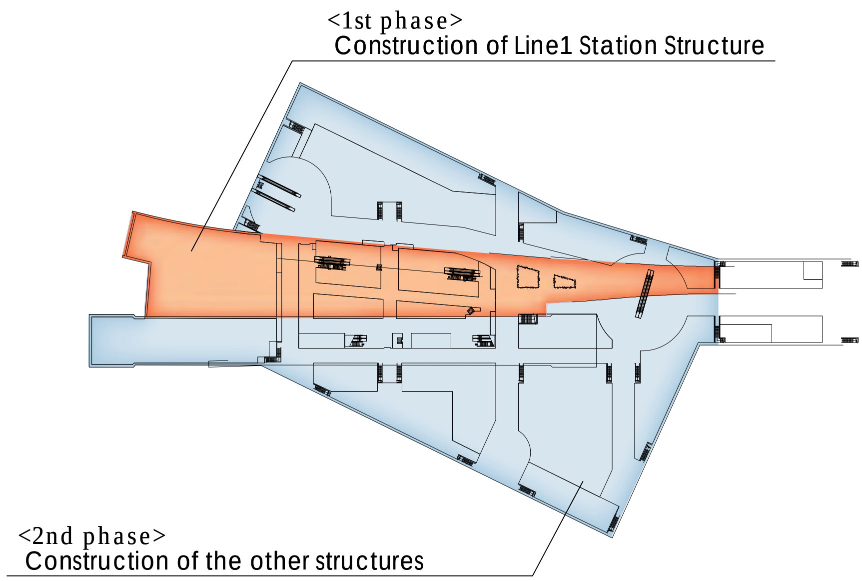
The comparison table of these two options is shown in Table 4.12. At first, comparative study of Option 2, in which the north side of underground shopping mall shall be constructed at the same time with Line-1's station, was performed. However, the result of the initial study shows that Option 2 has no advantage considering each comparison items such as the early opening of Line 1, the construction workability, and the construction cost. Therefore, Option 2 is omitted from the comparison table.

Regarding this comparison study, Option 1 (Unified Construction) is desirable from the viewpoints of construction planning and construction period. However, due to the uncertainty of the project scheme and schedule for the underground shopping mall and UMRT Lines except Line 1, simultaneous construction can not start until these project scheme and schedule are clarified. Especially, the project scheme of the underground shopping mall, which is under the feasibility study, has not yet been fixed; therefore 3 or 4 years are estimated to be necessary for the approval of this project. Thus, the considerable delay of the timing for starting Line 1 commercial operation is indispensable.

On the other hand, in case of option 3 (Phased Construction), through the integrated design the timing of commercial operation can be brought as early as possible. However, the planning of the phased construction is necessary. In addition, there is disadvantage that the total construction period is extended due to the two divided construction periods and the total construction cost would increases.

Accordingly, these two options have both advantages and disadvantages considering the overall comparison. However, UMRT Line 1 project funded by Japanese ODA has already proceeded with the development plan. The project schedule of UMRT Line 1 must not be delayed by the time the schedule of underground shopping mall is clarified. Furthermore, the early opening of Line 1 commercial operation is the priority of Ho Chi Minh City. Considering those facts, Option 3 is adopted as the feasible option in order to obtain the early opening of Line 1 as the first priority.

Table4.12 Comparison study on construction sequence

	Outline of Option	
Option 1 Unified Construction		
	Advantage	・The total construction period is not very long. ・Total cost is less than Option 3 ・Construction planning is not difficult and complicated
	Disadvantage	・Opening of Line1 operation is considerably delay
Option 3 Phased Construction		
	Advantage	・Early opening of Line 1 operation
	Disadvantage	・Long construction period ・Total cost is more than Option 1 ・Phased construction planning is necessary.

(2) Construction of Line 2 in Phased Construction

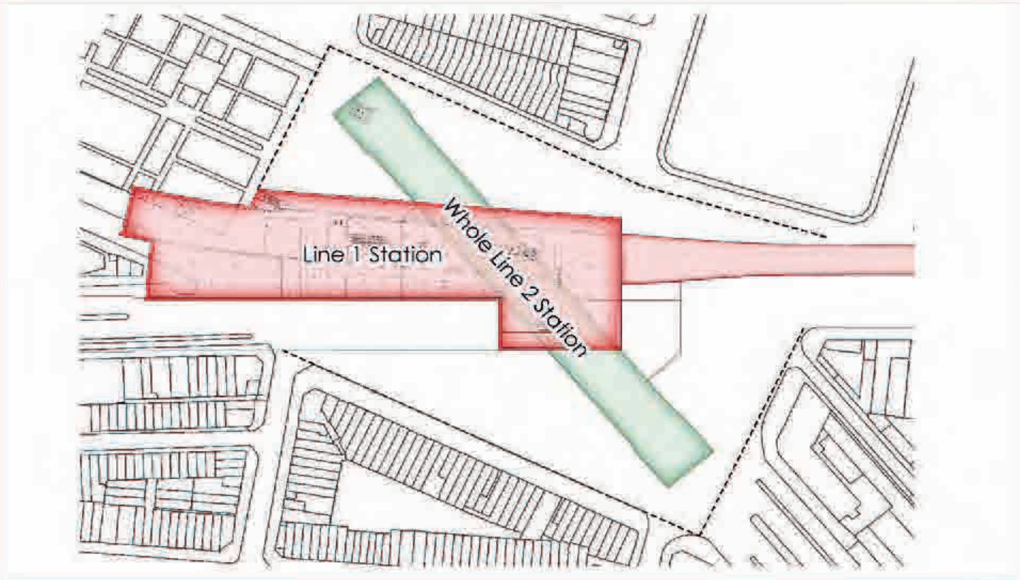
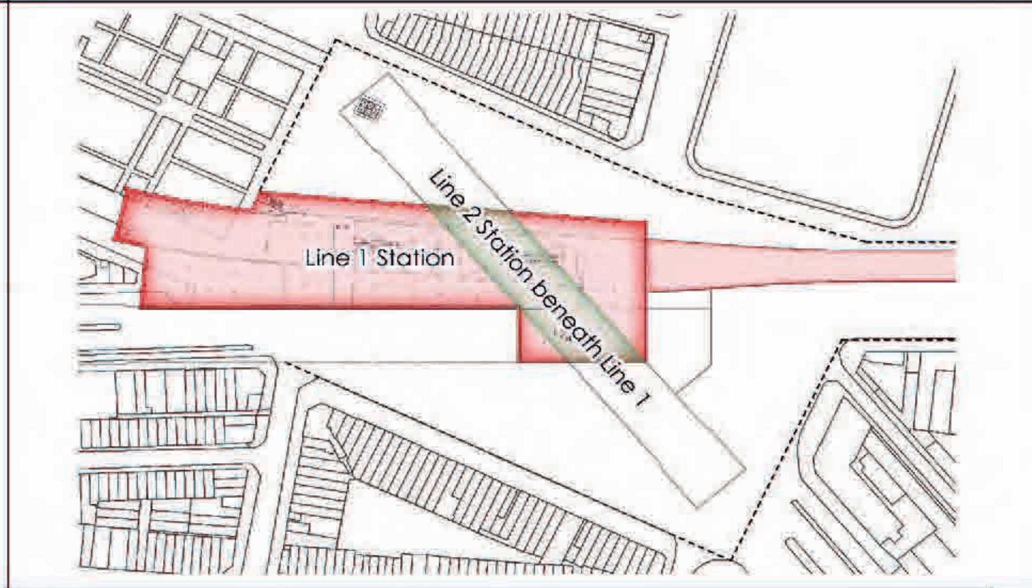
In Option 3 (Phased Construction) the simultaneous construction of Line 2 station with Line1 station is studied as shown below. In Ben Thanh Central Station, the platform of Line 2 is planned to be placed at the deepest and intersect slantwise beneath the Line 1 Platform. Since all of station structures are constructed by the cut and cover method from the ground, Line 2 station structure beneath the Line 1 station has to be constructed in the 1st phase at the same timing as Line 1 construction. Thus, the comparative study on the construction part of Line 2 station structure in the 1st phase is performed for the following two options.

Option 3 : Whole Line 2 station structure is constructed simultaneously with Line 1 in 1st phase

Option 3-1: Only partial structure of Line 2 beneath the Line 1 is constructed simultaneously with Line 1 in 1st phase

The first items to be considered in comparative study between these two options are the impact on the station structure, operation and the opening time of Line 1. The important notice for Line 2 construction and construction cost of Line 2 are also under studying. In addition, the design standard for the disaster prevention applied to the design of Ben Thanh Central Station was considered. The comparison table is shown in Table4.13.

Table 4.13 Comparative study on the Construction of Line 2 Station in 1st Phase

No.	Item	Sub-item	Option 3		Option 3-1	
1	Outline of the Alternative	Planning Concept	Construction of Line 1 station and whole Line 2 station in 1st Phase		Construction of Line 1 station and Line 2 partial station in 1st Phase	
		Construction Sequence	【1st Phase】 ・Line 1 Station ・Whole Line 2 Station → 【2st Phase】 ・Line 4 Station ・Underground Shopping Mall Note: Construction of Line 2 and Line 4 station includes only civil works.		【1st Phase】 ・Line 1 Station ・Line 2 Station beneath Line1 → 【2nd Phase】 ・Remaining of Line 2 Station ・Line 4 Station ・Underground Shopping Mall Note: Construction of Line 2 and Line 4 station includes only civil works.	
2	Construction planning in 1st Phase					
3	Impact on Line 1	Structural	* Because 2nd phase construction has some distance to Line1 platform and the excavation is shallower, the risk is much lower than Option3-1.	A	* As the construction of Line 2 station in 2nd phase is adjacent to Line 1 station, the risk is high for the settlement of Line 1 station and/or the uplift due to soil improvement works. * Due to the demolition of diaphragm wall in 2nd phase, there is some risk that Line 1 station is damaged.	C
		Operational	Same as above	A	* There is some risk that the vibration and the noise caused by Line 2 construction adjacent to Line 1 station have bad influence on Line 1 train operation in 2nd phase. * The accessibility for the Line 1 station is restricted by the construction of Line 2 station.	C
4	Impact on Line2 Station		* As the whole structure of Line 2 is constructed at same time, there is no risk caused by the joint for diaphragm wall and structure of Line 2 station due to phased construction.	A	* During the construction period, it is impossible for the 2nd phase diaphragm wall to be connected with the 1st phase wall completely, therefore the risk is hight for water leakage and discharging of background soil from this joint. * There is higher risk for water leakage on Line 2 station structure from the construction joint between phase1 and phase2.	C
5	Design Standards for Disaster Prevention		* The design standards for disaster prevention of Line 2 station could be the same as Line 1 station. * The BTN Central Station could be designed and constructed in accordance with unified design standard for disaster prevention based on japanese standard.	A	* In the case of application of design standard for disaster prevention different from Line 1 station due to Line-2 Station receive funding from sources different from Japanese ODA, then it is possibly complicated and difficult to unify the design standard and have an Integrated Design for BTN Central Station.	C
6	Construction Cost of Line 2		1st phase 5,900 2nd phase 0 Total 5,900 mil.JPY Note: The construction cost for Line 2 shows only Civil Works.	A	1st phase 1,400 2nd phase 5,000 Total 6,400 mil.JPY Note: The construction cost for Line 2 shows only Civil Works.	B
7	Implementation Period of Line 1 (CP-1)		88.0 months	B	84.0 months	A
8	Comprehensive Evaluation		Recommendation of JICA Study Team + Major advantages of Option3 are as follows; The total construction cost of Line 2 is lower than Option3-1, although the cost in 1st phase is higher . The many risk for construction and operation of Line 1 and Line 2 could be declined. - Major disadvantages of Option3 are as follows; The completion timing of line 1 (CP-1) will be delayed for just only 4 months to compare with option3-1. (The timing of commercial operation might not be delayed by adjusting to CP-3 works)	A	Not Recommended + Major advantages of Option 3-1 are as follows; The completion timing of line 1(Cp-1) could be 4 months earlier than Option-3. (It does not mean that the timing of commercial operation could be earlier than Option-3) - Major disadvantages of Option 3-1 are as follows; There are many risks for construction and operation of Line 1 and Line 2. The total construction cost of Line 2 is higher than Option 3.	B

"A" : EXELENT
"B" : GOOD
"C" : BAD

As shown in the comparison table, in case of Option 3-1 (the construction of the partial Line2 station structure beneath the Line1 only) there are many risks. Since the construction of Line 2 station in 2nd phase is adjacent to Line 1 station, the risk is higher for the settlement of Line 1 station and/or the uplift due to the soil improvement works. And due to the demolition of diaphragm wall in 2nd phase, there are some risks that Line 1 station structure could be damaged. In addition, there is some risk that the vibration and the noise caused by Line 2 construction adjacent to Line 1 station would have bad influence on Line 1 train operation in the 2nd phase construction. And the accessibility for the Line 1 station is restricted by the construction of Line 2 station. The bad influence is not only on Line 1 station but also for Line 2 station which should be considered. During the construction period in 2nd phase, it is impossible for the 2nd phase diaphragm wall to be connected with the 1st phase wall completely; therefore the risk is high for water leakage and discharging of background soil from this joint. Furthermore, there is higher risk for water leakage on Line 2 station structure from the construction joint between 1st phase and 2nd phase.

On the other hand, in case of Option3 (the construction of the whole Line 2 station structure at the same timing as Line 1's) these above mentioned risks are low. Therefore, the safe construction and operation could be ensured.

From the other view point, if the donor for the Line 2 station is different from Line 1 station in case of Option3-1, the different fire prevention design standard could be applied in one central station. Therefore the planning and the design of Ben Thanh Central Station are anticipated to become difficult and complicated. As for the construction cost, the phased construction is a little more expensive than the unified construction. The advantage of Option 3-1 is that the completion of civil construction of Line 1 is 4 months early to compared with Option 3. However, by adjusting the E&M work schedule for the railway, Option 3 does not have many disadvantages for the timing of Line 1 commercial operation.

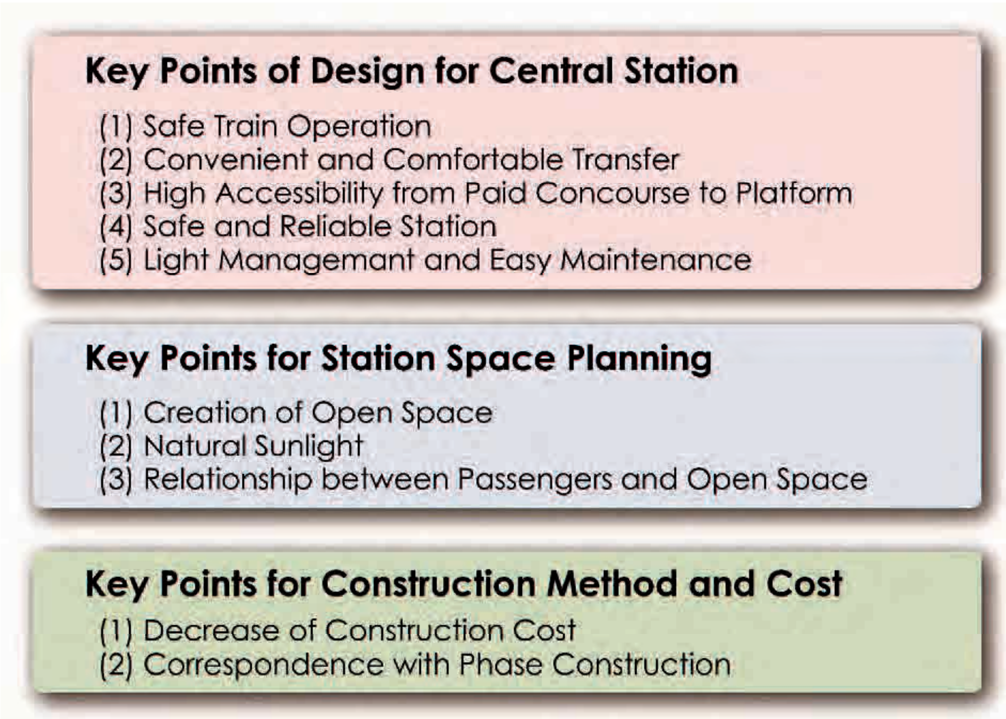
Through above mentioned comparative study, Option 3 (the construction of the whole Line 2 station structure at the same timing as Line 1) is recommended. Regarding this comparative study, in the consultation with MAUR, JICA and consulting team of Line 1, it has come to the conclusion that the same timing construction of Line 1 and whole Line 2 station structure is desirable, from the technical viewpoints. Therefore, in this survey, the whole station structure of Line 2 is constructed in 1st phase in case of phased construction.

3) Policy for planning of joint Ben Thanh Central Station

Since there are three platforms for 4 UMRT Lines 1, 2, 3a, and 4 in Ben Thanh Central Station, the planning of this central station should be comprehensive and convenient for the passengers to transfer from one platform to another. Therefore, the planning of the compact station is necessary as the platforms of UMRT lines are placed closely. On the other hand, considering that this central station is located in the center of Ho Chi Minh City, it is preferable to create the attractive and comfortable urban space with the large open space and the big atriums. Thus, Ben Thanh Central Station planning needs to take into account these two requirements.

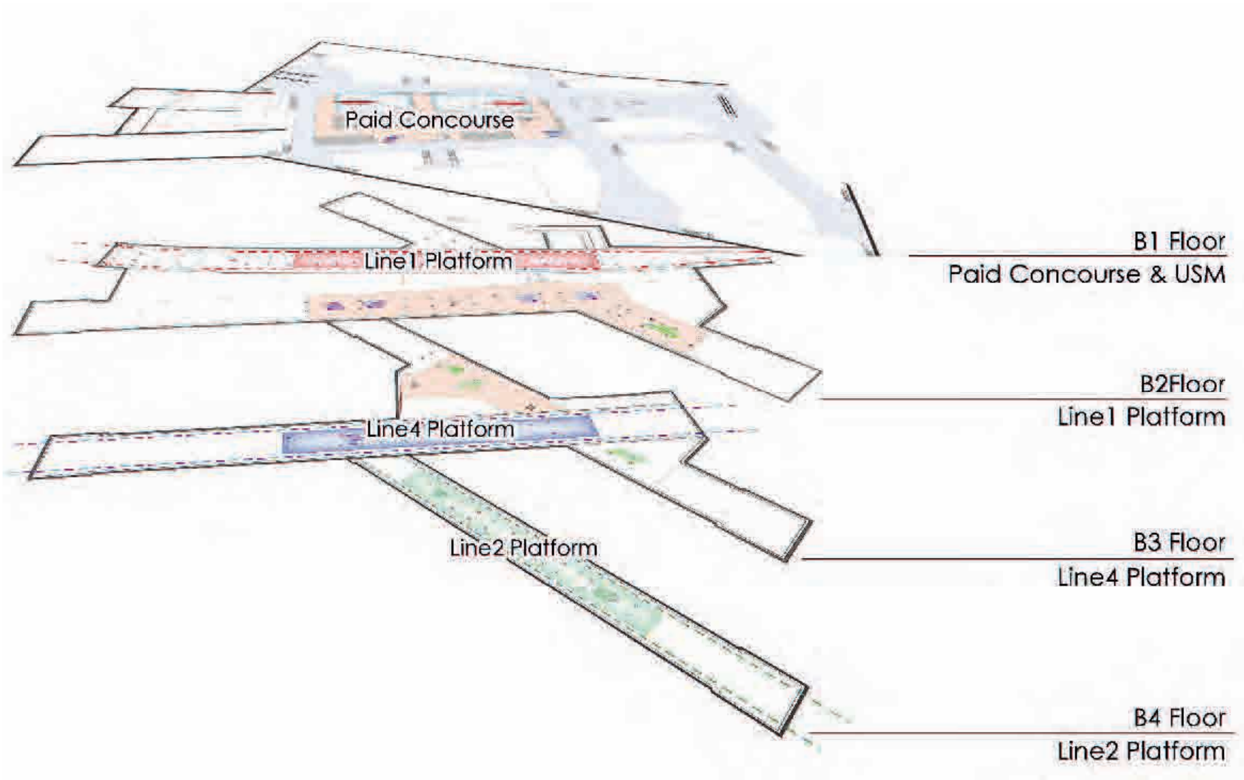
Fegure4.14 Concept for the design of Ben Thanh Central Station

In this project, the planning of the smooth transfer has the first priority. Next is the planning for an attractive urban space, which is suitable for the center of Ho Chi Minh City. Furthermore, in consideration of phased construction, the key points of the planning are determined as follows.



Fegure4.15 Key Points for design of Ben Thanh Central Station

In Ben Thanh Central Station,, the platform of Line 3a is same as Line 1 because Line 3a is an extension of Line 1, therefore there are three platforms for 4 UMRT Lines which are planned to be placed closely. Through this planning of the platform location, the smooth transfer among three platforms is ensured. This basic layout of UMRT Line platforms and the paid concourse in Ben Thanh Central Station are shown below based on to the information of UMRT Lines from MAUR. As shown Figure4.16 Ben Thanh Central Station will have four basement floors.



Fegure4.16 Basic Layout of Ben Thanh Central Station

For reference, the station layouts of three major subway transfer stations in Japan (Kasumigaseki Station, Ginza Station, and Otemachi Station) are shown in Figure4.17, with a diagram of the same scale as Ben Thanh Central Station. According to this figure, Ben Thanh Central Station has much more convenience for transferring from one platform to another.

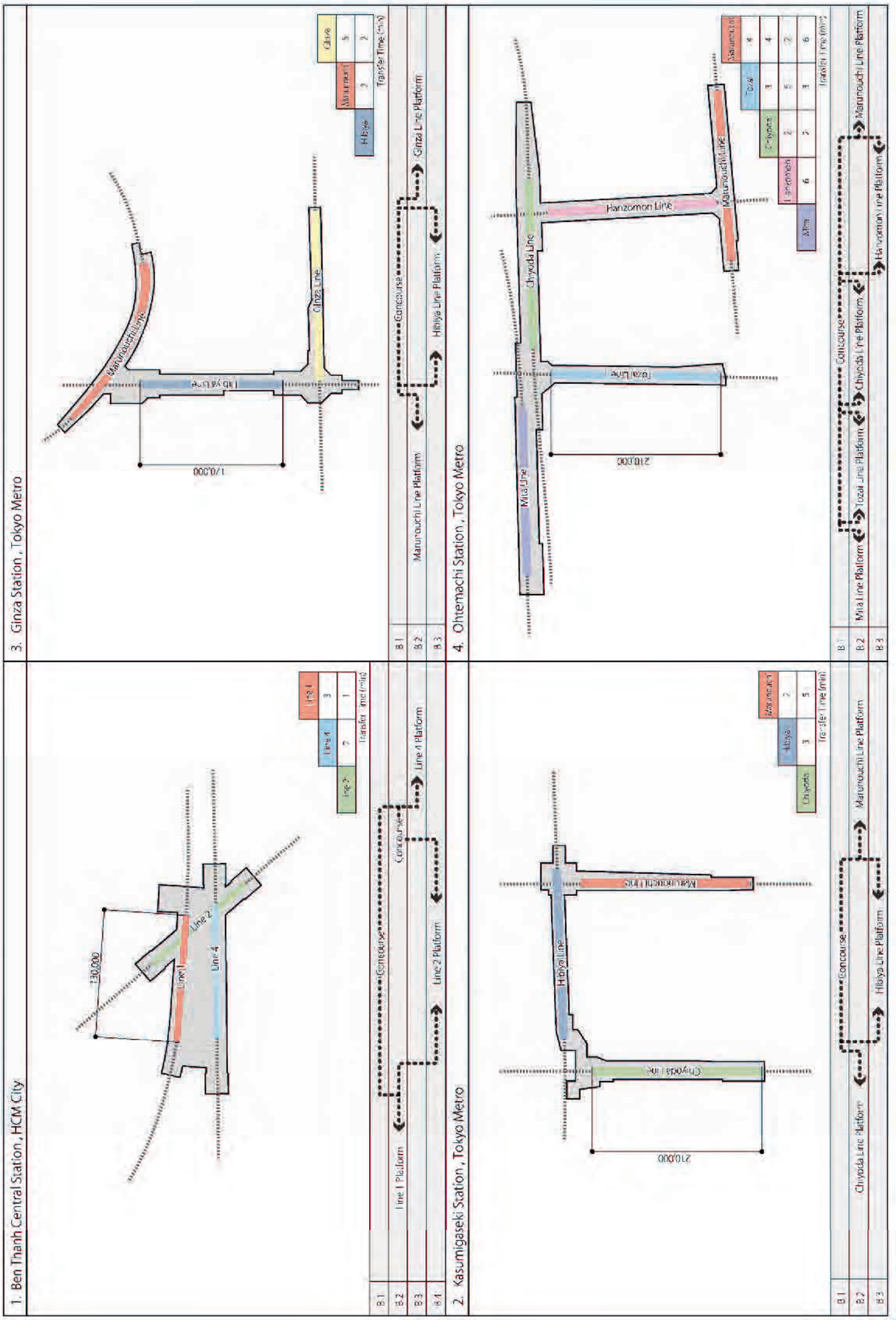


Figure 4.17 Comparison of platform layout with major subway stations in Japan

4.3 SCHEMATIC FACILITY DESIGN

4.3.1 Alignment Design of UMRT

The route plans for all UMRT lines (Line 1, 2, 3a, and 4) coming together at Ben Thanh Central Station are designed individually. Although these route plans are optimized separately in each project, the review and adjustment among the route plans is necessary for the whole design as a central station to ensure the smooth transfer.

The current route plan, revised points of each line, and design criteria applied for the revision are described in this section.

1) Current Route Plan

(1) UMRT Line 1

(a) Route Plan

The route starting from Ben Thanh Station goes toward North-east along Le Loi Street. The distance of station center between Ben Thanh and Opera House stations is 715m.

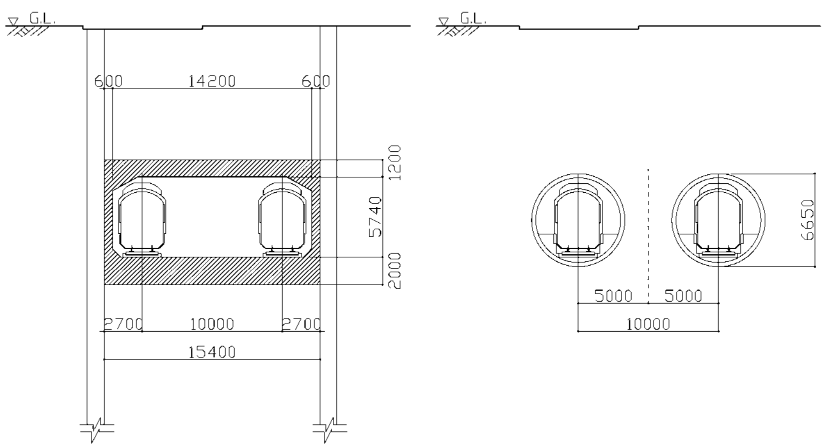
Ben Thanh Central Station area and Le Loi Street between Ben Thanh and Opera House Stations are established as the project area in this survey.

(b) Tunnel Plan

Ben Thanh Station, Opera House Station, and the tunnel section from Ben Thanh Station to KM+300 are planned to be constructed by cut and cover method. On the other hand the tunnel section from KM0+300 to Opera House Station is planned as TBM.

The 2 tunnels are arranged horizontally at Ben Thanh Station, and perpendicularly at Opera House Station. The tunnel layout is shifted in the TBM section. since the road width after Opera House Station is too narrow to arrange two shield tunnels in horizontally parallel.

Figure 4.18 shows the standard cross sections of the cut and cover tunnel and the shield tunnel of UMRT Line 1.



Source: Management Authority for Urban Railway (MAUR)

Figure 4.18 Standard Cross Section of C&C Tunnel and Shield Tunnel of Line1

(c) Station Plan

Ben Thanh Station for UMRT Line1 is designed as two (2) stories, namely the concourse is on the B1 floor and the platform is on the B2 floor. The platform layout is designed as one (1) island with two (2) tracks.

Since Ben Thanh Station is the terminal station of Line1, the scissors crossing is placed in front of Ben Thanh Station for the return operation. In addition, receiving sub-station is planned at Ben Thanh Station.

The rail level of Ben Thanh Station is designed as -13.65m.

(2) UMRT Line 2

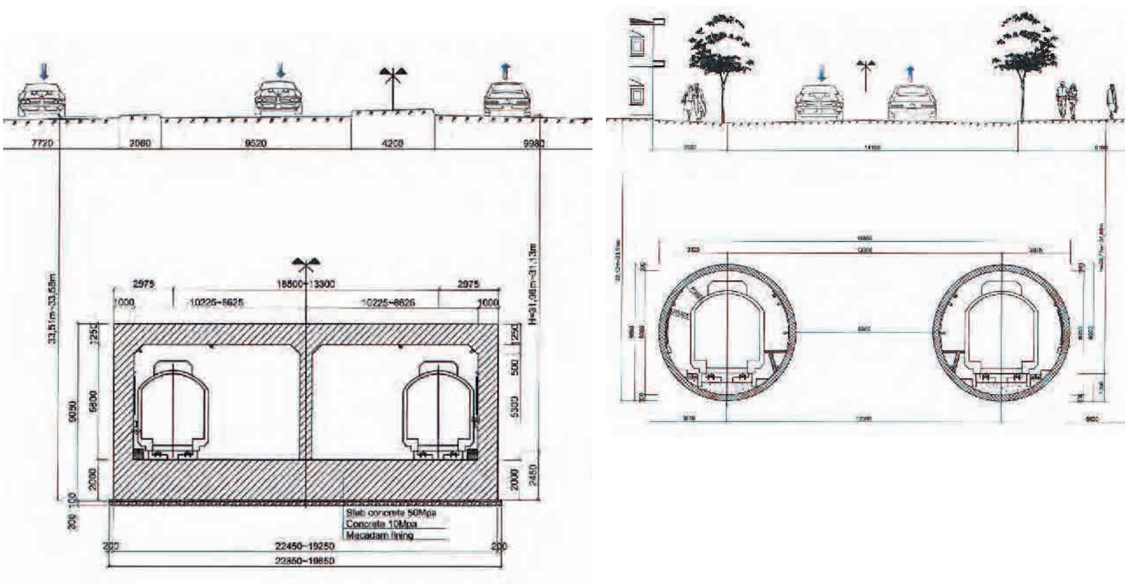
(a) Route Plan

The route of UMRT Line2 starting from Ben Thanh Station goes toward north-east along Pham Hong Thai street via Cach Mang Thang 8 street.

(b) Tunnel Plan

Ben Thanh Station and the connecting section of 224m are planned as cut and cover tunnel. The other section up to Tao Dan Station is planned as shield tunnel.

Figure 4.19 shows the standard cross section of the cut and cover tunnel and the shield tunnel of UMRT Line2.



Source: Management Authority for Urban Railway (MAUR)

Figure 4.19 Standard Cross Section of C&C Tunnel and Shield Tunnel of Line2

(c) Station Plan

Ben Thanh Station of Line2 is located at the deepest area in the Ben Thanh Central Station. No detailed design of Ben Thanh Station is shown in the F/S, however, the platform layout is designed as one (1) island type with two(2) tracks. Since Ben Thanh Station is the terminal station of Line2 in Phase 1, the scissors crossing is placed in front of Ben Thanh Station for return operation.

In the F/S, the rail level at the center of Ben Thanh Station is designed as -29.10m.

Special attention is paid to the rail level of UMRT Line 2 at Ben Thanh Station in developing the layout of Ben Thanh Central Station to keep the adequate vertical alignment of Line 2.

(3) UMRT Line 3a

UMRT Line 3a connects Ben Thanh Station to Tan Kien Station in the South-west of HCMC with length of 9.7km. The Line 3a route starting from Ben Thanh Station goes toward South-west along Pham Ngu Lao Street.

Detail description of Line3a shall be referred to Line1 since Line3a is an extension of Line1.

(4) UMRT Line 4

(a) Route Plan

The route of Line 4 around Ben Thanh Station runs along Pasteur Street toward South-east and turn to Le Loi Street toward South-west. Line 4 underpasses Line1 at the corner of Pasteur and Le Loi Streets, then runs parallel with Line1 up to Ben Thanh Station.
After Ben Thanh Station, Line 4 runs along Nguyen Thai Hoc Street via Tran Hung Dao Street.

(b) Tunnel Plan

Ben Thanh Station is planned as cut and cover tunnel. The other section around Ben Thanh station is planned as shield tunnel. The cross section of shield tunnel is the same with that of Line1.
At the crossing point of Line 1 and Line 4, Line 4 underpass Line1 with distance of 6.7m (the same size with the diameter of the shield tunnel).

(c) Station Plan

Ben Thanh Station of Line 4 is arranged almost parallel with Line1 station. The rail level of Line 4 at Ben Thanh Station is designed as -22.98m and there is a 9.33m height difference from the rail level of Line1. The platform layout is designed as one(1) island type with two (2) tracks.
No crossover is arranged fore and after Ben Thanh Station since Ben Thanh station is not a terminal station of Line 4.

2) Revised Points of the alignment

(1) UMRT Line1

(a) Horizontal Alignment

- The track center distance could be revised from 10m to 5m.
- With the revision of the track center distance, the horizontal alignment from Ben Thanh station to Opera House station shall be revised.
- IP is shown in appendix drawings.
- The end point of scissors crossing of Opera House side shall be moved 39.5m to Ben Thanh Station due to the above review.

(b) Vertical Alignment

- The vertical alignment from Ben Thanh station to Opera House station shall be revised, due to the review of horizontal alignment.
- The rail level at the station shall be unchanged.
  Ben Thanh Station = -13.65m
  Opera House Station = -12.95(EBT), -25.15(WBT)
- The rail level (WBT) at the crossing point with Line 4 shall be revised as shown below.
  Original = -19.40m @KM+435
  Revised = -19.85m @KM+435

(2) UMRT Line1

(a) Horizontal Alignment

- The alignment from Pasteur street toward Le Loi shown in the F/S shall be unchanged.
- Assuming that two tracks are concentric circles, the radius of two tracks is as follows.
  Inside Track: R350
  Outside Track: R360
- Outside S curve shall be revised with the consideration to avoid the conflict between the vertical curve to be inserted in front of Ben Thanh station and the transition curve.

(b) Vertical Alignment

- The rail level of Ben Thanh station (-21.01m) shown in the F/S shall be unchanged.
- In order to maximize the separation distance between Line 1 and Line 4 at the crossing point, the vertical alignment (see drawings) shall be revised with the consideration to design criteria. Besides it makes interference range of diaphragm wall of underground shopping mall reduce.

(3) UMRT Line2

(a) Horizontal Alignment

- In the F/S,the scissors crossing is placed in front of Ben Thanh Station, so the review of the alignment is not necessary in principle.
- However, the location of scissors crossing is relatively far from Ben Thanh Station, and this condition may be critical to setup the train headway.
- Considering the above mentioned information, it is proposed to relocate the scissors crossing at nearest to the station as shown in the drawings, and consequently, horizontal curve with R1,000 is allocated in platform.
- The adoption of this proposal shall be decided by MAUR.

(b) Vertical Alignment

- Rail level of Line2 at the Ben Thanh Station shall be planned as the lower of the following conditions.
  ① (Rail level of Line1 at the Ben Thanh station) -12.0m
  ② (Rail level of Line4 at the Ben Thanh station) – 6.5m
- According to the above results, rail revel of Line2 is determined to ①

  Rail revel of Line2 at Ben Thanh Station: -13.65 -12.0 = -25.65m

3) Design Criteria

The design criteria for the review of alignment are shown below.

(1) Horizontal Alignment

- Minimum Radius of Curve: R=300(m)
- Equilibrium Cant: $Cm = GV^2/127R$ (mm)
  Where, G: Track Gauge (1,435mm)
  V: Train Speed (kph)
  R: Curve Radius (m)
- Transition Curve: Half sin wave shape transition curve (according to Line 1 Project)
- Length of Transition Curve: Maximum Length among L1 to L3 (Round up with 5m interval)
  $L_1 = 450C_a$ (m)
  $L_2 = 7.4C_aV$ (m)
  $L_3 = 6.7\ C_dV$ (m)
  Where, C_a: Actually Applied Cant (mm)
  C_d: Cant Deficiency (mm)
  V: Train Speed (kph)

(2) Vertical Alignment

- Gradient:

Maximum gradient for main line	35 ‰
At point and crossing works	equal or less than 10 ‰
Within the horizontal curve section	equal or less than (35-600/R)
At stations (throughout the platform)	0 ‰
Minimum Gradient:	2‰

- Vertical curves: Minimum radius VCR=3,000m (exceptional case: 2,000m)

(3) Turnout

- For main line: No.10 turnout

(4) Track Center Distance

- The minimum distance between track centers in underground section shall be 4.2 meters. (Construction Gauge: 3.4m + Refuge space 0.8m)

(5) Others

i) Vertical curves shall, wherever possible, be positioned such that coincidence with horizontal transitions is avoided.

ii) Points and crossing shall not coincide with vertically curved track and horizontal transitions.

iii) Vertical curve is to be omitted for the gradient change with 10‰ or less, but for the study of i) and ii) above, VCR2,000 shall be assumed.

4.3.2 Subway Station Facility Planning

1) Intorduction

Station is the first contact point for railway passengers and railway industry association and also the starting point of providing services to passengers. In order to provide a good service to passengers efficiently, it is necessary for a service provider to examine the whole concept of the station.

Here, we will explain the facility plan of the station including not only Line 1 but Line 2, Line 3a and Line 4 which are planning to be expanded in the future and office facilities and its incidental equipments at Ben Thanh Central Station, and also introduce our challenges and countermeasures for development of Ben Thanh Central Station.

2) Station Facilities

About the facilities which should certainly be built a subway station, the designation and purpose are shown in Table 4.14. Moreover, we show the fundamental view of the station facilities planning in the Ben Thanh Central Station.

(1) Designation and purpose for use of Facilities

Table 4.14 Designation and Purpose of Station Facilities

Designation		Purpose
B1 (Concourse) or B2 (Facilities space)		
1	Station Office	Room which performs office work. The room serves as the station disaster prevention management office.
2	Station member’s Room	A station member's rest station. The room serves as cooking and a dining-room.
3	Station cleaning member’s Room	The room serves as cooking and a dining-room. It is utilized as a cleaning official's in charge rest station and locker room.
4	Women station member’s Room	The locker room of woman members.
5	Men station member’s Rest Room	A station member's bedroom. The room is classified into those for early shift and for late shift.
6	Crew’s Rest Room	The crew's bedroom. Since office hours differ, a single room is preferable.
7	Conference Room	The room is used as a station member's conference room, education, roll call, and a workplace.
8	Ticket Counter	Room which place ticket machines and adjustment machines.
9	Season Ticket Counter	The place which sells a season ticket.
10	Passenger's Toilet	The room makes man and woman separate.
11	Handicapped people's Toilet	The type toilet corresponding to a wheelchair user.
12	Station member's Toilet	The room makes man and woman separate.

13	Station member's Lavatory and Bathroom	The room is used for a shower or wash.
14	Warehouse	The storage place of documents, signboards, cleaning tools, and garbage, etc.
15	Crew's Toilet	The room makes man and woman separate.
16	Signal Treatment Room	Room which operates a signal and point and crossing.
B2,B3 and B4 (Platform of each Line)		
17	Waiting Room	For a passenger's waiting room. It is good to constitute a bench and air conditioning equipment.
18	Platform arrangement member’s Room	The room is also a place of emergency supplies.
19	Crew Waiting Room	Waiting room for the crews to the next crewing.

(2) The basic concept of the facility plan for Ben Thanh Central Station

(a) Passengers can transfer to Line 1, Line 2, Line 3a and Line 4 through inside gate.

(b) For passengers’ convenience, three gates will be installed at 1st Phase and four gates will be installed at 2nd Phase. Those gates will have an access to all lines.

(c) The structure of the station allows passengers to transfer between Line 1 and Line 2 directly from platform to platform.
Transfer between Line 1 and Line 4 can be done through B1 concourse.
Transfer between Line 2 and Line 4 can be done through an access way.
Line 3a will share a platform with Line 1 for Line 3a is considered as a continuous line of the Line 1.
As mentioned above, passengers can transfer among all lines without passing though the gate.

(d) With an aim of creating a subway that can be easily used by everyone including vulnerable road
users, escalators and elevators will be installed on all lines and also construct a walkway that enables passengers to move from ground to the platform by one route.

(e) Ticket Counter will be located near each gate.

(f) Station Office will be located in a concourse.

(g) Station Office and Staff Office should be located nearby each other in case of any passenger service will be needed.

(h) Office facilities and crew facilities should be intensively located on the B1 and B2 floor.

(i) Importing the concept of Universal Design, ticket vending machine, elevators, restrooms, information display, etc. should be designed user-friendly and easy to obtain necessary information.

(j) Subway concourse and Underground Shopping Mall should be connected on the same level of floor heights.

(k) Machinery equipments of each line should be installed at the space of each line.

(l) Due to security reasons, entry to the station outside hours will be restricted to station staff only.

Therefore, it is recommended to set up a station controlled area taking into consideration in relation to Underground Shopping Mall and install a roll-up door.

(m) Considering road configuration and passengers' convenience, ground level entrances should be preferably located where multi-way access is available.

(n) It is necessary to take measures to prevent water seepage not only in these areas controlled by station but also a whole basement area including Underground Shopping Mall.

(3) Station Office

Station Office is a central to railway operation and a place that provides management of general administration and disaster prevention as well as services to passengers. A full-range of disaster prevention equipment, centralized monitoring equipment and counting machine of operating data etc. should be installed here.

Also, extra space for emergency situation and providing assistance to passengers will be needed. Location of the station office is recommended to be near the center of the station considering the surroundings – entrance stairways, stairways to platforms, public roads and spaces.

(4) Toilets

Since toilets at the station are available to the general public, universal design is being actively introduced and it is important to combine these toilet facilities to work better for various people – hand washing basin, toilet basin, urinal, multifunctional toilet for wheelchair users.

Toilets for passengers should have;

・There needs to be large and bright open and functional space.
・There needs to be sanitary and feeling of purity.
・Consideration of crime prevention should be made.
・Consideration of the weak should be made.

Regarding multifunctional toilets, it is recommended to install male/female toilets separately as general use toilets for wheel chair users and elderly people, expecting mothers and person accompanying small children. It is necessary to take into account of gender differences between caregiver and person in need of care when deciding a location of the toilets.
Due to the staff toilets should be located separately from the one for passengers.

As for the position of installation, it is preferable to have annexed to the station office or the station member's room. About the number of installation, it is required to decide in consideration of the number of station members.

(5) Lighting Equipment

Appropriate lighting facilities shall be installed for station personnel offices, passenger platforms, and concourse areas. The illuminance and type of lighting equipment shall secure sufficient brightness by location, technique, and source of the lighting. Considering passenger convenience, safety and comfort, and the workability of station personnel, appropriate lighting levels shall be provided as follows.

Table 4.15 Standard Lighting Level

Area	Standard Lighting Level (lx)
Ticketing and Fare Adjustment	500
Concourse	300
Platforms	100
Station Offices	200
Passageway and Stairs	100
Toilets	100

(6) Proposal of the Installation Area of Station Facilities

We propose about the installation area of the station facilities in the Ben Thanh Central Station at 1st Phase on the basis of an installation base area required for each facility in a concourse floor and a platform. (Refer to Tables 4.16 - 4.17)
In addition, we propose the necessary area to control three lines at 2nd Phase. (Refer to Tables 4.18 - 4.19)

Table 4.16 The occupation area of the station facilities
in Ben Thanh Central Station (1st Phase)

【Facilities related to station members】

<table>
<tr><td colspan="2" rowspan="2">Designation</td><td>Ben Thanh Central Station</td><td colspan="2">（Reference: Tokyo Metro）</td></tr>
<tr><td>Occupation area (m^2)</td><td colspan="2">Required range (m^2)</td></tr>
<tr><td colspan="5">B 1 （Concourse: Community of Line 1 and Line 2）</td></tr>
<tr><td>1</td><td>Station Office</td><td rowspan="6">660＋190 = 850</td><td>180 × 2 Lines ＝ 360</td><td rowspan="6">732</td></tr>
<tr><td>2</td><td>Station member Room</td><td>1.3×25×2 Lines ＋ 35（Dining-room etc.）×2 Lines ＝ 135</td></tr>
<tr><td>3</td><td>Woman member Room</td><td>1.3 × 5 人 × 2 Lines ＝ 13</td></tr>
<tr><td>4</td><td>Assistant stationmaster’ bedroom</td><td>6 × 2 人 × 2 Lines ＝ 24</td></tr>
<tr><td>5</td><td>Station cleaning member Room</td><td>50 × 2 Lines ＝ 100</td></tr>
<tr><td>6</td><td>Passenger's Toilet (Including of Handicapped people's Toilet)</td><td>100 × 1 place ＝ 100</td></tr>
<tr><td>7</td><td>Signal Treatment Room</td><td rowspan="2">285</td><td>50 × 2 Lines ＝ 100</td><td rowspan="2">300</td></tr>
<tr><td>8</td><td>Conference Room</td><td>100 × 2 Lines ＝ 200</td></tr>
<tr><td>9</td><td>Ticket Counter</td><td>160 (Sum totals of three ticket gates)</td><td colspan="2">40 × 3 place ＝ 120</td></tr>
<tr><td>10</td><td>Season Ticket Counter</td><td>180</td><td colspan="2">150 × 1 place ＝ 150</td></tr>
<tr><td colspan="2">Total</td><td>1,475</td><td colspan="2">1,302</td></tr>
</table>

B 2				
11	The bedroom for men（early shift）	**480**	8 × 4 人 × 2 Lines ＝ 64	424
12	The bedroom for men（late shift）		8 × 4 人 × 2 Lines ＝ 64	
13	The bedroom for women		8 × 1 人 × 2 Lines ＝ 16	
14	Men station member's toilet		15 × 2 Lines ＝ 30	
15	Women station member's toilet		15 × 2 Lines ＝ 30	
16	Men station member's Lavatory and Bathroom		20 × 2 Lines ＝ 40	
17	Women station member's Lavatory and Bathroom		20 × 2 Lines ＝ 40	
18	Warehouse		70 × 2 Lines ＝ 140	
Total		**480**	424	
B 2， B 4 （The platform of Line 1 and Line 2）				
19	Waiting Room	**5**	5	
20	Platform arrangement member’s Room	**10**	10	
Total		**15**	15	

Table 4.17 The occupation area of the crew facilities in Ben Thanh Central Station (1st Phase)

【Facilities related to crew members】

Designation		Ben Thanh Central Station	（Reference: Tokyo Metro）
		Occupation area (m^2)	Required range (m^2)
B 1 （Concourse: Community of Line 1 and Line 2）			
1	Crew Office	**1,370**	180 × 2 Lines ＝ 360
2	Conference Room		30 × 2 Lines ＝ 60
3	Rest Room		20 × 2 Lines ＝ 40
4	Crew’s Room		50 × 2 Lines ＝ 100
5	Dining Room		60 × 2 Lines ＝ 120
6	Locker Room		60 × 2 Lines ＝ 120
7	Crew’s Bedroom		170 × 2 Lines ＝ 340
8	Crew's toilet		20 × 2 Lines ＝ 40
9	Crew's Lavatory and Bathroom		40 × 2 Lines ＝ 80
10	Warehouse		40 × 2 Lines ＝ 80
Total		**1,370**	1,340
B 2， B 3， B 4 （The platform of each line）			
11	Crew's standby Room	**5**	5
Total		**5**	5

Table 4.18 The necessary area to control three line (2nd Phase)

【Facilities related to station members】

<table>
<tr><th colspan="2" rowspan="2">Designation</th><th>Ben Thanh Central Station</th><th colspan="2">（Reference: Tokyo Metro）</th></tr>
<tr><th>Occupation area (m^2)</th><th colspan="2">Required range (m^2)</th></tr>
<tr><td colspan="5">Ｂ１（Concourse: Community of Line 1, 2 and 4）</td></tr>
<tr><td>1</td><td>Station Office</td><td rowspan="3">490 ＋ 350 = 840</td><td>180 × 3 Lines ＝ 540</td><td rowspan="3">782</td></tr>
<tr><td>2</td><td>Station member Room</td><td>1.3×25×3 Lines ＋ 35（Dining-room etc.）×3 Lines ＝ 222</td></tr>
<tr><td>3</td><td>Woman member Room</td><td>1.3 × 5 人 × 3 Lines ＝ 20</td></tr>
<tr><td>4</td><td>Assistant stationmaster’ bedroom</td><td rowspan="2">190</td><td>6 × 2 人 × 3 Lines ＝ 36</td><td rowspan="2">186</td></tr>
<tr><td>5</td><td>Signal Treatment Room</td><td>50 × 3 Lines ＝ 150</td></tr>
<tr><td>6</td><td>Station cleaning member Room</td><td>150</td><td colspan="2">50 × 3 Lines ＝ 150</td></tr>
<tr><td>7</td><td>Conference Room</td><td>300</td><td colspan="2">100 × 3 Lines ＝ 300</td></tr>
<tr><td>8</td><td>Ticket Counter</td><td>250</td><td colspan="2">40 × 4 place ＝ 160</td></tr>
<tr><td>9</td><td>Season Ticket Counter</td><td>150</td><td colspan="2">150 × 1 place ＝ 150</td></tr>
<tr><td>10</td><td>Passenger's Toilet (Including of Handicapped people's Toilet)</td><td>205</td><td colspan="2">100 × 1 place ＝ 100</td></tr>
<tr><td colspan="2">Total</td><td>2,085</td><td colspan="2">1,828</td></tr>
<tr><td colspan="5">Ｂ２（Between Line 1 and Line 4）</td></tr>
<tr><td>11</td><td>The bedroom for men（early shift）</td><td rowspan="8">720</td><td>8 × 4 人 × 3 Lines ＝ 96</td><td rowspan="8">636</td></tr>
<tr><td>12</td><td>The bedroom for men（late shift）</td><td>8 × 4 人 × 3 Lines ＝ 96</td></tr>
<tr><td>13</td><td>The bedroom for women</td><td>8 × 1 人 × 3 Lines ＝ 24</td></tr>
<tr><td>14</td><td>Men station member's toilet</td><td>15 × 3 Lines ＝ 45</td></tr>
<tr><td>15</td><td>Women station member's toilet</td><td>15 × 3 Lines ＝ 45</td></tr>
<tr><td>16</td><td>Men station member's Lavatory and Bathroom</td><td>20 × 3 Lines ＝ 60</td></tr>
<tr><td>17</td><td>Women station member's Lavatory and Bathroom</td><td>20 × 3 Lines ＝ 60</td></tr>
<tr><td>18</td><td>Warehouse</td><td>70 × 3 Lines ＝ 210</td></tr>
<tr><td colspan="2">Total</td><td>720</td><td colspan="2">636</td></tr>
<tr><td colspan="5">Ｂ２，Ｂ３，Ｂ４（The platform of each line）</td></tr>
<tr><td>19</td><td>Waiting Room</td><td>5</td><td colspan="2">5</td></tr>
<tr><td>20</td><td>Platform arrangement member’s Room</td><td>10</td><td colspan="2">10</td></tr>
<tr><td colspan="2">Total</td><td>15</td><td colspan="2">15</td></tr>
</table>

Table 4.19 The necessary area to control three line (2nd Phase)

【Facilities related to crew members】

Designation		Ben Thanh Central Station Occupation area (m^2)	(Reference: Tokyo Metro) Required range (m^2)
B 1 (Concourse: Community of Line 1, 2 and 4)			
1	Crew Office	**2,160**	180 × 3 Lines ＝ 540
2	Conference Room		30 × 3 Lines ＝ 90
3	Rest Room		20 × 3 Lines ＝ 60
4	Crew's Room		50 × 3 Lines ＝ 150
5	Dining Room		60 × 3 Lines ＝ 180
6	Locker Room		60 × 3 Lines ＝ 180
7	Crew's Bedroom		170 × 3 Lines ＝ 510
8	Crew's toilet		20 × 3 Lines ＝ 60
9	Crew's Lavatory and Bathroom		40 × 3 Lines ＝ 120
10	Warehouse		40 × 3 Lines ＝ 120
Total		**2,160**	2,010
B 2, B 3, B 4 (The platform of each line)			
11	Crew's standby Room	**5**	5
Total		**5**	5

3) Station Equipment

When the viewpoint of service to a user is also taken into consideration, the machinery of a station is equipment with many opportunities which I actually use or see for a user. For example, station equipment means equipment of ticket gate, a lift (escalator elevator), a platform screen door, etc. Here, we introduce the fundamental view and the main equipment about installation of station equipment.

Also at the Ben Thanh Central Station, we recommend installing these station equipments.

(1) Ticket Gate

Formerly, in the ticket gate of the station in Japan, the station member clipped the ticket with scissors, and collected the passenger's tickets. Recently, at the station of urban areas, the automatic ticket gate is installed for the simplification and economization of business. Many equipments of station office, station member's room and ticket counter, etc. are unified and economized.

There are several types of tickets according to the materials and functions.

a) Paper Tickets

Necessary information is printed on the paper.

b) Magnetic Tickets (Magnetic Stripe Cards)

Necessary information is recorded on a magnetic stripe on the paper or plastic card. Magnetic tickets made of plastic are recyclable.

c) IC Tickets

The necessary information is recorded on IC chips embedded in plastic cards, etc. IC cards function as SF (stored fare) cards and commuter passes. However, each passenger has to keep their own IC card.

Recently, the spread of the tickets of type corresponding to an IC card is progressing quickly, and advanced features of the ticket gate equipment corresponding to this are needed. Simultaneously, it is necessary to take into consideration the structure which is easier to use for the mobility impaired people.

Also in this project, the ticket shall be mainly a contactless IC ticket made of plastic in consideration of the future prospects of use on buses, in shops, and other places. However, it is necessary to install a ticket machine for a user without an IC card.

At least two ticket vending machines should be installed in order to ensure that they will operate properly. Those two machines should be located 1m apart from each other. Also, fare adjustment machines should be placed inside the ticket gate.

Ensure to keep extra space in case of additional machines will be required. Create a space for calculating and hand washing machine and air conditioner should be installed.

At least two ticket vending machines should be installed at one place. If an IC card system was to be implemented, it is expected that frequency of use will be lower, so that number of tickets to be sold per machine should be 150/hr, 1,400/day.

The number of installation of the station equipment in this project is shown.

・In 1st Phase

We recommend the number of "Passenger gate" in "Preliminary Design of Line 1 project" for operation of only Line 1.
Accordingly, 15 set / the number of ticket gates x 2 ticket gates = 30 sets.
As for the number of each ticket gate, it is preferable to install according to the width in front of a ticket gate.

・In 2nd Phase

The required number of automatic gates for this project are obtained from the following.

$$N = P \times C / T$$

Where;
N: Required numbers (unit)
P: Number of passengers per peak hour (people/hour)
C: Intensive volatility of passengers depending on events or
transfer from/to other transportation modes
T: Maximum number of processes per unit per hour (people/unit/hour)

In calculating the required number of the automatic ticket gate of 2nd Phase, we describe again the number estimation value of passengers of Ben Tyne Station ("4.1.2 Number of users at Ben Thanh Central Station").

Table 4.2 Result of Estimated Number of Users at Ben Thanh Central Station (Pax/day)

		2025	2050
Transfer	Line 1 <> Line 2	59,400	126,500
	Line 1 <> Line 4	38,300	50,100
	Line 2 <> Line 4	21,300	28,800
Station <> Outside		50,500	73,600
Total		169,500	279,000

From Table 4-2, since the number of passengers “Station <> Outside” is “73,600 Pax/day”, the passengers per peak hour is
73,600 pax/day x 0.2 (rate of peak per hour) = 14,720 (pax/hour).

On the other hand, the number of ticket gates will be four places.

Ｐ ＝ 14,720 pax / 4 parts ＝ 3,680 pax / 1 part
Ｃ ＝ 1.5 （Install in consideration of opening of an event）
Ｔ ＝ 50 pax / unit / minute ＝ 3,000 pax / unit / hour
Ｎ ＝ Ｐ×Ｃ／Ｔ ＝ 3,680 x 1.5 ／ 3,000 ＝ 1.84 ≈ 2 unit/ 1 part

In this project, we recommend installing eight automatic ticket gates [two sets x four places] in the ticket gate which we establish newly.

Next, although it is mentioned in the "Preliminary Design of Line 1 project" that “the number of Automatic ticket vending machines to be installed should be 9 unit/ 1 part in 2040”,iti is sufficient to install 9 unit x 2 parts = 18 machines considering the fact IC card is planned to be introduced.

(2) Automatic Fare Adjustment Machine

The fare adjustment machine is installed inside the ticket gates and used for fare adjustments, such as excess fare. This fare machine reads the ticket information when the ticket is inserted into the machine. At this time, the fare is deducted from the remaining balance on the ticket and any balance due is displayed. After inserting the necessary amount of money, an adjusted-fare ticket will be dispensed, with which the passenger can pass through the automatic gate.

About the Automatic adjustment machine in this project, two units should be installed at each gate in case the one stops its service for maintenance.

The required number in the following fiscal year of this project is shown in Table 4.20. However, about the time of installation, in consideration of the number of passengers, and an investment effect, it is necessary to discern suitable time so that it may not be overinvested.

Table 4.20 The number of installation of station equipment (Total)

Year	Automatic ticket gate	Automatic ticket vending machine	Automatic adjustment machine
2025	30	18	2
2050	38	18	2

(3) Lift (escalator, elevator)

In Japan of the aging society, a duty of installation of a lift (escalator elevator) is imposed aiming at barrier-free. Various escalators -- for example, a speed change type, a spiral type, or a horizontal level exists on the way -- are installed.

The guidelines for installation of escalators are as follows:

a) The escalator step width shall accommodate two people side-by-side.

b) In the part in which it can be constituted only one set, the escalator shall usually operate in the up direction, and the operation in the down direction shall be possible depending on passenger flow.

c) The escalator speed shall be approximately from 30 m/min to 40 m/min.

d) The step surface and comb plate shall have a slip-resistant design.

e) The demarcation lines such as yellow lines shall be added to clearly indicate the step and comb plate section for safety.

f) It needs attention to prevent women's national costumes from becoming caught in the escalator.

Then, the type corresponding to a wheelchair is installed in the elevator.
Furthermore, when using glazing (see-through type) structure, a prospect becomes good, the structure of a station is grasped visually, and there is an effect of criminal deterrence.

The guidelines for installation of elevators are as follows:

a) The entrance width shall be wider than 90 cm so that wheelchair users can get on and off smoothly.

b) The control panel inside and outside the elevator shall be installed in consideration of the position and display for wheelchair users and the visually impaired.

c) The voice guidance system shall be installed in the elevator car.

d) The elevator doors shall be equipped with glass windows that allow passengers to be seen from the inside or outside of the elevator.

e) Considering that passengers in wheelchairs can use elevators smoothly, the type of elevator shall be the walkthrough type, if available.

f) Flood measures shall be considered for the ground level.

Also at Ben Thanh Central Station, it is preferable to install an escalator or elevator in consideration of station structure, arrangement of a ticket gate and a station office, etc.

Here, we calculate the number of installation of the escalator in this project.

In Table 4.2, we calculate the number of installation of escalator from the numerical value of a "Line 1 < > Line 2" with most transfer number. In this case, we adopt the standard of Tokyo Metro.

Precondition: The numerical value per peak hour (Tokyo Metro standard)
Transport capacity of escalator (Form 1200type): 1.66 (pax/second) = 5,976 (pax/hour)
Amount of passenger flow: 0.85 (pax/m/second) = 3,060 (pax/m/hour)

・In the case of 2025 (Up-and-down passenger)
59,400 (pax) x 0.2 (the rate of a peak per hour) ＝ 11,880 (pax/hour)
11,880 (pax/hour) /5,976 (pax/hour) ＝ 1.99 ≈ 2 unit/ 1 part

Moreover, in order to build stairs, the transport capacity of escalator increases.
It would improve the quality of service for passengers if two escalators are installed in other areas.

・In the case of 2050 (Up-and-down passenger)

126,500 (pax) x 0.2 (the rate of a peak per hour) ＝ 25,300 (pax/hour)
25,300 (pax/hour) /5,976 (pax/hour) ＝ 4.23 ≈ 5 unit/ 1 part

Although our calculation shows that there will be 5 escalators are necessary, we propose installing 2 escalators.
However, it is expected to cause congestion situations on the platform.
Therefore, we calculate the width of stairs which must be wide enough for peak passenger flows.

25,300 (pax/hour) – 5,976 (pax/ hour) x 2 (unit) ＝ 13,348 (pax/hour)
13,348 (pax/hour) / 3,060 (pax/m/hour) = 4.36 (m) ≈ 4.4 (m)

For this project, we recommend to set the width of stairs between platform of Line 1 and Line 2 as 4.4 meters assuming not only the construction of Line 1 but also the construction of all three lines have been completed.
1.5~2.2 meters width should be enough for other stairs.

(4) Platform Screen Door、a platform fence of a movable type

Recently, the example which prepares a screen door between a platform and a track is increasing. The reason is for the purposes, such as preventing a passenger from falling from a platform, reducing a platform watchman's burden, and aiming at effective use of platform width.

There are two types. One is the "full-screen type" of the height covered to a ceiling, and another is the "fence type" of the height of the waist. A train door and a platform door are interlocked with both of the types, and open and close together. Therefore, the advanced driving skill for stopping within decided limits is required so that the position of both of doors may not deviate.

4) Passenger Information Display System in the Subway Station

There is much voice referred to as the passenger of a subway station “I do not know where the entrance is.” “I do not know where the exit is.” “I do not understand how to transfer.” There is needed the offer of the information in connection with suitable and effective guidance so that passenger can smoothly act within a station yard and a train.

It is preferable to devise a design, a sign, a color, etc. also at Ben Thanh Central Station, and it is preferable to guide a passenger to the destination not waver.

(1) Guidance signboard

We explain the main guidance signboard for every setting position.

(a) Station entrance

Subway logo mark……………………Illuminate from inside. In order to show the entrance of a station, we hang up the signboard in which the subway logo mark is shown over a conspicuous position.

Station name signpost…………………Illuminate from inside. We put up a station name post.

Wall type station name signpost………Illuminate from inside. We display a station name and a subway line name on the wall of a gateway section.

First train and last train timetable ……Illuminate from inside. We publish the timetable which first rain time and last train time.

When installing a shutter in an entrance, it is good to install in the outside.

(b) Concourse

Display of a stop station………………Illuminate from inside. We install in the wall of the front of platform stairs. When it cannot install, or when hard to see, we install in an intelligible position.

Ground exit guidance display…………Panel system. We install the surface of a wall of guidance zoon and near an entrance turning point. As for the number of information of a surrounding landmark, less than ten places are intelligible.

Station vicinity map……………………Same as "Ground exit guidance display"

(c) Near a ticket gate

All the subway line figure ……………Panel system. We install in the surface of a wall outside a ticket gate.

Fare table………………………………Panel system. We install in the ticket machine upper part.

Entrance sign of a ticket gate …………Panel system. We install on an automatic ticket gate and display the direction of an exit and platform guidance.

(d) Platform

Timetable………………………………We put up the timetable of "Weekday", "Saturday and Holiday."

The map of a transfer, the map of facilities…………We put up a pillar etc.

Station Yard Map………………………It is stuck on a signboard. When a transfer in other lines is complicated, we express a station yard in three dimensions, and guide an intelligible transfer route.

Ticket gate guidance sign………………It is stuck on a pillar or a wall. When there are two or more ticket gates, the direction of a ticket gate and surrounding landmark information are shown. The written contents of landmark information presuppose that it is the same as a ground exit guidance sign.

The station map which stops……………The map which displays the name of the station in a line.It is intelligible when it indicates according to a direction.

Automatic onboard indicator for train information………Train time, a destination, etc. are shown.

(e) Inside the train

The station map which stops ……………It is an electrical scoreboard form. It is notified on the upper part of a door.

Line network diagram……………………It is notified on the upper part of a door.

(2) Automatic onboard indicator for train information

It is equipment for providing information in advance to a passenger. Moreover, since it can also perform broadcast of passenger guidance, dangerous prevention, etc., it is considered about safety.

(3) Guidance for a visually impaired person

The guidance board by the voice type and the touch type…………It is installed near a ticket gate or a ticket machine.

Braille-type plate …………………… It is installed in all the stairs and handrails of all the stations.

Guidance chime………………………It is installed near an entrance, a ticket gate, and a ticket machine.

Tactile ground surface indicator, Braille block ……… It is installed in a passage, a platform, a concourse, etc. from the ground to a platform.

5) Machine and Equipment facilities

(1) Air Conditioning, Ventilation equipment

In a subway station, normally the air-conditioning system is used for keeping a high quality of air since it is difficult to let fresh air in from outside. Also, the ventilation system and smoke ventilation system should be installed to ensure passenger safety in the event of a fire breaking out.

(2) Water Supply and Drainage

Water is needed for toilets for station personnel and passengers, hot water supply, cleaning, and fire equipment. The facilities for water supply and drainage in each station shall be installed assuming that water supply and sewerage systems are already prepared. The daily water requirements of a station are as follows:

1) For station personnel and cooling water for air conditioning facilities, approximately 35 m^3 per day shall be assumed.
2) For toilet use, approximately 1.5 m^3 per 10,000 passengers per day shall be assumed.
3) For water for fire fighting, the water requirement shall be considered in the future in compliance with standards such as local fire laws.

As drainage facilities, septic tanks shall be installed to treat toilet and domestic wastewater. After the treatment complying with local wastewater standards, wastewater is drained to the outside of railway facilities.

For septic tank capacity, the targeted number of persons shall be assumed approximately 0.8% of the number of boarding and alighting.

(3) Necessary dimension of Machinery room

Based on an installation base area required for each machinery facilities in a concourse and a platform, we propose the installation area of the machinery facilities in Ben Thanh Central Station.
The area of the machinery facilities of Line 1and Line 2 is shown in Table 4.21 - 4.22.
However, finally it is necessary to perform a detail design about a required area.
In addition, we propose the area of machine facilities required for Line 4 to Table 4.23.

Table 4.21 The occupation area of the machinery facilities in Ben Thanh Central Station ofLine 1

【Facilities related to machinery of Line 1】

Designation		Ben Thanh Central Station		(Reference: Tokyo Metro)	
		Occupation area (m^2)	Space height (m)	Required range (m^2)	Space height (m)
B 1 (Concourse)					
1	Air Handling Unit Room	**1,280**	**5.4**	1,000～2,050	4.5～5.0
2	Electric Supply Room	**1,290**	**5.4**	200	4.5～5.0
3	Signalling/Telecomunication		**5.4**	250	4.0
4	Emergency Electric Room		**5.4**	200	4.5～5.0
5	Drain Pump Room		**5.4**	50	4.0
6	Hygiene Pump Room		**5.4**	25	4.0
7	Hygiene Ventilation Room		**5.4**	6	
8	Fire Service & Water Tank & Pump Room		**5.4**	50	4.0
9	Water Supply Pump Room		**5.4**	50	4.0
Total		**2,570**		1,831～2,881	
B 2					
10	Substation Room	**900+500**	**6.5**	1,100	more than 5.0
11	Tunnel Ventilation Fan Room	**Beginning side 740+510 End side 600+430**	**6.5**	Beginning side and End side 700 ～ 800	4.5～5.0
Total		**3,680**		1,800～1,900	

Table 4.22 The occupation area of the machinery facilities in Ben Thanh Central Station of Line 2

【Facilities related to machinery of Line 2】

Designation		Ben Thanh Central Station		(Reference: Tokyo Metro)	
		Occupation area (m^2)	Space height (m)	Required range (m^2)	Space height (m)
B 3 (The floor of a transfer)					
1	Air Handling Unit Room	**1,000**	**6.4**	1,000～2,050	4.5～5.0
2	Electric Supply Room	**490**	**6.4**	200	4.5～5.0

3	Emergency Electric Room		**6.4**	200	4.5～5.0
4	Signalling/Telecomunication	**560**	**6.4**	250	4.0
5	Drain Pump Room		**6.4**	50	4.0
6	Hygiene Pump Room		**6.4**	25	4.0
7	Hygiene Ventilation Room		**6.4**	6	
8	Fire Service & Water Tank & Pump Room		**6.4**	50	4.0
9	Water Supply Pump Room		**6.4**	50	4.0
10	Substation Room	**1,100**	**6.4**	1,100	more than 5.0
Total		**3,150**		2,931～3,981	
Ｂ４（platform）					
11	Tunnel Ventilation Fan Room	**Beginning side 680 End side 680**	**6.5**	Beginning side and End side 700 ～ 800	4.5～5.0
Total		**1,360**		1,400～1,500	

Table 4.23 The occupation area of the machinery facilities in Ben Thanh Central Station of Line 4

【Facilities related to machinery of Line 4】

Designation		Ben Thanh Central Station		（Reference: Tokyo Metro）	
		Occupation area (m^2)	Space height (m)	Required range (m^2)	Space height (m)
Ｂ２（The floor of a transfer）					
1	Air Handling Unit Room	**1,240**	**6.5**	1,000～2,050	4.5～5.0
2	Electric Supply Room	**900**	**4.6**	200	4.5～5.0
3	Signalling/Telecomunication		**4.6**	250	4.0
4	Emergency Electric Room		**4.6**	200	4.5～5.0
5	Drain Pump Room		**4.6**	50	4.0
6	Hygiene Pump Room		**4.6**	25	4.0
7	Hygiene Ventilation Room		**4.6**	6	
8	Fire Service & Water Tank & Pump Room		**4.6**	50	4.0
9	Water Supply Pump Room		**4.6**	50	4.0
10	Substation Room	**790(+540)**	**6.5**	(1,100)	more than 5.0
Total		**2,930**		2,400～3,650	

Ｂ３　(The both ends of Line 4 platform)					
11	Substation Room	**540(+740)**	**5.4**	1,100	more than 5.0
12	Tunnel Ventilation Fan Room	**Beginning side 1,290 End side 560+380**	**7.9 7.9,6.5**	Beginning side and End side 700 ～ 800	4.5～5.0
Total		**2,770**		1,800～1,900	

6) Communication Facilities

Communication facilities have very important role in a station – they provide information to passengers and ways of contact with each other to station staff. “Public address facilities”, “passenger information display system” and “clock system” shall be recommended as telecommunication facilities for passenger services. CCTV Monitoring System is also recommended to maintain passenger safety and to monitor the station.

(1) Public Address Facilities

Public address facilities are used to broadcast information on train operations and emergencies to passengers in the station. Usually, an automatic broadcast is made to all stations or to specified stations via centralized control. Furthermore, an independent broadcast is enabled for each station.

(2) Passenger Information Display System

For the passenger information display system, a display panel is installed on the platform of each station to indicate the departure time of trains, operational status, and other information.

(3) Closed Circuit Television (CCTV) Monitor System

The CCTV monitor system is installed to monitor the status (flow of passengers at the station concourse) in the station yard for each station. The monitor cameras are installed at the station entrance, stairs, escalators, and platforms. On the platform, in particular, the system is used by train crews and station service staffs to confirm the safety of passengers from arrival to departure of a train.

7) The structural measurements of each floor (height, width) and a proposal

Regarding the height and width of the structure, each line is based on F/S, and we are considering the compatibility of station facilities for Ben Thanh Central Station.
The result was that there is no difficulty in the F/S proposal for each line’s 2D figure.

As for the longitudinal line figure, it is the advantage that the lines are shallow, but when passing Ben Thanh Central Station of line four, plenty of space is necessary in order to start the shield machine, and due the offset needed at the intersection where Line 1 crosses Le Loi Street, we determined the current F/S rail level is valid.
In accordance with that, the measurement of each floor was decided the height necessary for

the machinery facilities and necessity of earth covering, and the rail level for line was calculated.
Therefore, keeping in mind, the R.L. of Line 4 at Ben Thanh Central Station and the construction of Le Loi Street, the current R.L. of the F/S investigation is valid.

From that, the height of the structure was considered, the R.L. of Line 1, and the height of the concourse are deliberated, it was discovered that by securing the necessary amount of earth covering the necessary height for the facilities in the underground space and concourse can be secured. Therefore, the height of Line 1 R.L. and the measurements of the structure were determined.

8) Air Conditioning, Ventilation equipment on the platform or concourse

In a subway station air –conditioning and ventilation systems are equipped with platform, concourse, station offices and communication facilities room in order to improve the internal air circulation for the human and operating devices.
At the same time, a smoke control system is also equipped to ensure passengers' safety in the event of a fire.

9) Tunnel ventilation system

High density of train operation causes a temperature rise in the subway tunnels.
Especially it is greatly affected by the exhaust when using air-conditioning system.
Therefore, ventilation system and smoke exhaustion systems are installed to control a temperature rise and provide fresh air and safe evacuation routes for passengers in case of fire and the train stops inside the tunnel.

There are two types of ventilation, that is "Longitudinal ventilation system" and "Ventilation tower system between stations".
The former is the system that blows the air and the airflow moves in the same direction the train runs along the track.
The latter is the system that exhausts air from the ventilation tower between stations.
For this project, we recommend to a longitudinal ventilation system which is used mainly in a parallel single track shield tunnel.
In this case, station should have its own air supply and exhaust system.
Figure 4.16 shows the standard descriptions of the ventilation system facilities.

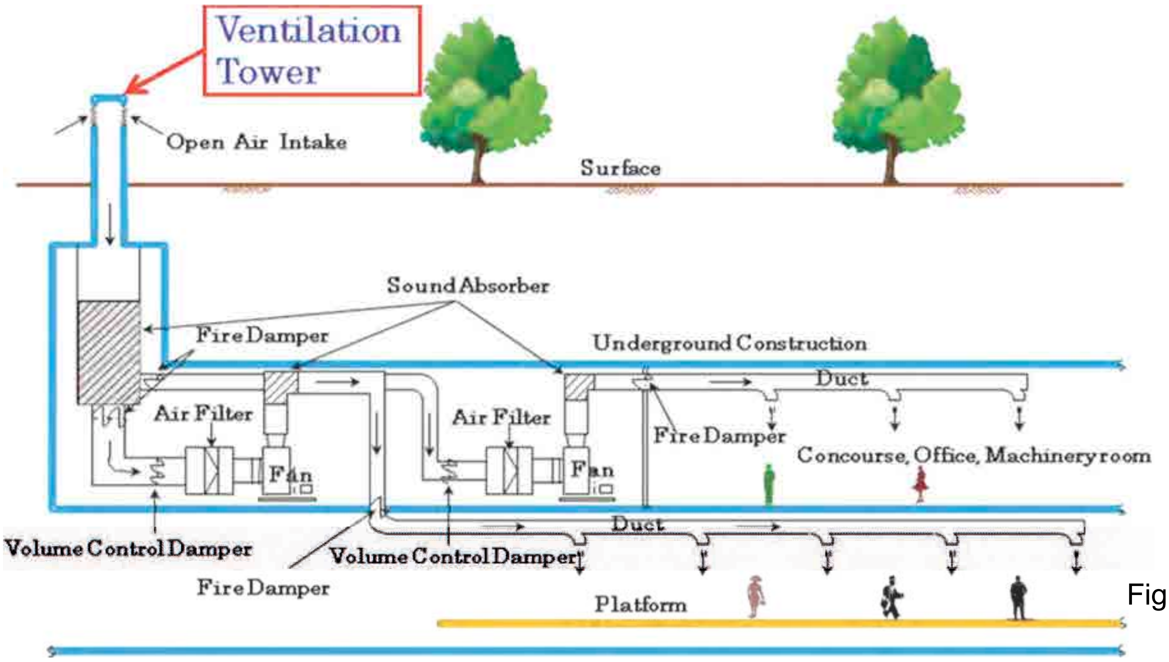


Fig 4.20 Ventilation Tower Equipment Outline (open air intake case)

10) Regarding fire prevention measures and the related equipment

Japan has standards for fire prevention measures that must be followed when building an underground railway.

We will introduce Japan's standards for fire prevention measures here, and we recommend that the same measures be implemented into this project.

(1) Standards for Fire Prevention Measures in Japan

(a) Fireproof building structures

All building structures underground should be made non-burnable.

(b) Install of a disaster prevention monitoring room

A disaster monitoring room should be set up in the station where information is collected, communication and commands is carried out, and staff is always present to give passengers guidance as well as monitor the fire prevention shutters.

(c) Install alarm and warning devices

i) Alarm devices

All stations should be equipped with automatic fire detection devices which transmit the information to a receiver in the disaster prevention monitoring room.

ii) Warning devices

The following equipment should be installed in the stations;

・Communication equipment for communication between the disaster prevention monitoring room and the fire department, the police department, traffic control at the Integrated Control Center as well as within the station and the other buildings in the area.

・A unified public announcement equipment should be installed in the disaster prevention monitoring room.

・A wire-less back-up antenna should be provided in the disaster prevention monitoring room to ensure that communication is possible with those above ground.

(2) Regarding security

(a) Fireproof building structures

As a rule, they are built using non-flammable materials, and non-flammable materials should be used for furniture as well such as desks and lockers.

(b) Cables should be heat resistant and non-burnable

Equipment for disaster prevention should be as fire resistant as the building standard laws and fire prevention laws state and electric power supply cables must be heat and fire resistant for all intended purposes.

(c) Sectionalize for fire control

For instead the station, other than the platform, the station is sectionalized by fire prevention shutters and non-flammable floors, walls and fire doors are located within every 1,500m2, in order to ensure and escape route and to prevent the fire from spreading.

(3) Types of disaster prevention equipment

Disaster prevention equipment can be broadly divided into five categories

(a) Fire-fighting equipment

Equipment that detects and displays the outbreak of a fire, equipment to put out a fire, such as fire extinguisher, and equipment to prevent a fire from spreading, such as fire door, fire shutters are installed

(b) Ventilation equipment

Smoke exhaust equipment to discharge smoke, and smoke barriers are installed to prevent smoke from spreading.

(c) Evacuation guidance equipment

Public announcement equipment can be heard throughout the station premises, and emergency lighting with illumination intensity in case of a black out, and guidance lights to indication the evacuation route are installed.

(d) Communication and liaison equipment

Communication equipment for emergency contact with police and fire departments as well as buildings which have direct access, and intercoms between rooms on the station premises, an in-house telephone, a regular telephone and a telephone used exclusively for contact with the Integrated Control Center are installed.

(e) Other

Also, a private power generator and storage batteries are installed in case of a blackout, in order to provide the power needed for disaster prevention equipment.

(4) Smoke Exhaust Equipment

By using smoke exhaust equipment to discharge smoke outside and preventing it from permeating the station premises, it is possible to ensure that an escape route is available and people can evacuate with confusion, and also fire-fighting activities can be carried out effectively.

As for the concourse and rooms to be occupied, the distance between the ventilation shafts, and the location of the manual closing devices is decided, and it is necessary to make the ventilation shaft and ducts non-flammable, airtight and install fire spreading prevention equipment.

(5) Evacuation guidance equipment

(a) Guide lights

Types of guide lights can be divided according to where they are located, such as the evacuation door guide light, passageway guide light, stairway guide light.

(b) Emergency lighting

Fluorescent lights with self-contained batteries or incandescent lamps are used for emergency lighting, taking into consideration reliability and economic efficiency. They should be able have enough power to be lit for at least one hour.

(6) Automatic fire alarm equipment

Through the receiver, transmitter, detection device and sound alarm, a fire is quickly detected automatically, not only warning the people in the building, but also the precise location of the outbreak is shown in the disaster prevention monitoring room.

(7) Emergency alarm equipment

Should an accident occur or fire breakout, it is possible to communicate with each location by using the warning button, to report the location and what the emergency is.

A regular phone can also be used to communicate.

11) The view and the equipment of inundation measures

It is necessary to install the equipment corresponding to inundation for the purpose of protecting a subway from protection from a flood, the river flood by local severe rain, etc.

There are the following openings in the opening of a subway -- for example, --(1) a station entrance, (2) a ventilation opening and a ventilation tower, and (3) a tunnel part (tunnel pithead) underground connected from the ground. As a plan which prevents a flood, we recommend the following thing.

(1) We install a waterproof-board and a watertight door in a station entrance.

(2) We install an inundation prevention machine in a ventilation opening.Since the opening of a ventilating tower exists in a high position, we install a board in the direction into which rain cannot enter easily.

(3) We install a waterproofing wall or gate in a tunnel pithead.

However, these are unnecessary in the high area of the foundation.

On the other hand, as for operation of a waterproof-board and operation of the inundation prevention machine of a ventilation opening, it is preferable to operate it by directions of the Operation Control Center or judgment of the station. We recommend that the operation method can be made to do the following thing,

(1) Remote control from the Operation Control Center or from the distribution power board of each station,

(2) The automatic closed door by an inundation sensor,

(3) Manual operation in the spot.

12) The Concept of Smooth access and Transferring

The followings are the concept of barrier-free and universal design in Japan, and we recommend to install these facilities in Ho Chi Minh City.

(1) Barrier- free

We, railway industries are required to follow the barrier-free guidelines when building a large-scale facilities regardless of the number of passengers.

The main guidelines are;

(a) All platforms should have at least one pathway to a station.

(b) Screen doors, Half-height platform doors, guide blocks should be installed at platforms to prevent falling and accidental injury or death.

(c) Provide space (140cm x 135cm) for wheelchairs to turn around in the elevators.

(d) Install slopes to eliminate the gap (if there is any) between elevator and floor.

(e) Install stair lifts, automated ticket vending machine and multipurpose toilets which are easy-to-use for wheelchair bound and elderly passengers.

(f) Install guide blocks that provide both warning and guidance on where to go and facilities to provide information for individuals with impaired vision and hearing.

(g) Stairways should be equipped with slopes on both sides.

(h) Provide enough space for wheelchairs to turn around at the hallway.

(i) Provide with a place (facilities) to rest.

Those above guidelines make it possible for elderly and disabled people to travel more safely and convenient. We have once established the system that reflects elderly and disabled people's opinion at the start of a station plan. This maybe works well for Ben Thanh Central Station.

(2) Universal Design

An idea of barrier-free environment is a space that allows free and safe movement, function and access for the elderly and people with disabilities; however, it is practically used by people of all ages and abilities in different situations and under various circumstances. Thus, it is important to make an environment as "accessible" "easy to understand" "user-friendly" . The environment means buildings, stations, roads, parks and other places, service, products of daily use, etc.

Universal Design, on the other hand, is targeting all people both without and with disabilities. In recent years, there are many stations and station facilities are built using universal design features. However, "design for all people" could mean high cost. Thus, the important point that will help to achieve high leveled universal design is to find the right balance between user's need and cost-effective and increase options.

13) Tasks and Countermeasures for Subway Station Plan at Ben Thanh Central Station

The followings are the tasks and countermeasures for subway station plan at Ben Thanh Central Station.

(1) Construct a subway station that provides easy access and convenience to passengers

(a) Task

It is necessary to ensure passengers convenience and easy access when designing a station structure as four lines (Line 1, Line 2, Line 3a and Line 4) will operate at Ben Thanh Central Station.

(b) Countermeasure

Reviewed the following points;

- Rationalize the system for easy and smooth transferring considering passengers' flow line including walking distance.
- Making a flow line plan which is barrier-free and easy to use for all passengers , especially the elderly and disabled.
- Convenient location of the subway station entrance for passengers

(c) Result

Regarding transferring and barrier-free flow plan, ensure to keep a barrier-free route from ground–level station entrances to the platform by elevator and escalator considering passengers' flow line.

As to the location of subway station, it is necessary to consider the surroundings and the path which does not intersect from an entrance to a ticket gate.

(2) The station plan in consideration of safety and relief

(a) Task

It is essential to ensure passengers' safety in the event of an emergency such as the fire.

The task will be to secure an evacuation route for passengers to evacuate to the ground and passenger flow line in case of an emergency. Also, flood prevention measures will be needed for basement floor.

(b) Countermeasure

Reviewed the following points;

- Anticipated passengers' flow line at the time of disaster
- Secure evacuation route in case of an emergency
- Prevent water from flooding

(c) Result

In consideration of emergency evacuation route, an anticipated passengers' flow at the time of disaster should be reviewed. Also, it is recommended to take into consideration the location of exits and entrances, ventilating hole and ventilation tower when reviewing flood prevention measures.

(3) Station Plan without disrupting the town's environment

(a) Task

The ventilation facilities subway station would require a ventilation tower which you can see above ground. It is important to be careful not to disrupt the town’s environment when allocating a ventilation tower.

(b) Countermeasure

Reviewed the following points;

・shape of the ventilation tower
・size of the ventilation tower
・quantities

(c) Result

Although detailed design work should be carried out for the shape, the size and numbers of the ventilation tower, at this point we propose the shape, the size and numbers that would not disrupt the town's environment.

4.3.3 Underground Pedestrian Network Planning

The underground pedestrian network will feature integrated placement of underground pedestrian passageways that connect to subway stations as well as bus terminals and other public transport facilities and the basement floors of adjacent private sector buildings, in order to increase both the convenience and comfort of pedestrians traveling underground. This network will encourage pedestrians to stroll around and will enhance coordination between individual facilities, and it will serve as the foundation for mutual growth. In this way, the underground pedestrian network will form a center for local cooperation in central Ho Chi Minh City and will be an infrastructure facility that contributes to regional development.

The planning of this underground pedestrian network will be conducted from the following perspectives.

- Establishment of the basic axis for pedestrian passageways and an intuitive pedestrian passageway layout
- Liaison between public transport facilities and private sector buildings in the surrounding area
- Placement of underground plazas at strategic locations to form centers and provide richness to the underground environment

The following sections will cover each of these perspectives in detail. Figure 4.21 shows an overview of the overall network.

1) Establishment of Basic Axis for Pedestrian Passageways and Intuitive Pedestrian Passageway Layout

Underground environments have no buildings or sun or other landmarks as in the case of above-ground areas, and it is difficult for pedestrians to recognize directions or even to know in which direction they are heading. For this reason, if underground pedestrian passageways are given a complicated layout, they will become mazes, and it will be difficult for pedestrians to travel to their desired location. To prevent this from happening, a main passageway is established to serve as the basic axis for the pedestrian passageways, and then other pedestrian passageways are placed at right angles to this main passageway in order to create an intuitive pedestrian passageway layout.

For this project, the main pedestrian corridor will be the axis leading from Opera House Station along Le Loi and then passing through the underground plaza in front of the Ben Thanh Market and on to the bus terminal at Twenty-Three September Park. The subway stations and bus terminals and other public transport facilities will be placed along this basic axis, and many private sector buildings in the surrounding area will also be placed adjacent to this basic axis to make it the main route for pedestrian travel. As the basic axis will have a great volume of pedestrian traffic in the underground area around Ben Thanh Station and will be adjacent to subway stations and shops, it should be planned as a single wide pedestrian passageway. However, out of consideration for the fact that the volume of pedestrians will be reduced in the area beneath Le Loi, and to ensure connectivity with the private sector buildings on both sides of Le Loi and to encourage pedestrians to stroll around, it will be planned as two pedestrian passageways.

Supplementary pedestrian passageways are placed at right angles to the main pedestrian passageway that serves as the basic axis. These will be passageways that connect to the BRT Terminal beneath Ham Nghi (street) and other public transport facilities and private sector buildings.

In this way, the layout of the main passageway that will serve as the basic axis and the pedestrian passageways that intersect this main passageway at right angles will form a layout plan that will be easily understandable to pedestrians.

2) Linkage to Public Transport Facilities and Private Sector Buildings in Surrounding Area

Linkages will be established along the underground pedestrian passageway with various public transport facilities and private sector buildings in the area. The pedestrian passageways for linkage to these establishments will be the main passageway and the supporting passageways that intersect the main passageway at right angles. It is particularly important for these supporting passageways to have the most effective layout possible to ensure connectivity. This is because, for connection to public transport, highly convenient pedestrian passageways are needed to accommodate the flow of passengers transferring to other means of transport, and it is important to enable passengers to move without wasting time and effort.

To ensure connectivity to public transport facilities in this project, passageway layout planning will consider the following connections.

- Joint Ben Thanh Station ← → Bus terminal (beneath Twenty-Three September Park)
- Joint Ben Thanh Station ← → BRT terminal (beneath Ham Nghi street)
- Joint Ben Thanh Station ← → Ground level transport

The passageway planning will also take into consideration future connectivity with private sector buildings in the area. Connection to these private sector buildings will expand the pedestrian network, as there are corridors in the interior of these buildings, and it will increase access to more distant areas for pedestrians passing through the corridors inside the building. In this way, connectivity will be expanded throughout the surrounding area.

3) Placement of Underground Plazas at Strategic Locations to form Centers and provide Richness to Underground Environment

The passageways making up the pedestrian network will extend connectivity in the area. However, it is important for the network to not consist solely of passageways, but rather for it to have underground plazas as well. These underground plazas will serve as landmarks in the underground environment, providing pedestrians with a means of identifying their current location. There will also be resting places for pedestrians while walking or waiting for people, providing richness to the passageway network. For this reason, the underground plazas will be planned with atrium spaces that lead to ground level and so on to ensure that they help to create an attractive urban environment.

In this project, two underground plazas with large atriums will be placed adjacent to the joint Ben Thanh Station, one on the northeast side and one on the southwest side. In coordination with ground level planning, the underground plaza on the northeast side will be placed in front of the Ben Thanh Market to provide underground access to the Ben Thanh Market from the underground passageways. The underground plaza on the southwest side will connect to the bus terminal beneath Twenty-Three September Park as well as providing access to the park itself. Moreover, these underground plazas will secure a gathering place for people next to the entrance gates to the station, as well as providing a place for them to rest or when waiting for others.

In addition, in the area under Le Loi, underground plazas will be placed at the intersections with Nam Ky Khoi Nghia and Pasteur in accordance with the locations of ground level blocks, in order to help pedestrians traveling underground recognize these locations.

In this way, the underground pedestrian network will be accented with underground plazas to create a more intuitive underground environment and provide pedestrians with a more convenient and comfortable underground pedestrian space.

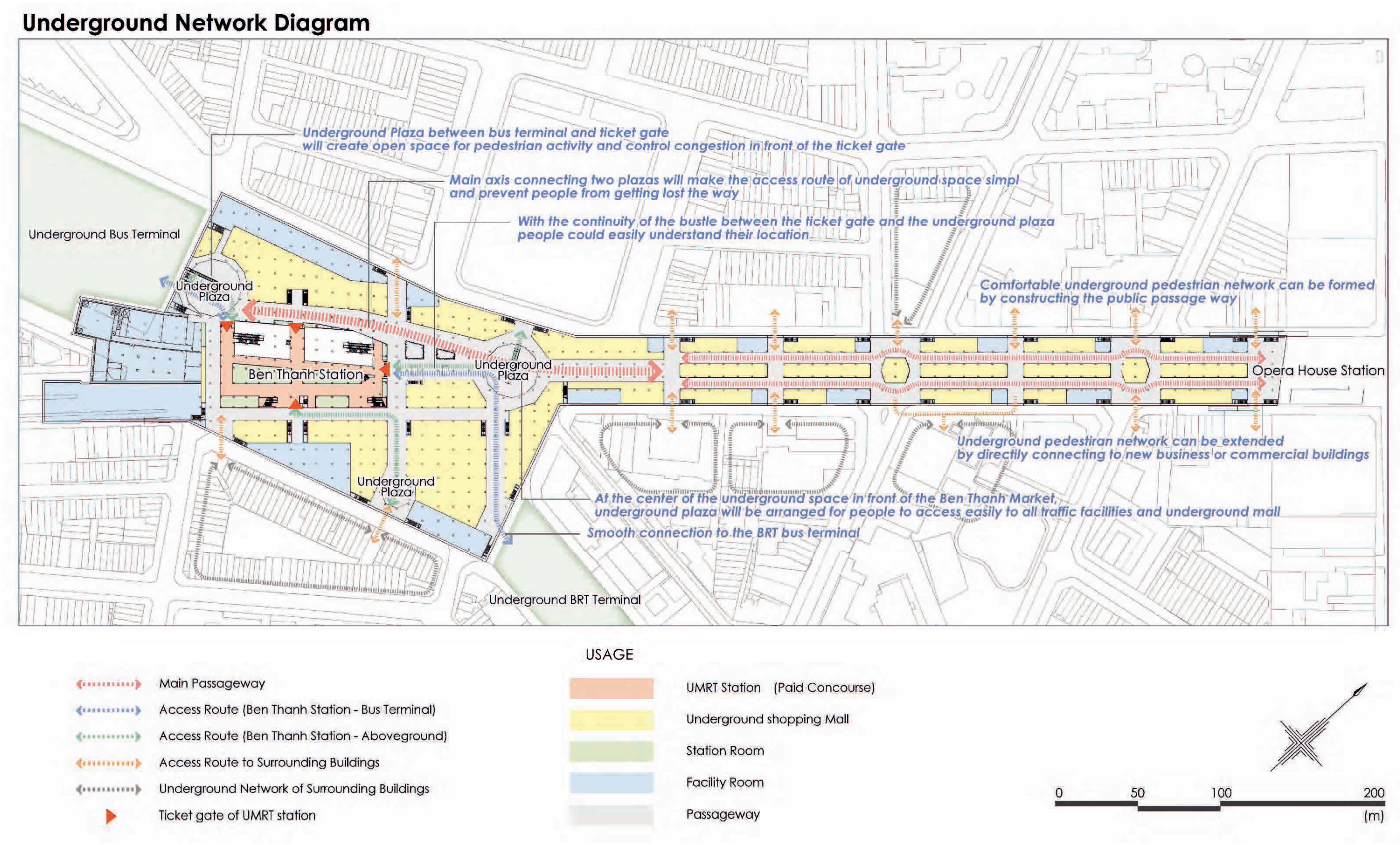


Figure4.21 Pedestrian Network in Underground Development

4.3.4 Underground Shopping Mall Planning

1) Layout Planning

(1) Planning for Underground Shopping Mall around Ben Thanh Station

- Underground plazas will be placed centering on the Ben Thanh subway station, beneath Le Loi on the northeast side and next to the bus terminal on the southwest side, to serve as the starting points for the underground pedestrian network. The layout of underground pedestrian passageways will give consideration to providing underground connectivity with the surrounding area.
- Underground pedestrian passageways will be placed around the Ben Thanh subway station to accommodate the flow of pedestrians and encourage pedestrians to stroll around. Shops will be provided facing the station to provide vitality and avoid creating a maze-like environment.
- The underground pedestrian passageways that connect the two underground plazas will admit natural lighting through the atriums of the subway station platforms and the skylights placed at ground level, incorporating the ground level scenery and forming an integrated environment between the underground and ground level spaces.
- To the greatest degree possible, shops and emergency evacuation stairs will be located in the sections that face the underground pedestrian passageways and underground plazas, while out of consideration for access from surrounding buildings the main equipment rooms and sorting spaces will be concentrated on the side next to the surrounding neighborhood.
- The locations of the emergency evacuation stairs, elevators and escalators will be determined through coordination with ground level planning.

(2) Planning for Underground Shopping Mall around Le Loi

- Two underground pedestrian passageways will be provided to connect the Ben Thanh and Opera House subway stations. Underground plazas (which are effective in disaster prevention) and emergency evacuation stairs will be placed at the end and middle of the section that connects to Opera House Station. This will ensure safety and encourage pedestrians to stroll around, as well as creating an underground environment that is rich in variation.
- Safety zones (which are effective in disaster prevention) and emergency evacuation stairs will be placed between the underground plazas. Like the underground plazas, these will provide underground connectivity with the surrounding area.
- To the greatest degree possible, the sections facing the underground pedestrian passageways and underground plazas will be provided with shops and show windows and the like to create the vitality appropriate for a shopping mall.
- The equipment rooms, toilets, etc. will be placed facing the underground plaza and safety zone so they do not break up the shop area.
- The locations of emergency evacuation stairs will be determined in coordination with ground level planning.
- The locations of elevators and escalators will be determined based on coordination with ground level planning as well as the planning conducted to ensure connectivity with neighboring buildings.

2) Disaster and Evacuation Planning

(1) Basic Policy

- Due to their public character, closed nature and other attributes, underground shopping malls must have a higher level of fire protection and safety measures than ordinary buildings. Planning must naturally give priority to preventing the outbreak of fire as well as, in the event of fire, preventing the spread of fire and ensuring safe evacuation.
- Planning must be based on connectivity with underground subway stations, neighboring buildings and redevelopment planning in the surrounding area. In the connecting sections as well, planning must give priority to preventing the spread of fire and ensuring safe evacuation.
- In case of the flood due to the heavy rainfall or the high tide, the planning must prevent the water coming into the underground space and ensure the safe for underground pedestrian.

(2) Disaster Planning

(a) Fire Prevention

- Fire zones are established for areas with a total area of 3,000 m^2 or less or 500 m^2 or less in the case of a shop zone, under the assumption that the structures are of fire-resistant construction and are equipped with automatic fire extinguishing equipment.
- The Ben Thanh subway station and the underground pedestrian passageways will be established as fire zones. Safety zones, as double fire zones, will also be established for the underground pedestrian passageways that intersect subway station evacuation routes.
- In the underground shopping mall beneath Le Loi, the plazas (which are effective in disaster prevention) and safety zones will be established as a fire zone with a total area of 3,000 m^2 or less that includes shops and underground pedestrian passageways.
- With regard to the underground connectivity between the Opera House subway station, the bus terminal and the neighboring buildings will be connected via the plazas (which are effective in disaster prevention) and the safety zones, and the connecting zones will be connected by means of either a double fire zone or a sunken garden.
- All of the fire zones in the underground shopping plazas will be planned as fire or smoke control zones. The shutters along the evacuation routes will be 2-stage drop-down shutters.
- The smoke control zones will be 300 m^2 or less in the case of the underground pedestrian passageways, and 500 m^2 or less in areas other than underground pedestrian passageways.
- Shops and underground pedestrian passageways will be equipped with mechanical smoke control mechanisms. Plazas (which are effective in disaster prevention) and safety zones will be equipped with automatic smoke control mechanisms.

(b) Flood Prevention

- In order to prevent the water coming into the underground space in case of the flood due to the heavy rainfall or the high tide, the planning makes the same flood prevention level as the planning of UMRT Line 1.
- As for the on-ground structure like the entrance, the atrium, and the ventilation tower, the concrete parapet wall should be constructed around that structure in principle, and the height

of the wall must be more than the flood prevention level.

- The flood prevention sheet must be installed at the entrance. The sheet automatically stands up in case of the flood and protects the underground space from the flood.

(3) Evacuation Planning

- The walking distance to the emergency evacuation stairs will be planned as 40 meters from each shop and underground pedestrian passageway, based on the assumption that the structures will be of fire-resistant structures with nonflammable interior furnishings.
- For evacuation to the emergency evacuation stairs inside the plazas (which are effective in disaster prevention) and safety zones, in order to prevent the fire from spreading and ensure the safe evacuation of the general public, the area in which the fire occurred and the zone on the opposite side will instantly be closed through a fire alarm interlock, and the fire shutters in the underground pedestrian passageway on the side of the area in which the fire occurred will form a shutter sequence in which the fire shutters descend in two stages to secure the evacuation width. In addition, the system will guide evacuees in the opposite direction from the location in which the fire occurred.
- The fire shutters in the plazas (which are effective in disaster prevention) and the underground pedestrian passageways in the safety zone will be combined with evacuation doors from the standpoint of ensuring that people are able to escape from the area of the fire and evacuate in two directions following the closure of the shutters.
- The emergency evacuation stairs will be 1.5 meters or more in width. The exact width will be determined based on the evacuation calculations and the volume of traffic in the stairs and passageways.
- For evacuation in the sections connecting to the subways stations, bus terminal and neighboring buildings, independent evacuation plans will be established for each section, for use following the closure of the connecting area zones in the event of a fire.

3) Above-ground Planning

In planning underground shopping malls and above-ground facilities, it is essential to secure the functions of the underground shopping malls, and to coordinate efforts with the urban planning of surrounding districts and the landscaping plans for above-ground areas. Coordination is needed for the location and design of stairs and elevators in underground shopping malls as well as atriums, skylights, air intake and exhaust towers, cooling towers and so on. In addition, the idea of providing flood barriers and flood panels for use in the event of water inundation should be studied.

(1) Stairs

- Stairs that are used exclusively for evacuation will be 1.5 meters or more in width. Other stairs will be determined by the amount of traffic and the service level of the stairs and passageways.
- Stairs that are used on a daily basis will be provided with roofs to ensure safety, and to make it unnecessary to use umbrellas on rainy days.

- The placement of stairs and ventilation towers together will be avoided. Stairs will be isolated and will have a simple design.
- Handrails and roofs will be made of glass to provide transparency and blend in with the surrounding environment.

(2) Atrium and Skylights

- The atrium will bring in natural lighting and visually integrate the underground shopping mall with the ground level. Its design will make it a landmark of both below-ground and ground level structures.
- The skylights will have a design that functions both to bring in natural lighting and exercise natural smoke control.

(3) Ventilation Towers

- An ventilation tower for air intake and exhaust will be placed in each block of the ventilation system in the underground shopping mall, in coordination with the ground level planning.
- Air intake towers will have a height of three meters or more in order to take in fresh air. The towers will be made of glass in order to minimize their presence.
- Exhaust towers will also provide smoke control functions. As they will emit foul odors, they will have a height of three meters or more. They will have a design that distinguishes them from air intake towers in order to hide the polluted matter.
- For ventilation towers that require a large area, and those that cannot be placed on top of roads due to above-ground planning considerations, the idea of using sites in the surrounding area will be studied.
- As cooling towers require a large area, the idea of using sites in the surrounding area will be studied.

4) Electrical Services

(1) Receiving and Transformer Facilities

- It is envisaged that the method of receiving electricity will be the 3-phase, 3-wire 22kV single circuit method that is most common in Vietnam. For improvement of reliability, it is desirable to have two circuits receive electricity, if possible.
- Distribution of electricity to all parts of the underground mall will be via auxiliary electrical rooms. The number of locations and the positions of installation of the auxiliary electrical rooms will be determined taking into consideration the low voltage distribution distance and the load capacity. The distance from the auxiliary electrical rooms to each part of the underground mall will be set to be about 150 to 200m or less straight line distance.
- The transformer for the heat source will be provided adjacent to the heat source machine room.
- Measures against water seepage will be taken for the electrical rooms, piping for other uses will not pass through the electrical rooms, and other comprehensive measures against water damage will be taken.
- Dry type electricity receiving and transformer equipment will be adopted from the viewpoint

of fire prevention.

- High efficiency power receiving and transforming equipment will be adopted, to achieve energy efficiency by reducing transformer losses.

(2) Electrical Generators

- Electrical generator power sources will be supplied for the following loads, in order to ensure safety of the underground mall.
    1) Power for disaster prevention
    2) Power for water drainage
    3) Safety lighting for passageways
    4) The main communication equipment, important communication and information related equipment, various monitoring devices, etc.
    5) Elevators
- The generators will be ordinary air-cooled diesel generators, and will be installed at two locations, taking into consideration the shape of the facility and the layout of the electrical rooms. Chimney and ventilation tower to cool the radiators will be provided.
- It is necessary to locate the ventilation shafts in a position close to the generator rooms, so it is necessary to examine the locations of the generator rooms and the associated locations of the ventilation shafts above ground.
- Fuel tanks will be located buried in the ground nearby. However, if it is not possible to locate the fuel tanks in the nearby ground because of circumstances such as buried objects, etc., space will be provided as an indoor storage facility within the underground mall.

(3) Trunk Line Facilities

- Low voltage trunk lines will be distributed by cable rack. (3-phase, 4-wire 380/220V)
- Tenant trunk lines will be provided after determining the rental conditions. In particular, electrical power supply for restaurants/cafes kitchens has a major effect on the total power demand of the underground mall, so this will have to be examined sufficiently.

    Reference rental criteria: Retail 200VA/m^2
    Restaurant/cafes: 750VA/m^2 (assuming electrical kitchen equipment)

- Installing tenants' distribution boards in the electrical pipe space of the common area will provide tenant power supply.
- Electricity meters will be centrally located within the tenants' distribution boards for ease of management.

(4) Lighting Equipment

- The lighting scheme will harmonize with the interior design of the underground plazas, underground walkways, and stairs. Light sources will be mainly high efficiency, long life LEDs that light instantly.
- The lighting intensity for each part will depend on the underground mall development policy. The light from the shops will affect the design lighting intensity of the common areas, so it is considered that 500Lx to 1000Lx is sufficient.
- Taking into consideration that this is an underground space, the underground plazas and the

underground walkways will be capable of being supplied with electrical power from the generators, so that sufficient lighting can be ensured during power cuts. (About 100 to 200Lx provided when lighting is powered by the generators.)

(5) Telephone and Information Communication Equipment

- A main distribution board room will be provided adjacent to the location where telephone is brought in, to simplify the incoming route. To improve the reliability, bringing in telephone from several locations will be examined.
- Distribution ducts will be laid to the shops for the cabling for telephone and various pieces of information communication equipment, and a sufficient number will be laid in advance. (Number of ducts 5 to 6.)
- If necessary, a telephone exchange for management use will be provided. Also, intercom will be installed at the specific essential locations for communication at entrances and exits at nighttime, etc.
- Cable routes and equipment installation space will be provided as measures to eliminate mobile phone dead zones.

(6) Broadcasting Equipment

- There will be announcement broadcasting and BGM broadcasting, combined with emergency broadcasting.
- The broadcasting system will be divided into blocks according to use, such as shops, passageways, etc., and according to zone, and will be capable of broadcasting to each block.

(7) Television Reception Equipment

- A reception antenna will be installed on the ground in a suitable location, from which TV signals will be distributed to each tenant.
- This is not necessary for all shops, so cabling and equipment will be installed to the electrical pipe space of each block, and will be provided to shops that wish to receive it.

(8) Emergency Warning Equipment

- In locations where it is considered that communication is necessary in an emergency, such as toilets, etc., emergency call buttons will be installed, which will communicate with the disaster prevention center in an emergency.

(9) Crime Prevention Equipment

- Monitoring cameras will be installed at the necessary locations in the underground mall, such as the underground plazas, underground walkways, stairs, elevators, etc., and monitoring will be carried out from the disaster prevention center.
- Also, the monitored images will be recorded using a disk recorder.
- For important rooms and backyard entrances and exits, etc., entry/exit control devices will be installed to control entry and exit. Control of entry and exit will be by electrical lock control, and the locks can be opened by coupling with fire detection equipment.

(10) Disaster Prevention Equipment

(a) Fire detection equipment

- Fire detection equipment will be installed in accordance with the criteria in the fire prevention plan.
- The system will be designed to have the following function.
  1) Detectors will be an analog detectors and an alarm will be displayed for each detector
  2) Early detection of a fire using pre-alarms
  3) An automatic inspection function will be provided
- Shutters or other automatic closing devices will be installed for compartmentalizing fire prevention zones.
- The following combined control for the shutter control method will be carried out in accordance with the concepts for forming fire prevention zones.
  1) Coupling control for forming initial zones using fire detection sensor alarms
  2) Individual control to prevent spread of smoke to adjoining areas using special sensors
- Also, the equipment will enable manual operation from a fire prevention panel, so that closure can be carried out at the operator's discretion by determining the situation using monitoring cameras, etc.

(b) Emergency Broadcast Equipment

- Emergency broadcast equipment will be installed in accordance with the criteria of disaster prevention plan. The equipment will be also used for normal business use.
- A broadcast amp will be installed in the disaster prevention center, coupled with a fire alarm receiver, so that when a fire alarm is raised, a fire warning can be automatically broadcast.
- Emergency broadcast areas will be divided in accordance with the fire prevention and smoke prevention zone settings, so that it will be possible to broadcast in each block, in accordance with the state of fire occurrence and state of zone formation.

(c) Emergency Lighting and Guide Lighting

- Emergency lighting and guide lighting will be provided in accordance with the criteria of the disaster prevention plan.
- Emergency power supplies will be provided within the fittings.
- Emergency lighting will provide illumination of passageways of about 101Lx, and will have direct current power source individually fitted.
- The guide lighting will have on/off control or off control in order to more clearly indicate the evacuation direction, in accordance with the closure of shutters for forming fire prevention zones.

(d) Disaster Prevention Panel

- A disaster prevention panel will be installed to enable central monitoring and operation of all disaster prevention equipment.
- A disaster prevention center whose safety is ensured will be provided, and the disaster prevention panel will be installed in the center.

(e) Central monitoring equipment

- A central monitoring panel will be installed in a central control room, where central monitoring and control of equipment such as power supply equipment, air conditioning and ventilation equipment, water supply wastewater, and plumbing equipment, lighting equipment, transport equipment, etc.
- Data on the various measurement values necessary for management and operation will be collected.
- Central metering of electrical power and water supply will be carried out for the quantities used by each tenant at each location, etc., and it will be possible to read and record all the quantities used in the central control room.
- The quantity of electrical power used will be measured, and data collection and analysis will be carried out using a Building Energy Management System (BEMS) to support energy efficient operation.

5) Air Conditioning Equipment

(1) Heat Source Machine Room

- A high efficiency centrifugal chiller will be installed in the basement 1st floor heat source machine room. The chiller will be divided into three or four units to cope with transporting in and out, inspection, and breakdown.
- The heat source method will be determined taking into consideration energy efficiency and environmental considerations, etc.
- A cooling tower for the chiller will be installed on the ground near to the heat source machine room.

(2) Air Conditioning Equipment

- An external air handling air conditioner that is combined with ventilation equipment, and single duct air conditioner will be installed in basement 1st floor machine room. Machine rooms will be provided at the rate of one location per 3,000m^2, approximately.
- The air conditioners and ducts will be divided into a shop system (external air handling air conditioner), a public underground walkway system (single duct air conditioner), and a public underground plaza system (single duct air conditioner), as independent systems respectively.
- Fan coil units (FCU) for individual load processing will be installed dispersed in the shops and public underground plaza.
- Chilled water piping will be provided to shops to deal with loads that exceed the rental criteria, and additional FCUs will be installed as required as separate work by tenants.
- A dedicated air heat source heat pump air conditioner will be installed in the disaster prevention center.

(3) Ventilation Equipment

- Dedicated ventilation equipment will be installed in food and beverage establishments, kitchens, and toilets.
- Ventilation machine room will be combined with smoke extraction room, and provided at the rate of one per 3,000m^2.

- Dedicated ventilation equipment will be provided in the disaster prevention center.
- The ventilation equipment will be divided into systems for electrical rooms, generator rooms, heat source machine rooms, other machine rooms, and store rooms, etc., and dedicated ventilation equipment will be provided for each.

6) Plumbing Equipment

(1) Water supply Equipment

- The standard water supply system will include a water tank room on the basement 1st floor in which a water tank and a pressurized water supply pump unit is installed, to supply water to all necessary locations.
- The miscellaneous water system will include a concrete water tank below the floor of the basement 1st floor, from which water will be supplied by a pressurized water supply pump, and used for flushing toilets.
- A concrete water tank will be provided below the floor of the basement 1st floor for the cooling tower replenishment water system, from which water will be supplied to the cooling tower using a pressurized water supply pump.

(2) Hot Water Equipment

- Electrical hot water heaters will be provided dispersed to each location where they are required.

(3) Plumbing Equipment

- Water saving equipment will be adopted.

(4) Wastewater and Aeration Equipment

- Separate foul water and miscellaneous wastewater systems will be used to collect the water in wastewater tanks, and the water will be pumped up and discharged into the main sewerage pipes.
- Wastewater from the kitchens of food and beverage establishments will be collected into a kitchen wastewater tank as an independent wastewater system, and the water will be pumped up and discharged into the main sewerage pipes. If necessary, kitchen wastewater treatment equipment will be provided.

(5) Fire Extinguishing Equipment

- A pump for fire extinguishing water will be provided in the basement 1st floor, and sprinkler devices and indoor fire extinguishing hydrants will be provided.
- Connected water delivery pipes will be installed. Water outlets will be installed at locations where fire trucks can easily approach, and water outlets and hose will be provided in all parts of the underground floors at an average spacing of 50m.
- Hood type fire extinguishing equipment will be provided in kitchens for food and beverage establishments. (Separate tenant construction.)

4.3.5 Ground Level Plan

The plan of site area is going to be regulated by the urban planning law that will come into effect, based on “the study on the formulation of urban construction detailed planning on scale of 1/2000 and urban architectural management regulation at level 2 for the existing center of Ho Chi Minh City”(referred as “The Legal Plan”), conducted by DPA. The Legal Plan is drawing up the zoning plan at 1:2,000, the architecture and landscape plan at 1:500, and the building design guidelines. In November 2011, the Assessment Committee (AC) was summoned by the City and discussed about the plan. As of December 2011, the Legal Plan is being finalized corresponding to opinions at the AC and ready for approvals by the Peoples’ Committee (PC), which is scheduled to be held in February 2012.

Considering this progress of the urban planning of Ho Chi Minh City, in this survey not only the ground level plan under current traffic arrangement is studied, but also the ground level plan based on the urban planning is studied and proposed. However, the proposed ground level plan shows the planning policy for the underground development which is main theme in this survey. The landscape design and the shape and design of on-ground structure like atrium should be studied and determined through the consultation with the relevant parties in the next detail design stage.

Therefore, as for the structures above grade such as the atrium, stairs, and ventilation towers which are necessary for the underground development, the location of these structures is studied and the ground level plan is proposed as the planning policy. However, for the easy comprehension the perspective views of some design options of the structure above grade are shown for reference. As shown in these views, many options for the height and the shape of the structures above grade can be studied and designed. The ground level design should be discussed and determined through the consultation with the relevant parties in the next detail design stage.

1) Ground Level Plan under Current Traffic Arrangement

(a) Ben Thanh Station Area

The center of the existing roundabout in front of Ben Thanh Market is called Quach Thi Trang Plaza. This plaza is located at almost same point as the underground plaza. Therefore the atrium planned in the center of the underground plaza is located in Quach Thi Trang Plaza. The diameter of this atrium is approximately 20m. In this plan the location of the bust of Quach Thi Trang and the statue of General Tran Nguyen Han is same as current point. The height of the atrium is bellower than 3.5m not to interrupt the view toward Ben Thanh Market. In addition, it needs to consider the detail design of elevated podium wall not to have rain water run into the underground.

In September 23rd Park two atria are planned. One is in the center of the underground plaza and the other is located above the Line 1 platform. These atria connect the ground level and the underground level, so the underground space can be impressive with natural sunlight.

On the other hand, currently there is a bus terminal on the south side of the Ben Thanh Market, however this bus terminal is determined to be relocated to the west side of September 23rd Park for the construction of UMRT Line 1. In this area the pedestrian space is planned with the bus stops of several bus routes. The atrium above the underground plaza is located in this area, so the underground station will be connected with the bus stops on ground.

The ground level plan under current traffic arrangement is shown as following.

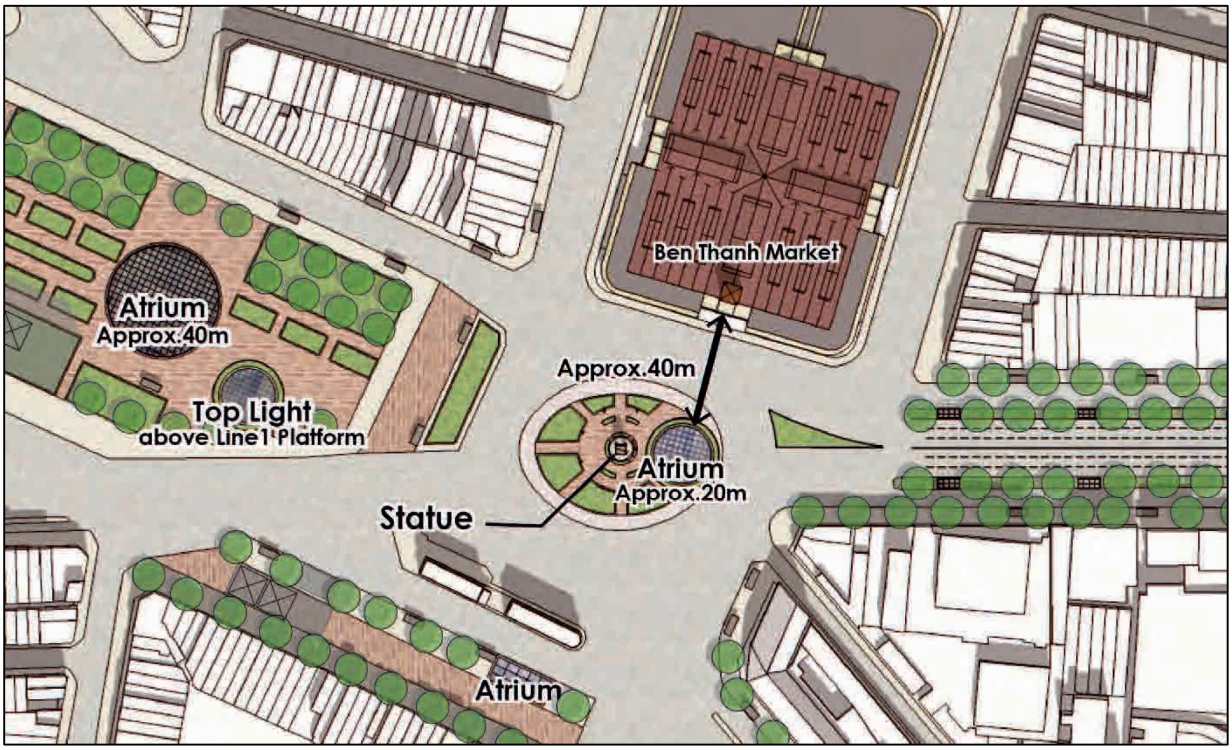


Figure 4.22 Ground Level Plan in Ben Thanh Station Area
(under Current Traffic Arrangement)

The perspective views of some design options in Ben Thanh Station area are shown in Figure4.23 and Figure4.24 for reference. In addition, for reference of the next detail design stage, Table 4.24 indicates both advantage and disadvantage regarding the atrium design such as its shape and height. In this table, the following issues are compared. The impact on the city landscape, mainly for Ben Thanh Market, the connection of accessibility and natural light between underground space and ground level, and location of statues.

In this survey, option 3 or option 3a are recommended, from the view point of the accessibility and the effects by a natural light.

(a) No Atrium

(b) Atrium（H=1.0m）

(c) Atrium（H=3.5m）

(d) Atrium（H=3.5m、Arch Shape）

Figure 4.23 Overall Perspective View in Ben Thanh Station Area
(under Current Traffic Arrangement)

(a) No Atrium

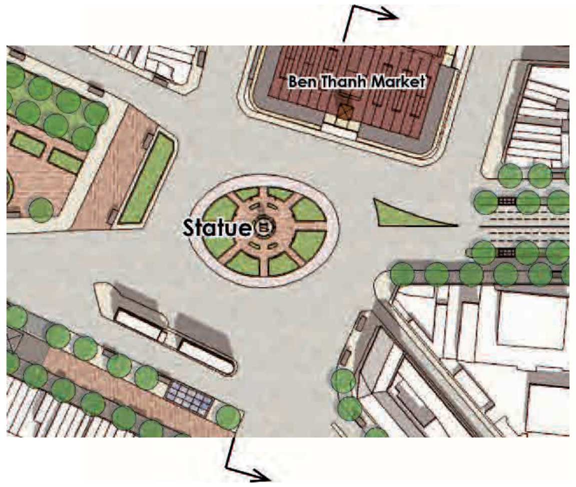
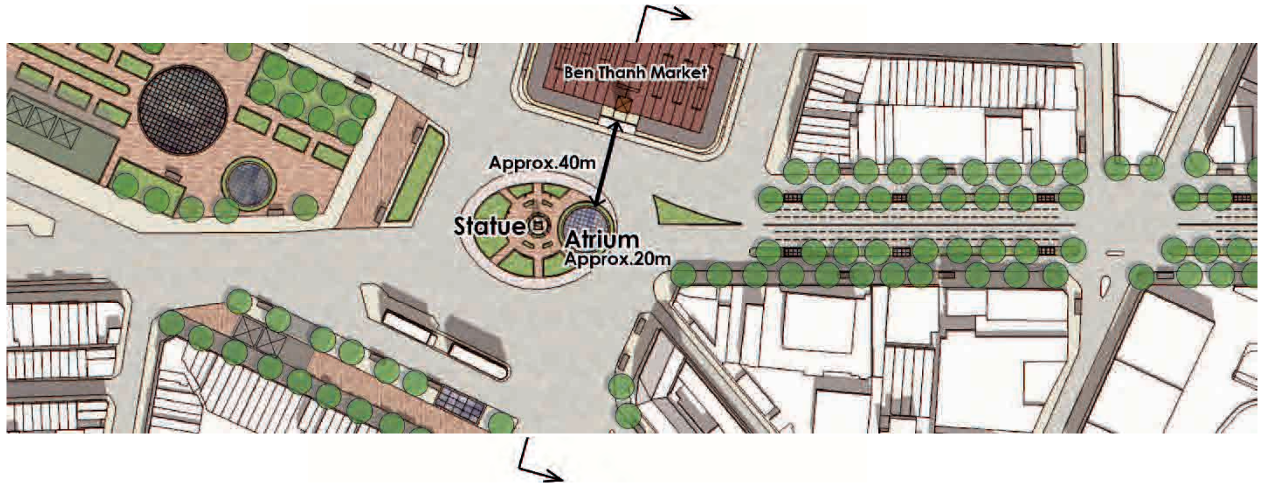
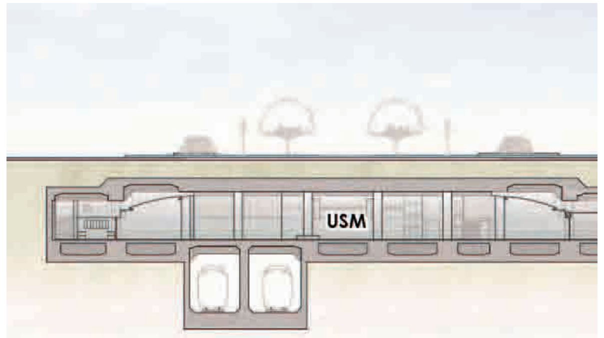
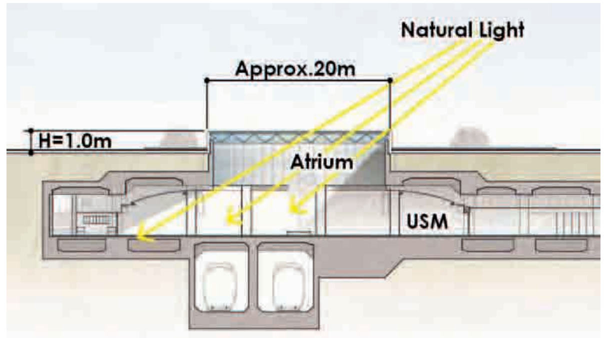
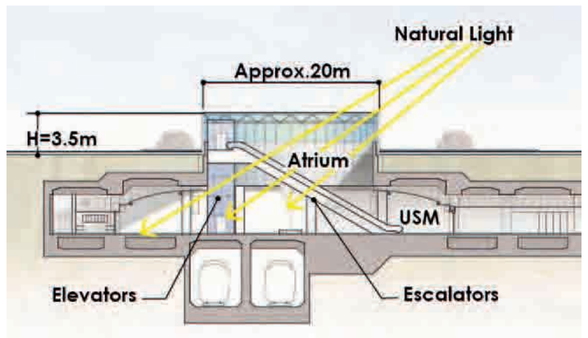
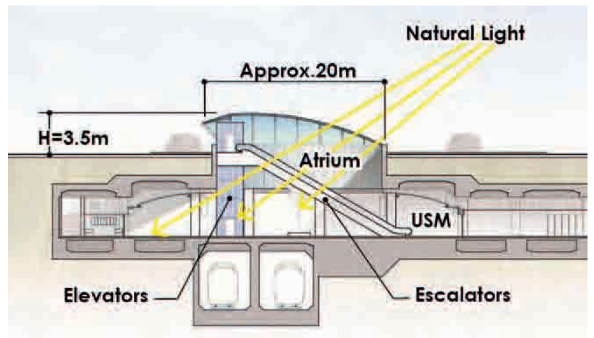
(b)　Atrium（H=1.0m）

(c)　Atrium（H=3.5m）

(d)　Atrium（H=3.5m、Arch Shape）

Figure 4.24　Eye-Level View in Ben Thanh Station Area
(under Current Traffic Arrangement)

Table4.24 Comparative Study for Ground Level Plan under Current Traffic Arrangement (For Reference)

	Option 1 No Atrium	Option 2 Atrium (H=1.0m)	Option 3 Atrium (H=3.5m)	Option 3a Atrium with Arch Shape (H=3.5m)
Plan				
Section				
Perspective View				
Impact on Scenery	・ There is no change for the scenery in front of Ben Thanh Market.	・ There is small change for the scenery in front of Ben Thanh Market.	・ There is some change for the scenery in front of Ben Thanh Market. ・ The high rise atrium will create new landscape.	・ There is some change for the scenery in front of Ben Thanh Market. ・ The arch shaped atrium will create new landscape.
Statue	・ Statues are able to be kept at the same location as current.	・ Same as Option 1	・ Same as Option 1	・ Same as Option 1
Entrance	・ There is no entrance to underground plaza.	・ Same as Option 1	・ The entrance with elevators and escalators to underground plaza can be designed.	・ Same as Option 3
Natural Light	・ There is no natural light poured into underground space.	・ Natural light can be poured into the underground space through glazed atrium.	・ Same as Option 2	・ Same as Option 2
Connection between Underground and Ground level	・ There is no accessibility between underground and ground level. ・ The attractive underground urban space can not be created.	・ The attractive urban space can be created because of the underground space connected with ground level through the atrium. ・ However People cannot move from underground plaza to ground level pedestrian space.	・ The attractive urban space can be created because of the underground space connected with ground level through the atrium. ・ People can easily move from underground plaza to ground level pedestrian space.	・ Same as Option 3
Recommendation	**C** **Not recommendable**	**B**	**A** **Recommendable**	**A** **Recommendable**

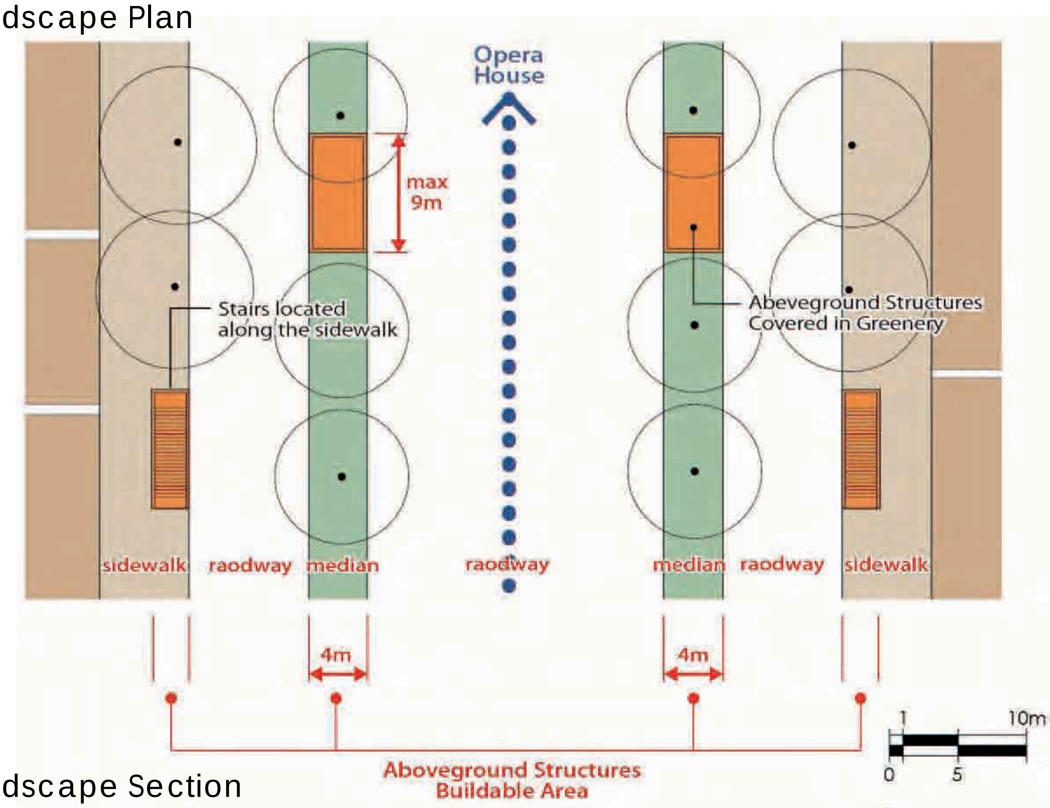
(b) Le Loi Street Plan

Le Loi Street has automobile lanes in the middle and the motorbike lane on the both sides. The median is located between the automobile and motorbike lanes, and sidewalks are on the both edge of the Street. Along Le Loi Street there will be structures from underground, such as staircases, and ventilation towers. The planning policies for the structures excluding the structures of UMRT are set as follows:

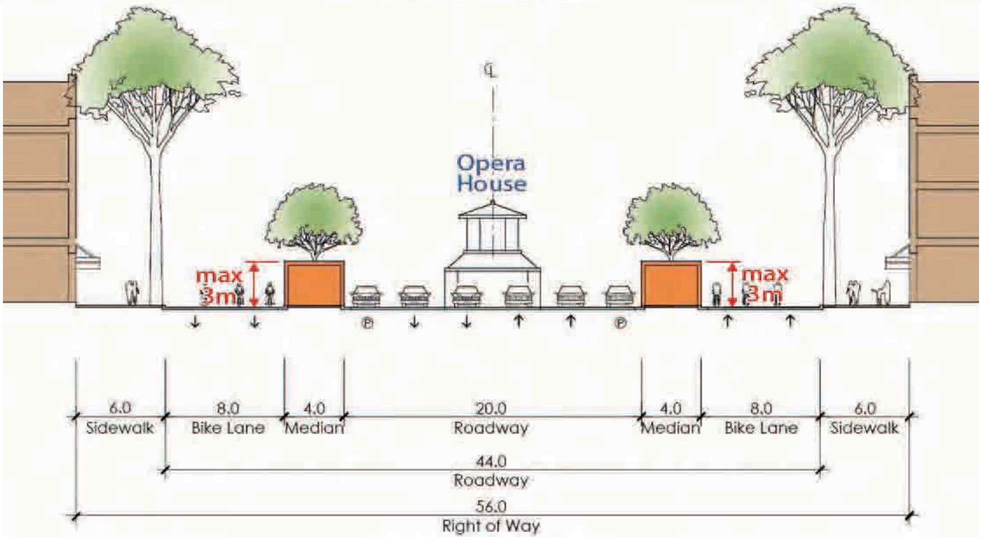
- It is preferred that PC requires the developers of future redevelopment projects along the Street, to accommodate some of the structures in their site or inside the building, if possible.
- The ventilation towers are installed in the median. The staircases are located in the sidewalk.
- In order to mitigate the massiveness of structure, the size of structure shall be approximately less than 9m at length, less than 3m at height.
- Structures shall use glassy transparent material to mitigate the massiveness, or green wall to contribute to the environment and Le Loi landscape.

Figure 4.25 Incidents for Structures above Grade

Landscape Plan



Landscape Section



Landscape Image

Figure 4.26 Basic Plan, Section, and Perspective View of Le Loi Street (under Current Street Condition)

2) Ground Level Plan based on Urban Planning of Ho Chi Minh City

(1) Concept

The ground level plan based on the urban planning of Ho Chi Minh City, which will be soon approved by the Peoples' Committee, is studied and proposed in this section. The site area is under the jurisdiction of the architecture and landscape plan by the Legal Plan. It sets the goals in the site area as follows:

- Le Loi Street will be a great pedestrian oriented transit mall. It will also provide a vista toward Opera and the landscape harmonizing with the historic buildings.
- The existing roundabout in front of Ben Thanh Market will change to be a new pedestrian station plaza, surrounded with the historic buildings as a heart of the city.

The Ground Level Plan is required to apply these goals above, by considering the size and location of the machines and structures from the underground levels, such as staircases, elevators, atriums, and ventilations, and coordinating with the plan for Le Loi Street transit mall and Ben Thanh Plaza, by the Legal Plan.

However, the proposed ground level plan shows the planning policy for the underground development which is main theme in this survey. The landscape design and the shape and design of on-ground structure like atrium should be studied and determined through the consultation with the relevant parties in the next detail design stage.

In addition, the Legal Plan is assuming that it will take about 25years to complete their goals. There is much possibility that Line 1 is developed sooner than Le Loi Street and Ben Thanh Plaza redevelopment. In this case, the phasing is assumed as follows:

- In phase one, to restore to its original condition at the time when Line 1 is built.
- In phase two when Ben Thanh underground development will be completed, to build Le Loi Street and Ben Thanh Plaza according to the Legal Plan.

(a) Ben Thanh Plaza Plan

The ground level plan based on urban planning of Ho Chi Minh City is shown in Figure4.27. As shown in this figure, There are three underground plazas. Each plaza is covered with atrium connecting the ground level and the underground level, so the underground plaza can be an impressive space with natural sunlight, casting from the atrium.

The underground plaza locates in front of September 23rd Park and in front of Ben Thanh Market. Setting the diameter of the atrium above about 40m and making it large to some extent, an attractive underground plaza space is created. The large plazas also helps solve disorientation problem that any underground developments likely to have, because it has the clear difference from other underground spaces by size.

The atriums above grade are assumed that they are round-shape, transparent and low thermal emissive structure. The height of each atrium is bellower than five meter to not to interrupt the view toward Ben Thanh Market. In addition, it needs to consider the detail design of elevated podium wall not to have rain water run into the underground.

(i) Ben Thanh Plaza and the Atrium

- Each plaza has a symbolic atrium which diameter is from 20m to 40m.
- Locating the atrium along the center line of the vista from both Le Loi Street and September 23rd Park, it works as a focal point.

- To not to interrupt the view toward Ben Thanh Market, the height of atrium shall be moderate and the distance from other atriums shall be more than 30m.
- The height of the Atrium elevated podium wall for rain water protection shall be higher than flood level. Drainage gradient is set outward from the atrium.
- In order to ease air condition load, Low-e glass and perforated panel are installed in the top of atrium. In addition, it allows the atrium to be illuminated with light from the underground.
- The historic façade of Ben Thanh Market and other buildings around the plaza, and the massive greenery trees in September 23rd Park that can be seen from Ben Thanh Plaza, should be main scenic resources to attract people to the plaza. Thus, the design of atriums shall not be vivid and fancy one to not to interrupt these resources.

(ii) The Statues in the Roundabout in front of Ben Thanh Market

The center of the existing roundabout in front of Ben Thanh Market is called Quach Thi Trang Plaza. There are the portrait bust of Quach Thi Trang who is the origin of the name of the plaza, and the bronze statue of General Tran Nguyen Han. The Legal Plan is planning to relocate these statues to the other side of Ben Thanh Plaza. The location of new Ben Thanh Plaza atrium in the Ground Level Plan is right next to the original location of statues. Therefore, it is capable of keeping the original location of statues by modifying the shape of the atrium, if it is necessary.

The perspective views of some design options in Ben Thanh Station area are shown in Figure4.28 and Figure4.29 for reference. In addition, for reference of the next detail design stage, Table 4.25 indicates both advantage and disadvantage regarding the atrium design such as its shape and height. In this table, the following issues are compared. The impact on the city landscape, mainly for Ben Thanh Market, the connection of accessibility and natural light between underground space and ground level, and location of statues. In this survey, option 3 or option 3a are recommended, from the view point of the accessibility and the effects by a natural light.

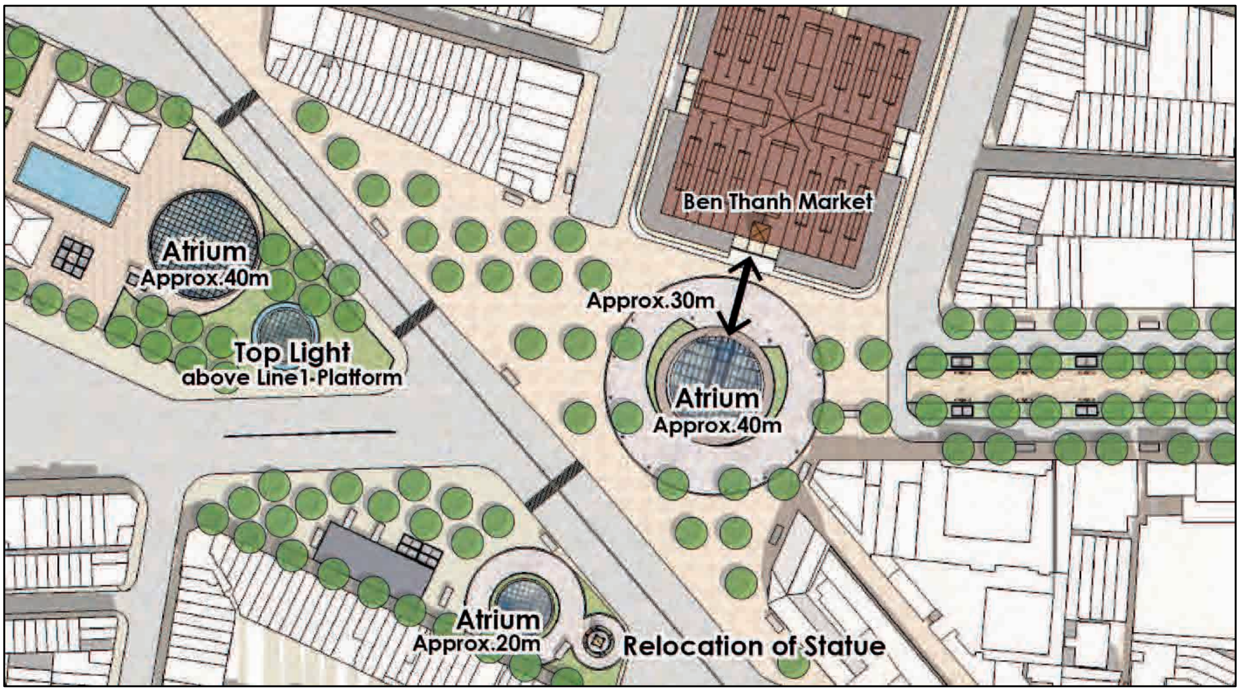
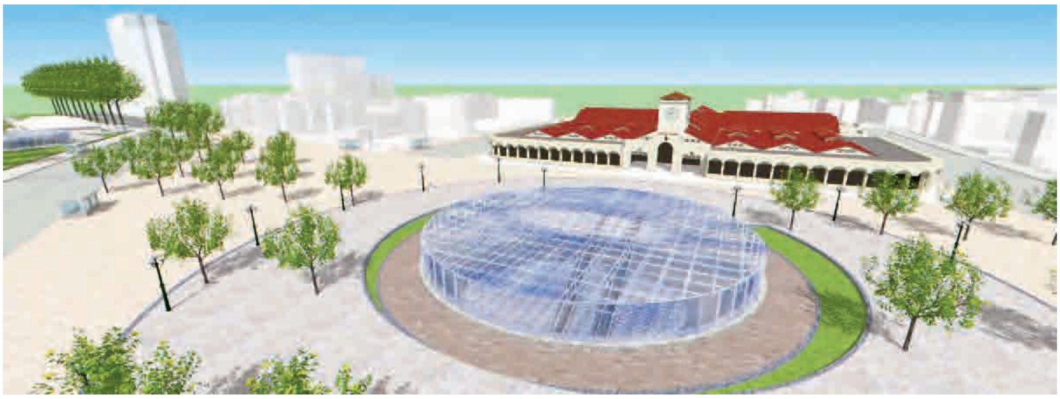


Figure4.27 Ground Level Plan in Ben Thanh Station Area
(based on Urban Planning of Ho Chi Minh City)

(a) No Atrium

(b) Atrium（H=1.0m）



(c) Atrium（H=3.5m）

(d) Atrium（H=3.5m、Arch Shape）

Figure 4.28 Overall Perspective View in Ben Thanh Station Area
(based on Urban Planning of Ho Chi Minh City)

(a) No Atirum

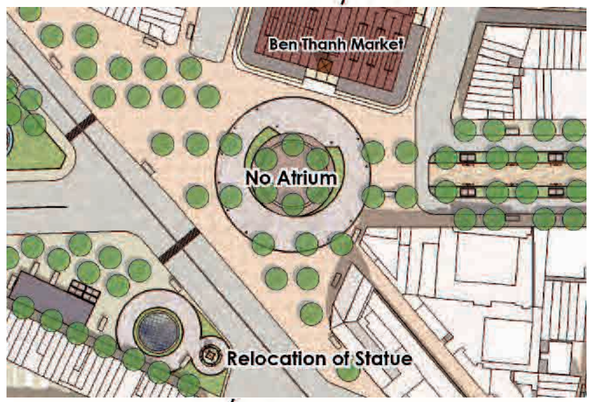
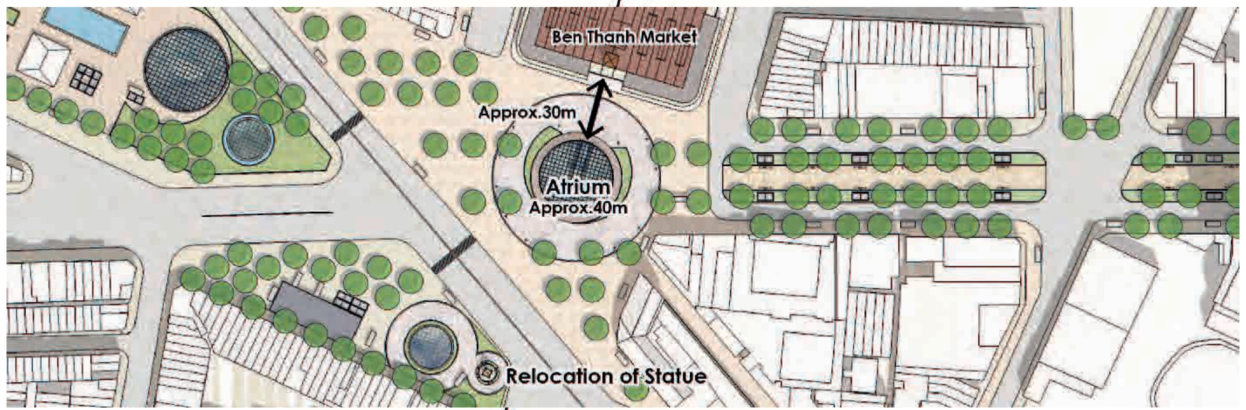
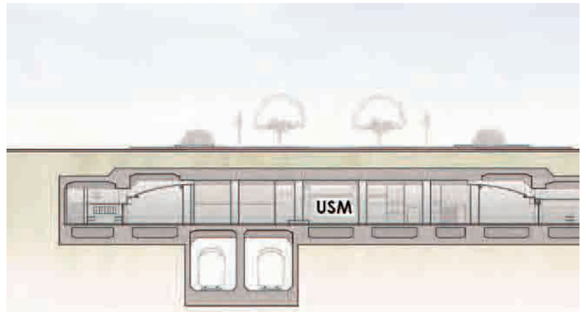
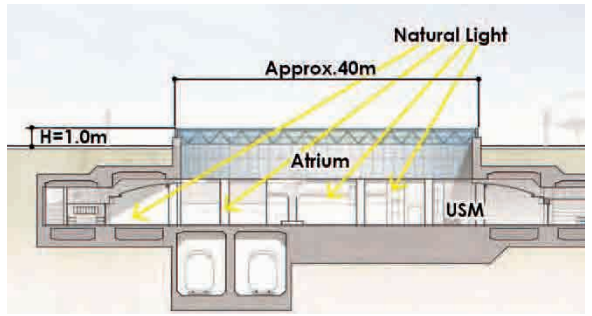
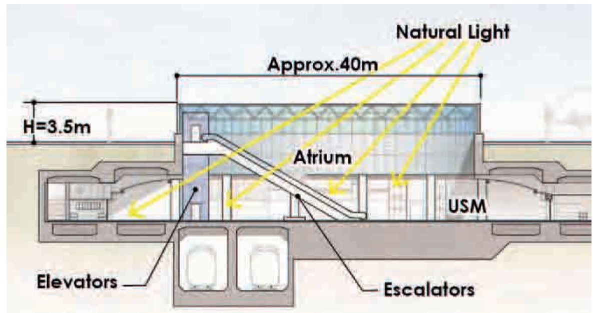
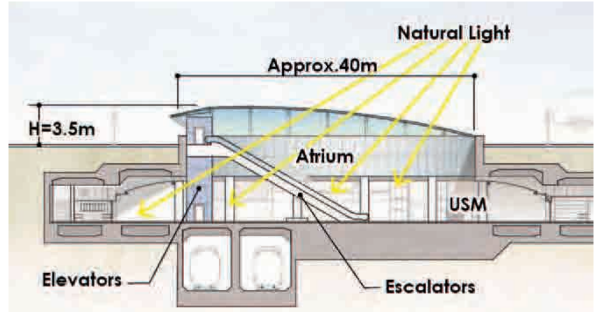
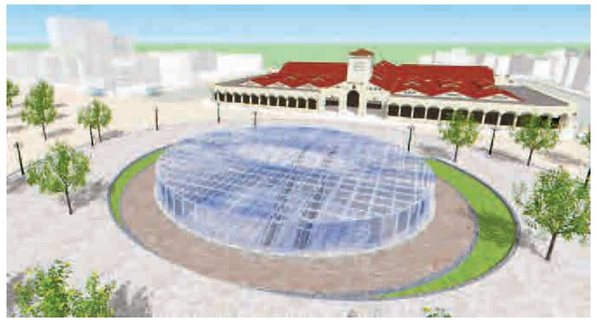
(b) Atrium（H=1.0m）

(c) Atrium（H=3.5m）

(d) Atrium（H=3.5m、Arch Shape）

Figure 4.29 Eye-Level View in Ben Thanh Station Area
(based on Urban Planning of Ho Chi Minh City)

Table 4.25 Comparative Study for Ground Level Plan based on Urban Planning of Ho Chi Minh City (For Reference)

	Option 1 No Atrium	Option 2 Atrium (H=1.0m)	Option 3 Atrium (H=3.5m)	Option 3a Atrium with Arch Shape (H=3.5m)
Plan				
Section				
Perspective View				
Impact on Scenery	・ The landscape in front of Ben Thanh Market will be renovated according to the new urban planning.	・ The landscape in front of Ben Thanh Market will be renovated according to the new urban planning. ・ The new landscape with low rise atrium will be created.	・ The landscape in front of Ben Thanh Market will be renovated according to the new urban planning. ・ The new landscape with high atrium will be created.	・ The landscape in front of Ben Thanh Market will be renovated according to the new urban planning. ・ The new landscape with arch shaped atrium will be created.
Statue	・ Basically statues will be relocated in accordance with urban planning of HCMC.	・ Same as Option 1	・ Same as Option 1	・ Same as Option 1
Entrance	・ There is no entrance to underground plaza.	・ Same as Option 1	・ The entrance with elevators and escalators to underground plaza can be designed.	・ Same as Option 3
Natural Light	・ There is no natural light poured into underground space.	・ Natural light can be poured into the underground space through glazed atrium.	・ Same as Option 2	・ Same as Option 2
Connection between Underground and Ground level	・ There is no accessibility between underground and ground level. ・ The attractive underground urban space can not be created.	・ The attractive urban space can be created because of the underground space connected with ground level through the atrium. ・ However people cannot move from underground plaza to ground level pedestrian space.	・ The attractive urban space can be created because of the underground space connected with ground level through the atrium. ・ People can easily move from underground plaza to ground level pedestrian space.	・ Same as Option 3
Recommendation	**C** **Not recommendable**	**B**	**A** **Recommendable**	**A** **Recommendable**

(b) Le Loi Street Plan

The ground level plan for Le Loi street based on urban planning of Ho Chi Minh City is shown in Figure4.30. According to this planning, Le Loi street is designed to form a pedestrian priority zone and serve as a transit mall while keeping the traffic flow of Nam Ky Khoi Nghia street and Pasteur street. Along Le Loi Street where the underground shopping mall will be developed, there will be structures from underground, such as staircases, ventilation towers, and cooling towers. The planning and design policies for the structures are set as follows:

- It is preferred that PC requires the developers of future redevelopment projects along the Street, to accommodate some of the structures in their site or inside the building, if possible.
- The most of structures are installed not in the sidewalk, but in the new median of Le Loi Street.
- In order to provide a vista toward the Opera, and to mitigate the massiveness of structure, the structure shall locate within five-meter-zone from the edge of the median. In addition, the size of structure shall be less than 8m at length, less than 3m at height.
- Structures shall use glassy transparent material to mitigate the massiveness, or green wall to contribute to the environment and Le Loi landscape.

The design image of the structures above grade like stairs, ventilation towers, and cooling towers is the same as Figure 4.25 shown in the Le Loi Street plan under the current street condition. In the next page the basic plan, section, and perspective view of Le Loi Street are shown as the planning policy of Le Loi street based on the urban planning of Ho Chi Minh City. The landscape design should be studied and determined through the consultation with the relevant parties in the next detail design stage.

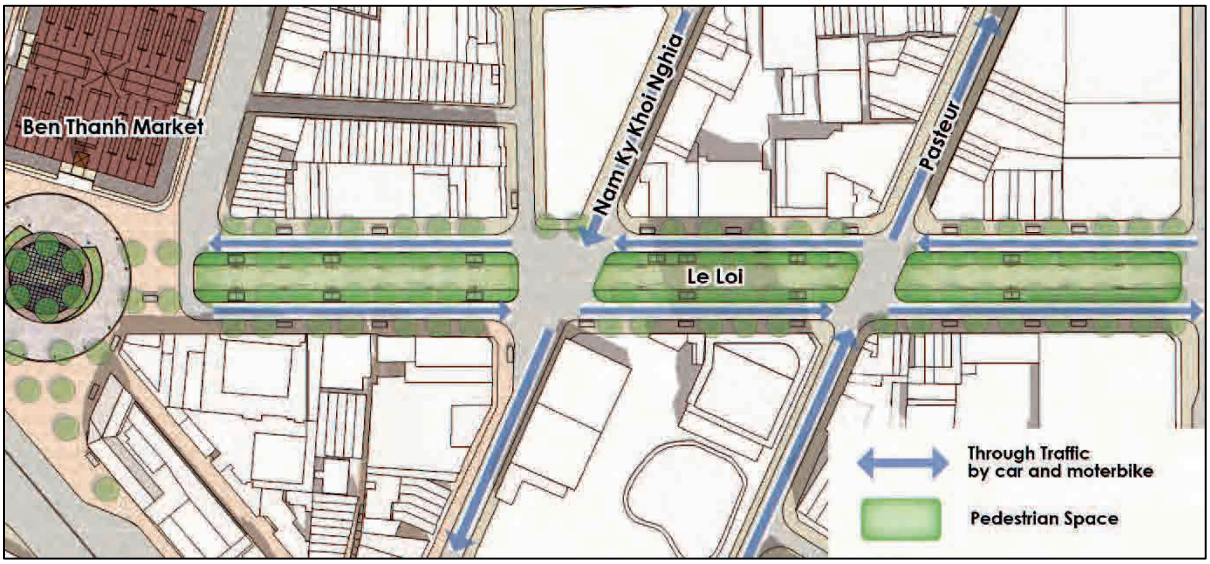
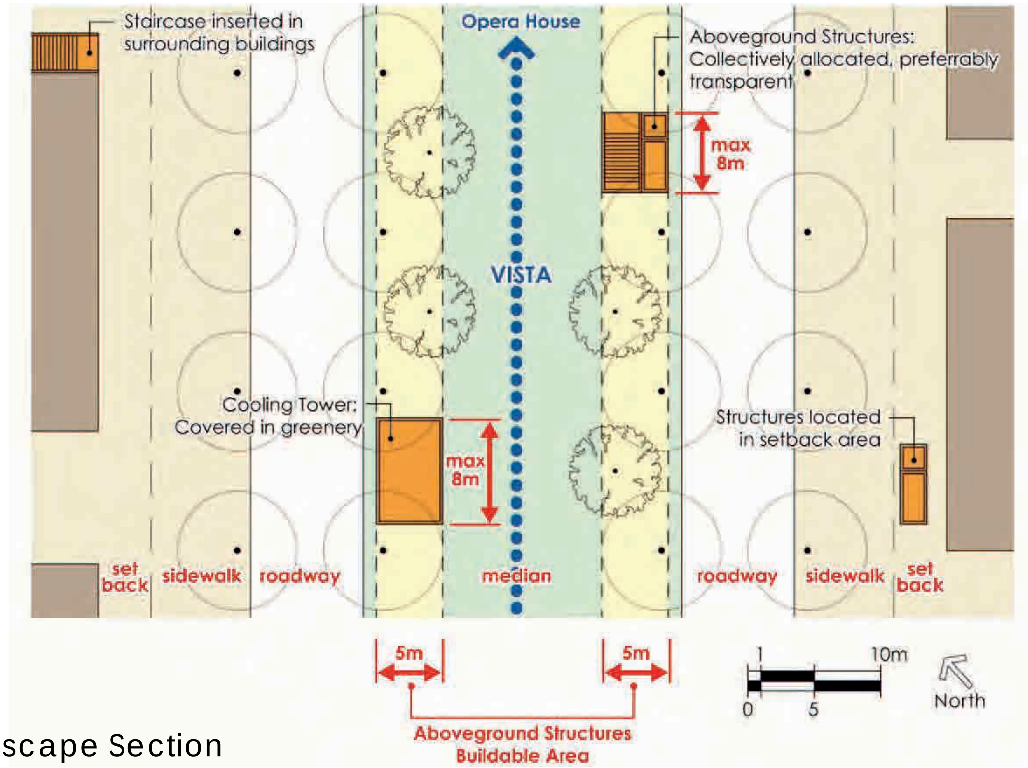
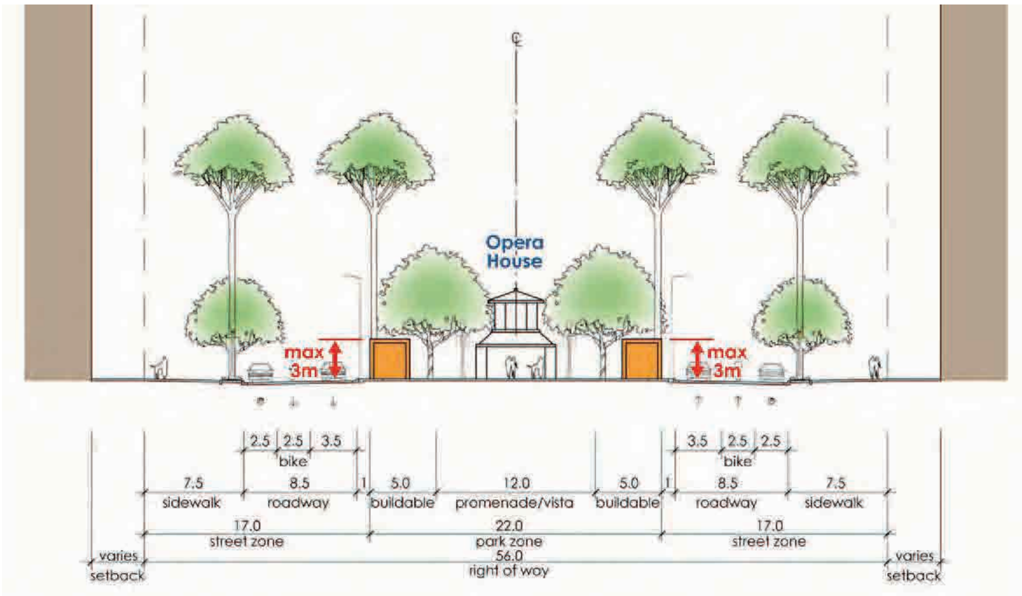


Figure4.30 Ground Level Plan of Le Loi Street
(based on Urban Planning of Ho Chi Minh City)

Landscape Plan



Landscape Section



Landscape Image

Figure 4.31 Basic Plan, Section, and Perspective View of Le Loi Street (based on Urban Planning of Ho Chi Minh City)

(2) Structures above Grade

The landscape design and the shape and design of on-ground structure like atrium should be studied and determined through the consultation with the relevant parties in the next detail design stage. However the design of the structure above grade, which is suitable for the urban planning of Ho Chi Minh City, is proposed for reference in this section.

(a) Atrium

- Structure : Fireproof-painted steel
- Outer wall : Tempered glass (Dot Point Glazing)
- Elevated podium wall: Stone tile on asphalt waterproofing concrete (H : above flood level)
- Roof : Tempered-laminated glass, Low-e glass, perforated steel panel below
- Natural smoke control system:Glass window
- Ground level entrance: Glass automatic door, airlock, Vertical damp proof barrier

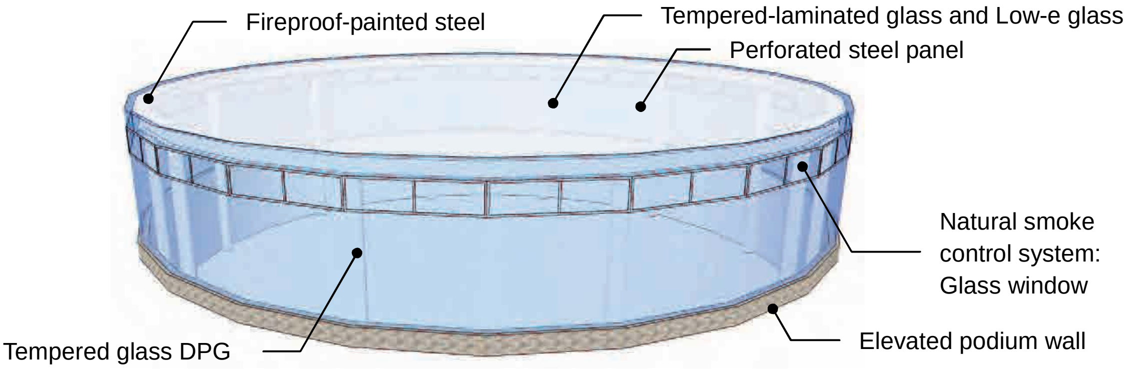


Figure 4.32 Atrium Image

(b) Staircase

- Structure : Stainless steel pipe frame
- Floor : Rough surface ceramic tile (Stair-nosing and Landing: anti-slip tile)
- Roof : Bake coating aluminum honeycomb panel (H=3,000)
- Wall : Ceramic tile
- Underground entrance: Roller shutter
- Ground level entrance: Vertical damp proof barrier

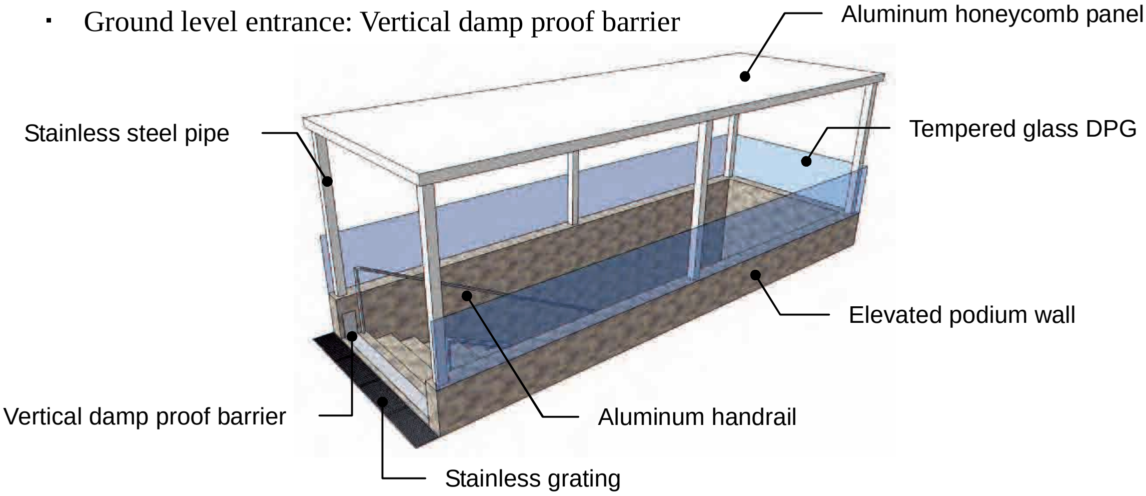


Figure 4.33 Staircase Image

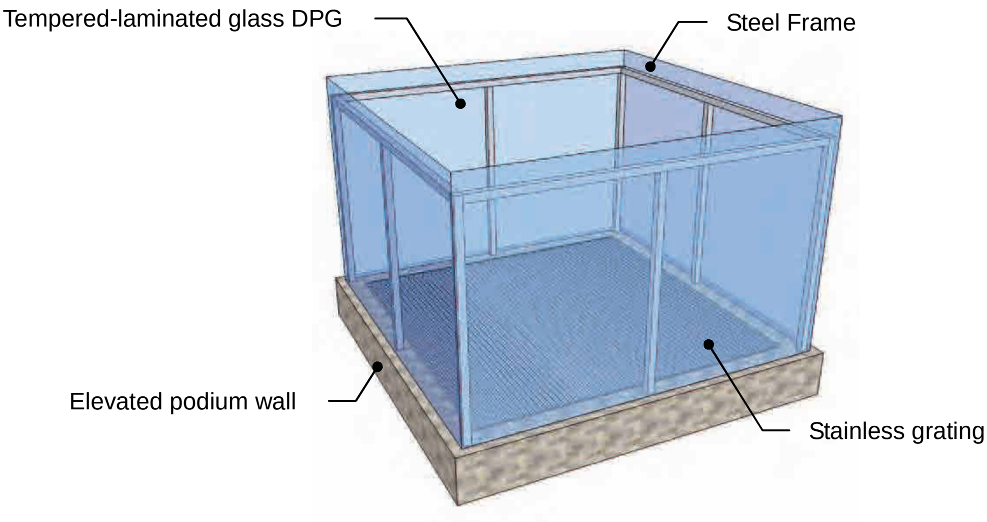
(c) Ventilation Tower

(i) Tempered Glass Type

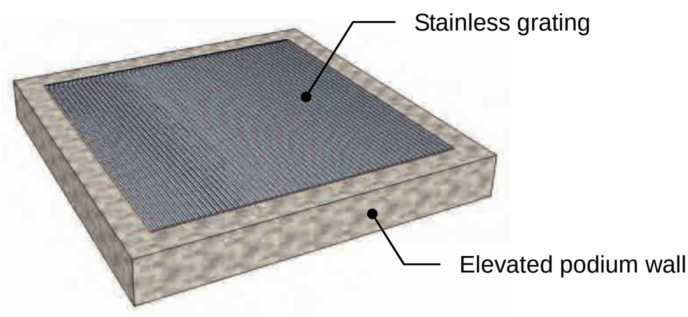
- Wall : Steel frame, tempered-laminated glass DPG (H:3,000)
- Elevated podium wall: Stone tile on asphalt waterproofing concrete (H: above flood level)
- Aperture : Stainless steel grating (aperture ratio: 75%)

(ii) Low-rise Type

- Elevated podium wall: Stone tile on asphalt waterproofing concrete (H: above flood level)
- Aperture : Stainless steel grating (aperture ratio: 75%)



(a) Tempered Glass Type Image



(b) Low-rise Type Image

Figure 4.34 Ventilation Tower (Low-rise Type) Image

(d) Cooling Tower

- Hiding Wall : Steel frame, precast concrete panel (H:5,000)
  To keep distance from the cooling tower at least 3m.
  Façade: green wall

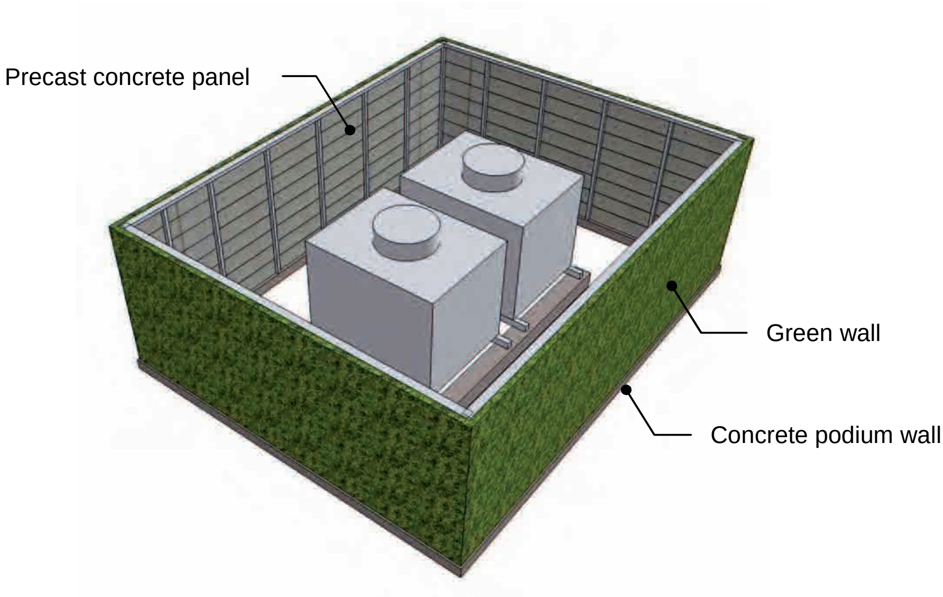


Figure 4.35 Cooling Tower Image

4.4 SCHEMATIC DESIGN DRAWINGS

The drawings for the schematic designs of each facility are shown in this section. The 1st phase means that UMRT Line 1 is constructed first, and the 2nd phase means that the whole facilities of this project are constructed finally. Both drawings of the 1st phase and the 2nd phase are shown as following.

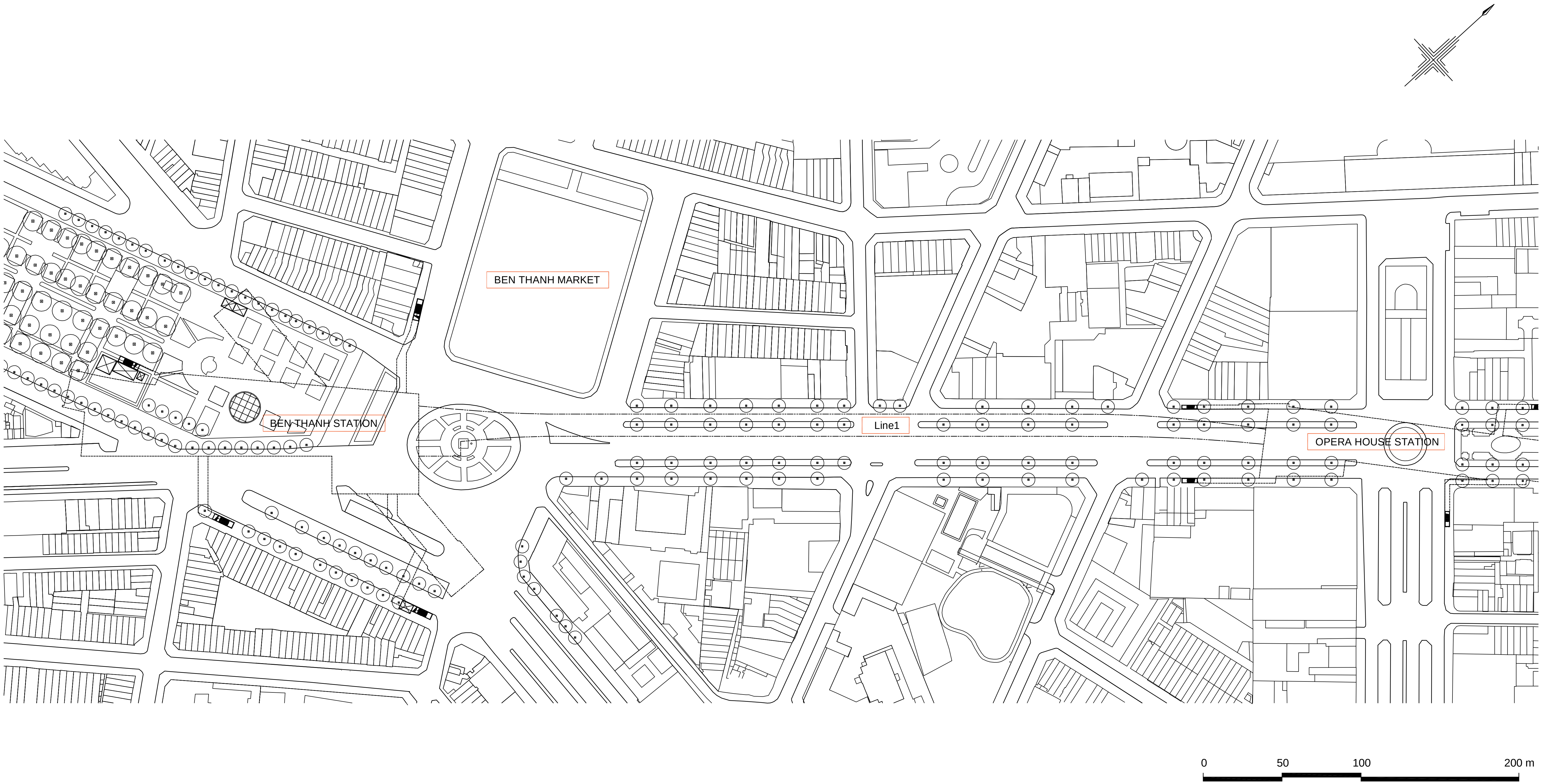
4.4.1 Schematic Design Drawings on 1st Phase

In case of the phased construction, the schematic design drawings on the 1st phase when UMRT Line1 is constructed first are shown in the following pages. The station structure of UMRT Line2 is supposed to be constructed simultaneously with the Line 1 construction. However, the construction is only station structure of Line 2 and does not include the architectural works and E & M works for the station. In these drawings the facility layout of the Line 2 station is shown for the comprehension of the necessary space as Line 2 station structure.

The list of the schematic design drawings is as below.

Table 4.26 Drawing List of 1st Phase

Drawing No.	Drawing Title		Scale
Figure 4.36	1st Phase	Ground Level Whole Plan	1/2500
Figure 4.37		Ground Level Plan 1	1/1000
Figure 4.38		Ground Level Plan 2	1/1000
Figure 4.39		Ground Level Plan 3	1/1000
Figure 4.40		B1 Whole Plan	1/2500
Figure 4.41		B1 Plan (Concourse Level)	1/1000
Figure 4.42		B2 Plan (Line1 Platform Level)	1/1000
Figure 4.43		B3 Plan (Line4 Platform Level)	1/1000
Figure 4.44		B4 Plan (Line2 Platform Level)	1/1000
Figure 4.45		Section 1	1/600
Figure 4.46		Section 2	1/600

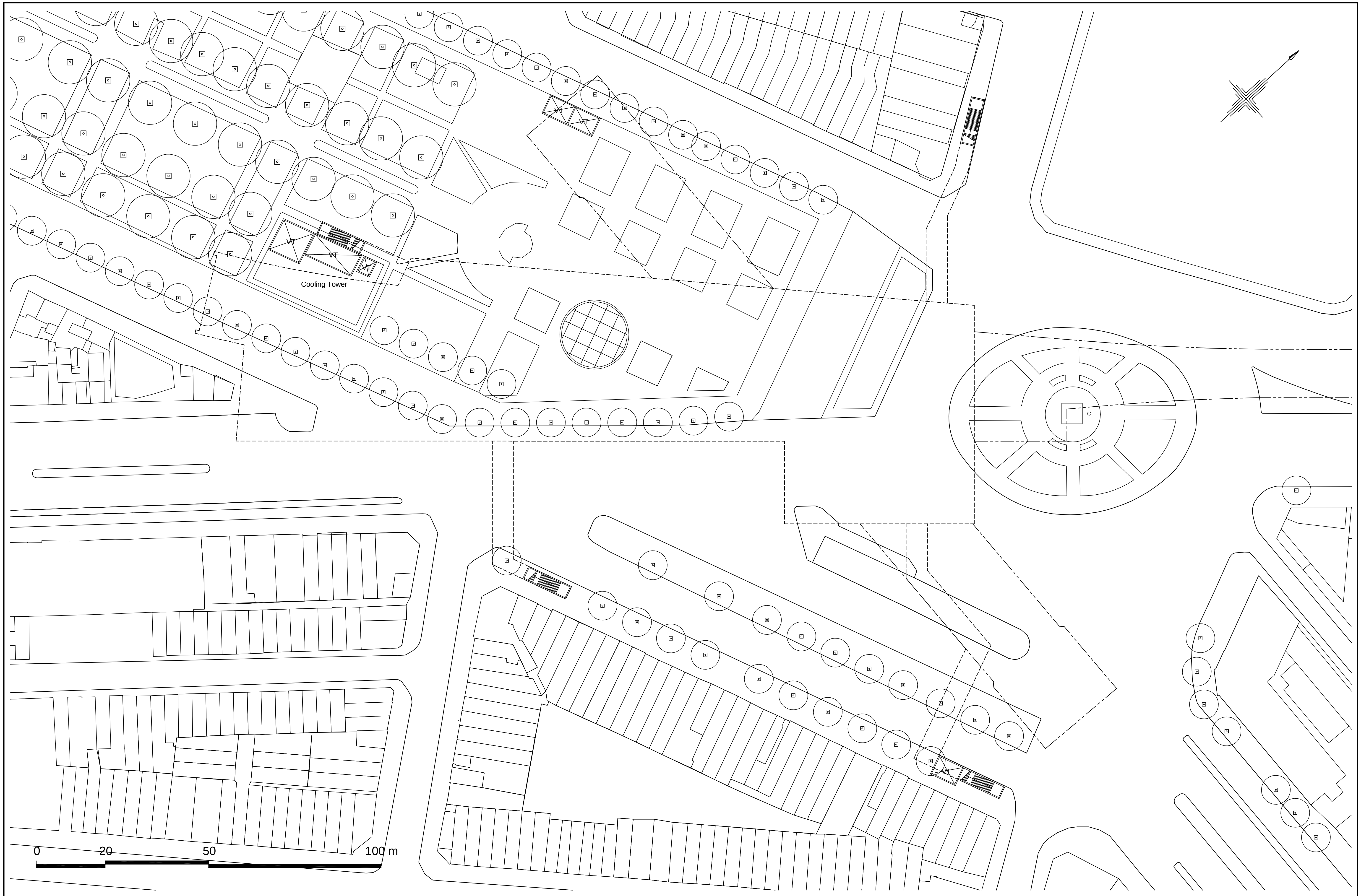


JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT
GLOUND LEVEL WHOLE PLAN (1st Phase)

DATA. 06.03.2012
SCALE. A1:1/1250 A3:1/2500
DWG NO. DFR-1-1

Figure4.36 Glound Level Whole Plan



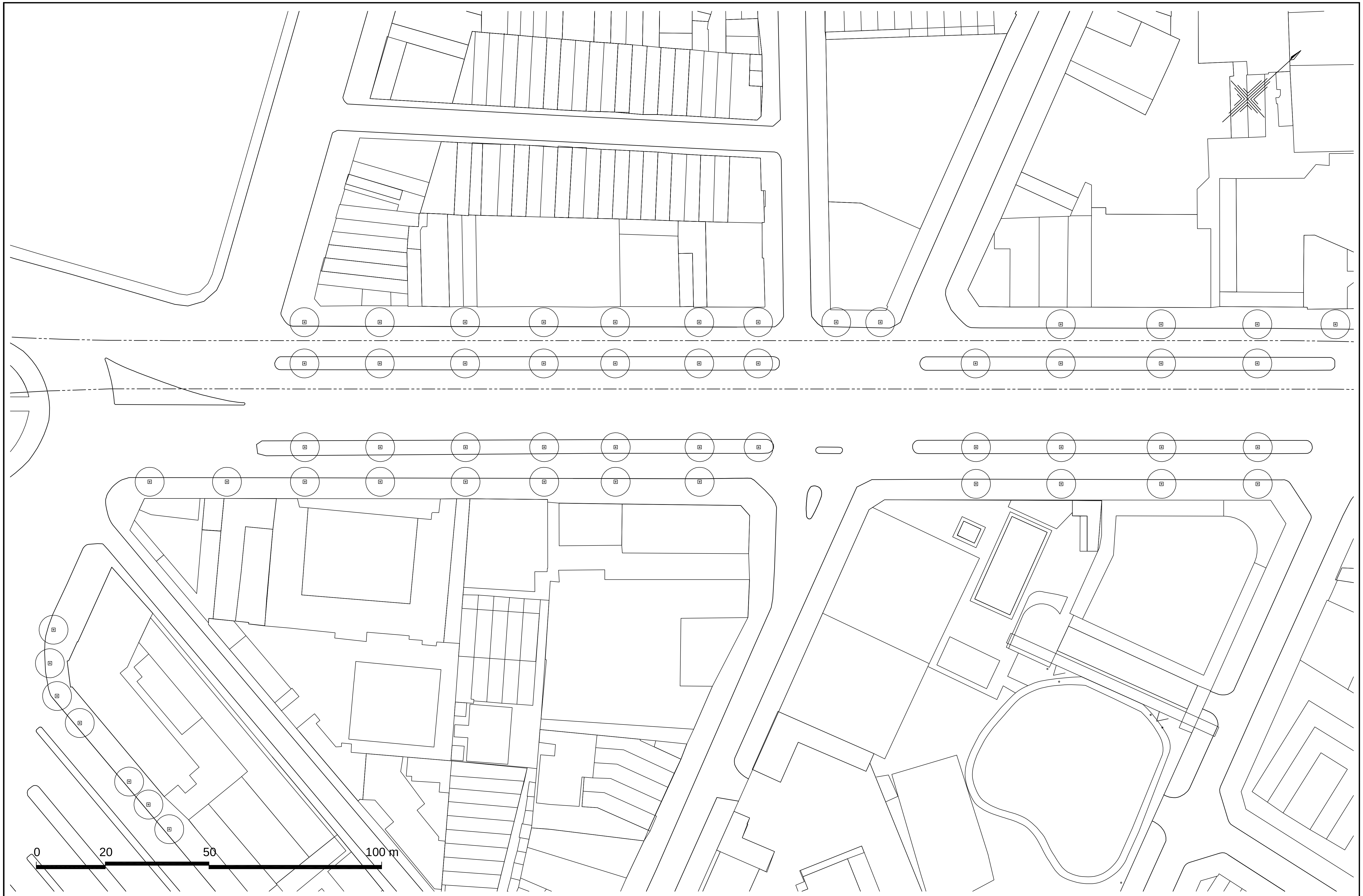
*VT : Ventilation Tower

Figure4.37 Glound Level Plan 1

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

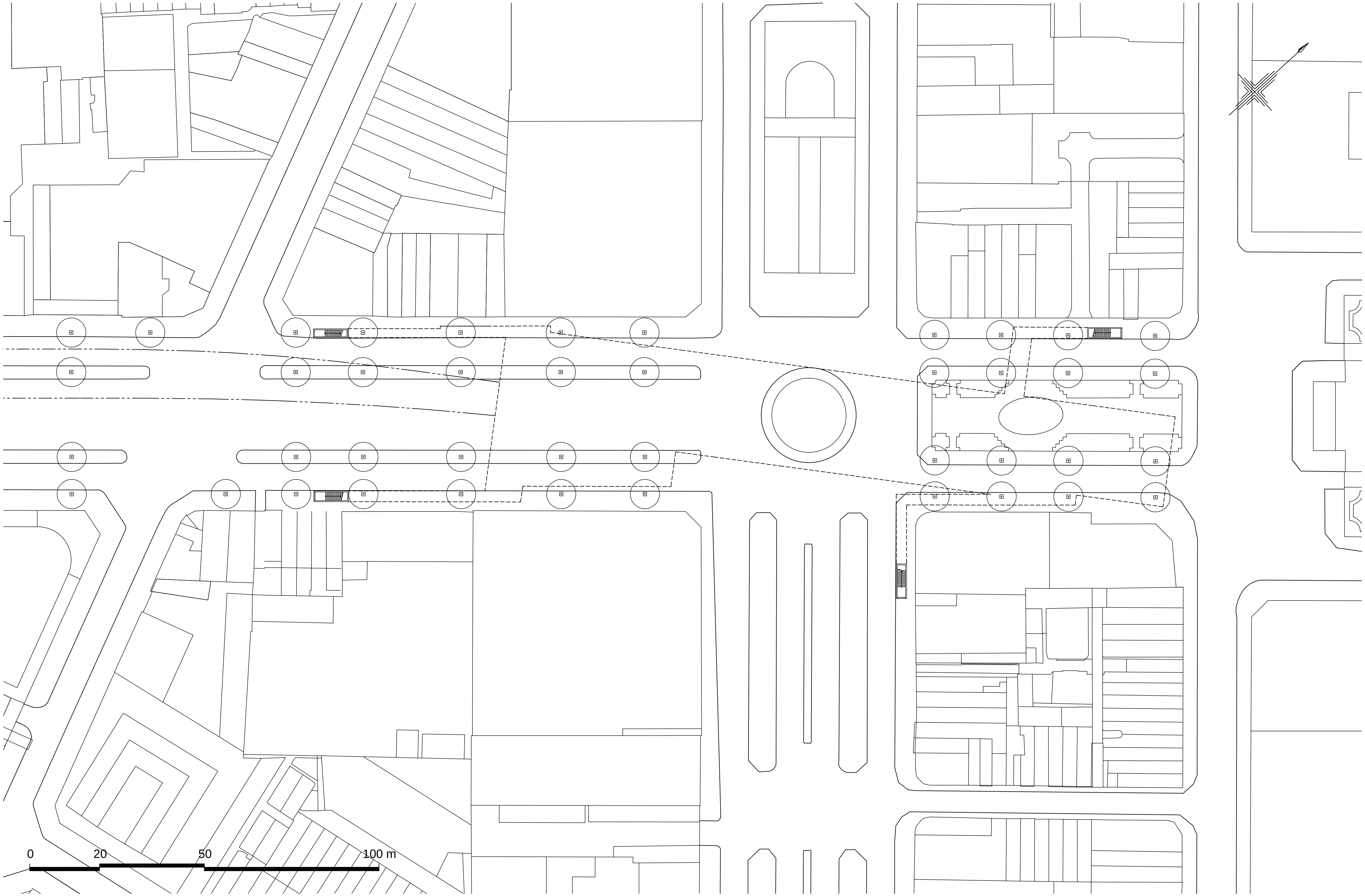
JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT
GLOUND LEVEL PLAN 1 (1st Phase)

DATA.	06.03.2012
SCALE.	A1:1/500 A3:1/1000
DWG NO.	DFR-1-2



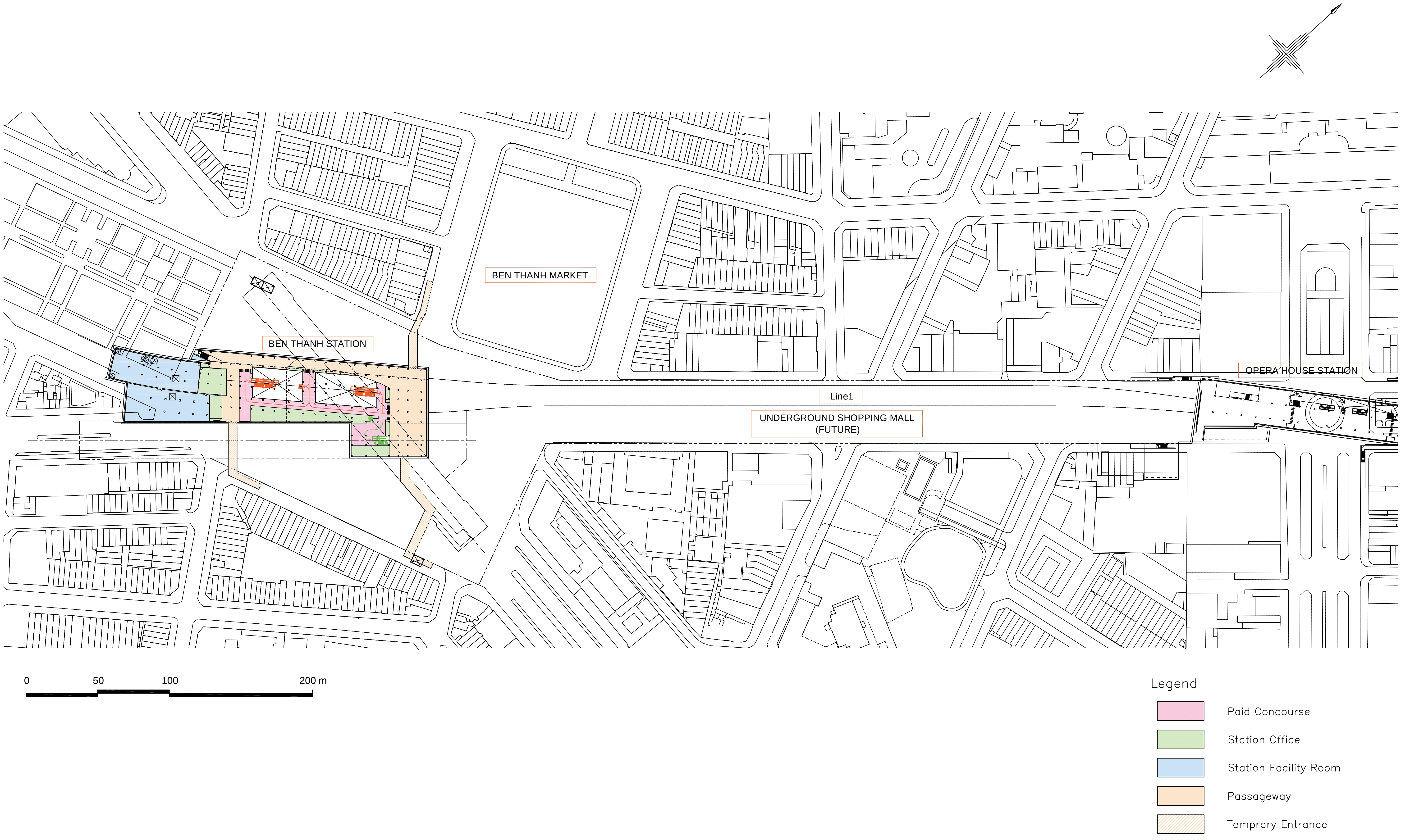
JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	DATA. 06.03.2012
		SCALE. A1:1/500 A3:1/1000
	GLOUND LEVEL PLAN 2 (1st Phase)	DWG NO. DFR-1-3

Figure4.38 Glound Level Plan 2



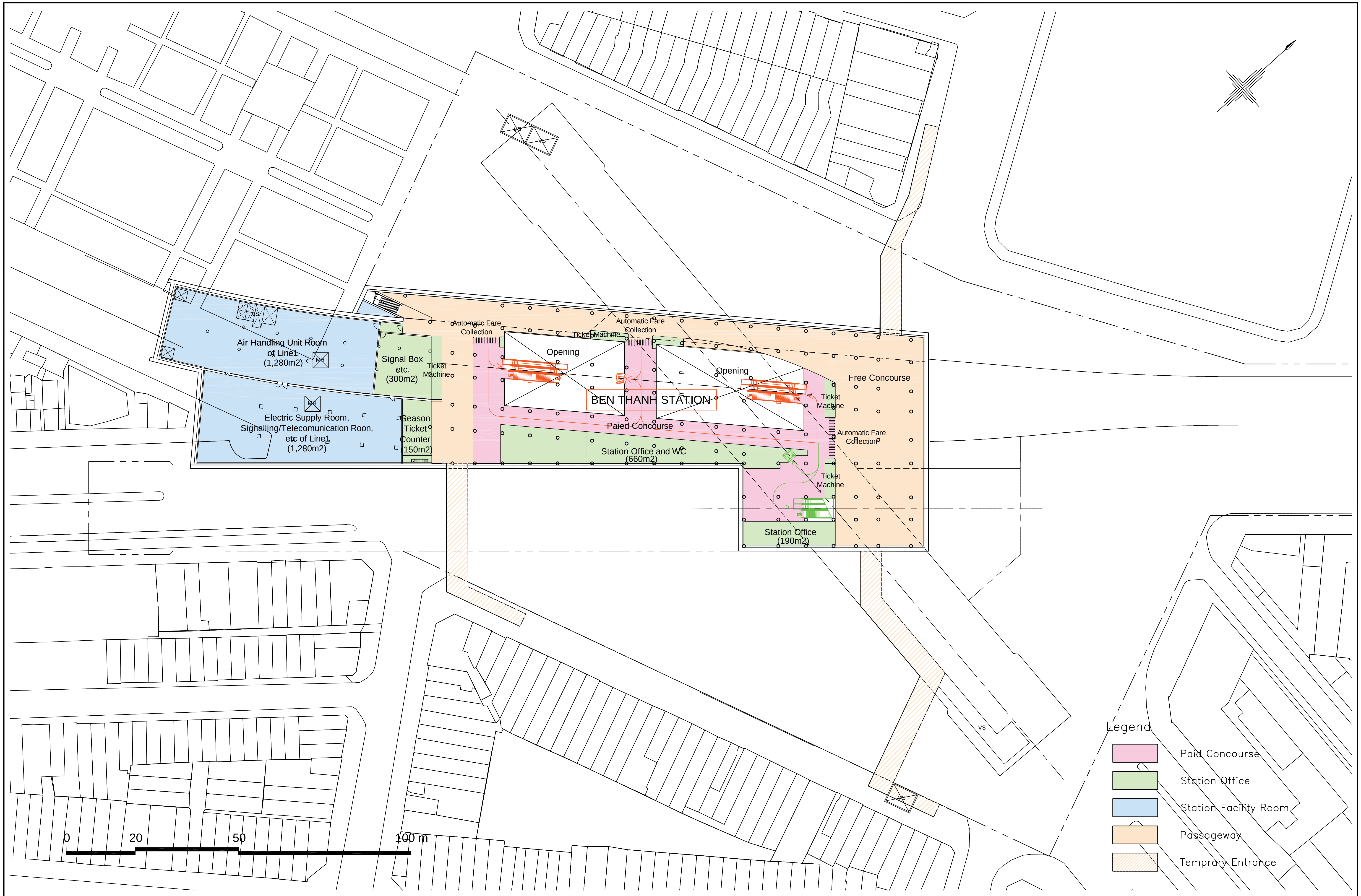
JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT GLOUND LEVEL PLAN 3 (1st Phase)	DATA. 06.03.2012 SCALE. A1:1/500 A3:1/1000 DWG NO. DFR-1-4

Figure4.39 Glound Level Plan 3



JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	DATA. 10.12.2011 SCALE. A1:1/1250 A3:1/2500
	B1 WHOLE PLAN (1st Phase)	DWG NO. DFR-1-5

Figure4.40 B1 Whole Plan



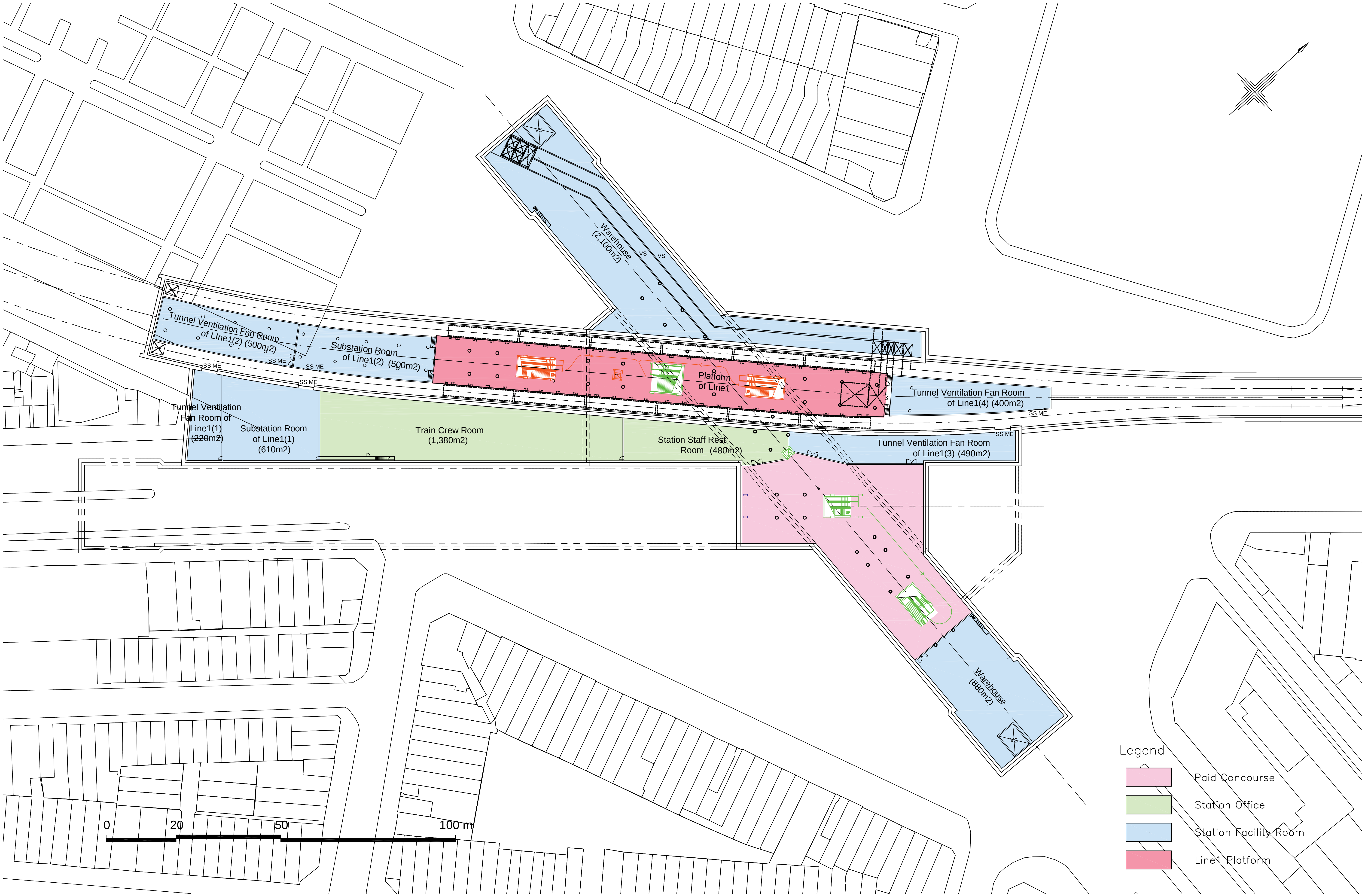
*VS : Ventilation Shaft
*MH : Machine Hatch

Figure4.41 B1 Plan (Concourse Level)

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT
B1 PLAN (1st Phase)

DATA.	10.12.2011
SCALE.	A1:1/500 A3:1/1000
DWG NO.	DFR-1-6



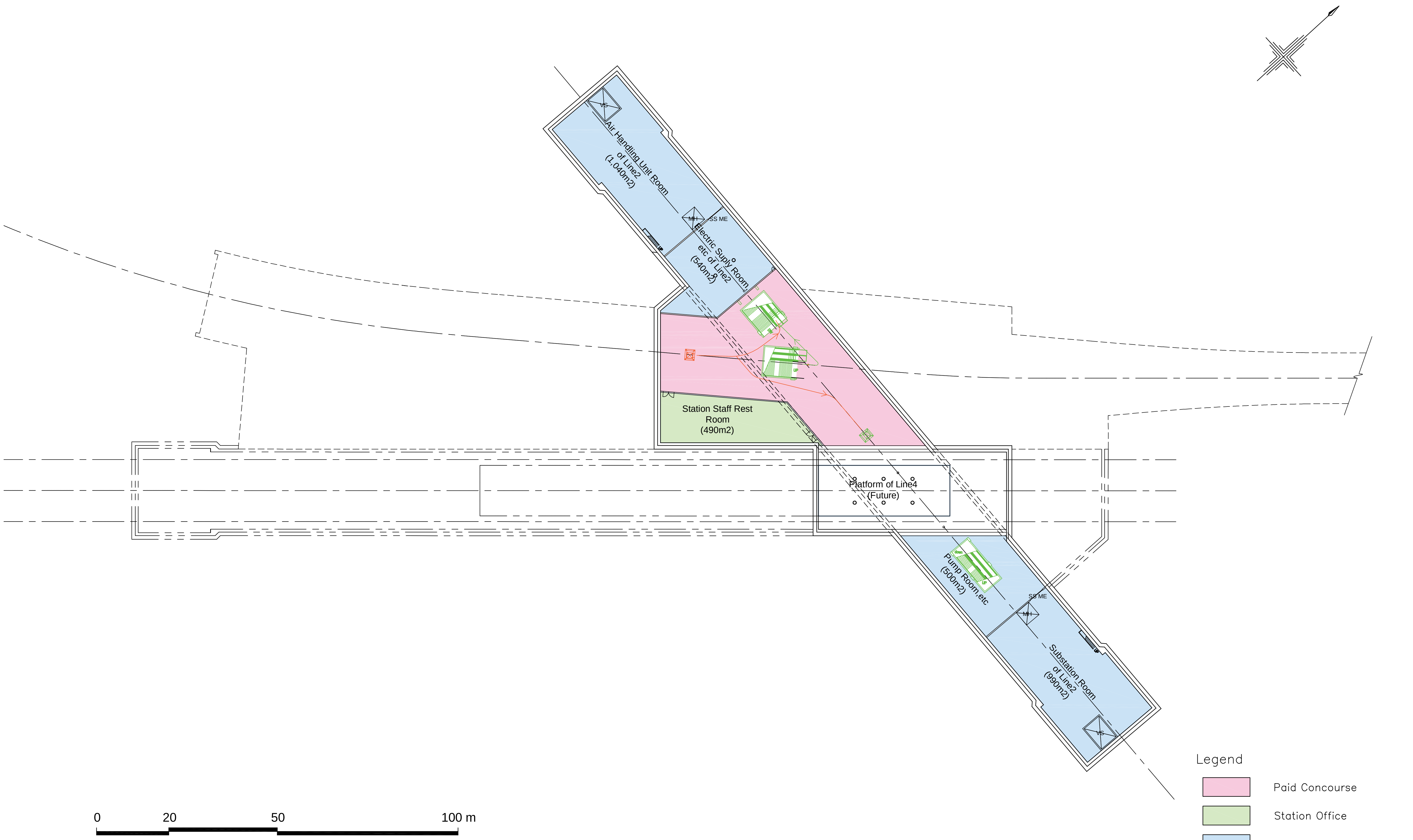
*VS : Ventilation Shaft
*MH : Machine Hatch
*SSME : Steel Shutter for Machine Emplacement

Figure4.42 B2 Plan (Line1 Platform Level)

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT
B2 PLAN (1st Phase)

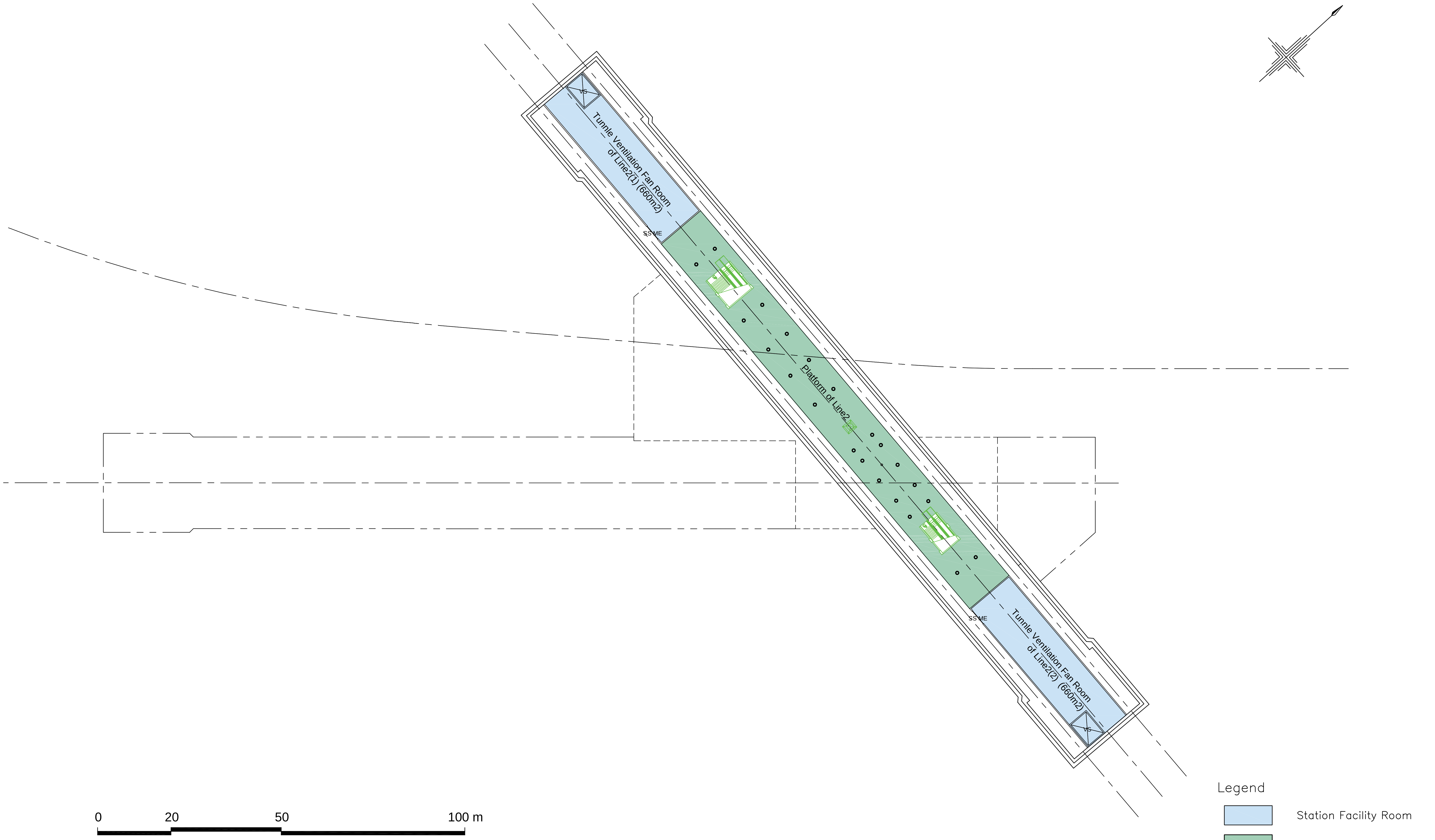
DATA. 10.12.2011
SCALE. A1:1/500 A3:1/1000
DWG NO. DFR-1-7



*VS : Ventilation Shaft
*MH : Machine Hatch
*SSME : Steel Shutter for Machine Emplacement

Figure4.43 B3 Plan (Line4 Platform Level)

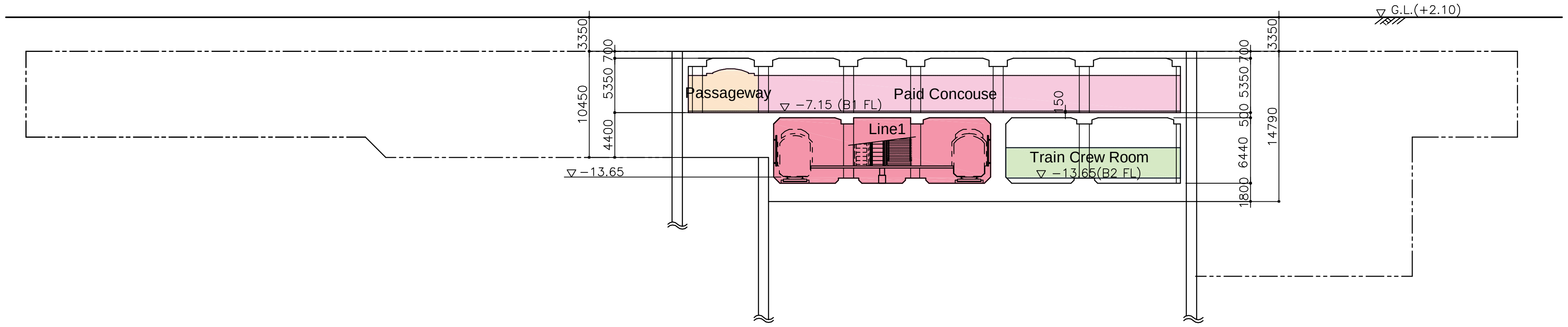
JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	DATA. 10.12.2011 SCALE. A1:1/500 A3:1/1000
	B3 PLAN (1st Phase)	DWG NO. DFR-1-8



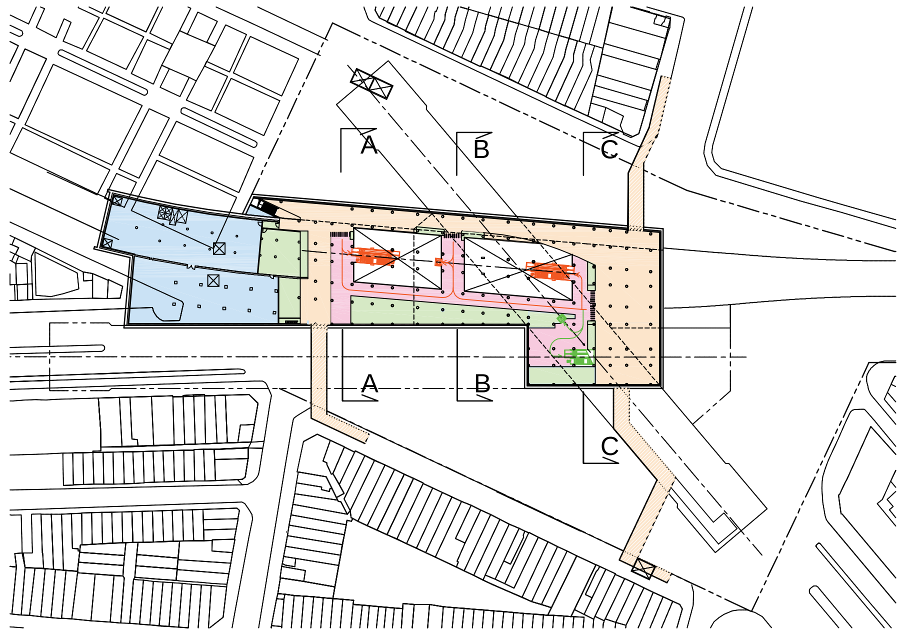
*VS : Ventilation Shaft
*SSME : Steel Shutter for Machine Emplacement

Figure4.44 B4 Plan (Line2 Platform Level)

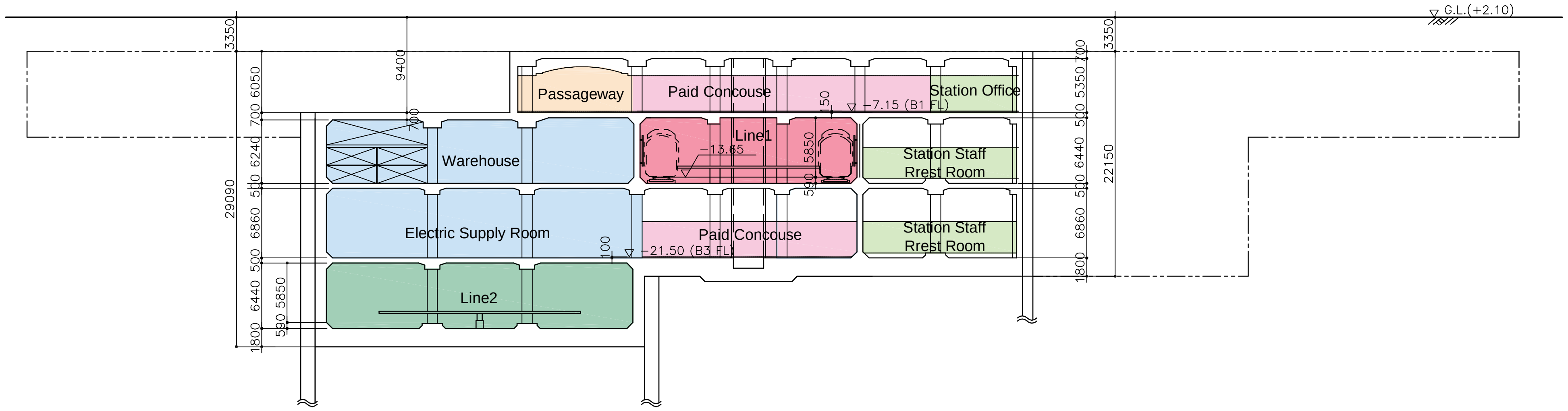
JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	DATA. 10.12.2011 SCALE. A1:1/500 A3:1/1000
	B4 PLAN (1st Phase)	DWG NO. DFR-1-9



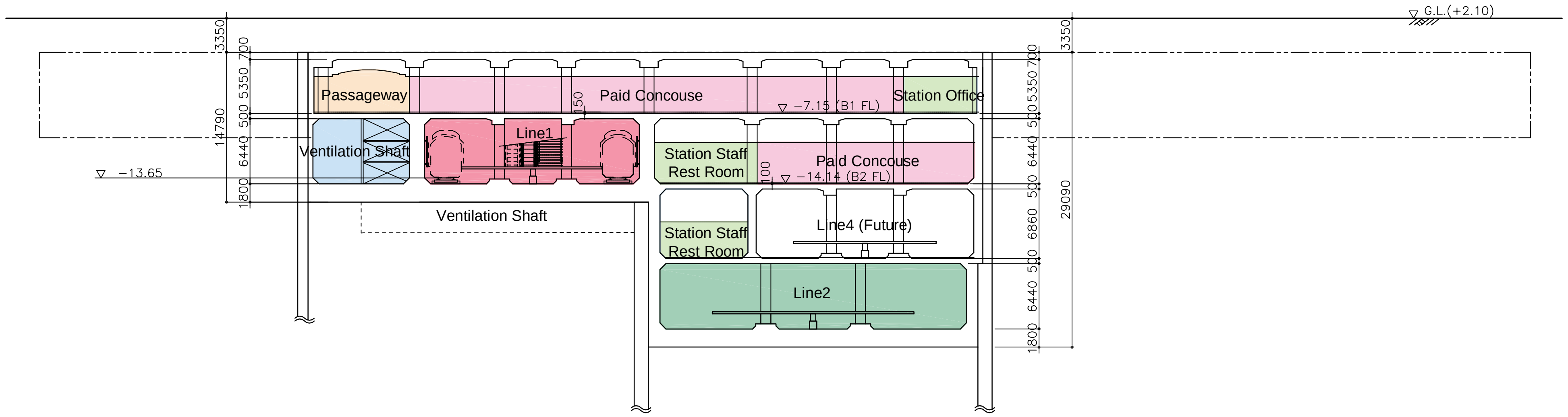
A–A CROSS SECTION



KEY PLAN 1/3000



B–B CROSS SECTION



C–C CROSS SECTION

Legend

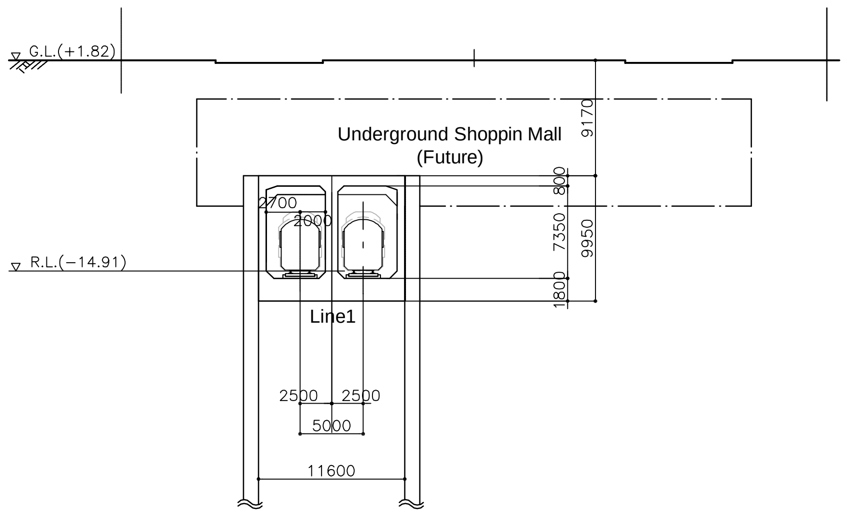
- Paid Concourse
- Station Office
- Station Facility Room
- Line1 Platform
- Line2 Platform
- Passageway

Figure4.45 Section 1

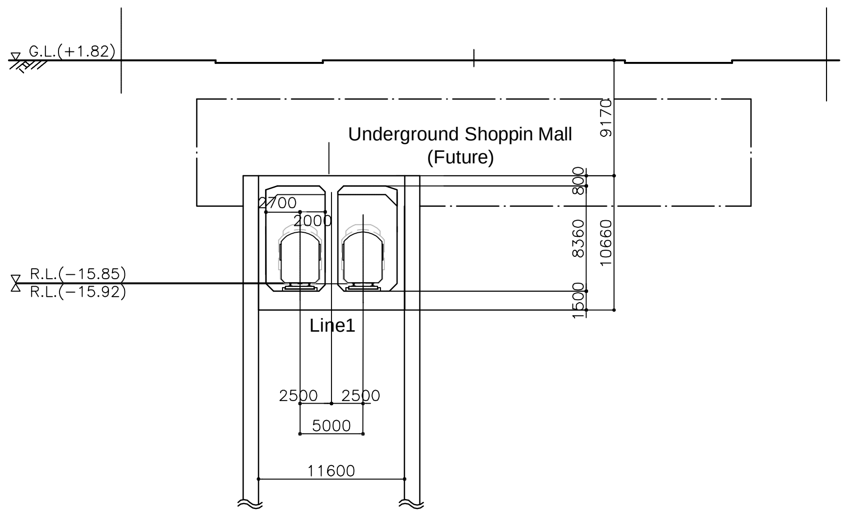
JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT
SECTION 1 (1st Phase)

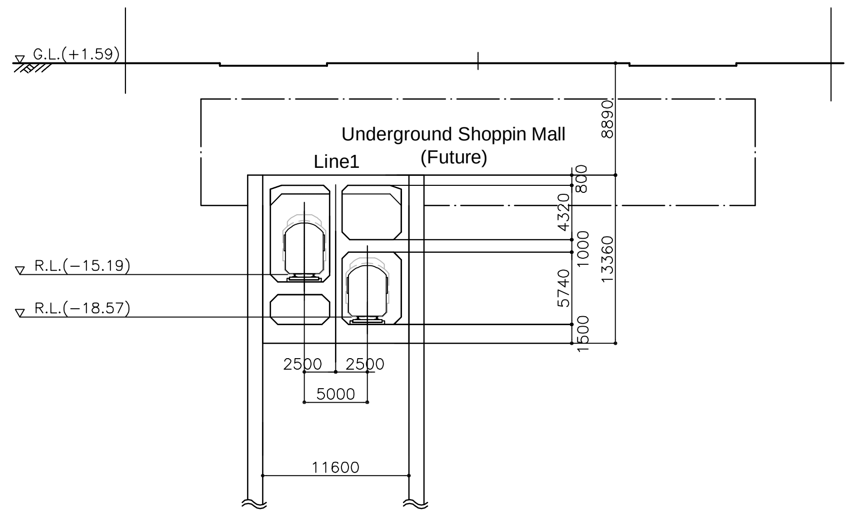
DATA. 10.12.2011
SCALE. A1:1/300 A3:1/600
DWG NO. DWF−1−10



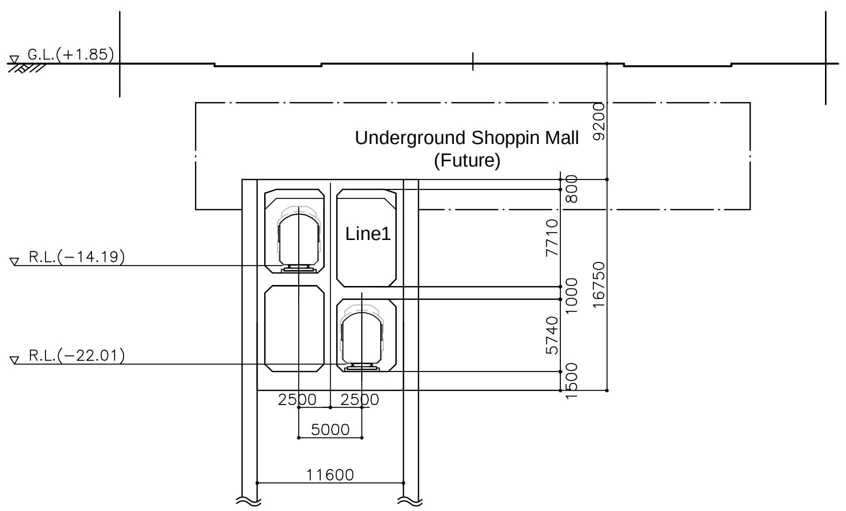
D−D CROSS SECTION (KM 0+200 OF LINE−1)



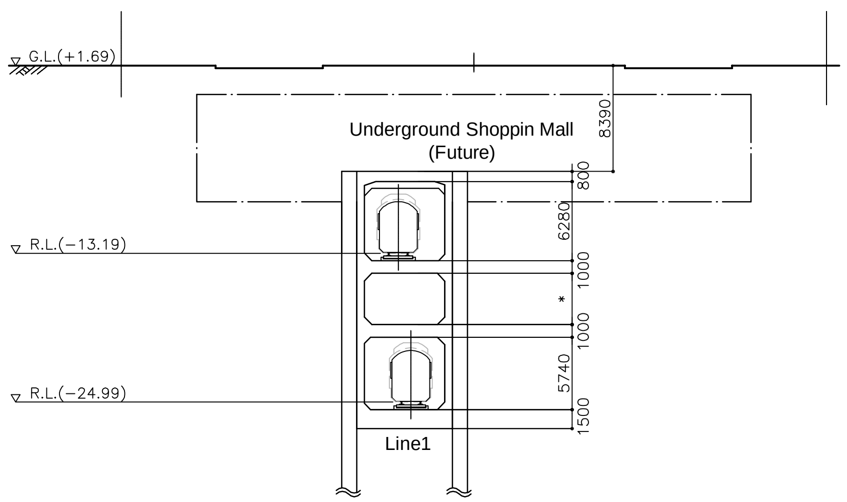
E−E CROSS SECTION (KM 0+300 OF LINE−1)



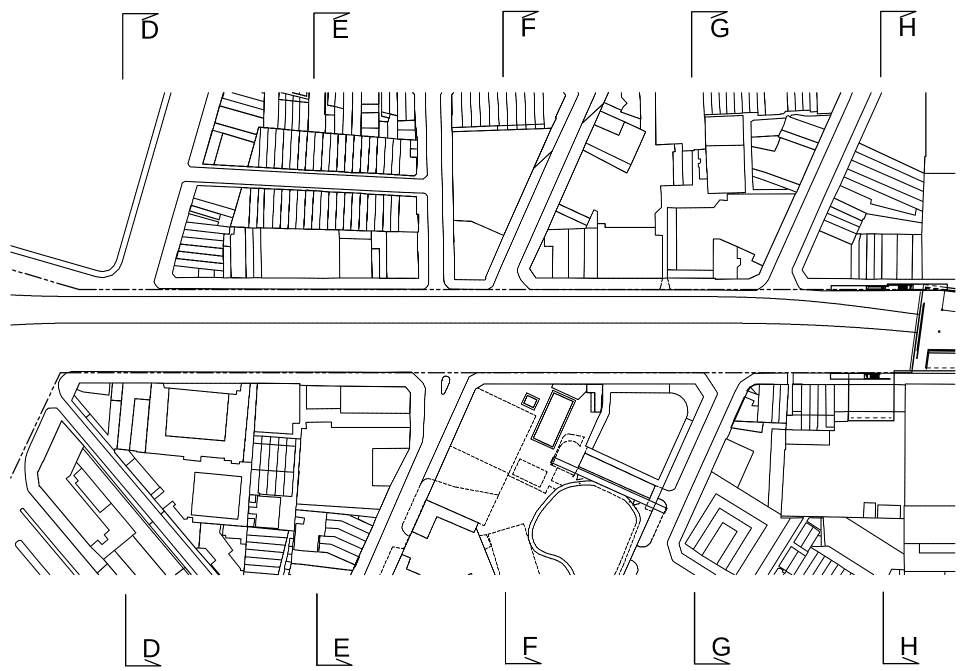
F−F CROSS SECTION (KM 0+400 OF LINE−1)



G−G CROSS SECTION (KM 0+500 OF LINE−1)



H−H CROSS SECTION (KM 0+600 OF LINE−1)



KEY PLAN 1/4000

Figure4.46 Section 2

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)	DATA. 10.12.2011
NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	SCALE. A1:1/300 A3:1/600
	SECTION 2 (1st Phase)	DWG NO. DFR−1−11

4.4.2 Schematic Design Drawings on 2nd Phase

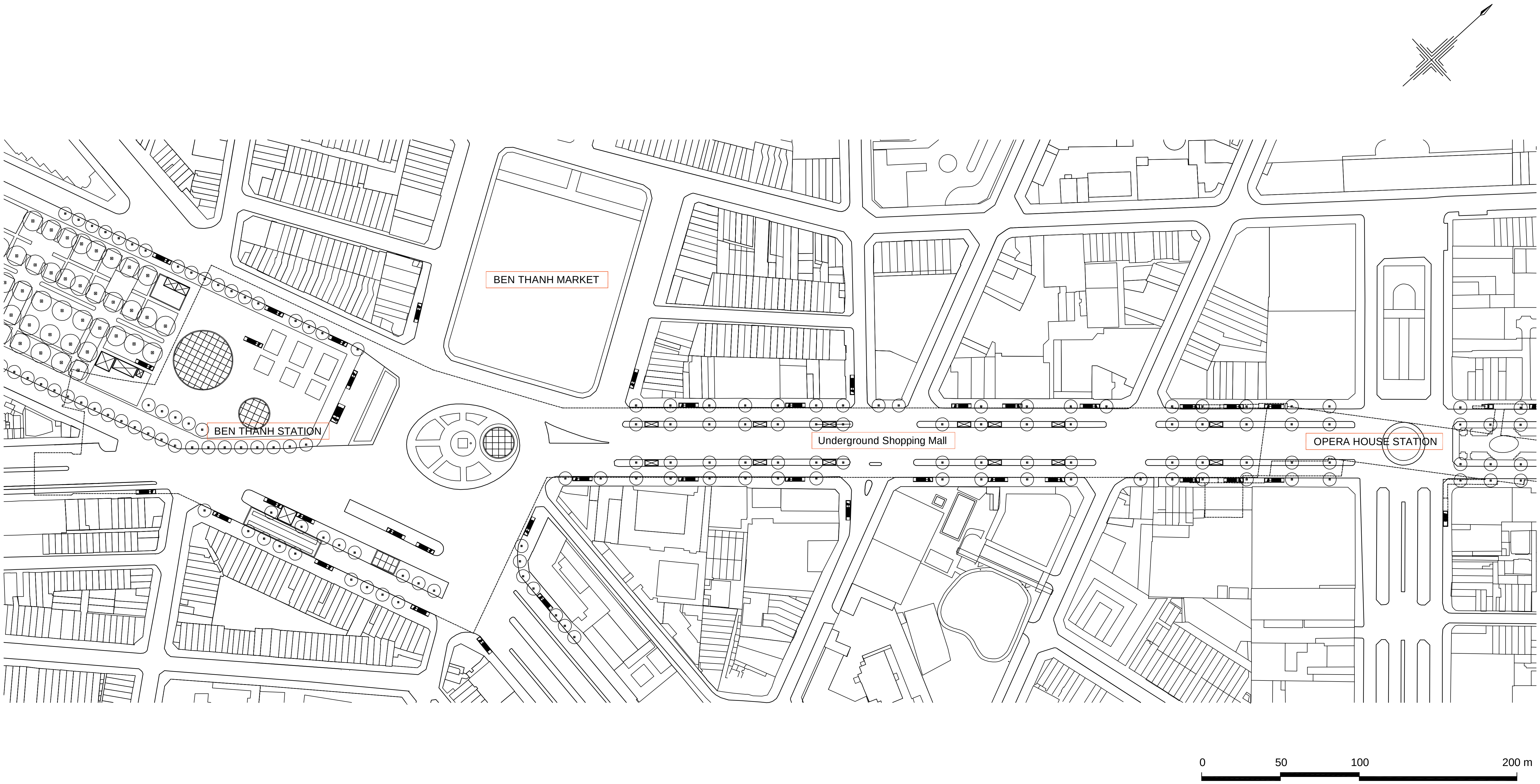
1) Schematic Design Drawings under Current Traffic Arrangement

The schematic design drawings on the 2nd phase, when the whole facilities of this project are constructed finally, are shown in the following pages. The whole layout of Ben Thanh Central Station and the underground shopping mall is also shown. In addition the perspective views of this project are attached.

The list of the schematic design drawings is as below.

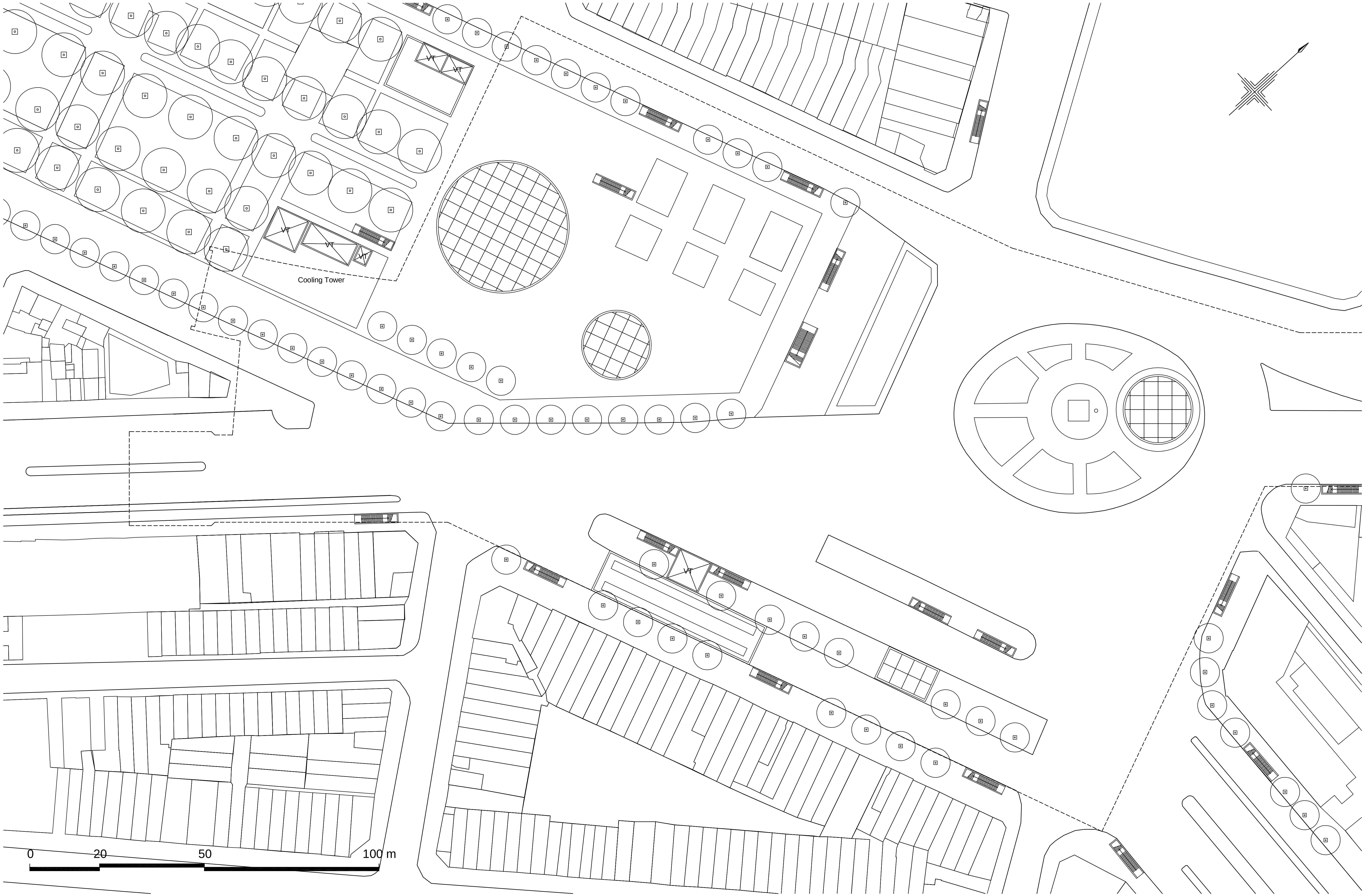
Table 4.27 Drawing List of 2nd Phase under current traffic arrangement

Drawing No.	Drawing Title		Scale
Figure 4.47	2nd Phase	Ground Level Whole Plan (Under current traffic arrangement)	1/2500
Figure 4.48		Ground Level Plan 1 (Under current traffic arrangement)	1/1000
Figure 4.49		Ground Level Plan 2 (Under current traffic arrangement)	1/1000
Figure 4.50		Ground Level Plan 3 (Under current traffic arrangement)	1/1000
Figure 4.51		B1 Whole Plan	1/2500
Figure 4.52		B1 Plan 1 (Ben Thanh Station Area)	1/1000
Figure 4.53		B1 Plan 2 (Le Loi Street Area)	1/1000
Figure 4.54		B1 Plan 3 (Le Loi Street Area)	1/1000
Figure 4.55		B2 Plan (Line1 Platform Level)	1/1000
Figure 4.56		B3 Plan (Line4 Platform Level)	1/1000
Figure 4.57		B4 Plan (Line2 Platform Level)	1/1000
Figure 4.58		Section 1	1/600
Figure 4.59		Section 2	1/600
Figure 4.60		Section 3	1/600
Figure 4.61		Section 4	1/600
Figure 4.62		Emergency Fire Escape Plan 1	1/1600
Figure 4.63		Emergency Fire Escape Plan 2	1/1600
Figure 4.64		Perspective View 1 (Underground Shopping Mall)	—
Figure 4.65		Perspective View 2 (UMRT Platform)	—



JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	DATA. 03.03.2012 SCALE. A1:1/1250 A3:1/2500
	GLOUND LEVEL WHOLE PLAN (1st Phase)	DWG NO. DFR-2-1

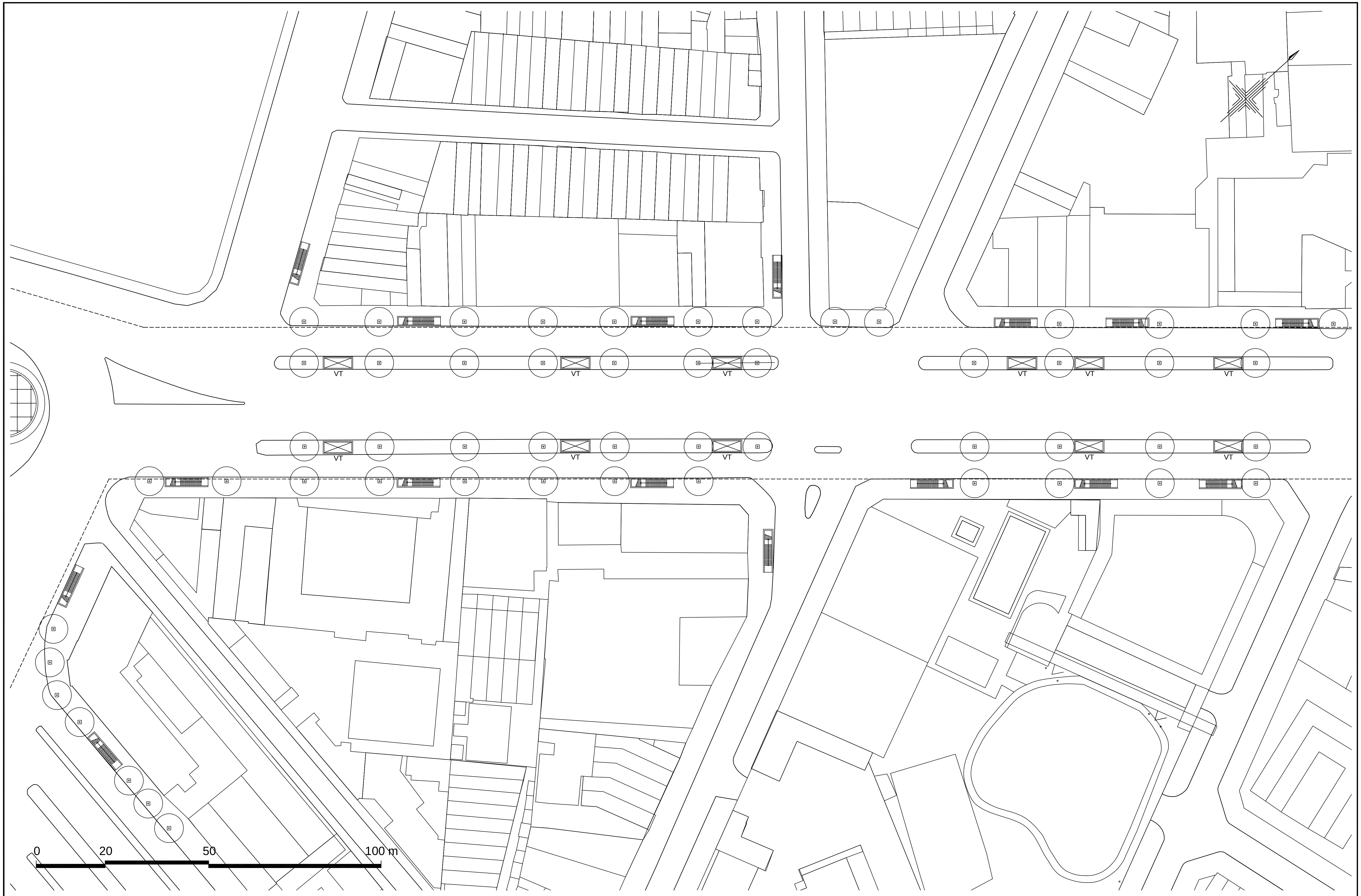
Figure4.47 Glound Level Whole Plan under current traffic arrangement



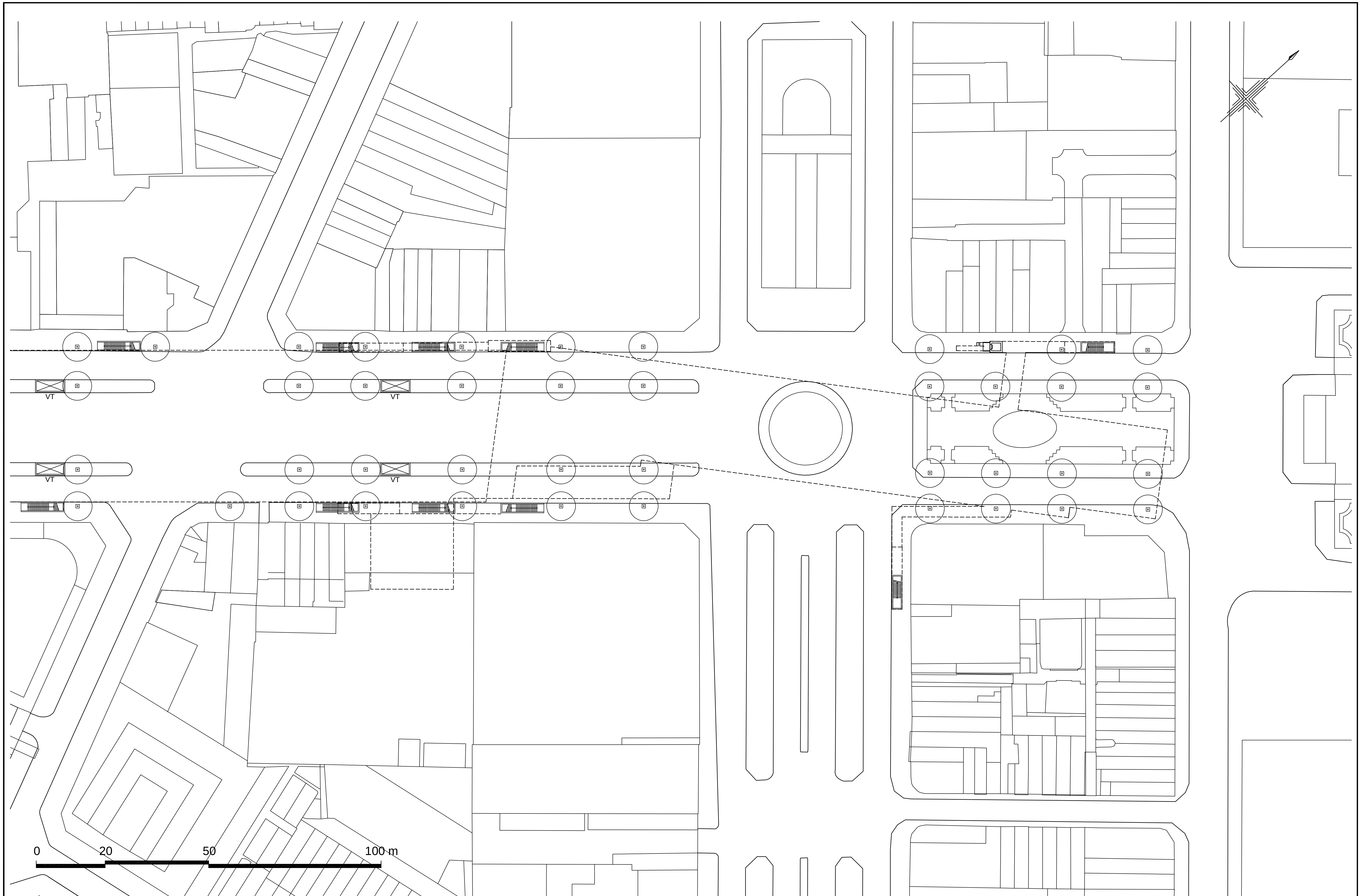
*VT : Ventilation Tower

Figure4.48 Glound Level Plan 1 under current traffic arrangement

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT GLOUND LEVEL PLAN 1 (1st Phase)	DATA. 03.03.2012 SCALE. A1:1/500 A3:1/1000 DWG NO. DFR-2-2



		*VT : Ventilation Tower	JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)	DATA. 03.03.2012
			NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	SCALE. A1:1/500 A3:1/1000
		Figure4.49 Glound Level Plan 2 under current traffic arrangement		GLOUND LEVEL PLAN 2 (1st Phase)	DWG NO. DFR-2-3



*VT : Ventilation Tower

Figure4.50 Glound Level Plan 3 under current traffic arrangement

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT GLOUND LEVEL PLAN 3 (1st Phase)	DATA. 03.03.2012 SCALE. A1:1/500 A3:1/1000 DWG NO. DFR-2-4

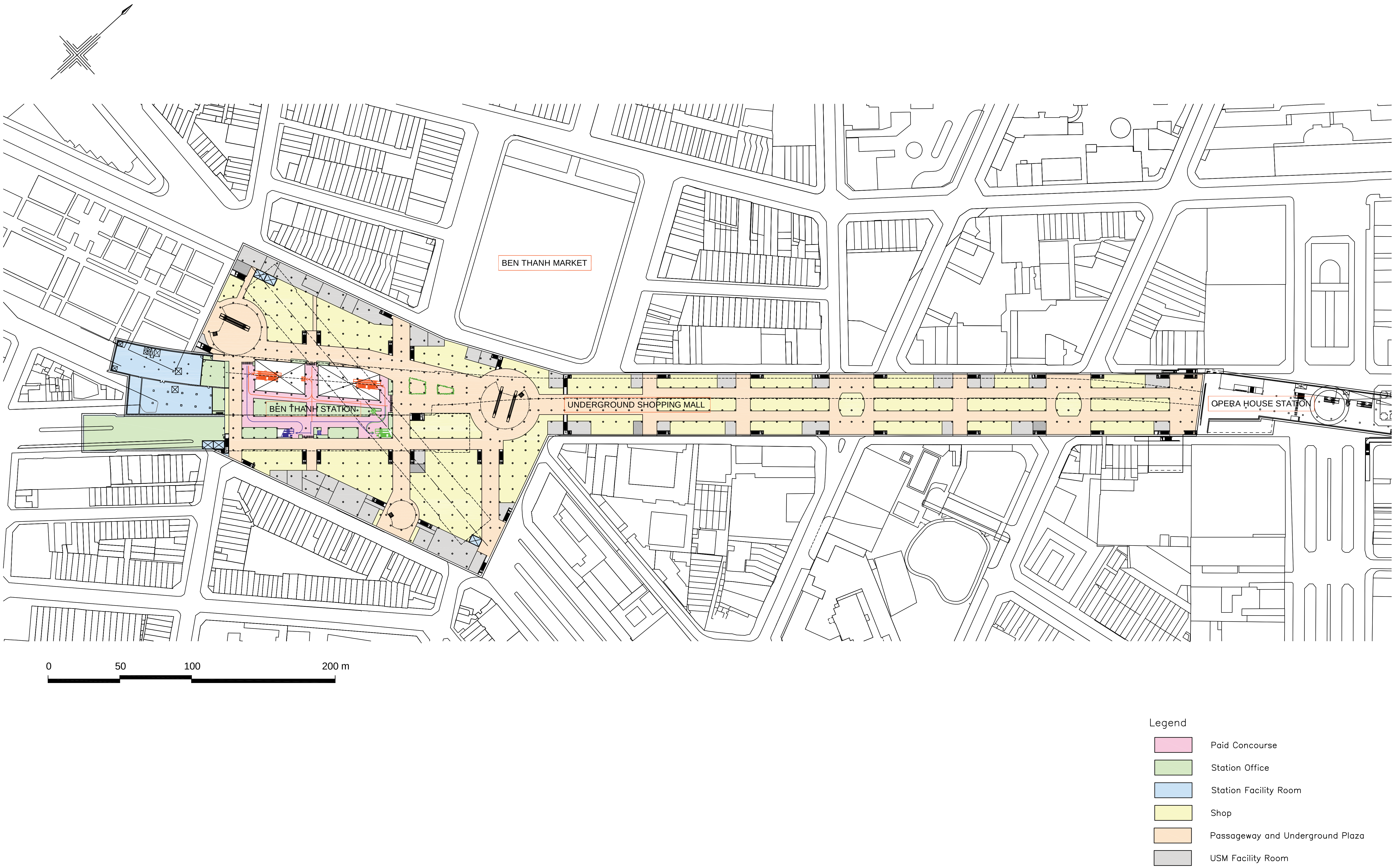
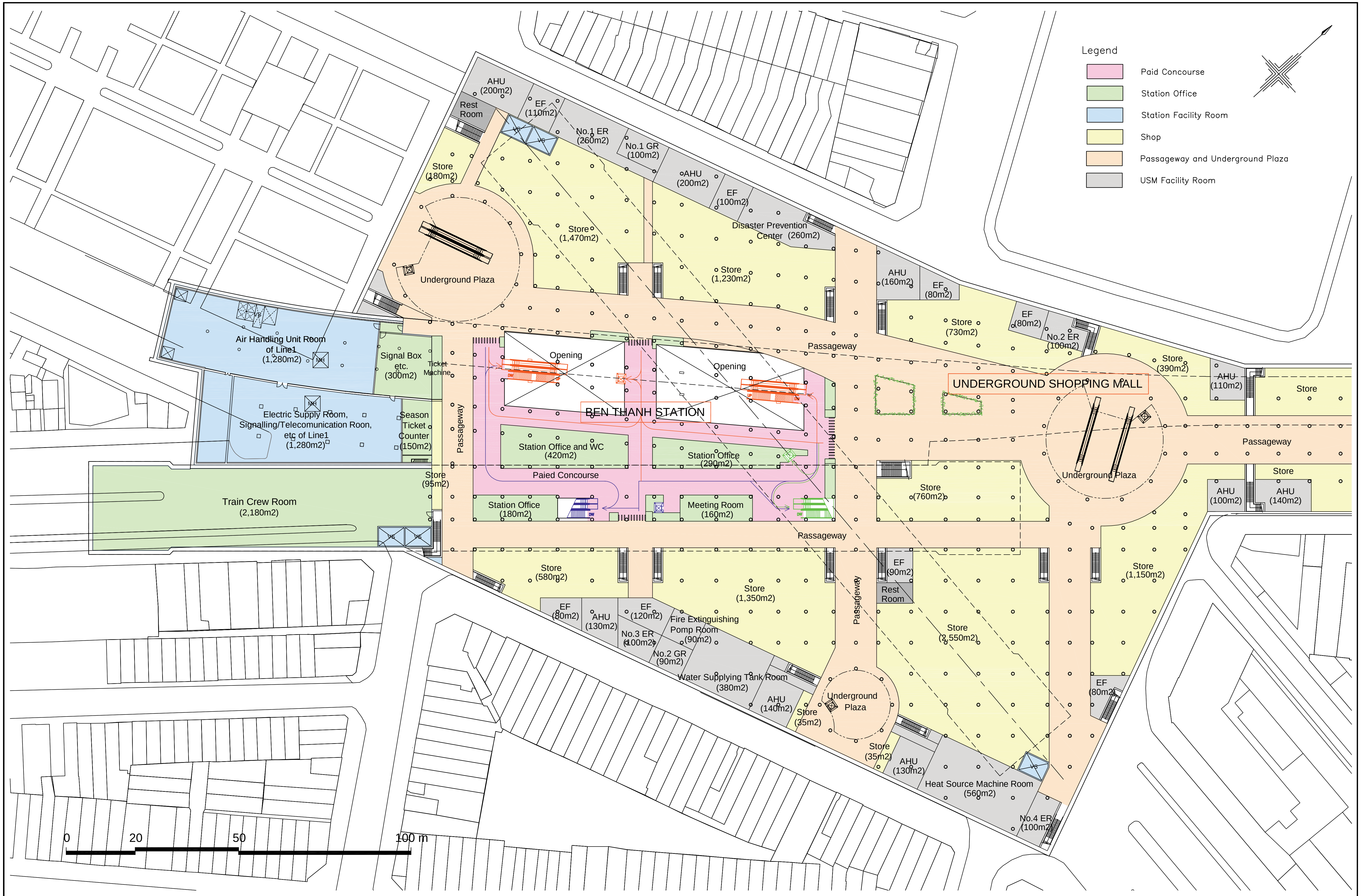


Figure4.51 B1 Whole Plan	JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	DATA. 10.12.2011
			SCALE. A1:1/1250 A3:1/2500
		B1 WHOLE PLAN (2nd Phase)	DWG NO. DFR-2-5



*AHU : Air Handling Unit Room	*VS : Ventilation Shaft
*EF : Exhaust Fan Room	*MH : Machine Hatch
*ER : Electrical Room	
*GR : Generator Room	

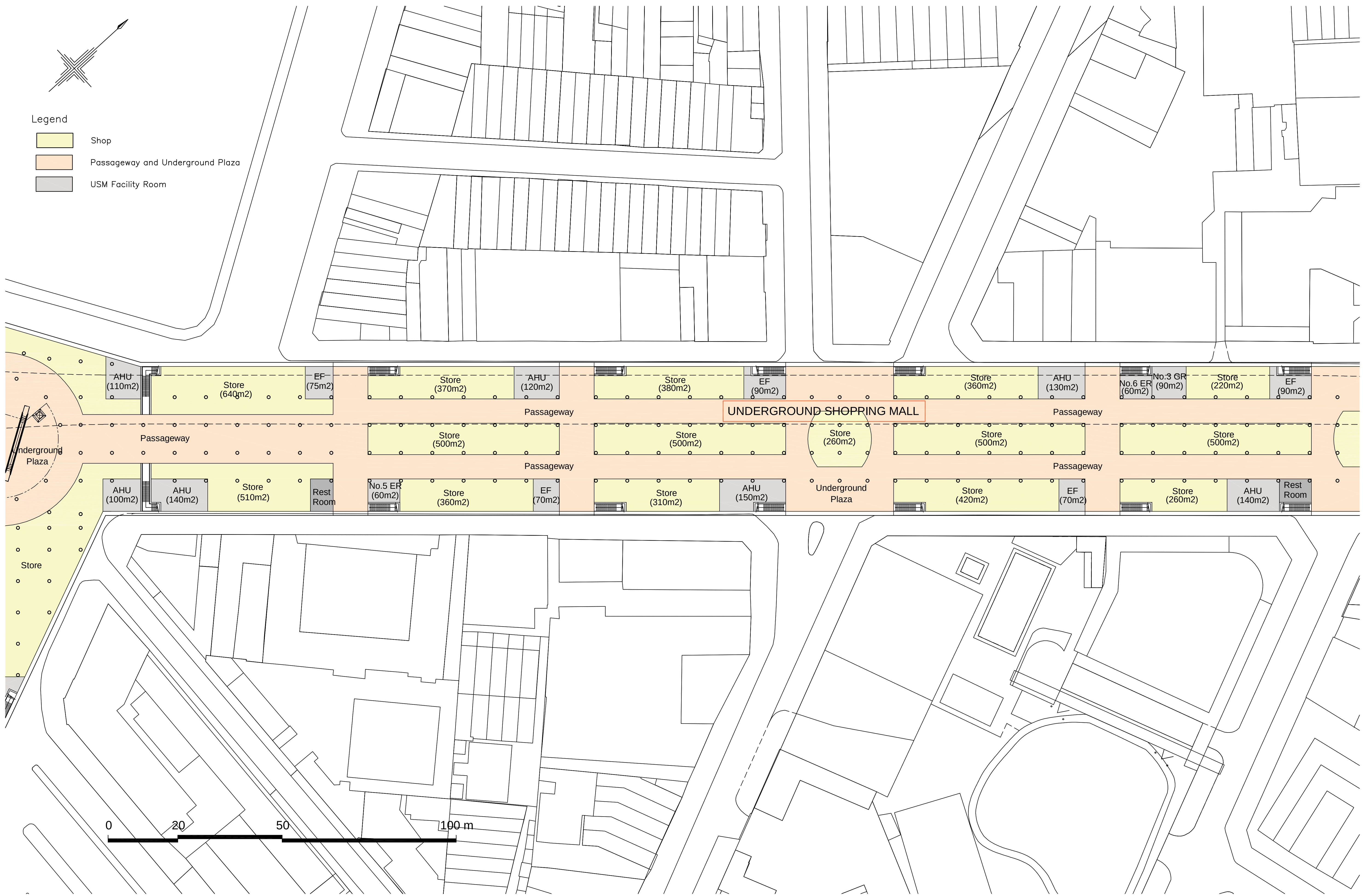
Figure4.52 B1 Plan 1 (Ben Thanh Station Area)

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT

B1 PLAN 1 (2nd Phase)

DATA. 10.12.2011
SCALE. A1:1/500 A3:1/1000
DWG NO. DFR-2-6



*AHU : Air Handling Unit Room
*EF : Exhaust Fan Room
*ER : Electrical Room
*GR : Generator Room

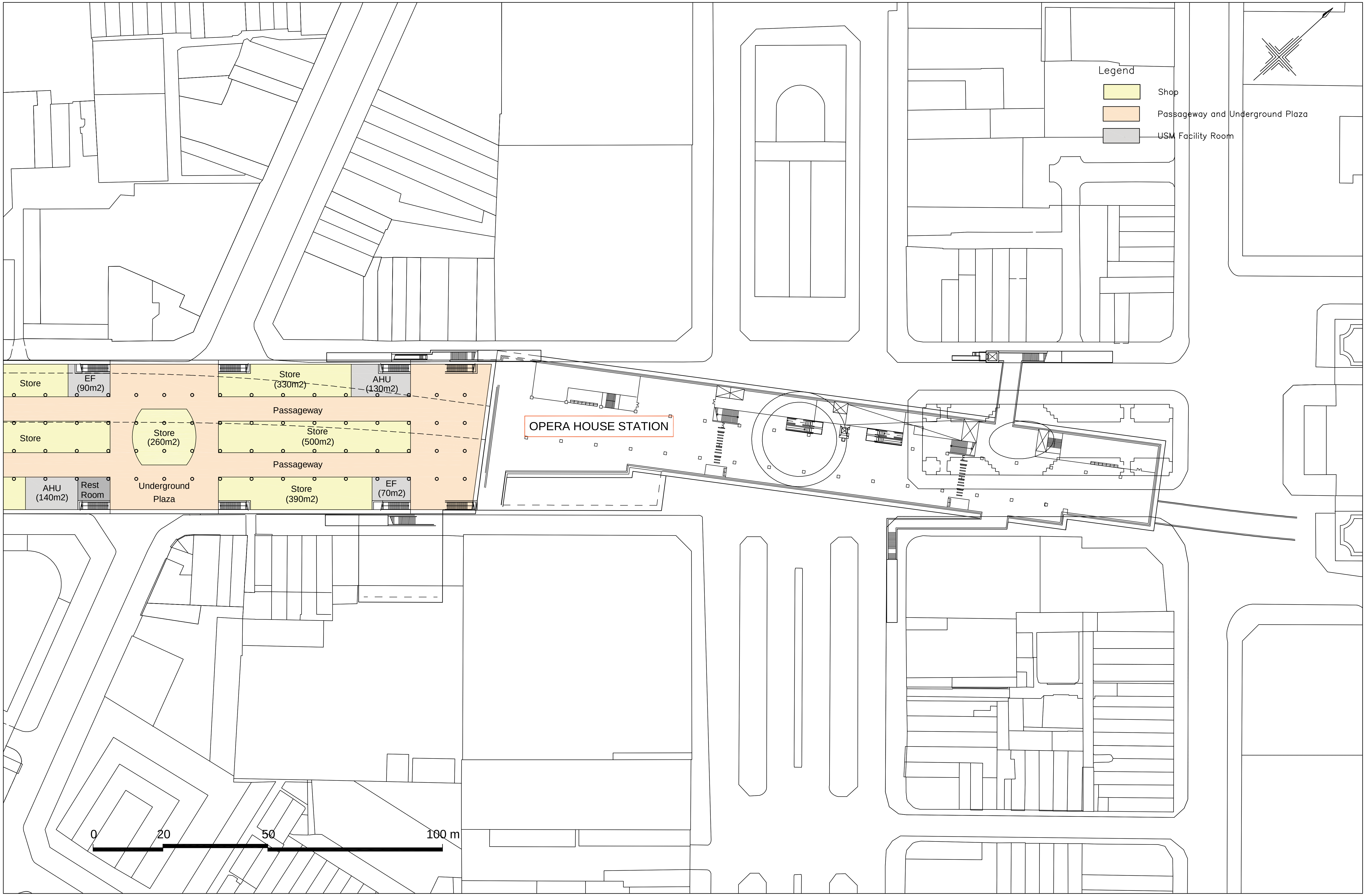
Figure4.53 B1 Plan 2 (Le Loi Street Area)

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT

B1 PLAN 2 (2nd Phase)

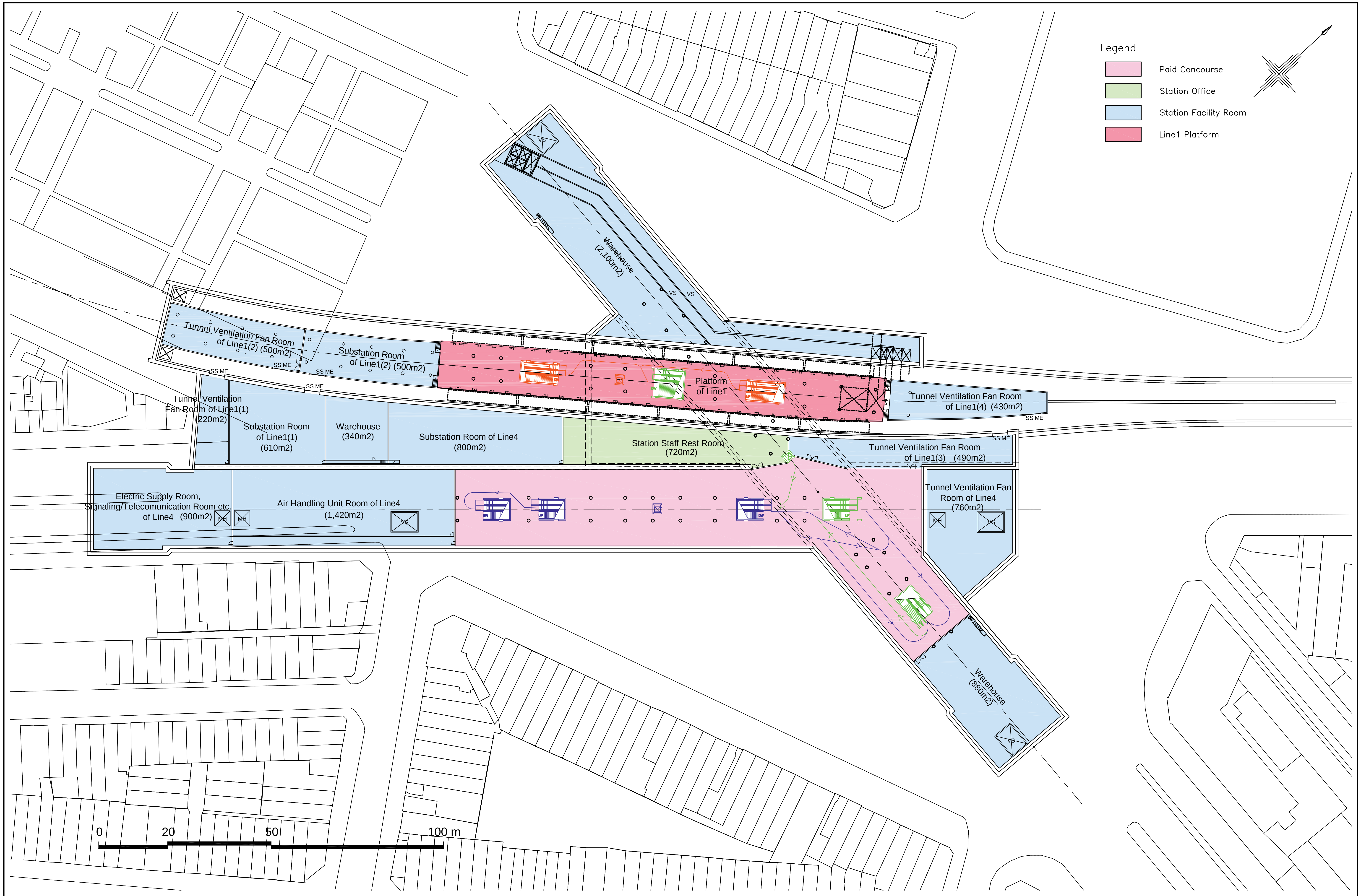
DATA.	10.12.2011
SCALE.	A1:1/500 A3:1/1000
DWG NO.	DFR-2-7



*AHU : Air Handling Unit Room
*EF : Exhaust Fan Room
*ER : Electrical Room
*GR : Generator Room

Figure4.54 B1 Plan 3 (Le Loi Street Area)

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	DATA.	10.12.2011
		SCALE.	A1:1/500 A3:1/1000
	B1 PLAN 3 (2nd Phase)	DWG NO.	DFR-2-8



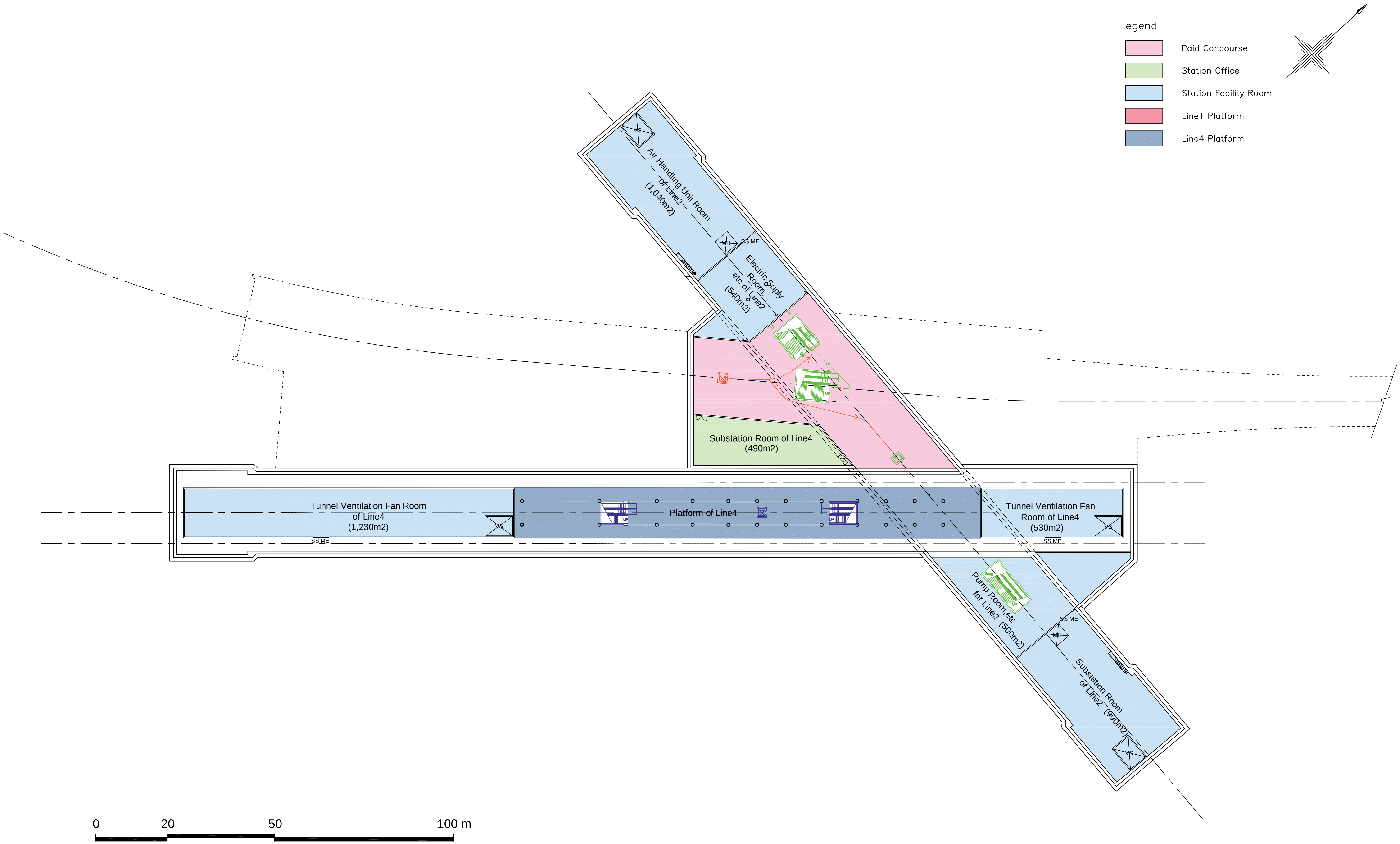
*VS : Ventilation Shaft
*MH : Machine Hatch
*SSME : Steel Shutter for Machine Emplacement

Figure4.55 B2 Plan (Line1 Platform Level)

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT
B2 PLAN (2nd Phase)

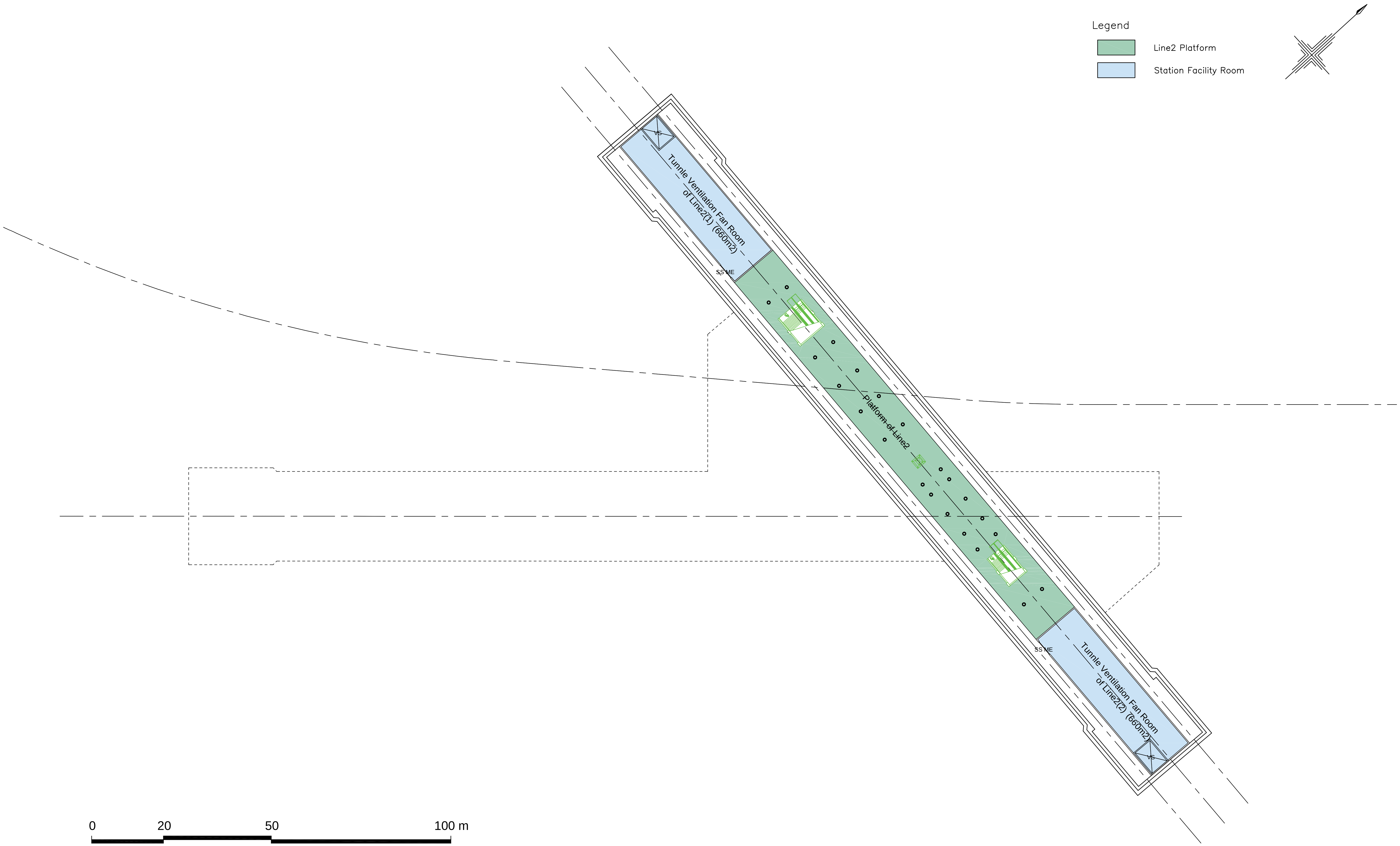
DATA. 10.12.2011
SCALE. A1:1/500 A3:1/1000
DWG NO. DFR-2-9



*VS : Ventilation Shaft
*MH : Machine Hatch
*SSME : Steel Shutter for Machine Emplacement

Figure4.56 B3 Plan (Line4 Platform Level)

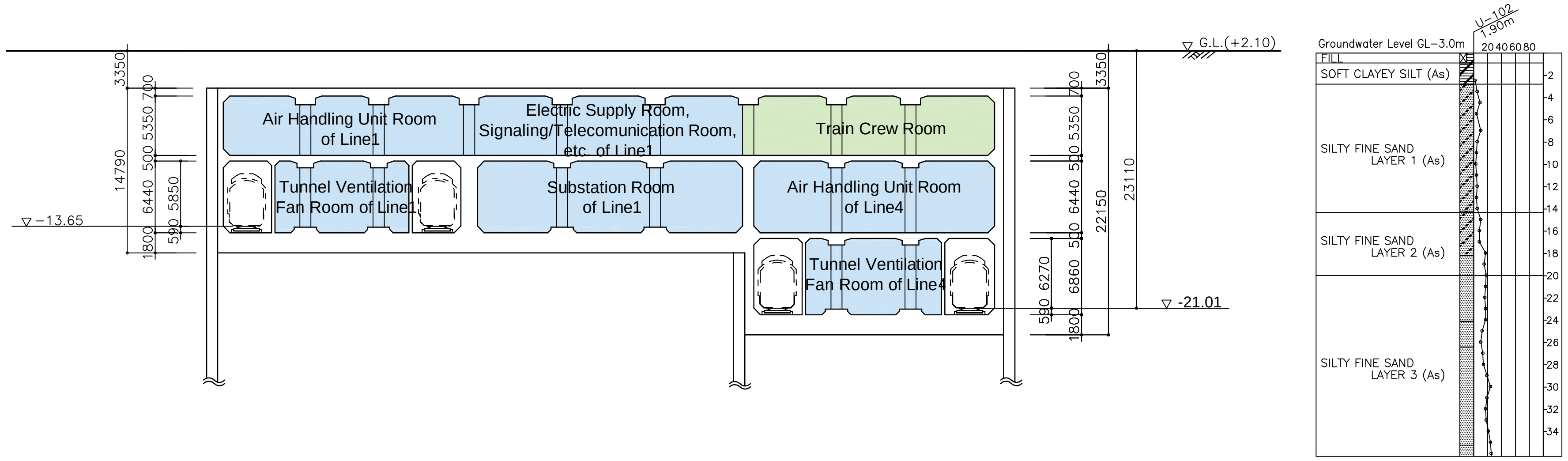
JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT B3 PLAN (2nd Phase)	DATA. 10.12.2011 SCALE. A1:1/500 A3:1/1000 DWG NO. DFR-2-10



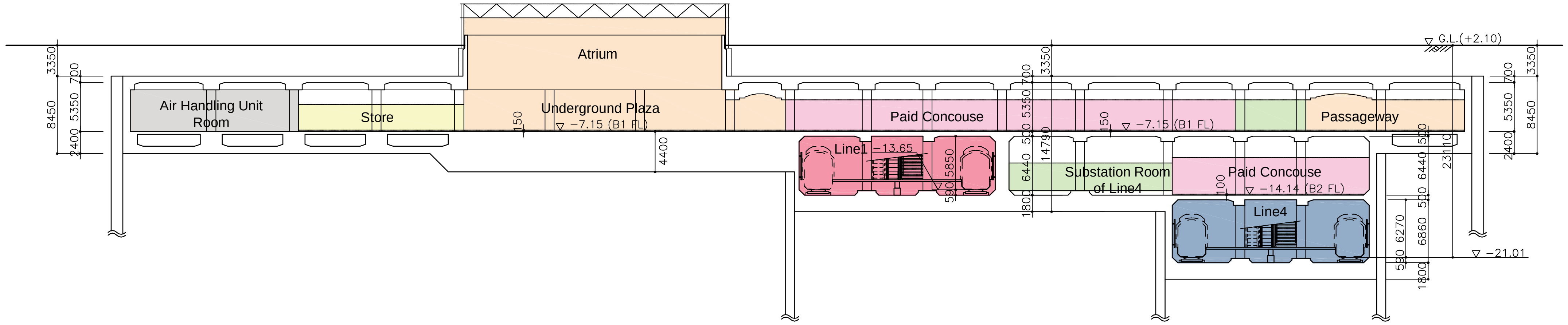
*VS : Ventilation Shaft
*SSME : Steel Shutter for Machine Emplacement

Figure4.57 B4 Plan (Line2 Platform Level)

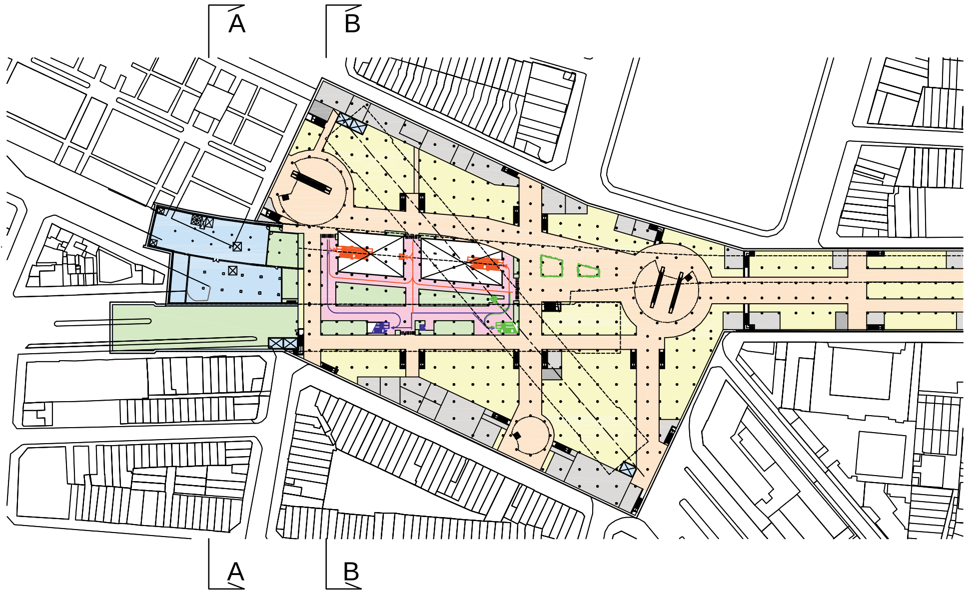
JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT B4 PLAN (2nd Phase)	DATA. 10.12.2011 SCALE. A1:1/500 A3:1/1000 DWG NO. DFR-2-11



A−A CROSS SECTION



B−B CROSS SECTION



KEY PLAN 1/3000

Legend

- Paid Concourse
- Station Office
- Station Facility Room
- Line1 Platform
- Line2 Platform
- Line4 Platform
- Shop
- Passageway and Underground Plaza
- USM Facility Room

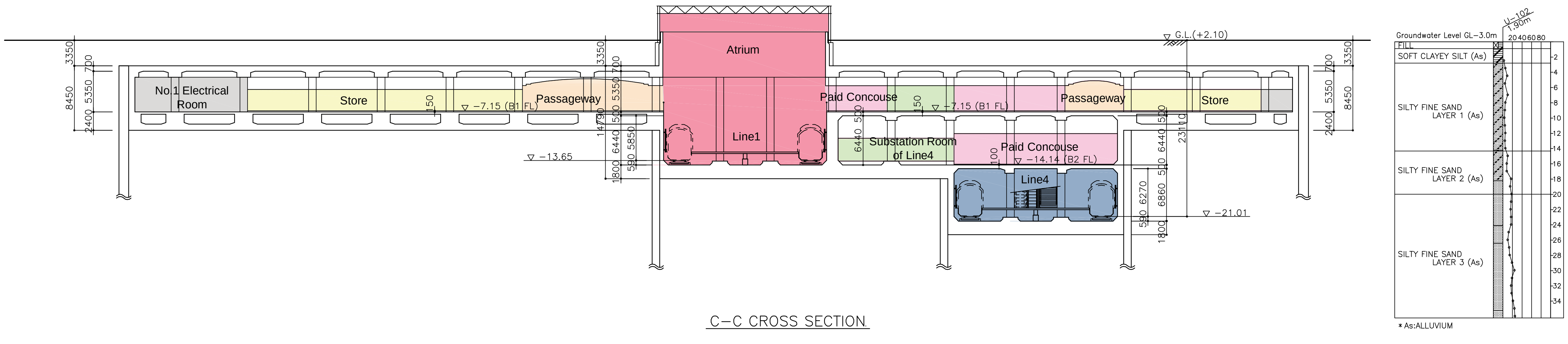
Figure4.58 Section 1

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

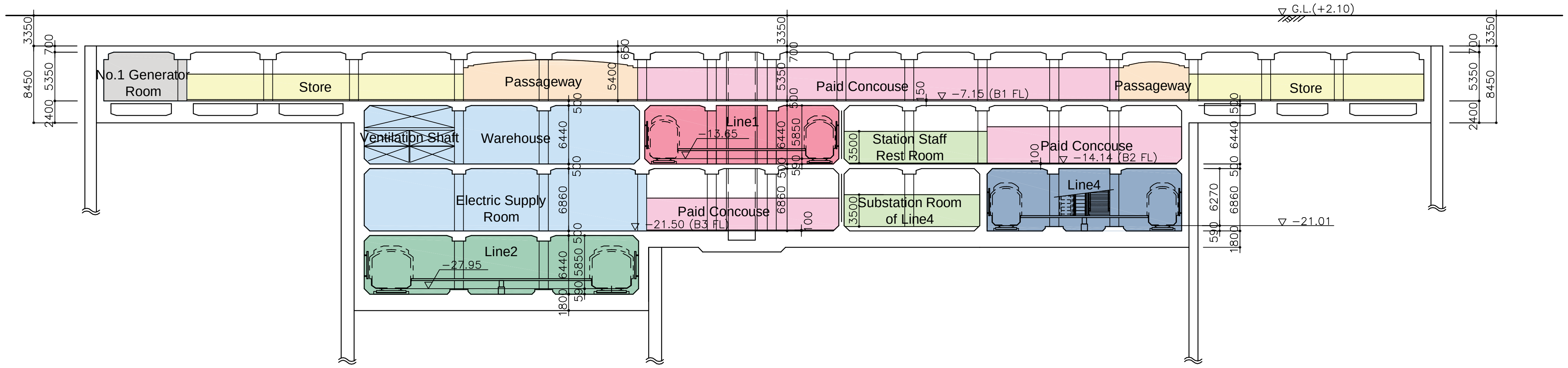
JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT

SECTION 1 (2nd Phase)

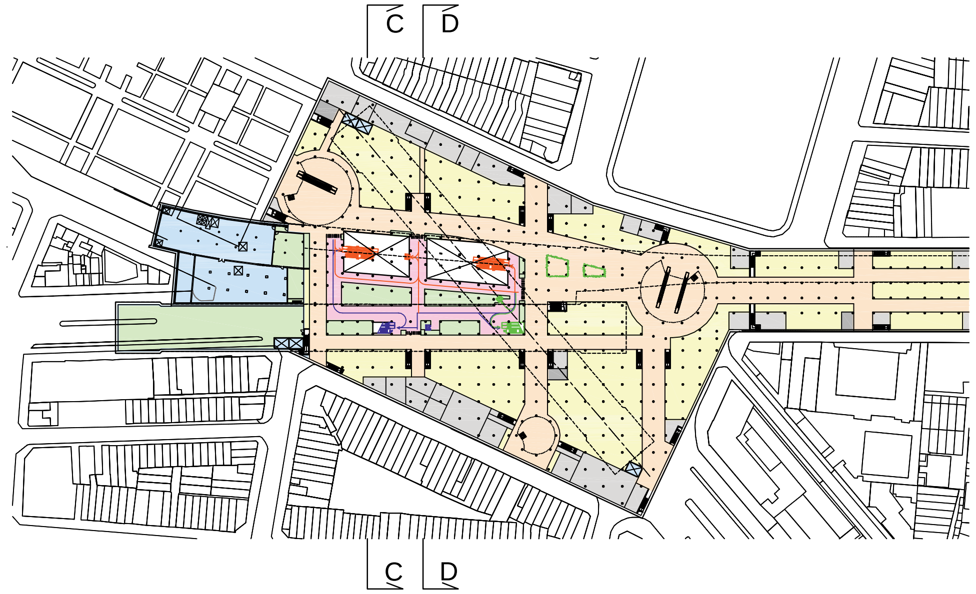
DATA. 10.12.2011
SCALE. A1:1/300 A3:1/600
DWG NO. DFR−2−12



C−C CROSS SECTION



D−D CROSS SECTION



KEY PLAN 1/3000

Legend

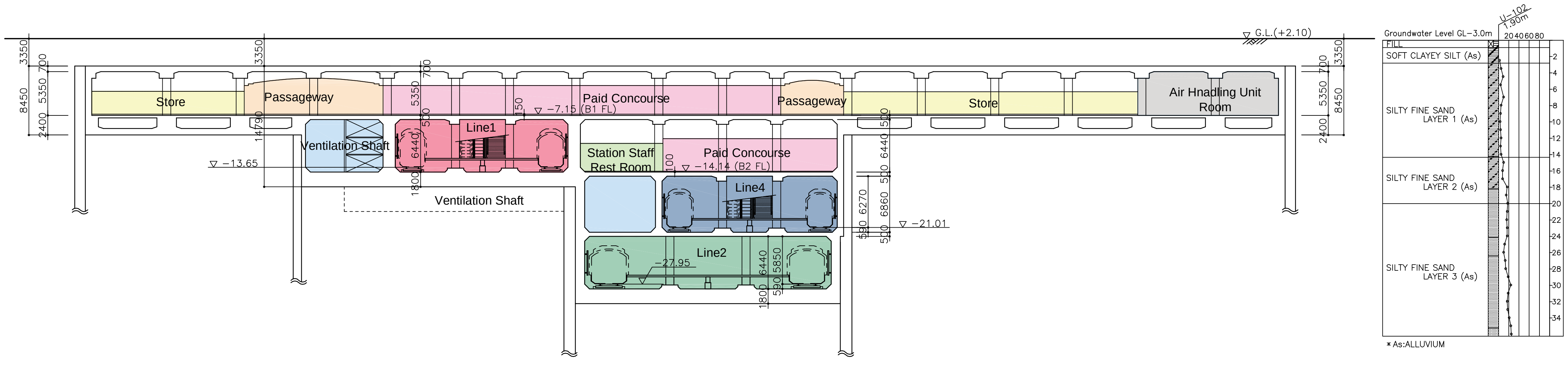
- Paid Concourse
- Station Office
- Station Facility Room
- Line1 Platform
- Line2 Platform
- Line4 Platform
- Shop
- Passageway and Underground Plaza
- USM Facility Room

Figure4.59 Section 2

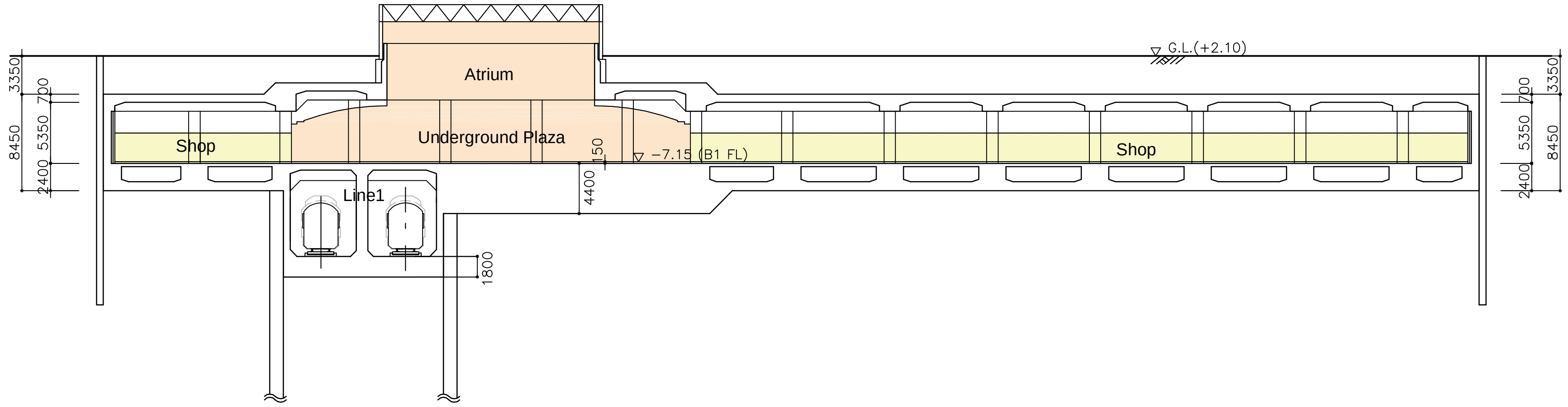
JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT
SECTION 2 (2nd Phase)

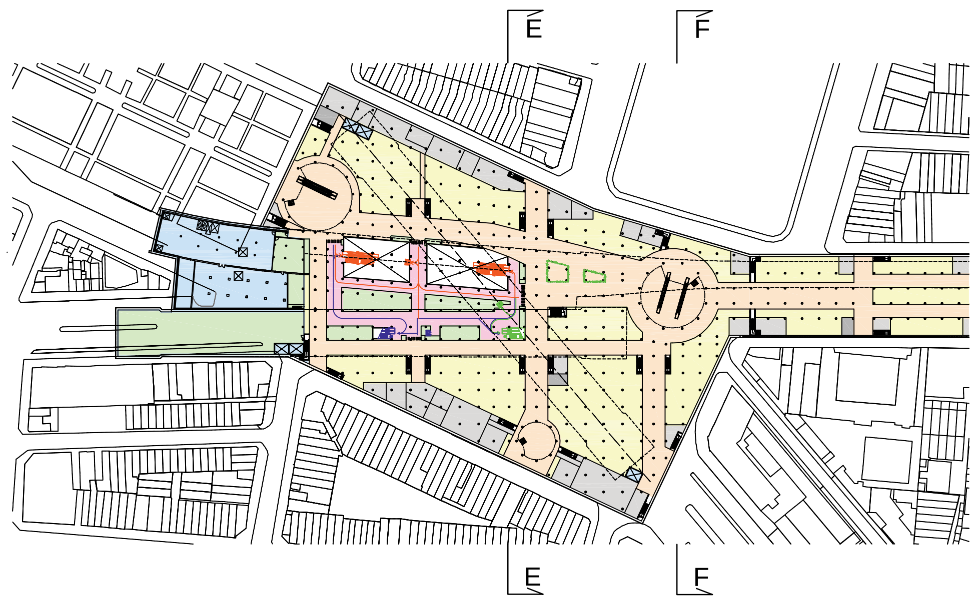
DATA.	10.12.2011
SCALE.	A1:1/300 A3:1/600
DWG NO.	DFR−2−13



E–E CROSS SECTION



F–F CROSS SECTION



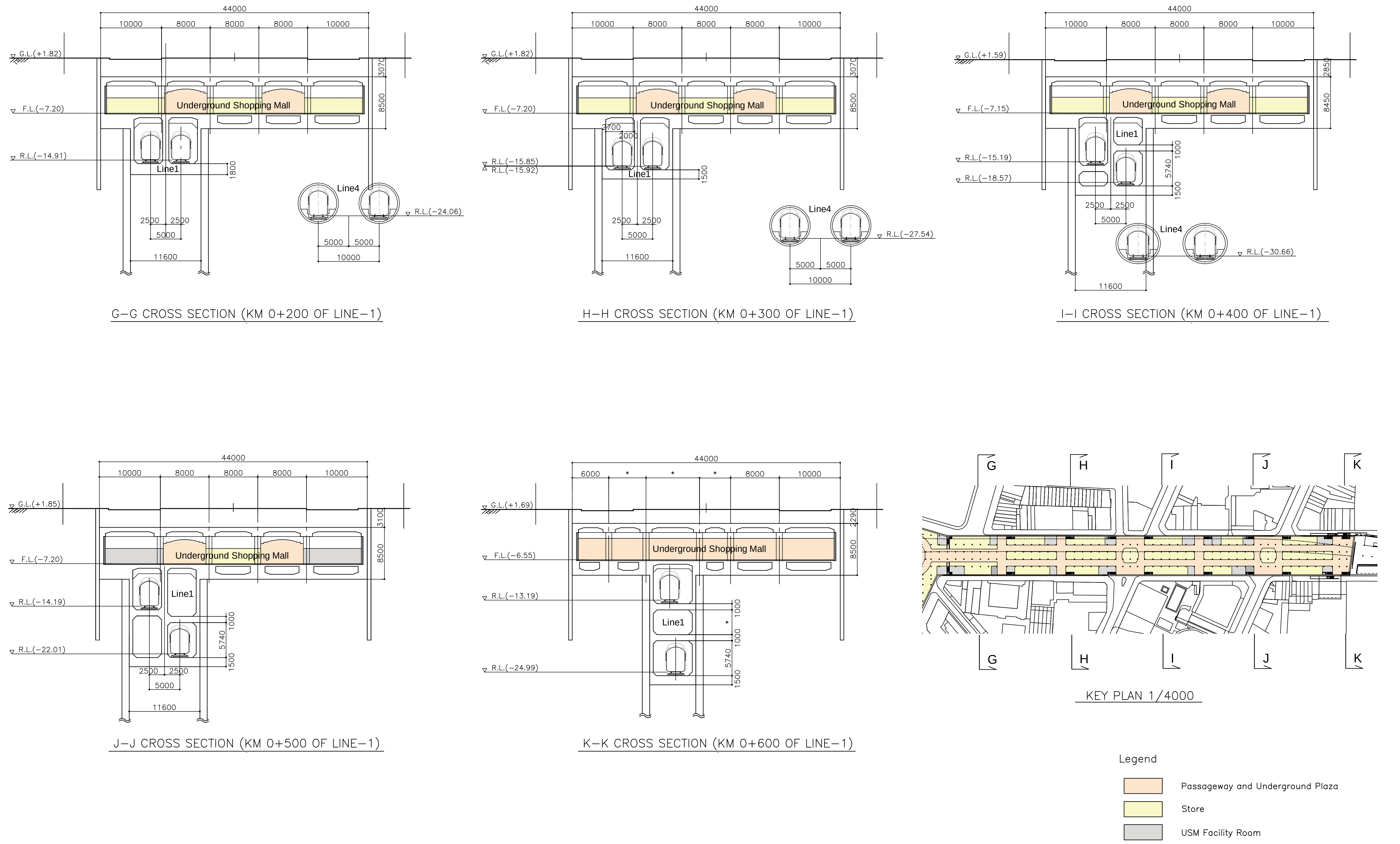
KEY PLAN 1/3000

Legend

- Paid Concourse
- Station Office
- Station Facility Room
- Line1 Platform
- Line2 Platform
- Line4 Platform
- Shop
- Passageway and Underground Plaza
- USM Facility Room

Figure4.60 Section 3

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)	DATA. 06.03.2012
NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	SCALE. A1:1/300 A3:1/600
	SECTION 3 (2nd Phase)	DWG NO. DFR−2−14



JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT SECTION 4 (2nd Phase)	DATA. 10.12.2011 SCALE. A1:1/300 A3:1/600 DWG NO. DFR–2–15

Figure4.61 Section 4

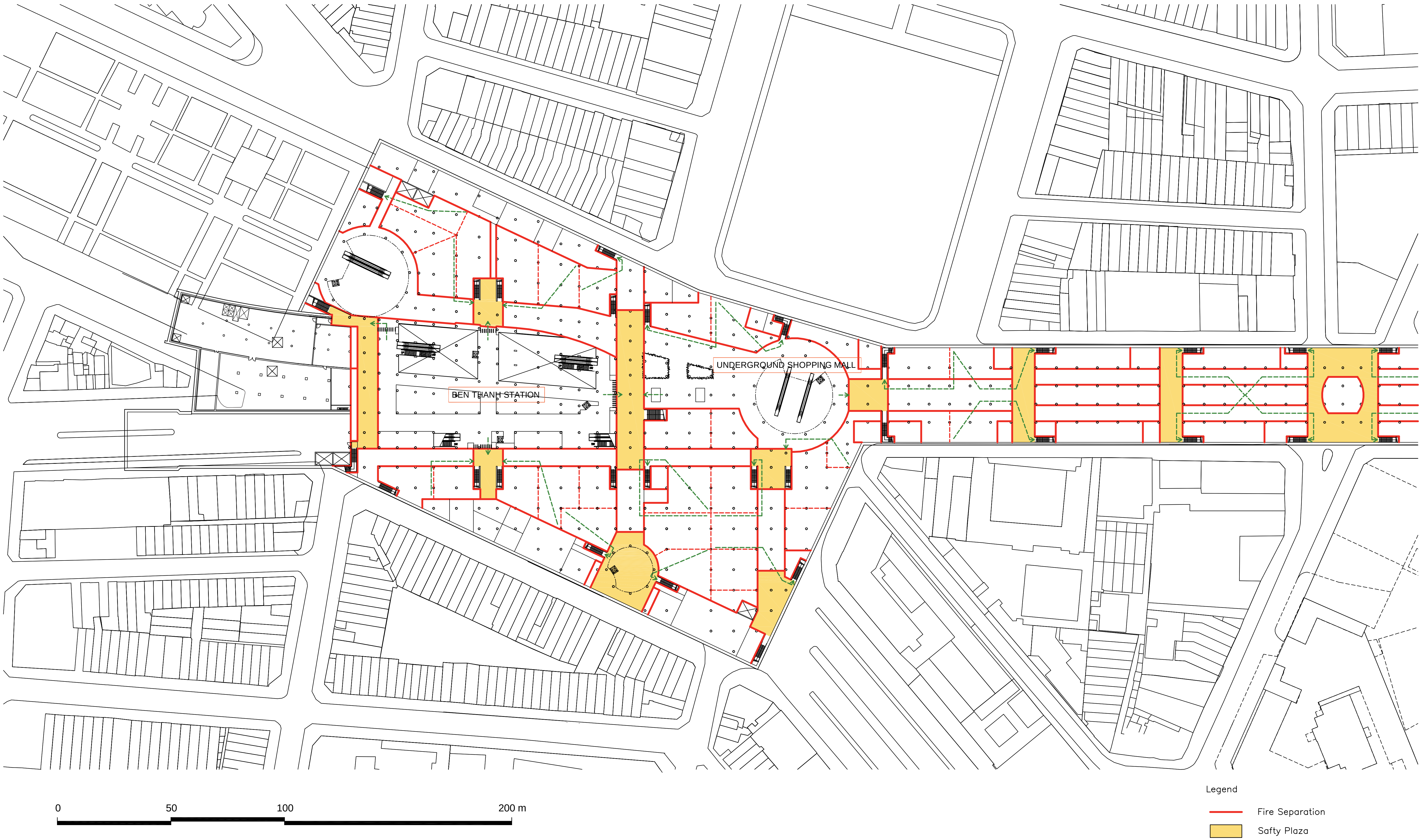
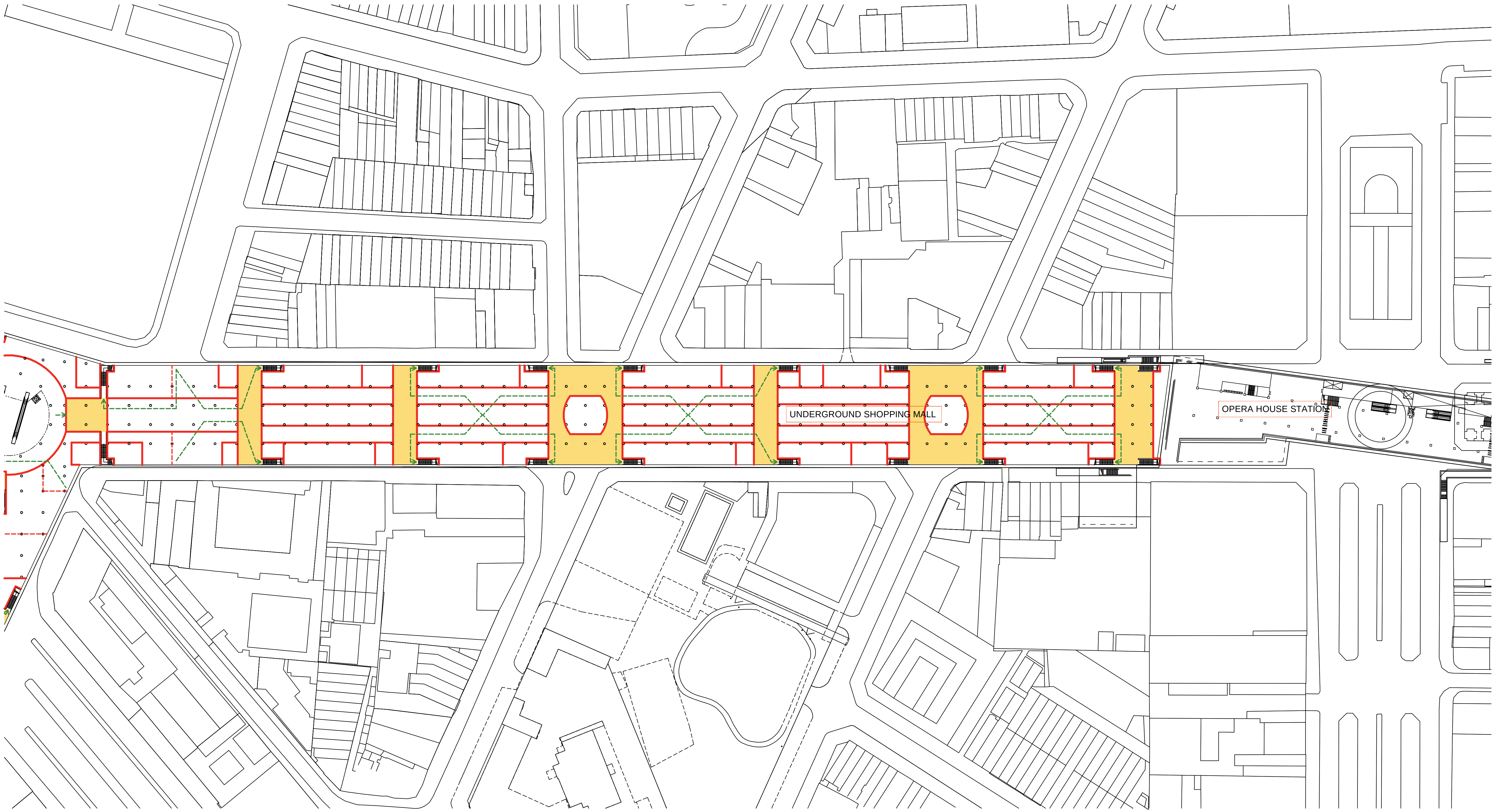


Figure4.62 Emergency Fire Escape Plan 1

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT EMERGENCY FIRE ESCAPE PLAN 1	DATA. 10.12.2011 SCALE. A1:1/800 A3:1/1600 DWG NO. DFR-2-19



JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	DATA. 10.12.2011 SCALE. A1:1/800 A3:1/1600
	EMERGENCY FIRE ESCAPE PLAN 2	DWG NO. DFR-2-20

Figure4.63 Emergency Fire Escape Plan 2

Figure 4.64 Perspective View 1 (Underground Shopping Mall)

Figure 4.65 Perspective View 2 (UMRT Platform)

2) Schematic Design Drawings based on Urban Planning of Ho Chi Minh City

The schematic design drawings on the 2nd phase based on the urban planning of Ho Chi Minh City are shown in the following pages. The ground level plans are different from the drawings under current traffic arrangement, however the underground plans and the sections are same as the drawings under current traffic arrangement. Therefore the relevant drawings to the ground level plan based on the urban planning of Ho Chi Minh City are shown in this section. In addition the perspective views of this project are attached.

The list of the schematic design drawings is as below.

Table 4.28 Drawing List of 2nd Phase based on Urban Planning of Ho Chi Minh City

Drawing No.	Drawing Title		Scale
Figure 4.66	2nd Phase	Ground Level Whole Plan (Based on HCMC urban planning)	1/2500
Figure 4.67		Ground Level Plan 1 (Based on HCMC urban planning)	1/1000
Figure 4.68		Ground Level Plan 2 (Based on HCMC urban planning)	1/1000
Figure 4.69		Ground Level Plan 3 (Based on HCMC urban planning)	1/1000
Figure 4.70		Architectural Section 1	1/200
Figure 4.71		Architectural Section 2	1/200
Figure 4.72		Architectural Section 3	1/200
Figure 4.73		Perspective View 1 (Ground Level)	—
Figure 4.74		Perspective View 2 (Underground Plaza)	—
Figure 4.75		Perspective View 3 (Le Loi Street)	—

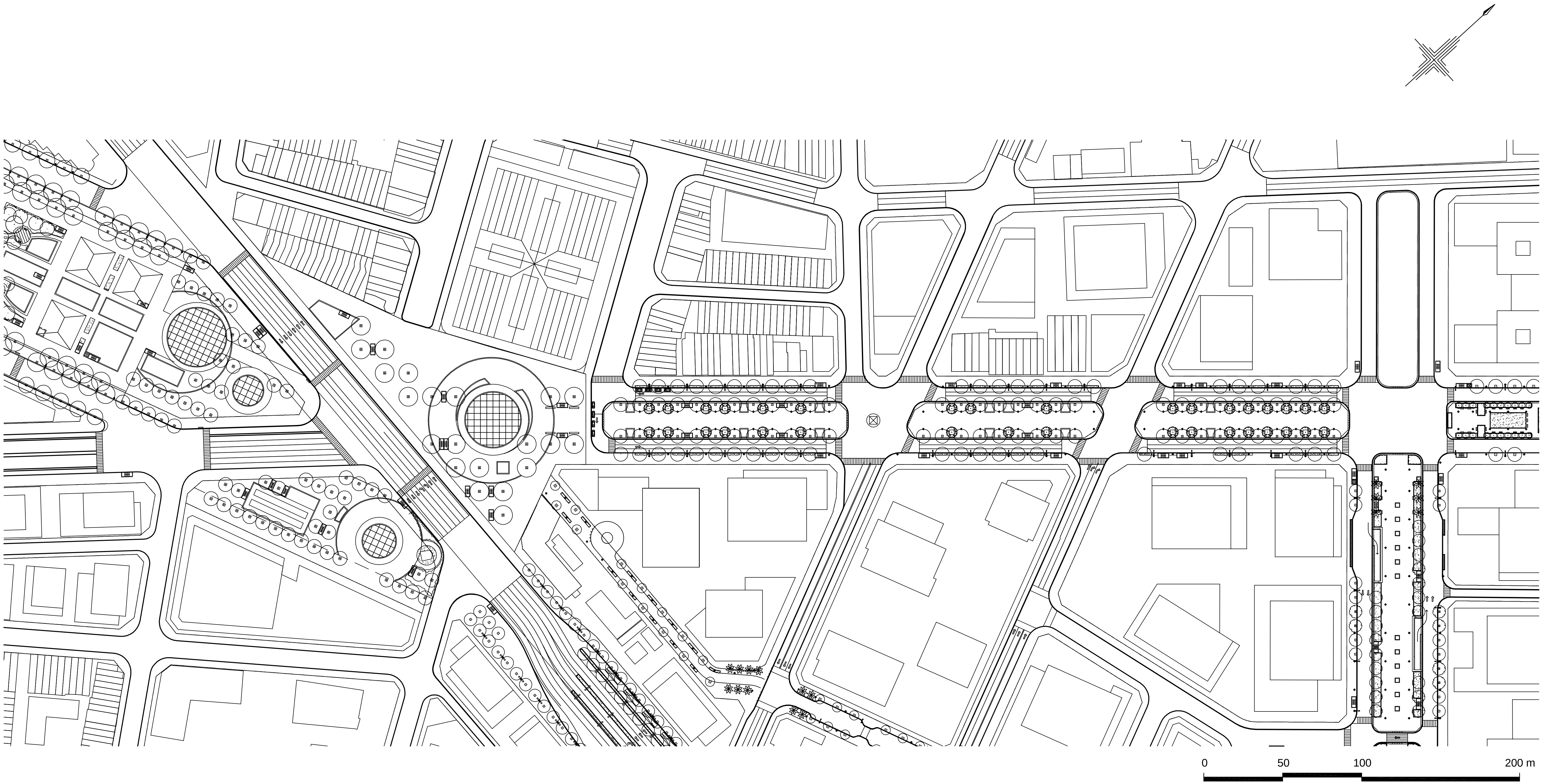
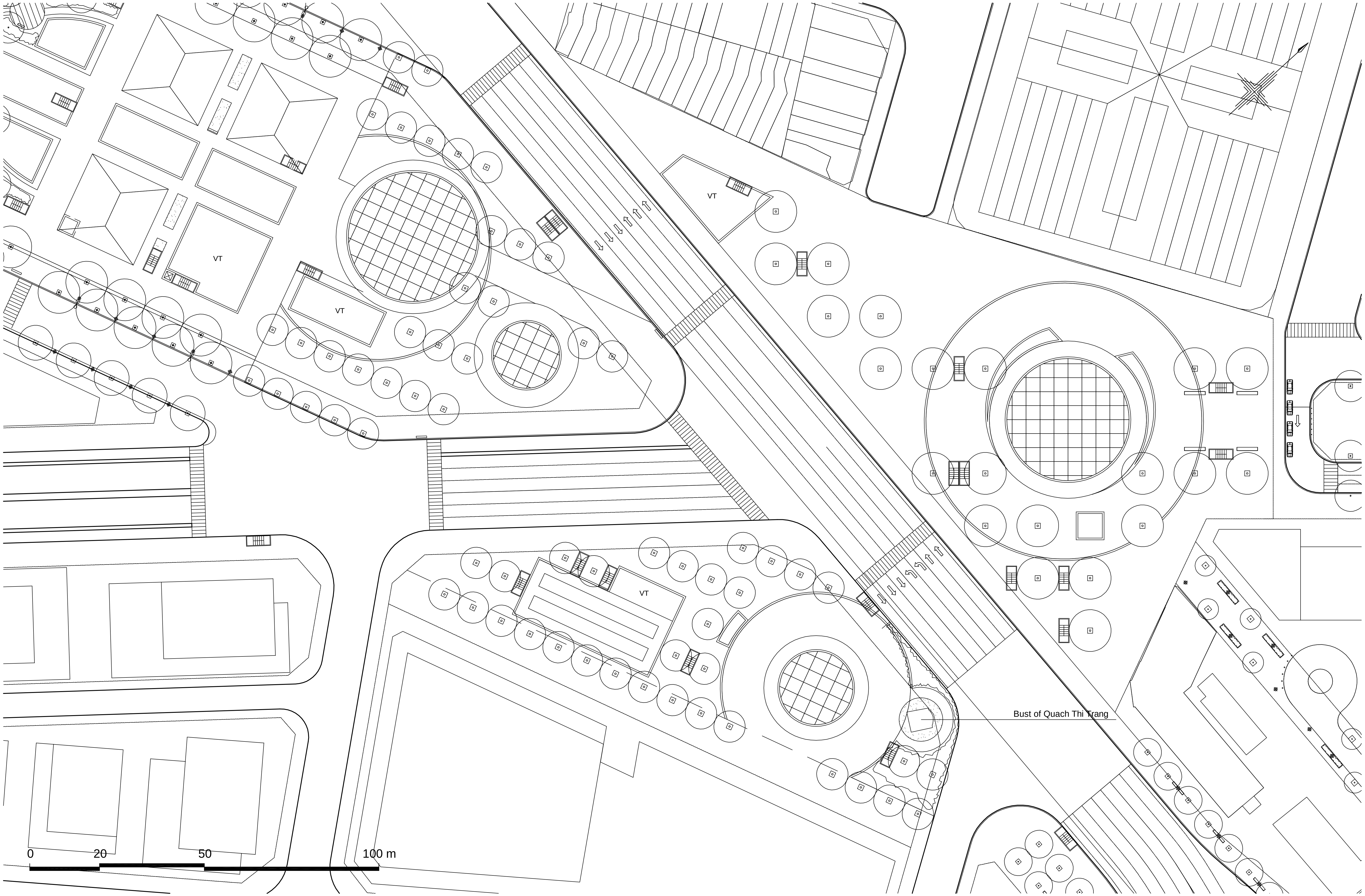


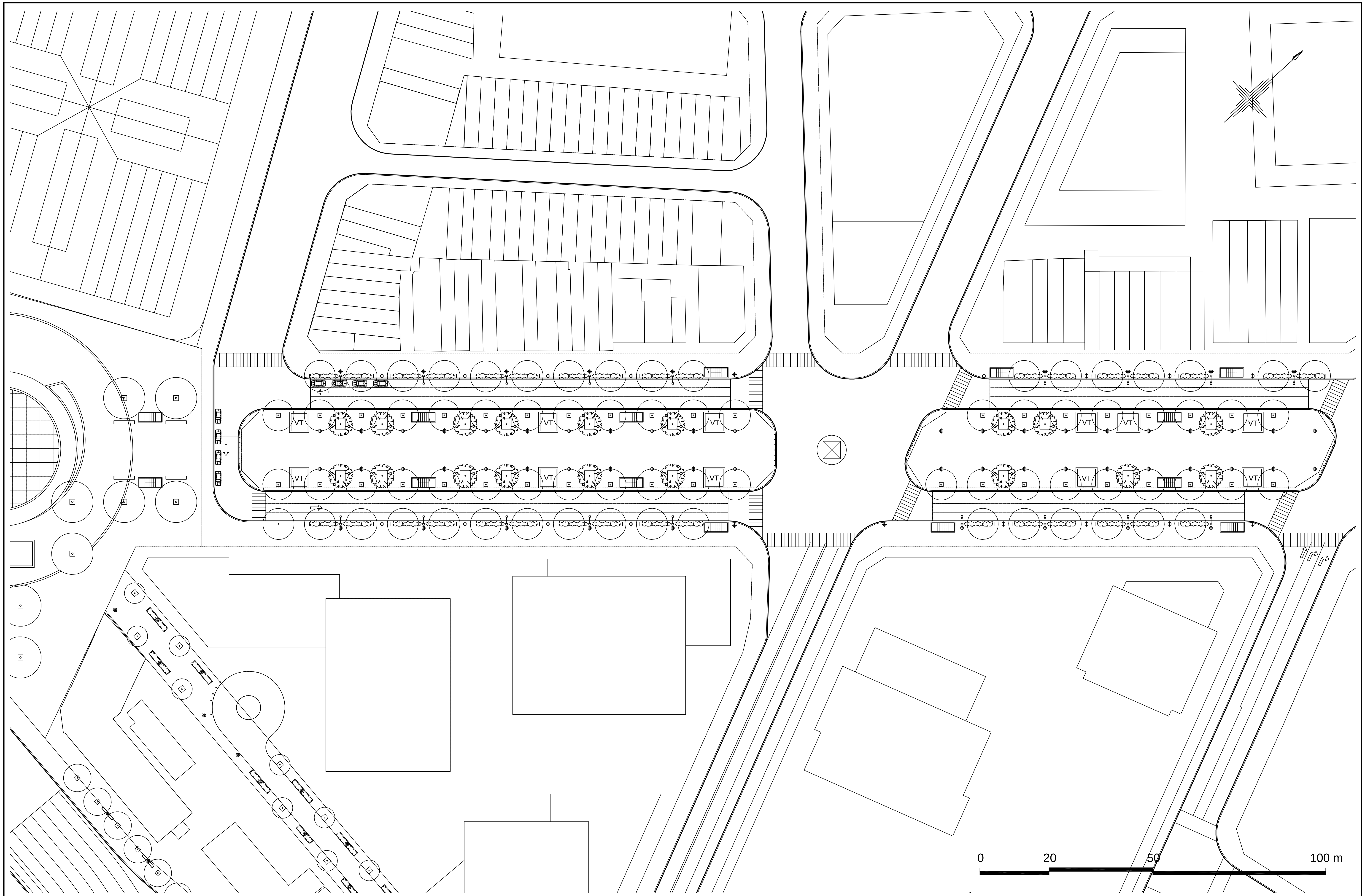
Figure4.66 Glound Level Whole Plan Based on HCMC urban planning	JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	DATA.	10.12.2011
			SCALE.	A1:1/1250 A3:1/2500
		GLOUND LEVEL WHOLE PLAN (2nd Phase)	DWG NO.	DFR-2-1



*VT : Ventilation Tower

Figure4.67 Glound Level Plan 1 Based on HCMC urban planning

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT GLOUND LEVEL PLAN 1 (2nd Phase)	DATA. 10.12.2011 SCALE. A1:1/500 A3:1/1000 DWG NO. DFR-2-2



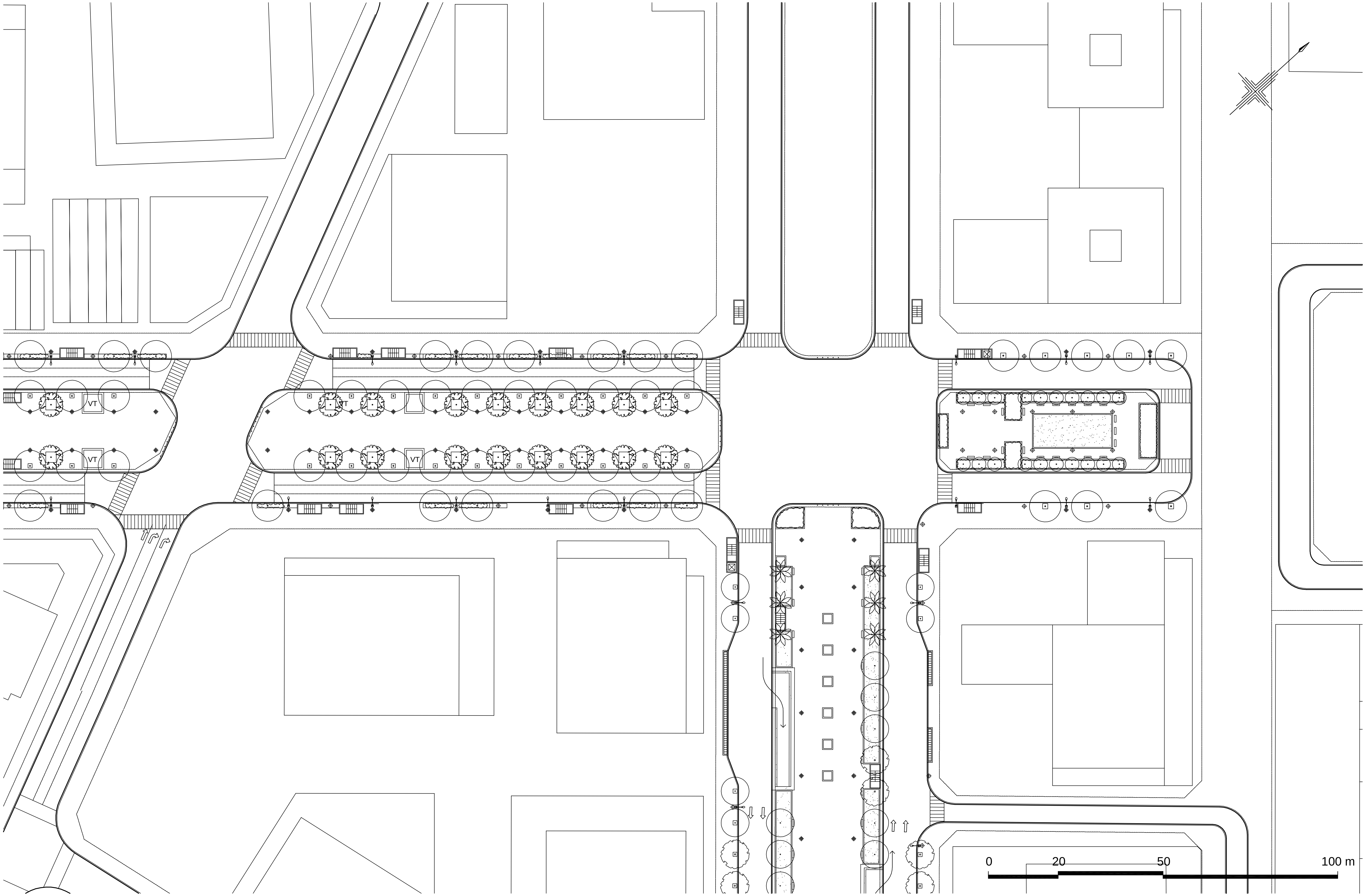
*VT : Ventilation Tower

Figure4.68 Glound Level Plan 2 Based on HCMC urban planning

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT
GLOUND LEVEL PLAN 2 (2nd Phase)

DATA.	10.12.2011
SCALE.	A1:1/500 A3:1/1000
DWG NO.	DFR-2-3



*VT : Ventilation Tower

Figure4.69 Glound Level Plan 3 Based on HCMC urban planning

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT

GLOUND LEVEL PLAN 3 (2nd Phase)

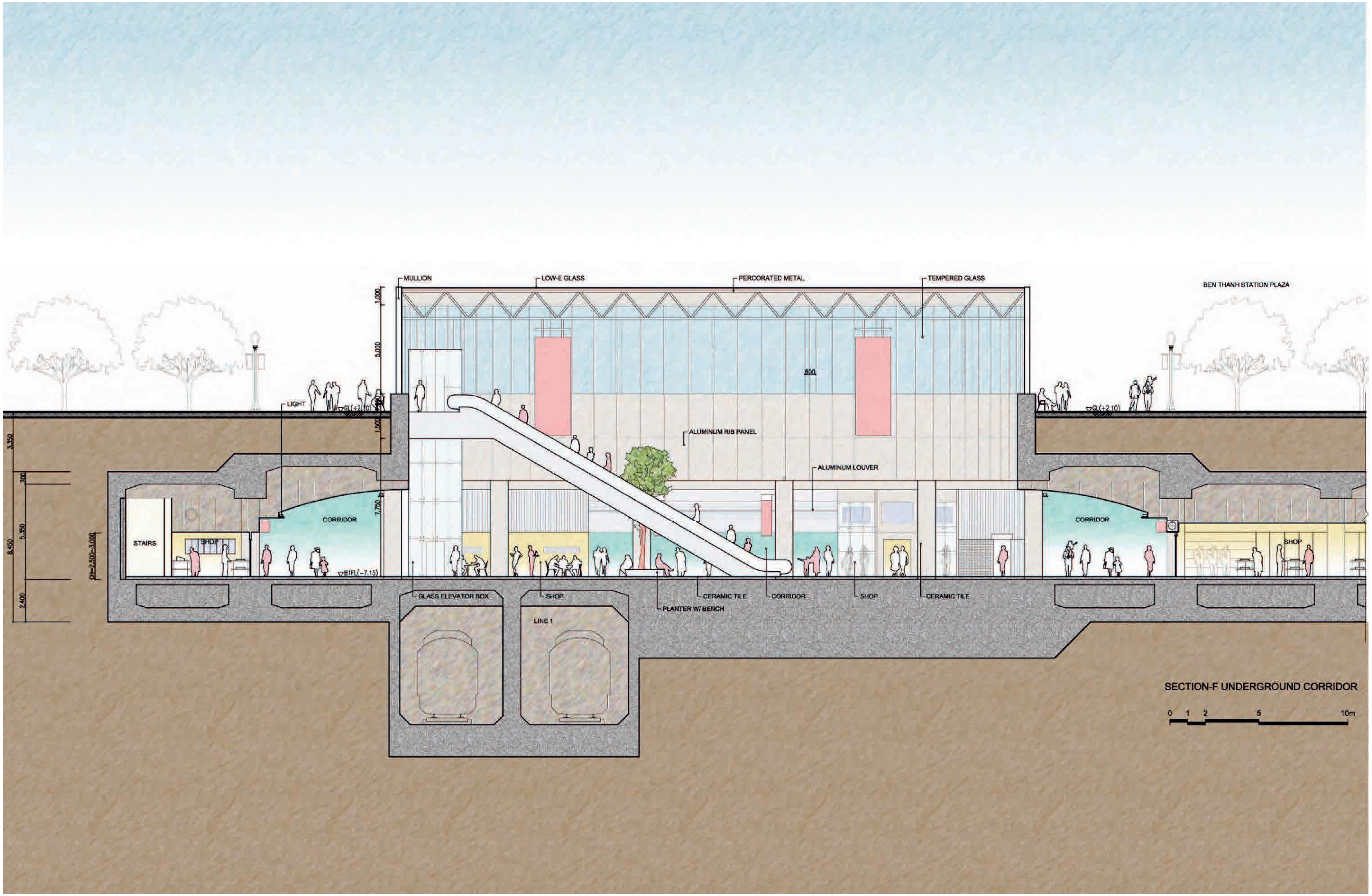
DATA.	10.12.2011
SCALE.	A1:1/500 A3:1/1000
DWG NO.	DFR-2-4

JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT
NIKKEN SEKKEI CIVIL ENGINEERING LTD.
NIKKEN SEKKEI RESEARCH INSTITUTE
NIPPON KOEI CO.,LTD.
JAPAN RAILWAY TECHNICAL SERVICE
SUMITOMO REALTY & DEVELOPMENT CO.,LTD.

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)
PREPARATORY SURVEY ON
BEN THANH CENTRAL STATION PROJECT
ARCHITECTURAL SECTION 1 (2nd Phase)

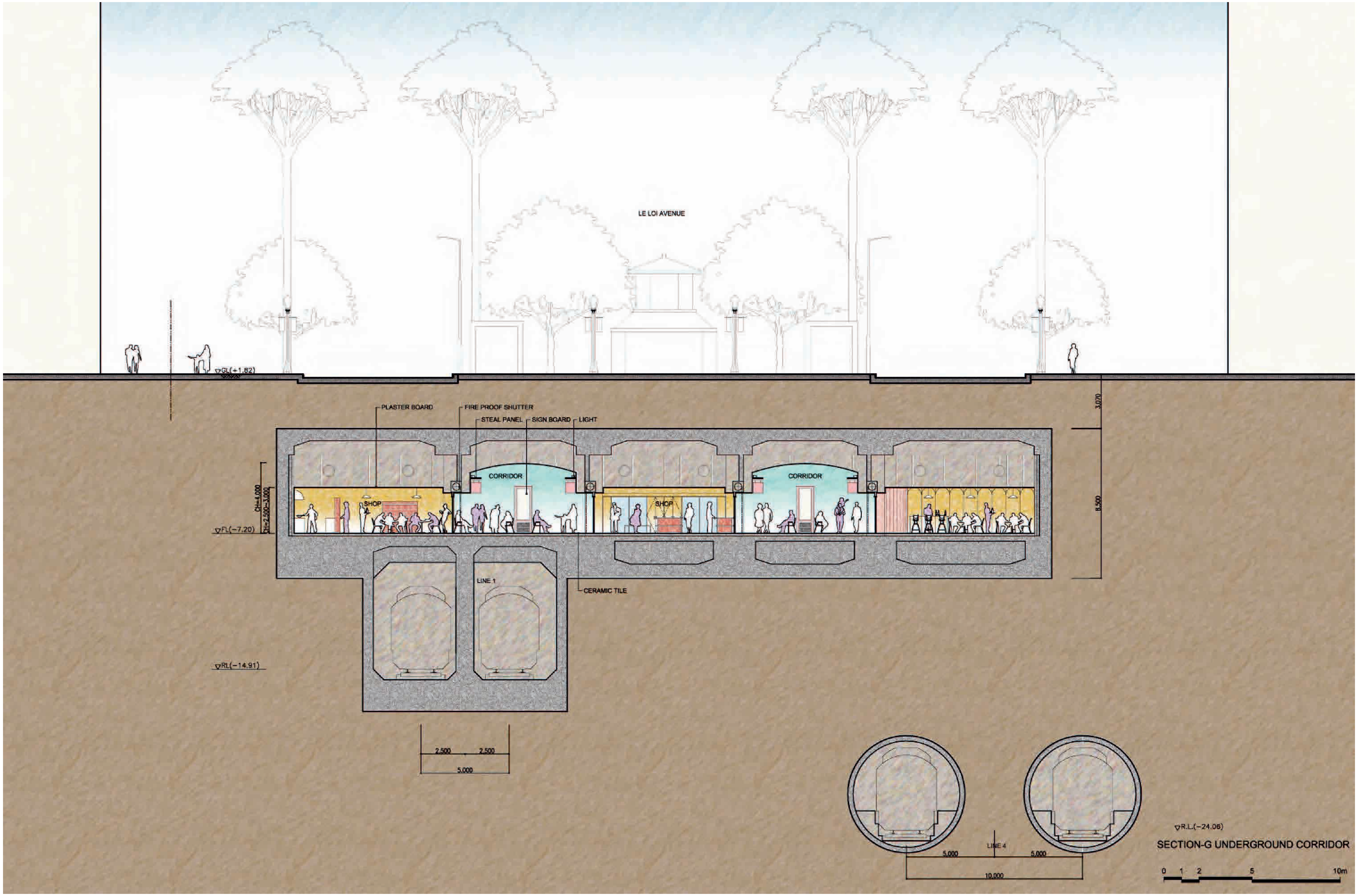
DATA. 10.12.2011
SCALE. A1:1/100 A3:1/200
DWG NO. DFR-2-16

Figure4.70 Architectural Section 1



JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT ARCHITECTURAL SECTION 2 (2nd Phase)
DATA. 10.12.2011	SCALE. A1:1/100 A3:1/200
DWG NO. DFR-2-17	

Figure4.71 Architectural Section 2



JICA STUDY TEAM FOR BTN CENTRAL STATION PROJECT NIKKEN SEKKEI CIVIL ENGINEERING LTD. NIKKEN SEKKEI RESEARCH INSTITUTE NIPPON KOEI CO.,LTD. JAPAN RAILWAY TECHNICAL SERVICE SUMITOMO REALTY & DEVELOPMENT CO.,LTD.	JAPAN INTERNATIONAL COOPERATION AGENCY(JICA) PREPARATORY SURVEY ON BEN THANH CENTRAL STATION PROJECT	DATA. 10.12.2011 SCALE. A1:1/100 A3:1/200
	ARCHITECTURAL SECTION 3 (2nd Phase)	DWG NO. DFR-2-18

Figure4.72 Architectural Section 3

Figure 4.73 Perspective View 1 (Ground Level)

Figure 4.74 Perspective View 2 (Underground Plaza)

Figure 4.75 Perspective View 3 (Le Loi Street)

4.5 CONSTRUCTION PLANNING

In this section, the construction plan was studied for "Ben Thanh Central Station with Underground Shopping Mall (USM)" and "Line 1 tunnels with USM beneath Le Loi Street".

The following issues were mainly studied:

1) Construction method and technical issues to be considered
   Construction methods including temporary works were studied, and the technical issues were listed with their countermeasures.
2) Countermeasures against traffic jam during construction
   Traffic management plan was studied as the countermeasure against traffic jam during construction.

4.5.1 Conditions for Study

The study was conducted based on the following conditions:

1) As shown in Figure 4.76, the construction plan was studied for two major areas, "Ben Thanh Central Station Area" and "Le Loi Street Area".
2) For "Le Loi Street Area", the construction plan was studied for the underground shopping mall together with the structures of Line 1 which also located beneath Le Loi Street.
3) For USM of Le Loi Street Area, Cut & Cover construction method was studied because of its shallow location for the connection with the commercial buildings along Le Loi Street and for the smooth access with the surface ground level.
4) For Ben Thanh Central Station Area, Cut & Cover construction method was planned. This is because of its complex structure formed by station structures for Line 1, Line 2, Line 3a (future extension of Line 1), Line 4 and USM.

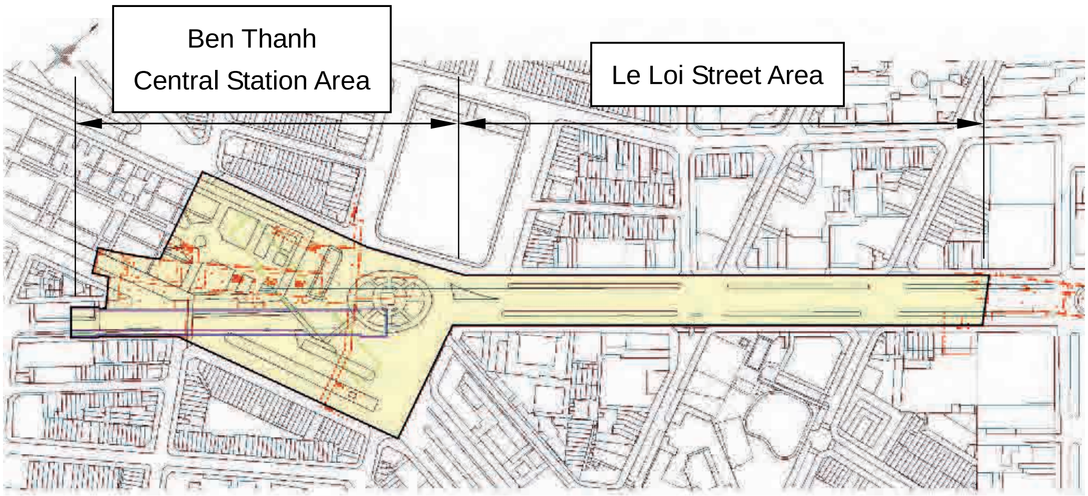


Figure 4.76 Demarcation of Construction Planning

5) Along the area for study, many neighbor buildings exist densely on the soft alluvial sandy layers, and the types of retaining walls and excavation methods were studied to prevent the settlement etc. of the neighbor buildings.
6) The alignment of Line 4 was planned to pass under Line 1 and go parallel with USM and Line 1 to Ben Thanh Station. The construction methods for “Crossing point of Line 1 and Line 4” and “Section where Line 4 and USM exist in parallel” were studied as the important points.
7) Many underground utilities were observed in the study area, and several utilities are impossible to be removed. The method to protect and maintain those utilities was studied.
8) Considering the heavy public traffic at the study area, the traffic management plans were studied for each step of construction plan.

4.5.2 Construction Planning for Le Loi Street Area

1) Objectives in Construction Planning

USM beneath Le Loi Street was planned above the underground structure of Line 1 with almost full width of Le Loi Street. After the commencement of commercial operation of USM, Line 4 tunnel structures are scheduled to be constructed by TBM under USM.

Furthermore, soft alluvium sandy layers exist thickly with high ground water level at the study area, with dense neighbor buildings, many underground utilities and heavy public traffic including pedestrians.

Considering the above conditions, the following objectives shall be studied:

(1) The effects to ongoing Line 1 Project shall be minimized.
(2) The plan, design and construction of Line 4 Project shall not be restricted.
(3) The effects to the neighbor buildings shall be minimized.
(4) The protection and maintain methods of underground utilities difficult to be removed shall be studied.
(5) The effects to public traffic shall be minimized.

2) Study on Construction Method of Line 1 Tunnel Structures related to USM Width

For the construction of USM beneath Le Loi Street by Cut & Cover Method, the coordination with the construction method of Line 1 tunnel (under preliminary design) is indispensable. The construction method of Line 1 tunnel was studied in this section, on the presumption that the USM is constructed by Cut & Cover Method.

In the Preliminary Design of Line 1 Project, about 310m of Line 1 tunnel at Opera House Station side is scheduled to be constructed by TBM, and the remaining part at Ben Thanh Station side is to be constructed by Cut & Cover Method. The typical cross section of Line 1 tunnels (about 310m section by TBM) with USM is shown in Figure 4.77.

As shown in the Figure, the structural distance between Line 1 tunnel and USM is not enough at Ben Thanh Station side. Furthermore, those structures are overlapped in the cross section at Opera House Station side.

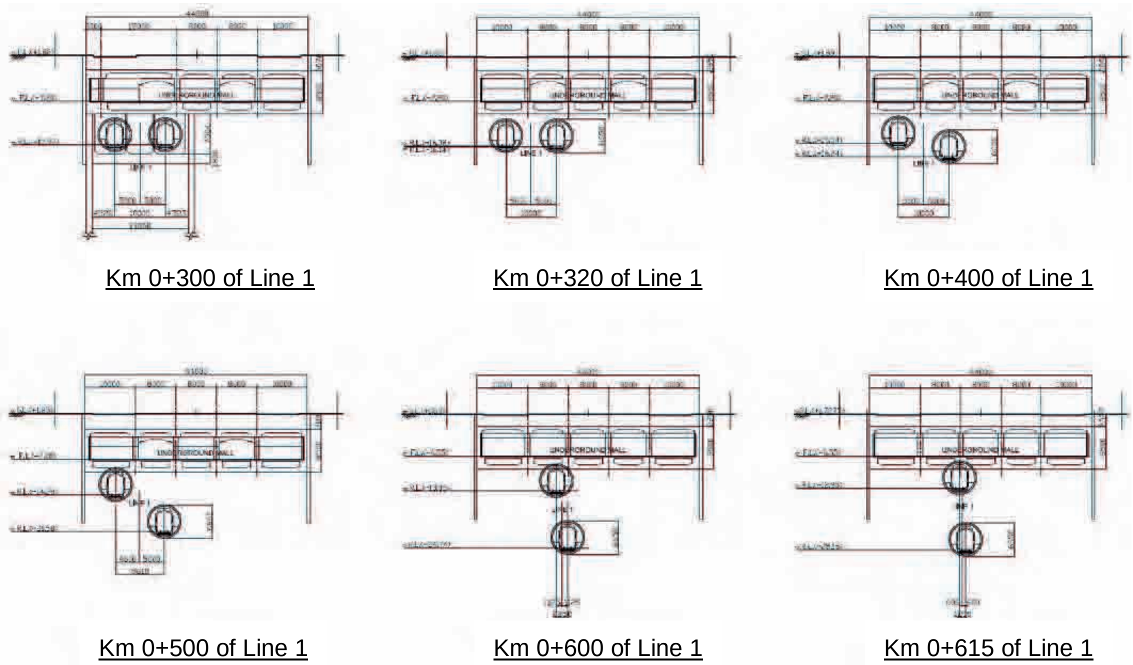


Figure 4.77 Locations of Line 1 Tunnels and USM

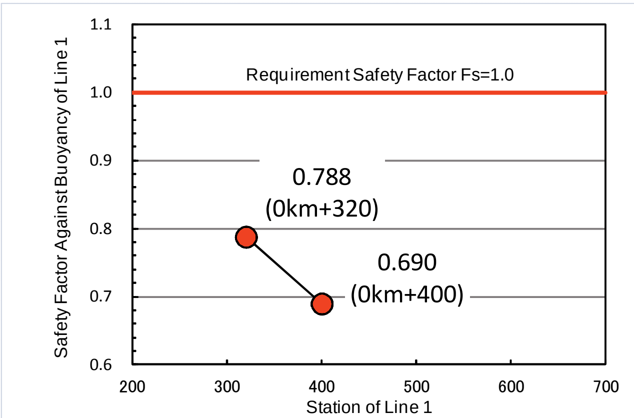


Figure 4.78 Safety Factors of Line 1 Tunnels against Buoyancy during Construction of USM by Cut & Cover Method

At the section (from km 0+320 to km 0+400 of Line 1) where the structural distance between Line 1 Tunnel and USM is impossible to be maintained, the problems like "floating of Line 1 tunnel structures" and/or "deformation of segment ring of Line 1 tunnel" will arise during the construction of USM. Besides, the USM structures are physically impossible to be constructed at the section (from km 0+500 to km 0+615 of Line 1) where Line 1 Tunnel structure and USM are overlapped.

Figure 4.78 indicates the stability of Line 1 Tunnel against buoyancy during the construction of USM by Cut & Cover Method. As shown in the figure, the safety factors against buoyancy fall below the prescribed safety value, 1.0 at the points of Line 1, km 0+320 and km 0+400. These results reveal the risk for the floating of Line 1 structure by the buoyancy during the construction of USM.

- The safety factors of Line 1 Tunnels against buoyancy were calculated based on page 45 to 45, "Design Standards for Railway Structures and Commentary (Shield Tunnel)" published by Railway Technical Research Institute of Japan.

Considering the above results, the construction of Line 1 Tunnel structures by TBM is impossible, and the Cut & Cover Method shall be adopted as the alternative.
The safety factors of Line 1 Tunnel against buoyancy are derived from the following formula:

$$Fs = \frac{2R_o\{\gamma'(H_w+R_o)+\gamma(H-H_w)\}-\pi R_o{}^2/2+2\pi R_o g+2R_o g+2R_o p_0+P_1}{\pi\gamma_w R_o{}^2} > 1.0$$

Where, F_s : Safety Factor (= Sum of "Loads & Resistances" divided by Buoyancy)
H : Depth of Earth Cover after Excavation (m)
H_w : Depth of Earth Cover above Ground Water Level (m)
g : Unit Weight of Segment Ring of Tunnel per m2 (kN/m2)
p_1 : Unit Load inside of Tunnels (kN/m)
p_0 : Unit Load on Ground (kN/m2)
γ : Unit Weight of Soil (kN/m3)
γ' : Unit Weight of Soil under Water Level (kN/m3)

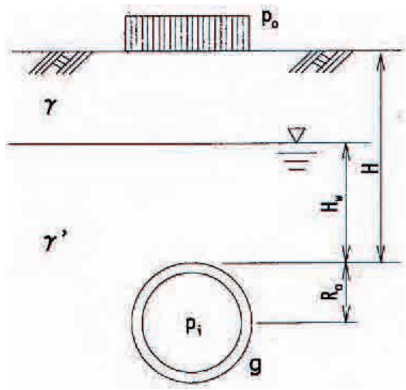


Figure: Cross Section for Analysis

The Unit Weight of Segment Ring of Tunnel is calculated by the following formula:

$$g = \frac{W}{\pi \cdot D_c \cdot b}\ (kN/m^2)$$

Where, g : Unit Weight of Segment Rings per m2 (kN/m2)
W : Total Weight of 1 Segment Ring (kN)
D_c : Diameter of Segment Ring at Centroid (m)
b : Width of Segment Ring (m)

Total Weight of 1 Segment Ring is calculated by the following formula:

$$W = \gamma_s \cdot \frac{\pi}{4}\left(D_o{}^2 - D_i{}^2\right) \cdot b\ (kN)$$

Where, W : Total Weight of 1 Segment Ring (kN)
γ_s : Unit Weight of Segment Ring (kN/m3)
D_o : Outer Diameter of Segment Ring (m)
D_i : Inner Diameter of Segment Ring (m)

Symbol	Unit	Description	Km 0+320	Km 0+400
H	m	Depth of Earth Cover after Excavation	0.654	0.114
H_w	m	Depth of Earth Cover above Ground Water Level	0.654	0.114
γ	kN/m^3	Unit Weight of Soil	19.5	19.5
γ'	kN/m^3	Unit Weight of Soil under Water Level	9.5	9.5
D_o	m	Outer Diameter of Segment Ring	6.650	6.650
D_i	m	Inner Diameter of Segment Ring	6.050	6.050
D_c	m	Diameter of Segment Ring at Centroid	6.350	6.350
γ_s	kN/m^3	Unit Weight of Segment Ring	26.0	26.0
g	kN/m^2	Unit Weight of Segment Rings per m2	7.80	7.80
P_i	kN/m^2	Unit Load inside of Tunnels	32.0	32.0
p_0	kN/m^2	Unit Load on Ground	0.0	0.0

3) Study of Retaining Walls

In Table 4.29, the results of alternative study are summarized for retaining walls necessary for Cut & Cover construction method.

The requirements for the retaining walls at the study area are as follows:

- High impermeability to prevent the fall down of underground water level
- High rigidity to prevent the settlement of surrounding grounds and neighbor buildings
- Low vibration and noise during construction

"Diaphragm wall" and "Soil-cement diaphragm wall" satisfy the above requirements. Diaphragm wall is constructed by excavation of the ground with stabilization by bentonite slurry or polymer slurry, installation of steel members or rebar cages and casting of concrete. The structures of diaphragm wall can be used as the part of the permanent structure.

Soil-cement diaphragm wall is one type of column type diaphragm wall. Soil-cement is used for the wall structure instead of cement mortar for other column type diaphragm wall. The soil-cement wall is constructed by continuous sliding of trench cutter with ejecting of the hardening agent slurry.

For "Le Loi Street Area", "Diaphragm wall" was applied for most part of the retaining walls of USM and Line 1 tunnel to utilize them as the permanent structure, and "Soil-cement diaphragm wall" was applied for important points, namely the "Section where Line 4 and USM exit in parallel." The details were described in the following section 5).

Figure 4.79 indicates the cross section of USM, Line 1 & Line 4 tunnels with soil boring log. The excavation depth of USM is 12m approximately, and the embedment length of retaining walls was assumed as the same length, 12m.

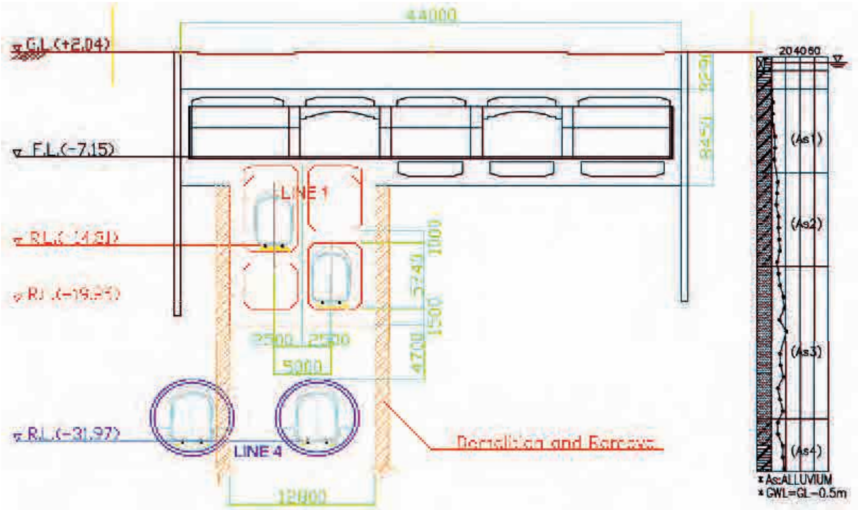


Figure 4.79 Cross Section of USM with Soil Boring Log

4) Study of Excavation Method

Two excavation methods, “Bottom up” and “Top down” are applicable for the Cut & Cover Construction of USM. “Bottom up” method is generally applied in the past, and recently, “Top down” method is often applied for the cases that the allowable displacement of retaining wall is limited because of the existence of the important structures in neighborhood.

Figure 4.80 indicates the construction sequence of “Bottom up” and Figure 4.81 indicates that of “Top down”, respectively. By “Bottom up” method, the excavation is completed to the bottom and subsequently the construction of the tunnel structure is commenced from the bottom slabs to top slabs. By “Top down” method, excavation and construction of tunnel structure is conducted alternately from the ground surface level to the bottom.

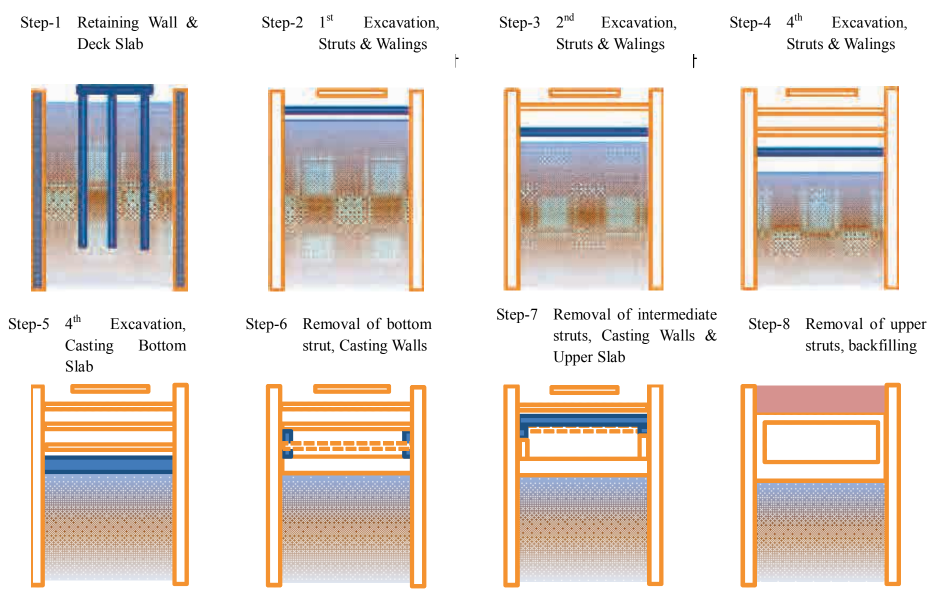


Figure 4.80 Construction Sequence of “Bottom up” Method

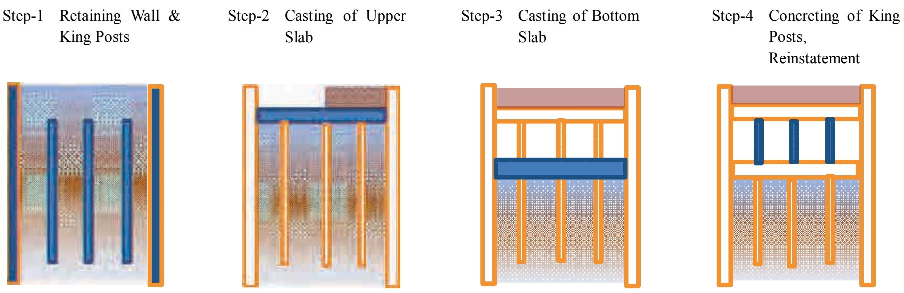


Figure 4.81 Construction Sequence of "Top down" Method

Dr. Eiri studied "Top down" method applied for the construction of Akiharaba station of Tukuba Express, and compared with "Bottom up" method in the aspects of the construction cost and duration. According to that study, the advantages of "Top down" method over "Top down" method are as follows:

- Struts of temporary support for retaining walls can be reduced, because the casted concrete slabs prior to the excavation can behave as the struts.
- Duration for installation of struts can be shorter, and struts can be reused smoothly from upper part to lower part, because the struts are able to be released after the upper slabs are constructed.
- Deformation of retaining walls is reduced because the rigidity of the concrete slabs supporting the retaining wall is higher than that of struts.
- The space on the constructed concrete slabs can be utilized for the construction yards.
- The construction works beneath the constructed concrete slabs is not affected by the weathers.
- The construction duration is reduced because of the deduction of the rows of struts, no necessity of temporary replacement of struts, simultaneous construction works at upper and lower sides, deduction of quantities of supports & formworks for concrete structures.

Besides, the following issues are mentioned as disadvantages of "Top down" method:

- Increase of quantities of king posts to support the dead load of concrete slabs and live loads for construction works
- Additional construction cost for non-shrinkage mortar for connection of side walls & columns with upper slabs, disposal of debris of lean concrete after casting of slabs.

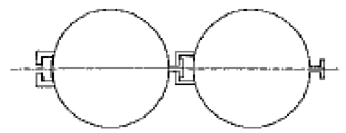
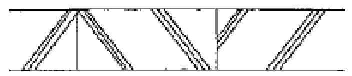
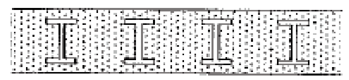
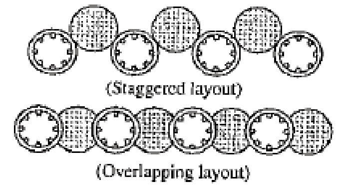
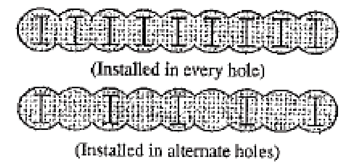
Generally, "Top down" method causes more thickness of permanent structures including concrete slabs and retaining walls (diaphragm wall to be used as permanent structures), and contributes to reduce the quantities for temporary works including steel deck slabs and temporary supports (steel beams and columns etc.) for retaining walls.

Generally in the developing countries like Vietnam, the labor costs and material costs for concrete etc. are comparatively lower than those of Japan, and the procurement costs for steel materials including deck slabs, beams and columns are not so cheap.

Because of its contribution to reduce the quantities for temporary works including steel materials, "Top down" method is frequently adopted in those countries.

It is recommended that the excavation method shall be finally defined based on the further study and design results of USM in the next stage, with considering the advantages and disadvantages of "Bottom up" and "Top down" methods.

Table 4.29 Alternative Study of Retaining Walls

		Sheet pile soil retaining wall	Steel pipe sheeting soil retaining wall	Diaphragm wall	Slurry solidified diaphragm wall	Column type diaphragm wall	Soil-cement diaphragm wall
Structure		 Soil retaining wall formed by continuously placing sheet piles with U-shaped, Z-shaped, straight, H-shaped sections underground, and engaging their joints.	 Soil retaining wall made by continually placing steel pipe piles with shape steel, pipes, or other joints attached underground, by engaging their joints.	 Method of constructing a continuous soil retaining wall underground by using the ground stabilization action of bentonite slurry or polymer slurry to cut the ground and inserting steel material or rebar columns, then filling them with concrete.	 A type of diaphragm wall, it is a soil retaining wall made by inserting H-shaped steel, sheet piles, or precast panels into a trench that was cut using a stabilizing fluid such as bentonite slurry, then mixing a hardener with the stabilizing fluid to solidify the stabilizing fluid.	 A soil retaining wall that is continuously constructed by inserting re-bar columns or shaped steel into cast-in-place concrete piles. Existing piles are also inserted in place of the rebar columns or shaped steel.	 One type of column diaphragm wall, it is a soil cement in place of mortar. Recently, it has been used as a method of constructing a soil cement wall by sliding a trench cutter continuously while ejecting a hardening agent slurry.
Characteristics	Merits	Its water cutoff property is good and the embedded part under the bottom surface of the cut maintains continuity, so it is a generally used in ground where the groundwater level is high or in soft ground.	Its water cutoff property is good, the embedded part under the bottom surface of the cut maintains continuity, and its section performance is large, so it is used for large-scale cutting work in ground with groundwater or in soft ground.	Its water cutoff property is good, the embedded part under the bottom surface of the cut maintains continuity, and its section performance is large, so it is used for large-scale cutting work, work near important structures, and for work is soft ground. Its characteristics are that it can be used as part of the main structure and the work produces little vibration and noise.	With the diaphragm method, disposing of unnecessary stabilizing fluid is a problem, but this is a method that solidifies the stabilizing fluid to use it as part of the soil retaining wall.	Cast-in-place piles provide substantial section performance and the work produces little noise and vibration, so this method is often used in place of sheet pile soil retaining wall in urban districts.	Its section performance is not quite as good as that of the column type diaphragm wall, but its water cutoff property is good. In the case of the TRD method, ground materials above and below are mixed by agitation, so relatively uniform section performance is obtained in the depth direction.
	Demerits	If the noise and vibration produced by the placing will cause problems, it is necessary to take care to adopt a low noise and low vibration execution method. Generally there are many cases where U-steel or plates are used, but their stiffness may be inadequate for large-scale cutting.	When noise or vibration will cause problems, it is necessary to considering adopting a low noise, low vibration method. Generally, it cannot be removed, so in many cases it is left in the ground.	To adopt this method, the work cost and work period must be studied, because it is time-consuming work, many obstructions are moved, and it is necessary to extend continuous working hours.	Because execution conditions have a big impact on work costs, its adoption must be studied.	In many cases, its water cutoff performance is poor, its work cost high, and its work period is long.	Soil cement, but according to the ground is used as material for use as material for soil cement, so the method is used carefully. And according to the layer, large variations in the section performance may appear in the depth direction.
Adaptability of the site	Applicable length of soil retaining wall	about until 25m	about until 50m	about until 100m	about until 50m	about until 25m (It is possible until 50m by all casing boring machine.)	about until 40m (It is impossible until 50m under soil condition.)
	Water cutoff property	good	good	good	slightly less	no good	good
	Use of soil retaining wall as the main structure	impossible	impossible	possible	possible	impossible	impossible
	Bending rigidity	medium	high	high	medium	medium	slightly high
	Impact of cut and cover excavation to adjacent buildings	slightly less	good	good	slightly less	slightly less	slightly less
	Temporary diversion and/or protection of existing underground utility facilities	It is desirable temporary diversion. If temporary diversion of existing underground utility facility is impossible, It is necessary soil improvement for covering loss of retaining wall.	It is desirable temporary diversion. If temporary diversion of existing underground utility facility is impossible, It is necessary soil improvement for covering loss of retaining wall.	It is desirable temporary diversion. If temporary diversion of existing underground utility facility is impossible, It is necessary soil improvement for covering loss of retaining wall.	It is desirable temporary diversion. If temporary diversion of existing underground utility facility is impossible, It is necessary soil improvement for covering loss of retaining wall.	It is desirable temporary diversion. If temporary diversion of existing underground utility facility is impossible, It is necessary soil improvement for covering loss of retaining wall.	It is desirable temporary diversion. If temporary diversion of existing underground utility facility is impossible, It is necessary soil improvement for covering loss of retaining wall.
	Noise during construction	It should be adopt jacking-up method.	It should be adopt jacking-up method.	little noise	little noise	little noise	little noise
	Vibration during construction	It should be adopt jacking-up method.	It should be adopt jacking-up method.	little vibration	little vibration	little vibration	little vibration
	Cost of construction	relatively reasonable	relatively unreasonable	unreasonable	unreasonable	relatively unreasonable	relatively reasonable
	Period of construction	relatively quick	relatively slow	slow	relatively slow	relatively slow	relatively slow
Comprehensive evaluation		Not Recommended	Not Recommended	Recommendation	Not Recommended	Not Recommended	Recommendation

5) Study of Construction Method for Important Points

(1) Crossing point of Line 1 and Line 4

The construction method for crossing point of Line 1 and Line 4 was studied in this section. (The final decision on construction method and further study is recommended to be conducted in Line 1 Project.)

Because Line 1 tunnel is planned to be constructed by Cut & Cover method, TBMs for Line 4 tunnel will encounter the diaphragm walls of Line 1 tunnel with sharp angles, in the future.

a) Soil Improvement for Facilitation of TBM (Line 4) boring through of Diaphragm Walls of Line 1 Tunnels

The soil improvement around the diaphragm walls of Line 1 tunnels can be an alternative to facilitate TBM for Line 4 boring through of diaphragm walls of Line 1 tunnels. (Refer to Figure 4.82)

i) Purpose and Area of Soil Improvement

The purpose and area of soil improvement are as follows:

* <u>Facilitation of Boring through of Diaphragm Walls of Line 1 Tunnels by TBM:</u>

As shown in Figure 4.82, TBMs for Line 4 tunnels will bore through the parts of diaphragm walls of Line 1 tunnel with sharp angles. Because of the different hardness of diaphragm walls and surrounding soils, it will be difficult to control the TBMs in the right positions during the boring through of diaphragm walls.

The careful operation of TBMs will be required and the driving speed of TBMs will be reduced. Consequently, the exceeding excavated soils might be taken inside of TBMs, and it will induce the risk of ground subsidence at neighbor areas.

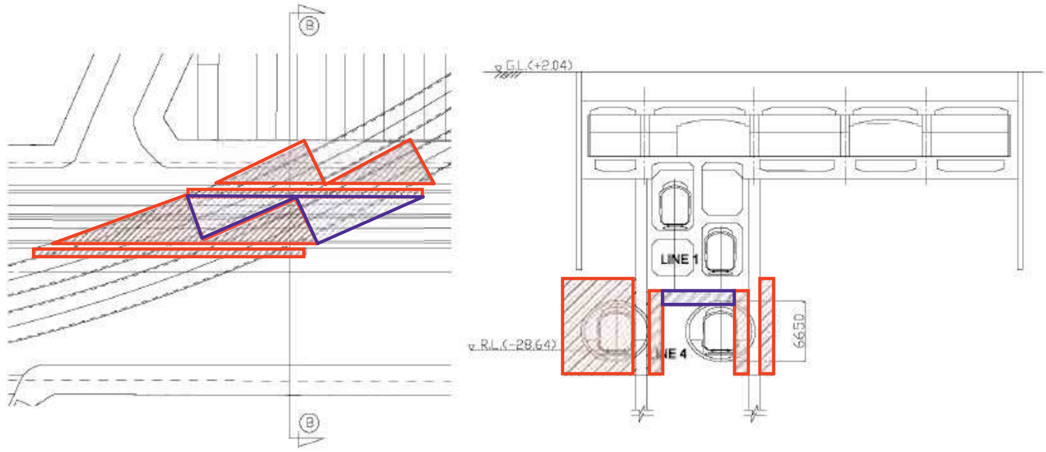
To avoid the above mentioned difficulties, the soil improvement around diaphragm walls is proposed by the creation of high strengthened soils at the red-colored areas in Figure 4.82. This soil improvement will reduce the different hardness of soils and diaphragm walls and also relieve the sharp angles for boring by TBMs.

* <u>Facilitation of TBMs Driving under Line 1 Tunnels and Prevention of Risks for Stability of Line 1 Tunnels:</u>

The soft sand layers existing under Line 1 tunnels will be plasticized when Line 1 tunnels are constructed by Cut & Cover method, and the further plasticization might occur when TBMs for Line 4 tunnels will bore through them.

This plasticization will induce the possibilities of tunnel face collapse (by abnormal disposal of excavated soils) or difficulty of the control of TBMs in the right positions, and it will cause unfavorable effects for the stability of Line 1 tunnels.

To avoid the above risks, soil improvement under Line 1 Tunnels (blue-colored areas in Figure 4.82) by the creation of high strengthened soils is proposed.



: (1) Facilitation of Boring through of Diaphragm Walls of Line 1 Tunnels by TBM

: (2) Facilitation of TBMs Driving under Line 1 Tunnels and Prevention of Risks for Stability of Line 1 Tunnels

Figure 4.82 Area for Soil Improvement

ii) Features of Construction Method (CJG Method) for Soil Improvement

CJG Method (Column Jet Grouting Method) will be recommended for soil improvement. The soils at site are cut by the high pressure water jet and slimes will be exhausted to the construction base levels. Simultaneously the hardening agents are injected to replace the cut slime and to create a cylindrical stabilized and strengthened soil columns. (Refer to Figure 4.83)

The work procedure is indicated in Figure4.83. Because the stabilized and strengthened soil columns are created at the same time with disposal of slimes, the ground water shall not be pressured at the construction base level. Accordingly, the construction base level for this method is the ground surface level in the most of the cases.

iii) Construction Method for Point

The described soil improvement is necessary for the construction of Line 4 tunnels by TBM method, and preferable to be conducted in the scope of Line 4 project.

Besides, the areas for soil improvement locate below both of USM and Line 1 tunnels. Furthermore, the construction of Line 4 (driving of TBMs) will be commenced when the Line 1 and USM will be under commercial operations.

Based on the above conditions, it is recommended that the soil improvement is conducted simultaneously with the construction of Line 1 tunnels by Cut & Cover method, because of the following reasons:

* After Line 1 tunnels and USM will be constructed, it is relatively difficult to conduct the soil improvement from the ground surface level. The tunnel structures of Line 1 and USM will be obstacles to install the casing pipes etc. for soil improvement. The drilling into tunnel structures will be required, and it will induce the risks to cut of reinforcement steels in tunnel structures. Furthermore,

the soil improvement can not be conducted during the business hours of Line 1 and USM.

* Soil Improvement from within TBM for Line 4 tunnel is studied, and it is concluded that the chemical grouting method from within TBM is not suitable for the point.

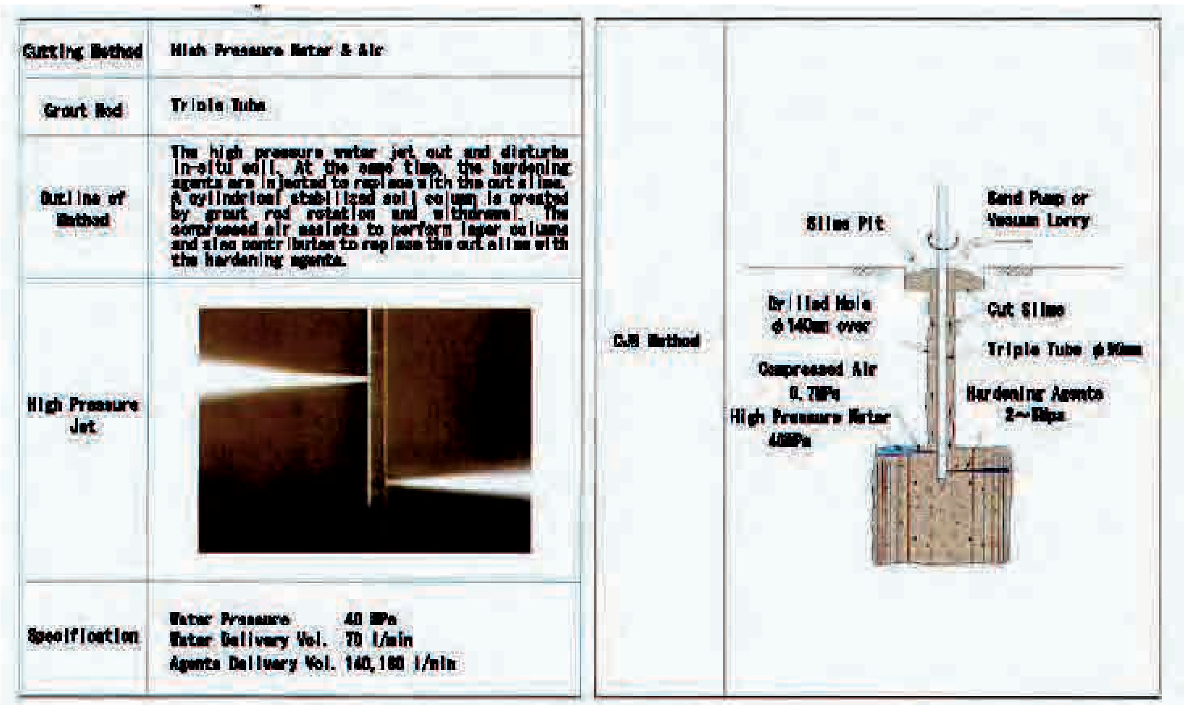


Figure 4.83 Specifications of CJG Method

iv) Issue to be considered for “Soil Improvement at Crossing Point of Line 1 and Line 4 at Le Loi Street”

The soil improvement creates the high strengthened soils around diaphragm walls, reduces the different hardness of soils and diaphragm walls, and relieves the sharp angles for boring by TBMs.

This soil improvement shall be conducted by the Contractor of Line 1 tunnel prior to the construction of Line 4 tunnel, because it is impossible to be conducted simultaneously with the construction of Line 4 tunnel, or after the construction of USM above Line 1 Tunnel.

In case TBM for Line 4 cannot bore through the improved soils & the diaphragm walls of Line 1, or in case the ground subsidence at neighbor areas is caused by tunnel face collapse of Line 4 during the operation of TBM, the Contractor of Line 4 tunnel claims to the Employer that those problems are caused by the insufficient quality of soil improvements conducted by the Contractor of Line 1 tunnel.

The quality of soil improvement by the Contractor of Line 1 tunnel shall meet the Employer’s Requirements in the Contract, and the Contractor of Line 1 tunnel has the responsibility for the quality to the Employer. Subsequently, the Employer provides the improved soils with diaphragm walls of Line 1 tunnel to the Contractor of Line 4 tunnel as the site conditions for the construction, and the Employer has the responsibility for the quality to the Contractor of Line 4 tunnel.

In case the Contractor of Line 4 tunnel submits the claim, the complicated arguments about the responsibility of the quality of soil improvement are unavoidable.

b) Demolition and Removal of Diaphragm Walls of Line 1 Tunnel

The removal of the diaphragm walls of Line 1 tunnel is studied.

The photographs and figures of "Demolition and Removal of Diaphragm Walls" are shown in Figure 4.84, and Figure 4.85 indicates the construction sequence.

Application of Hydraulic crush machine with casing (inner excavation method) contributes the removal of the underground RC structures etc. with low vibration and less noises.

The advantages of this method are as follows:

(1) Underground structures are demolished in the casing, and accordingly, debris does not scatter widely.
(2) Structures are broken by hydraulic arm with cutting edges (open & close type), and no vibration occurs.
(3) Hydro Grab enables the taking out of crushed concrete debris and re-bars simultaneously.
(4) Easy separation of concrete debris and re-bars contribute the smooth disposal and also recycle.
(5) Low vibration and less noises of the machine enable the night time works.

source：http://www.yokoyamakiso.co.jp/industrial/acr/index.html

c) Cost Comparisons of Construction Methods

The construction costs of two construction methods, "Soil Improvement" and "Demolition & Removal of Diaphragm Walls" are summarized in Table 4.30.

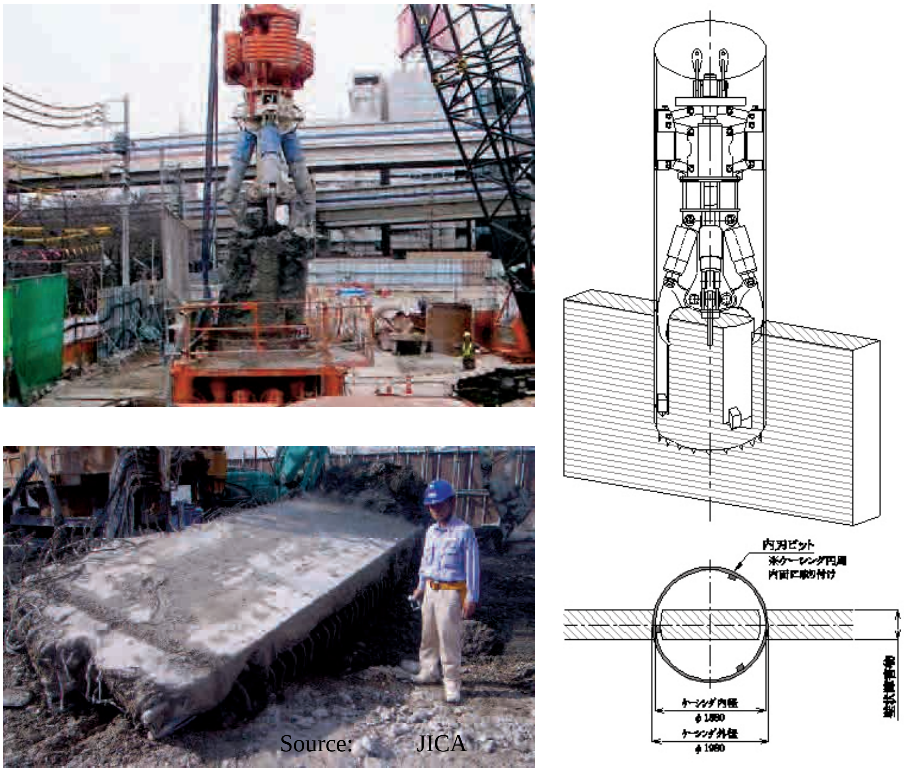
Table 4.30 Comparison of Construction Costs for Countermeasures

Items	Unit	Quantity	Unit Price (Combined in JPY)	Amount (Combined in JPY)
Soil Improvement under Diaphragm Wall of Line 1	m^3	7,500	99,000	742,500,000
Removal & Demolition of Diaphragm Wall of Line 1	m^2	5,600	178,000	996,800,000

The construction cost for "Soil Improvement" is about 25% lower than that of "Demolition & Removal of Diaphragm Walls". However, if "Soil Improvement" will be adopted, the potential risk of the claim by the Contractor of Line 4 tunnel about the quality of Soil "Improvement" will arise. Consequently, the total construction cost including both of Line 1 and Line 4 might increase more than the originally estimated cost.

d) Conclusion and Recommendation

To avoid the potential risk of the claim by the Contractor of Line 4 tunnel about the quality of "Soil Improvement" by the Contractor of Line 1 tunnel, the adoption of "Demolition & Removal of Diaphragm Walls" is strongly recommended.



source：http://www.yokoyamakiso.co.jp/industrial/acr/index.html

Figure 4.84 Removal & Demolition of Diaphragm Wall

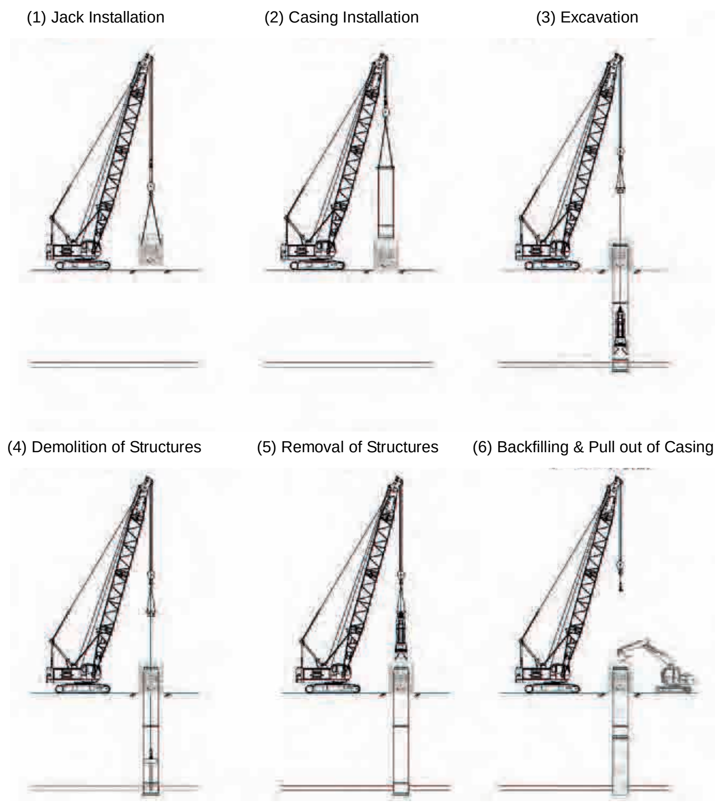


Figure 4.85 Work Procedure of Removal & Demolition of Diaphragm Wall

(2) Section where Line 4 and USM exist in parallel

As shown in Figure 4.86, the horizontal alignment of Line 4 comes from north east, and go to Ben Thanh Station along Le Loi Street. In this section, about 150m of the retaining walls of USM will be the obstacles for TBM driving for Line 4 tunnels, as shown in Figure 4.87.

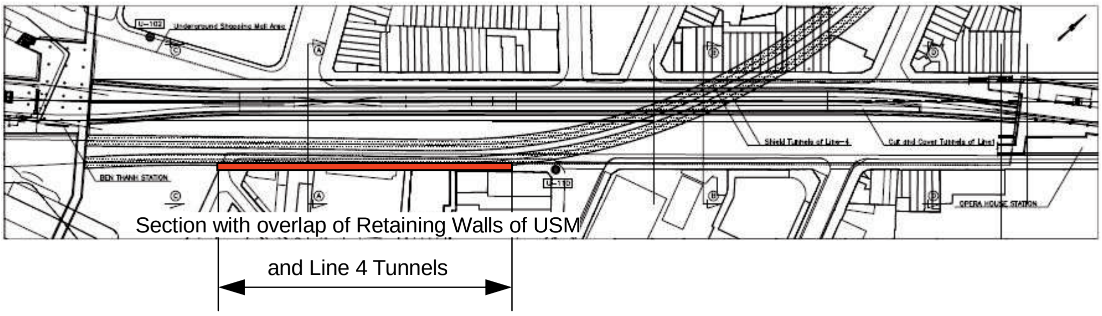


Figure 4.86 Section with Overlap of Retaining Walls of USM and Line 4 Tunnels

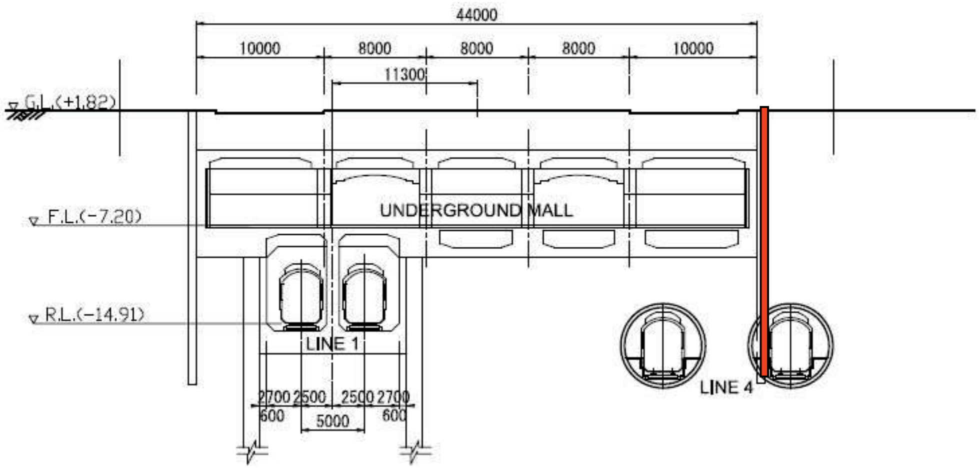


Figure 4.87 Cross Section with Retaining Walls of USM and Line 4 Tunnels

The type of retaining walls of USM was studied as follows:

i) Soil-cement diaphragm wall is adopted to be bored by TBM for Line 4.

ii) Commonly, H Steel beams are applied for the core piles. For the core piles in Soil-cement diaphragm wall, the material, FFU (Fiber Reinforced Foamed Urethane, etc.) which can be bored by TBM is applied for the necessary portions of walls.
(Refer to Figure 4.88 and Figure 4.89)

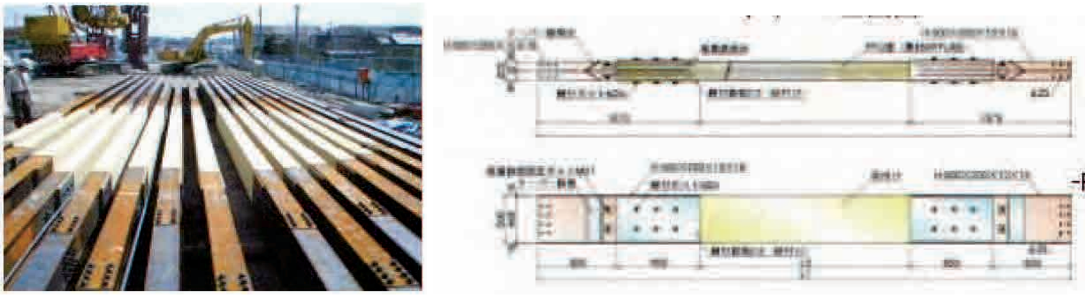


Figure 4.88 Connection of FFU and H Steel Beam (Core pile for Soil-cement D-Wall)

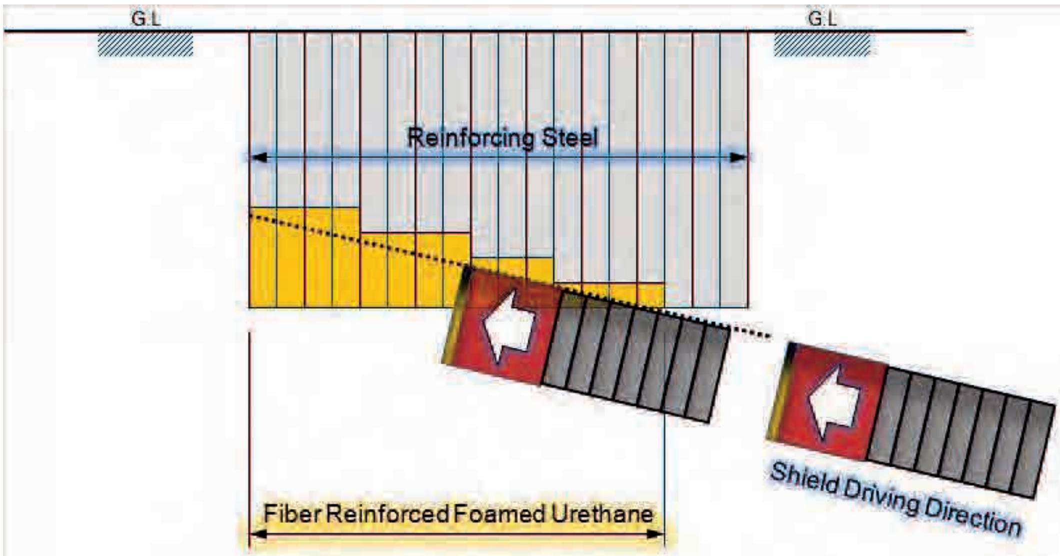


Figure 4.89 Boring of Soil-Cement Diaphragm Wall by TBM

(6) Protection and Maintenance of Underground Utilities during Construction

Underground utilities will be the obstacles for the construction of USM, if they will not be removed. In principle, it is recommended that the underground utilities at study area shall be removed by HPC prior to the commencement of the construction of USM.

For several underground utilities which are difficult to be removed (drainage etc.), temporary diversions and/or temporary protections are required. For those protection and maintenance works, the Contractor of USM shall check the type, earth covering, form, strengths of the utilities at site or available data, and the location of the utilities at site shall be indicated by plates or tapes etc. with the presence of the staff of the responsible organization. The details of the protection and maintenance methods shall be approved by the responsible organization, prior to the actual works. The procedure of diversion of utilities is shown in Figure 4.90.

The major drainage pipes are difficult to be diverted and temporary protection by hanging method shall be applied. At the locations of hanged drainage pipes, the retaining walls of USM are impossible to be constructed and soil improvement by jet grouting method is required. The work procedure is summarized in Figure 4.91. The photograph of temporary hanging method is shown in Figure 4.92.

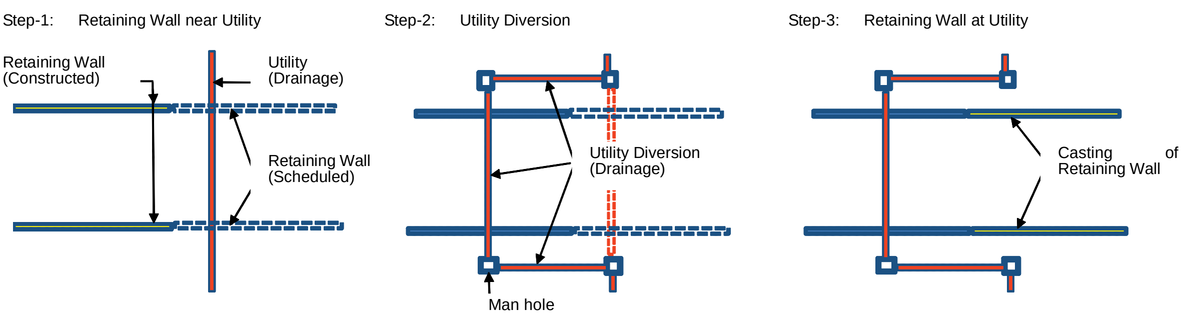


Figure 4.90 Diversion Procedure of Utility crossing Le Loi Street

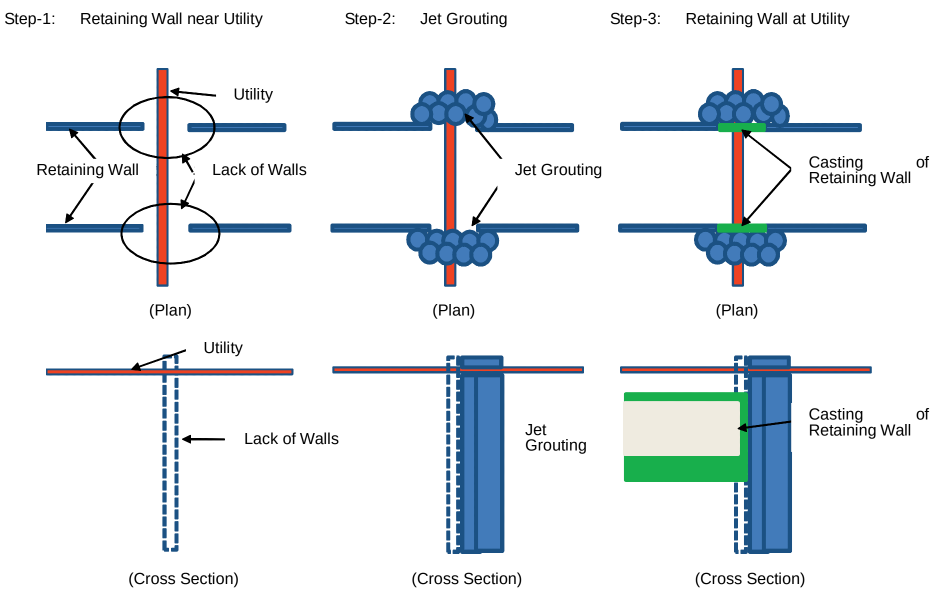


Figure 4.91 Temporary Hanging Method with Jet Grouting Reinforcement

Figure 4.92 Temporary Hanging Method (Example)

7) Traffic Management and Construction Sequences

The Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street is indicated in Figure 4.93 – Figure4.106. The construction of Line 1 Tunnel is scheduled in the 1st stage, and subsequently, the construction of USM will follow. The traffic management plans are also studied considering the following issues, and indicated in the figure.

1) Principally, the current traffic on Le Loi Street shall not be blocked.
2) The duration of the traffic restrictions shall be minimized for the roads crossing Le Loi Street.

8) Preliminary Construction Schedule

The preliminary construction schedule of "Phased Construction (1st Phase: Line 1 Tunnel, 2nd Phase: USM)" of Line 1 Tunnel and USM beneath Le Loi Street is shown in Table 4.31.

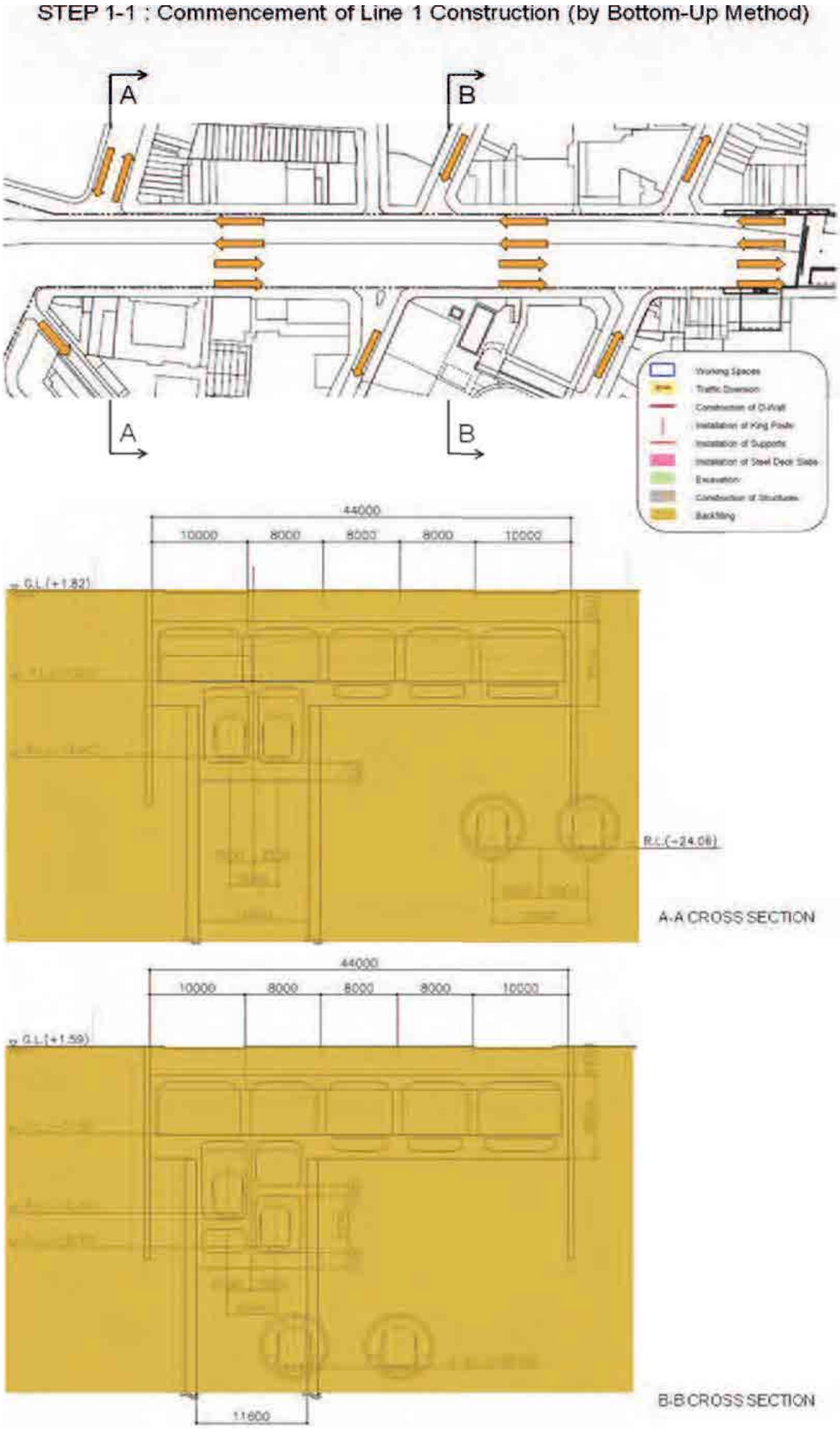


Figure 4.93 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (1/14)

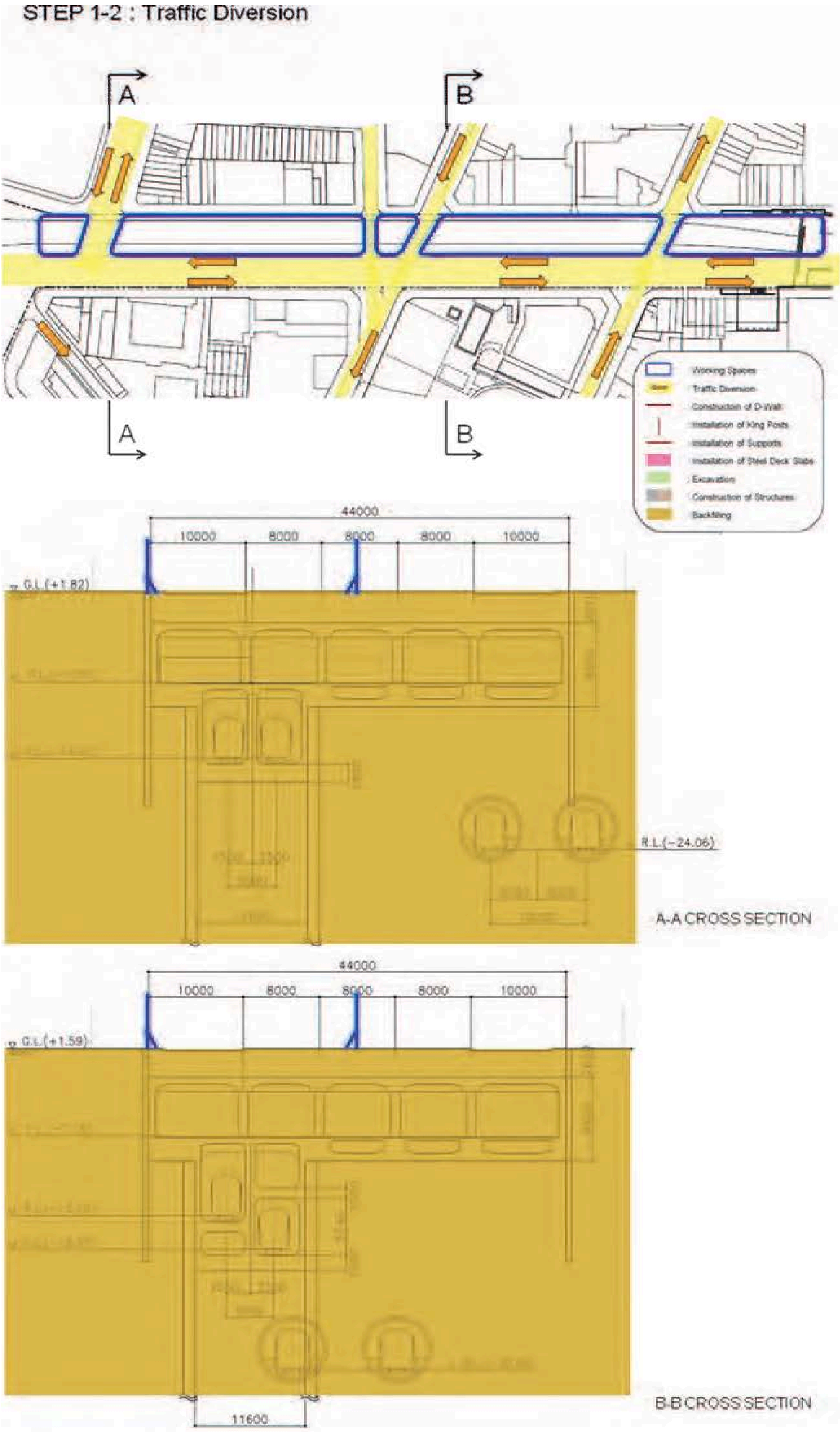


Figure 4.94 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (2/14)

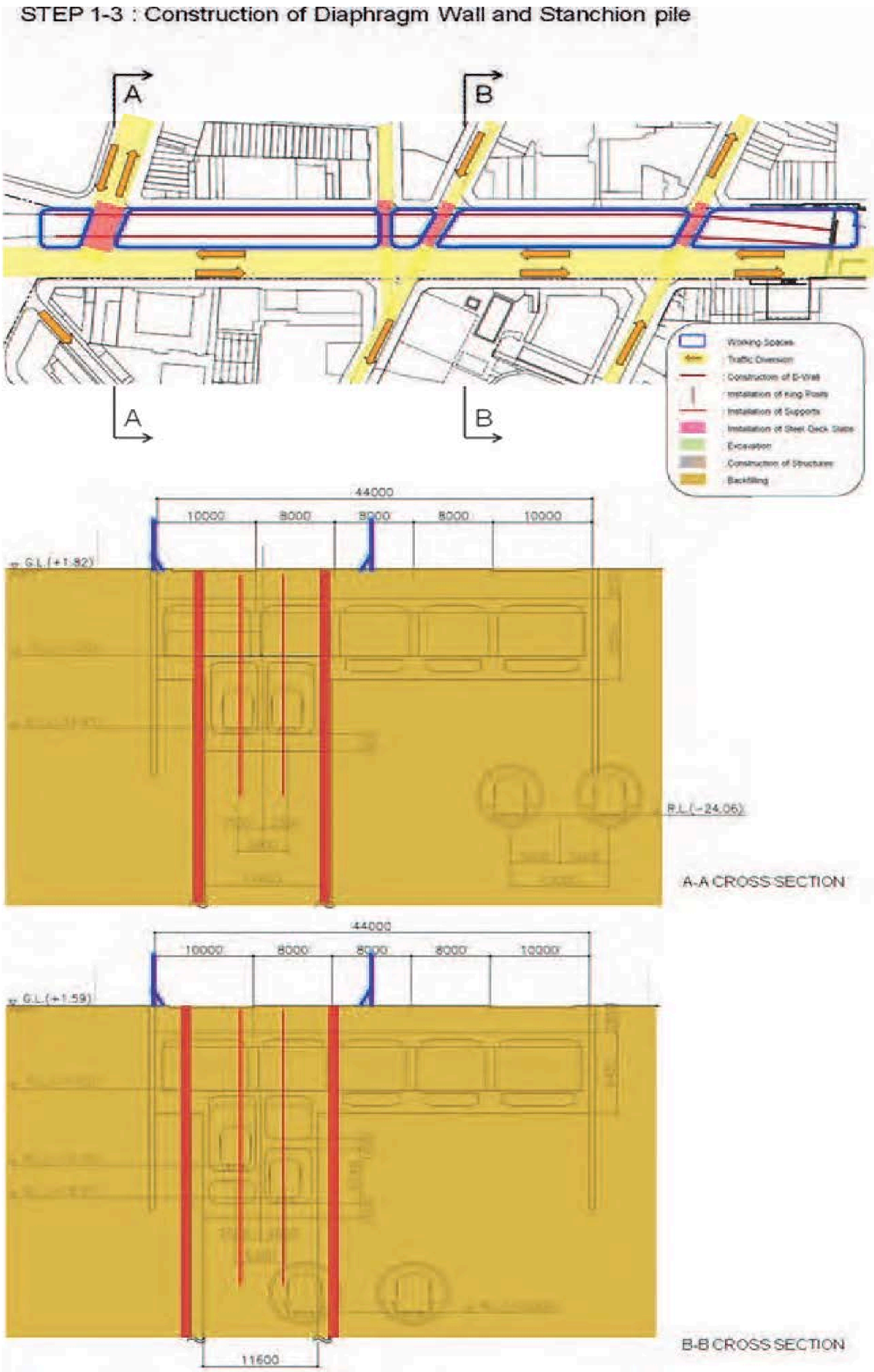


Figure 4.95 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (3/14)

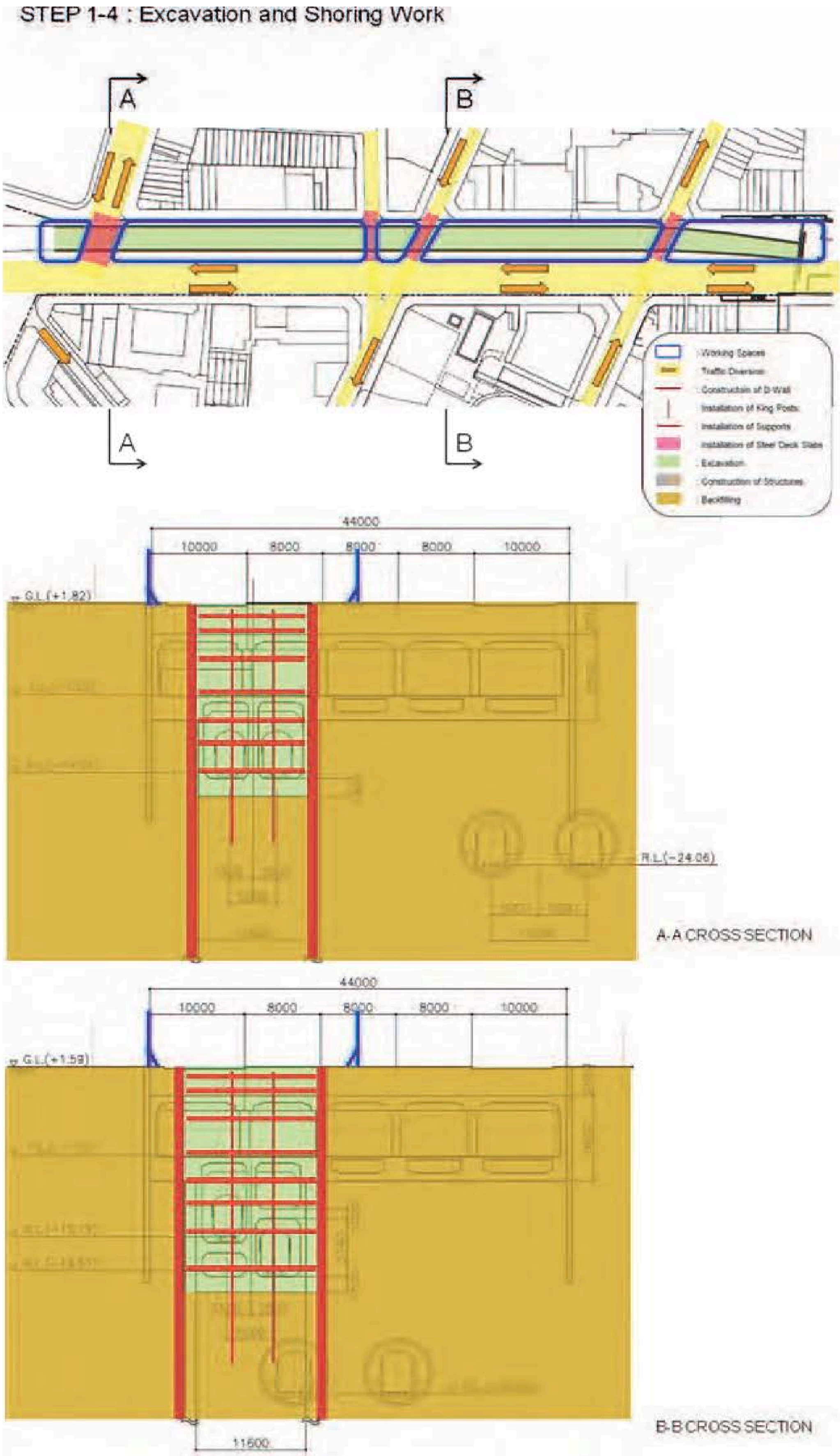


Figure 4.96 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (4/14)

Figure 4.97 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (5/14)

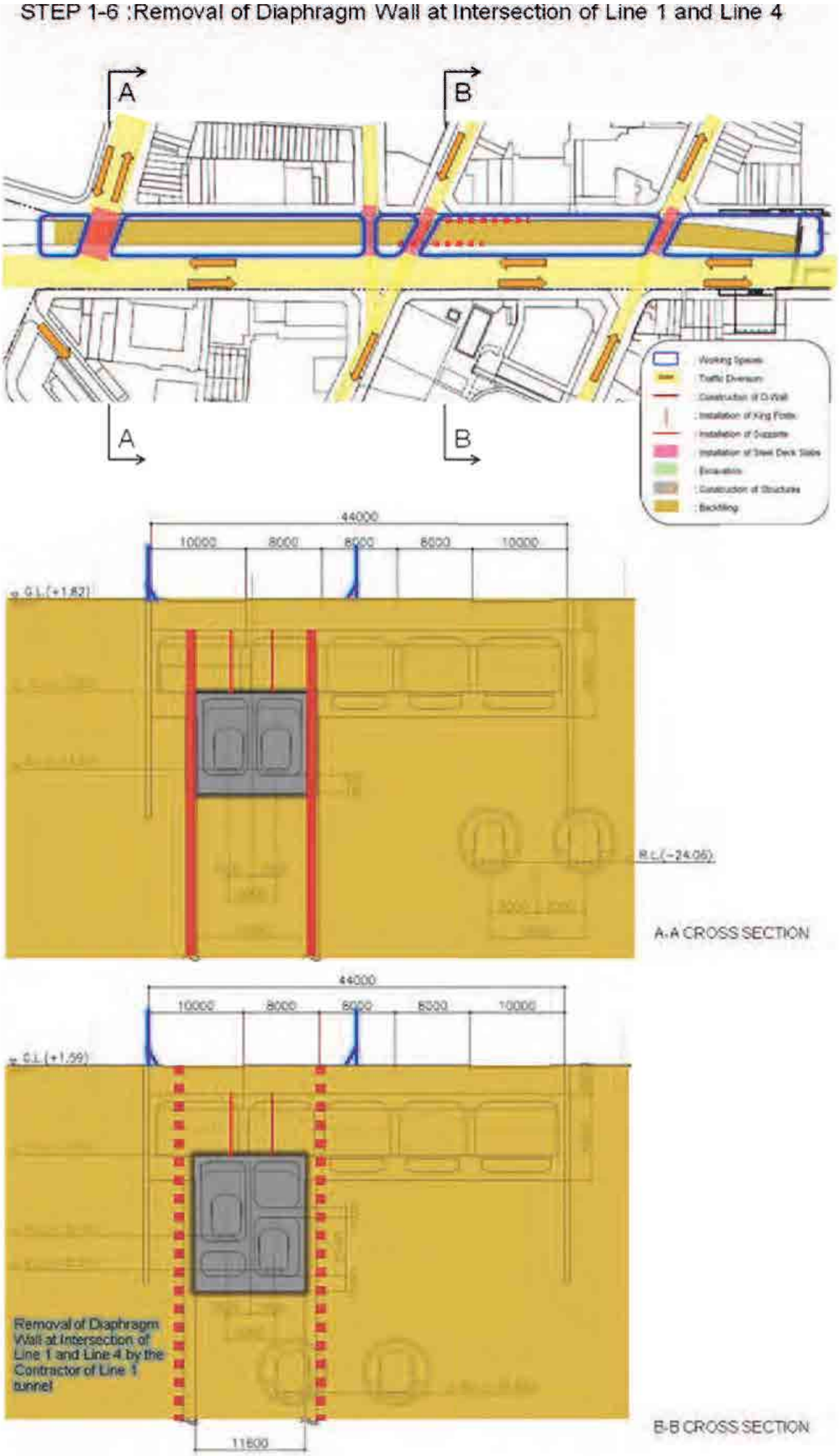


Figure 4.98 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (6/14)

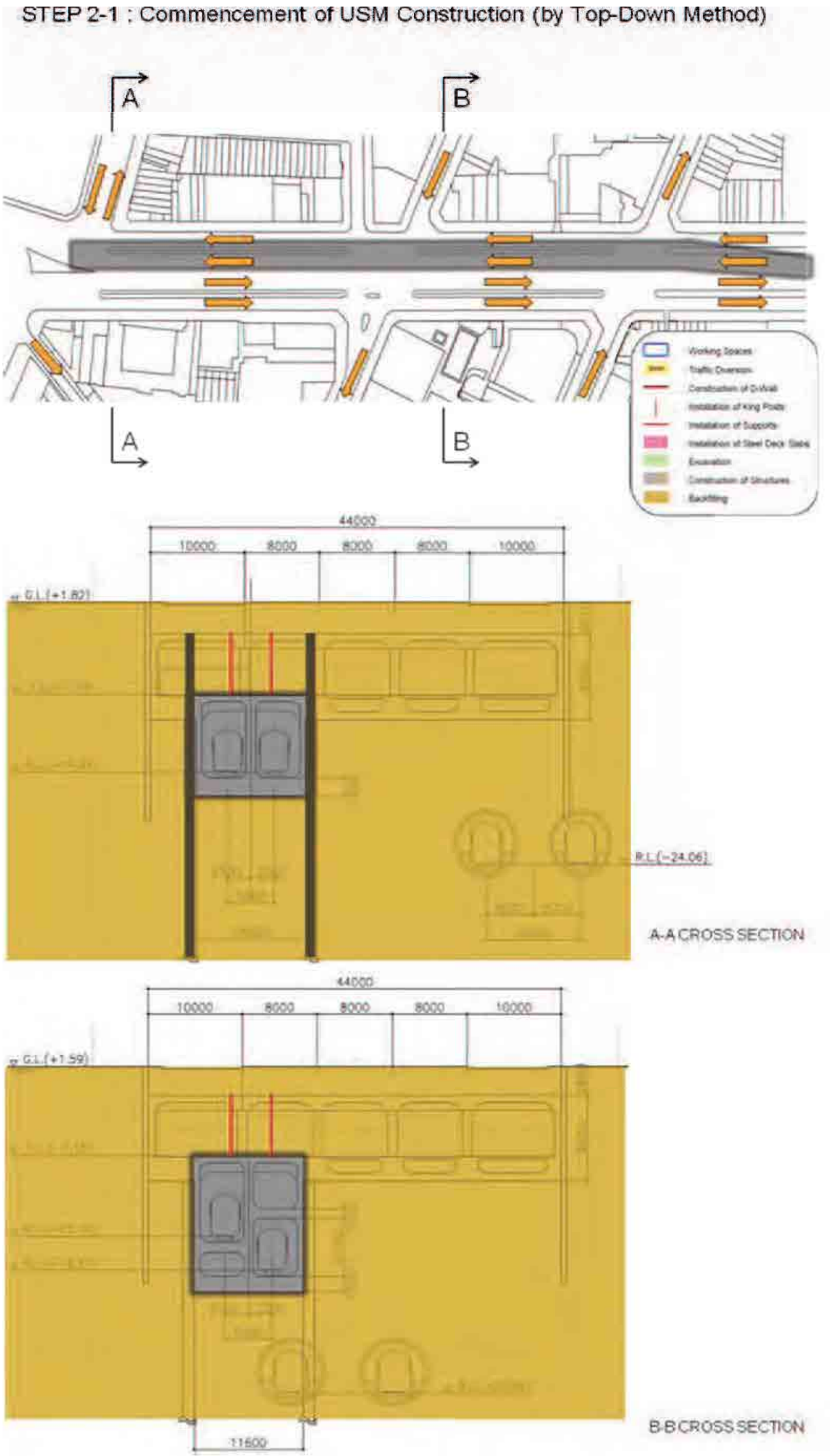


Figure 4.99 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (7/14)

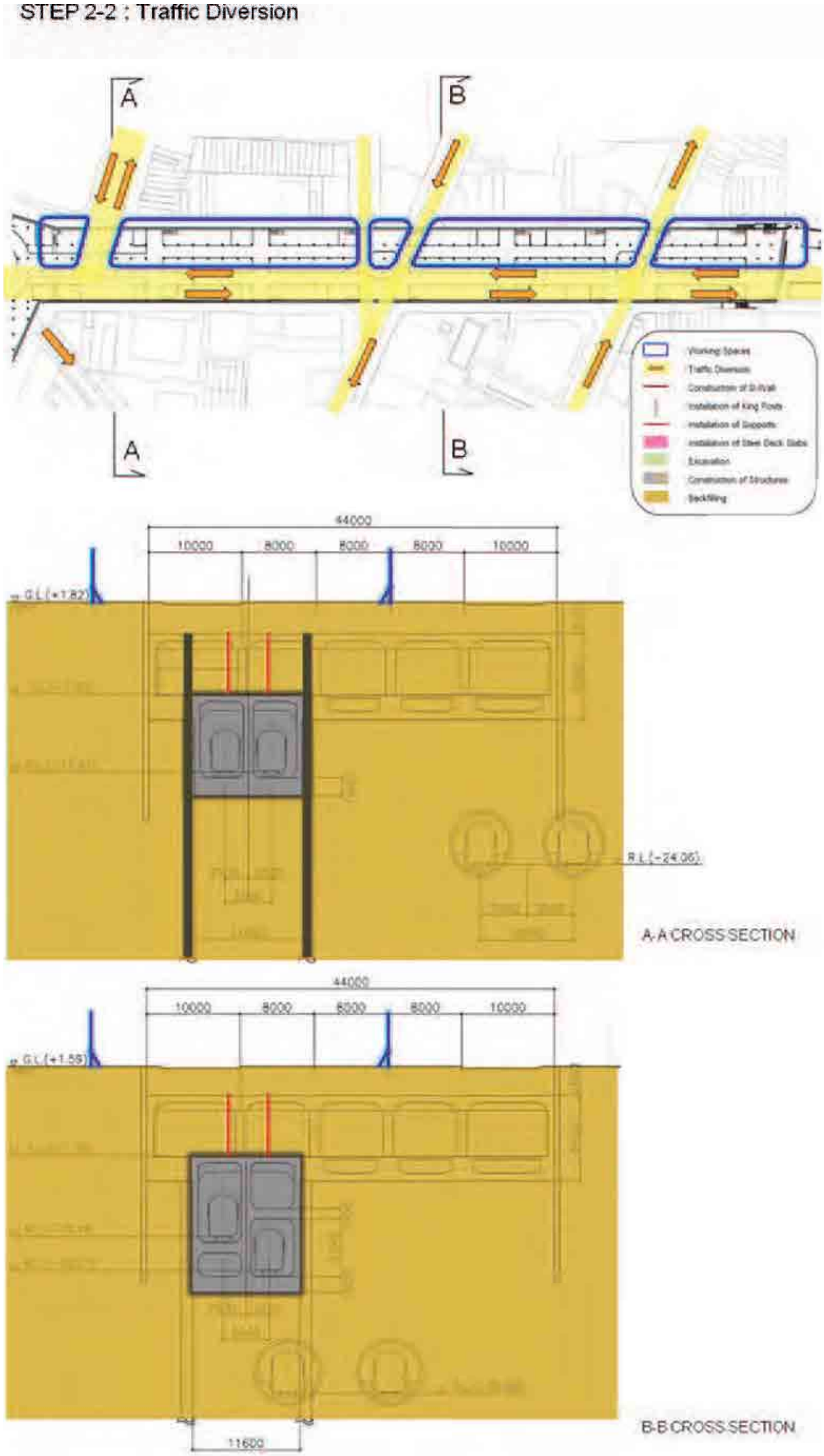


Figure 4.100 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (8/14)

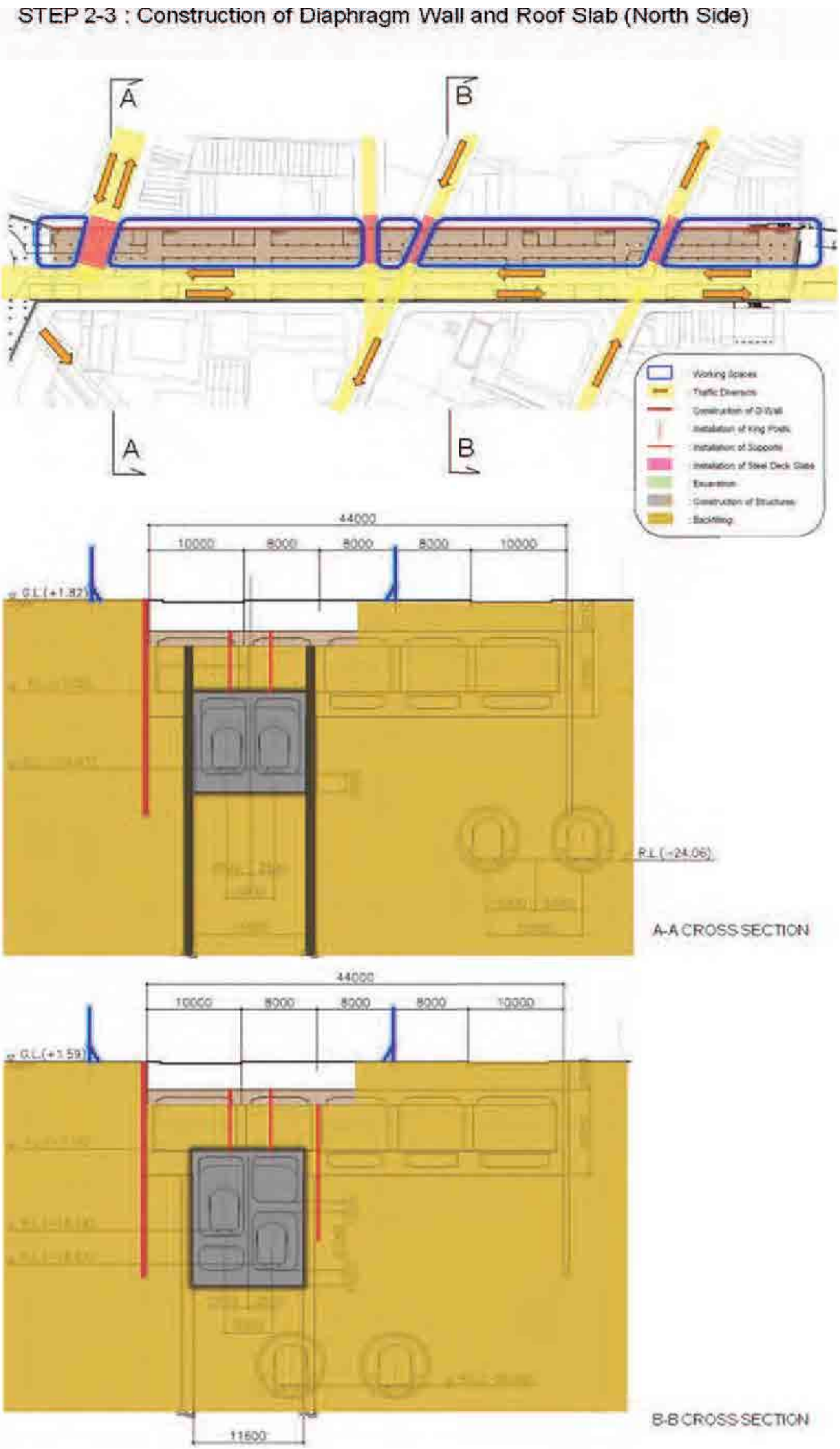


Figure 4.101 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (9/14)

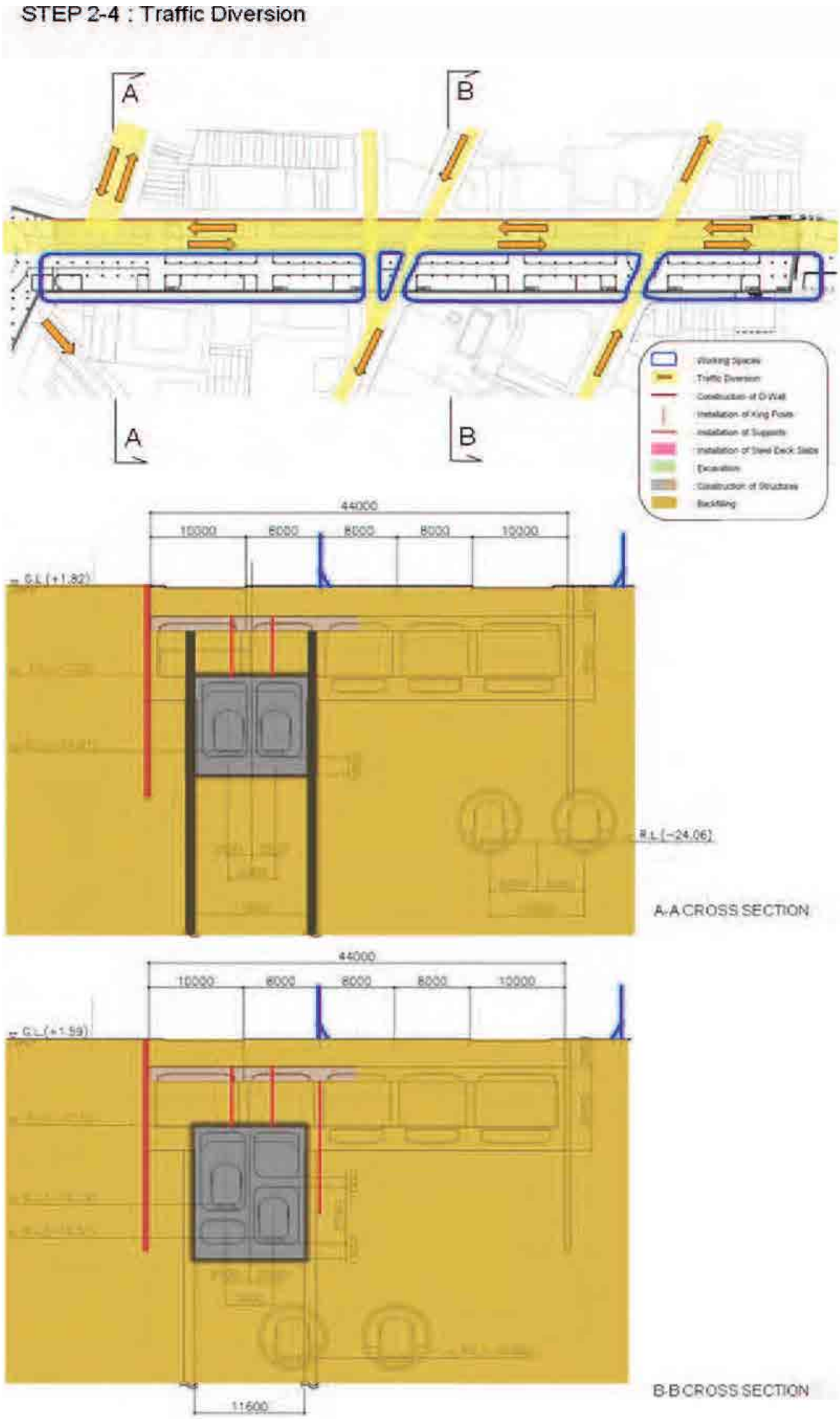


Figure 4.102 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (10/14)

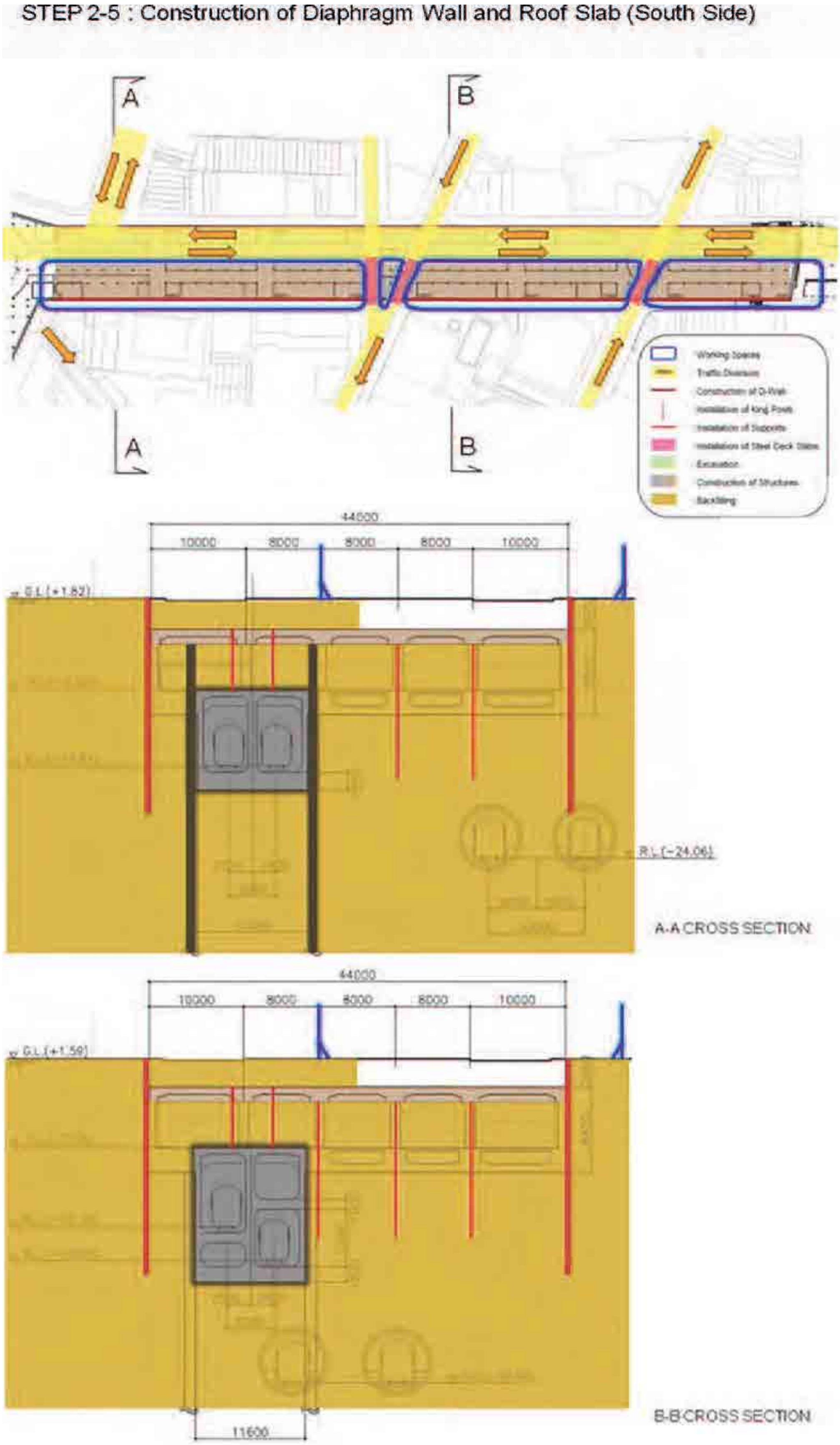


Figure 4.103 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (11/14)

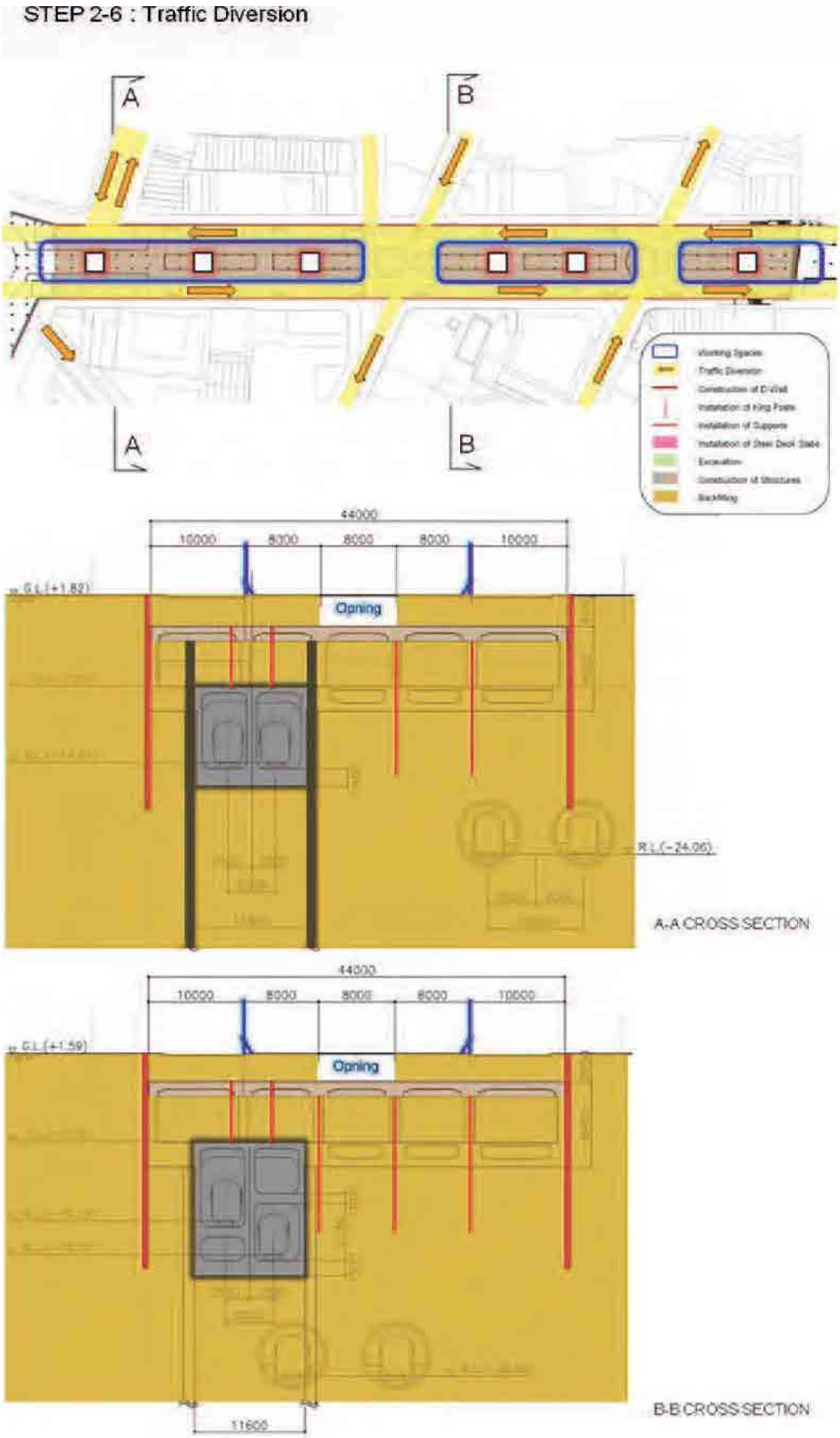


Figure 4.104 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (12/14)

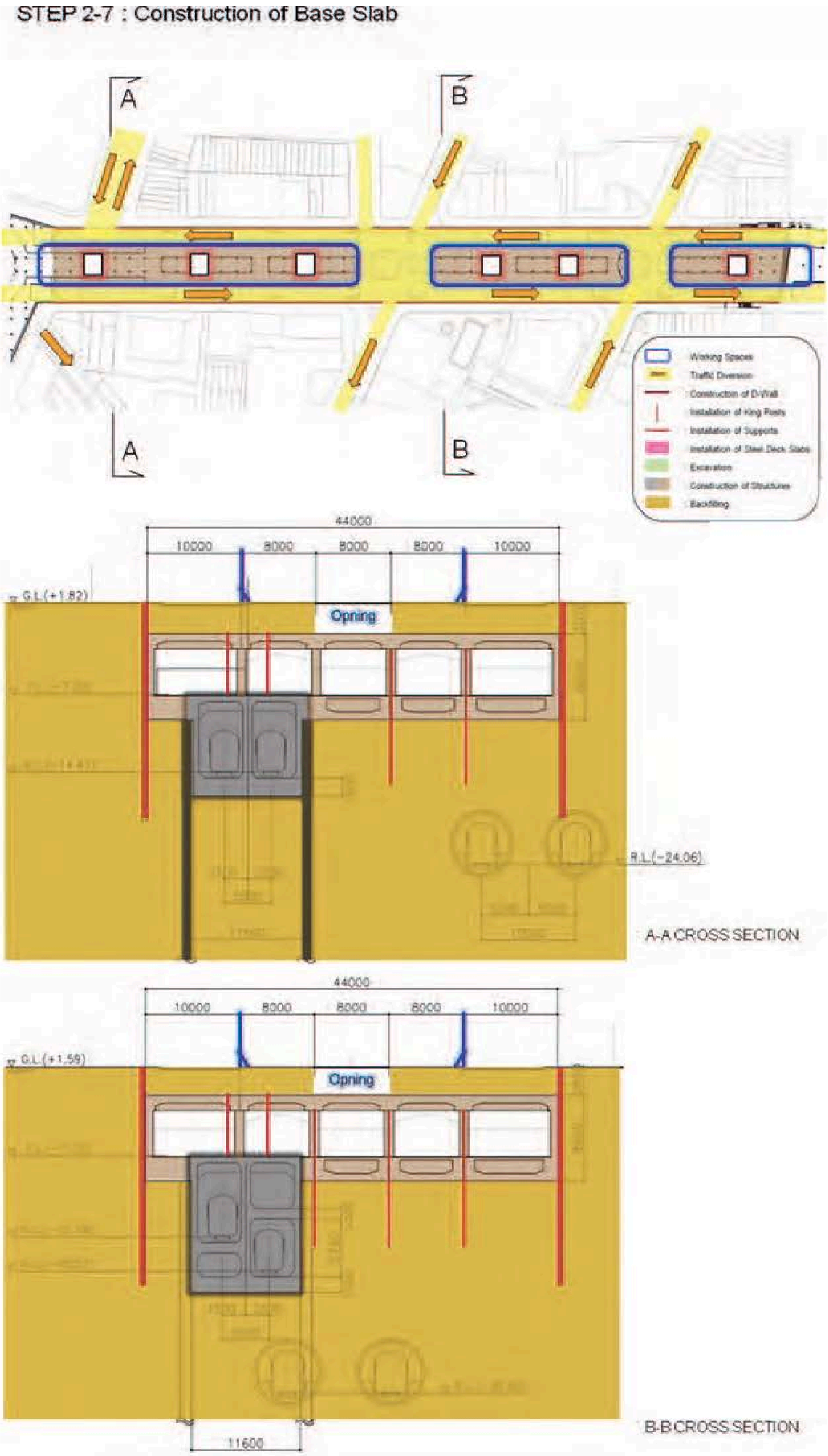


Figure 4.105 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (13/14)

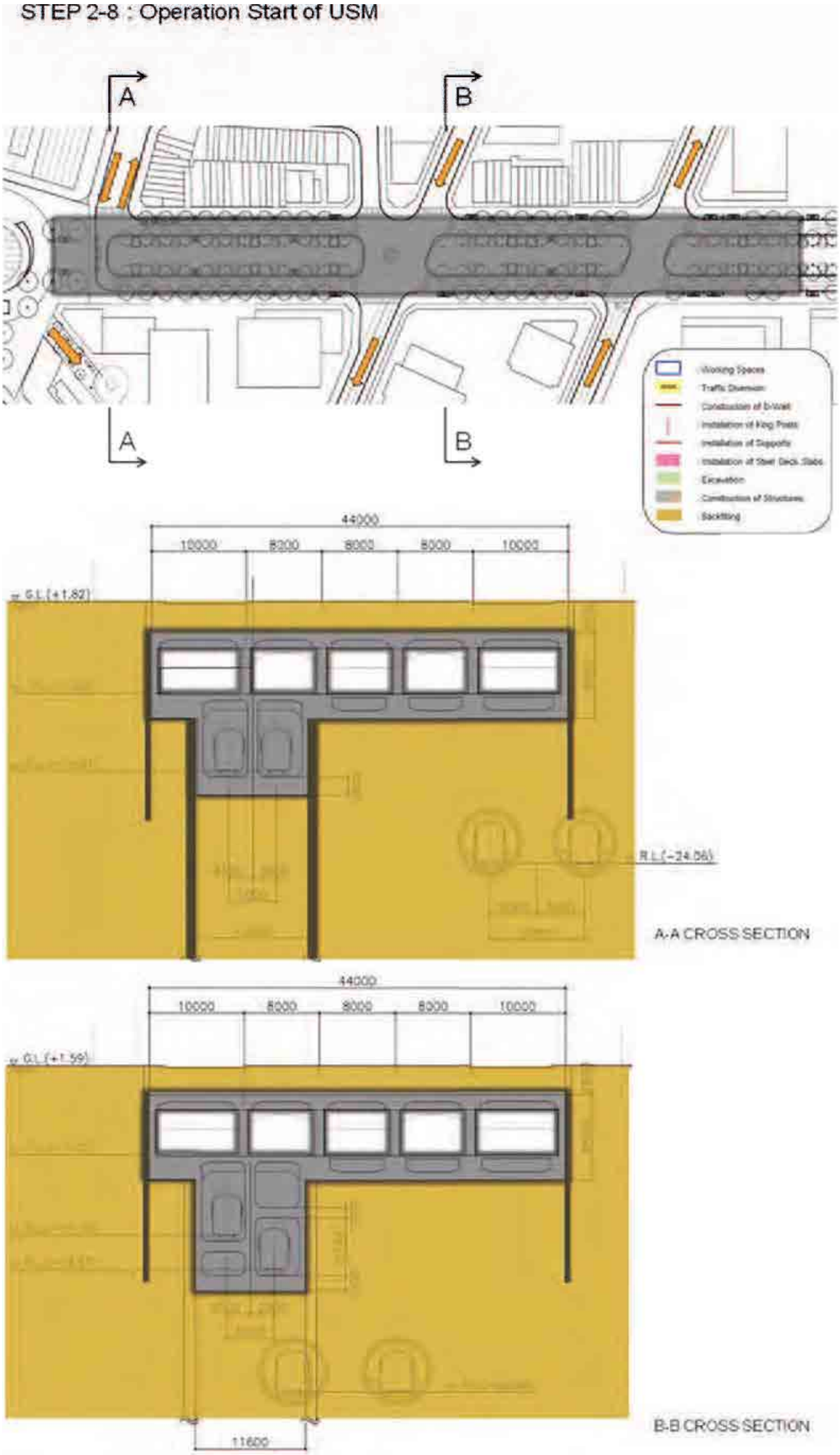
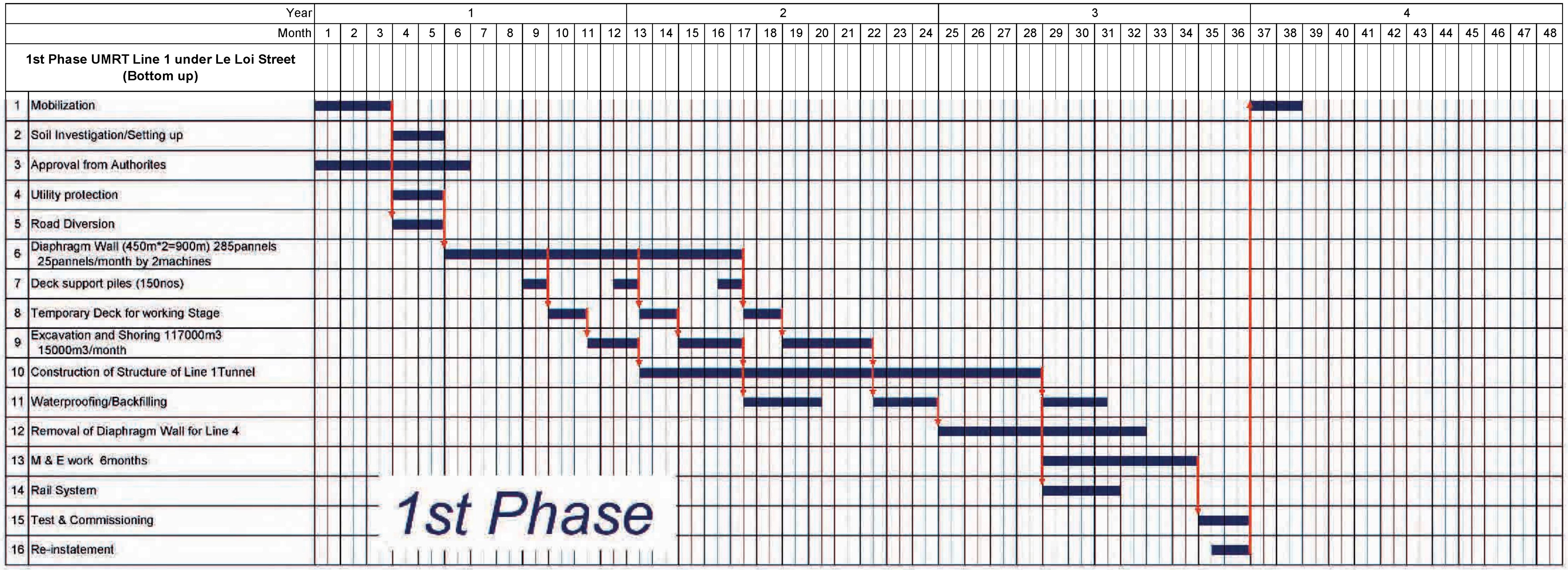
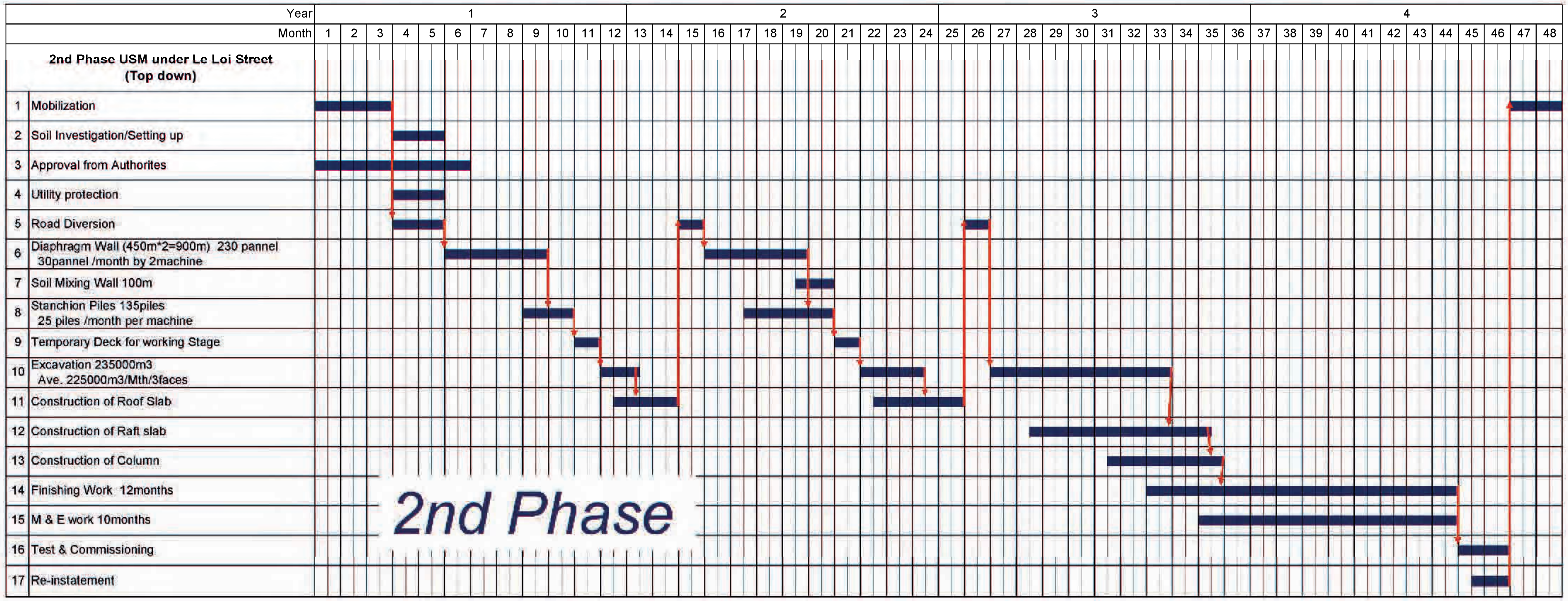


Figure 4.106 Construction Sequences of Line 1 Tunnel and USM beneath Le Loi Street (14/14)

Table 4.31 Preliminary Construction Schedule of Line 1 Tunnels and USM beneath Le Loi Street (Phased Construction)





4.5.3 Construction Planning for Ben Thanh Central Station Area

1) Objectives in Construction Planning

Ben Thanh Central Station consists of the terminal stations with Line 1, Line 2, Line 3a & Line 4, and USM above those lines.

The general plan of B1 floor and typical cross section of Ben Thanh Central Station are shown in Figure 4.108 and Figure 4.109, respectively. Line 2 station exists at the bottom level (B4F), Line 4 station locates at B3F, Line 1 station locates at B2F, and USM exists above those stations (B1F). The overall structure is relatively complex, and the construction works shall be large scale with deep excavation.

At the study area, soft alluvium sandy layers exist thickly with high ground water level with dense neighbor buildings, many underground utilities and heavy public traffic including pedestrians. The overview of the area for study is shown in Figure 4.107.

Considering the above conditions, the following objectives shall be studied:

(1) The effects to ongoing Line 1 Project shall be minimized.
(2) The connection with TBMs for Line 2 and Line 4 in the future shall be considered.
(3) The effects to the neighbor buildings shall be minimized.
(4) The protection and maintain methods of underground utilities which is difficult to be removed shall be studied.
(5) The effects to public traffic shall be minimized.

Figure 4.107 Overview of Ben Thanh Central Station Area

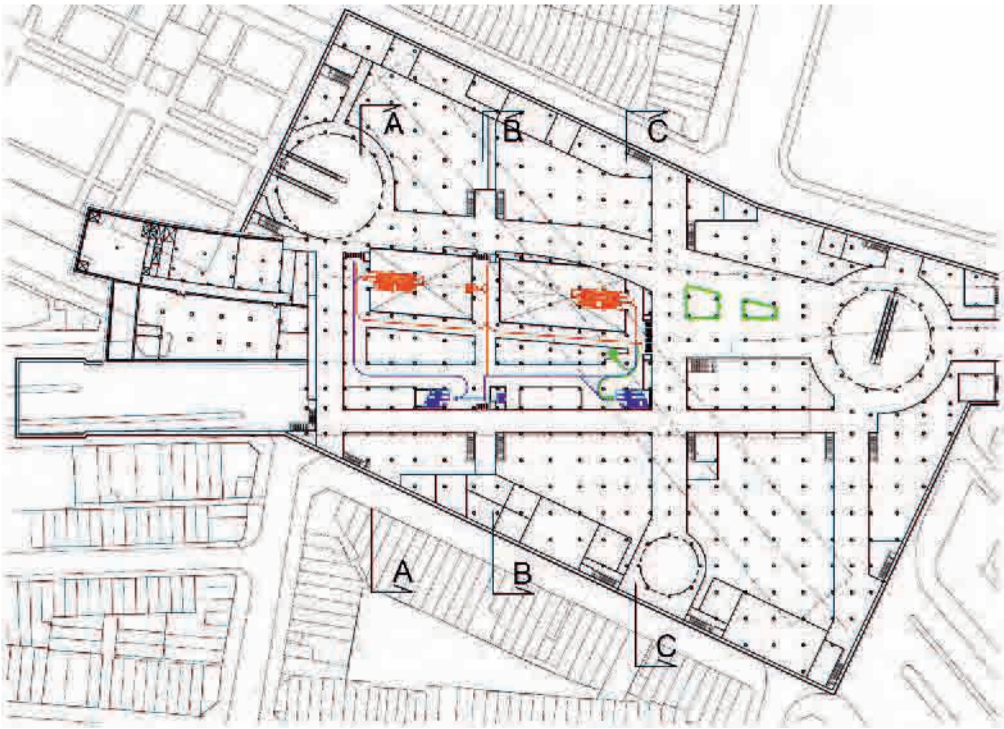


Figure 4.108 The general plan of B1 floor, Ben Thanh Central Station

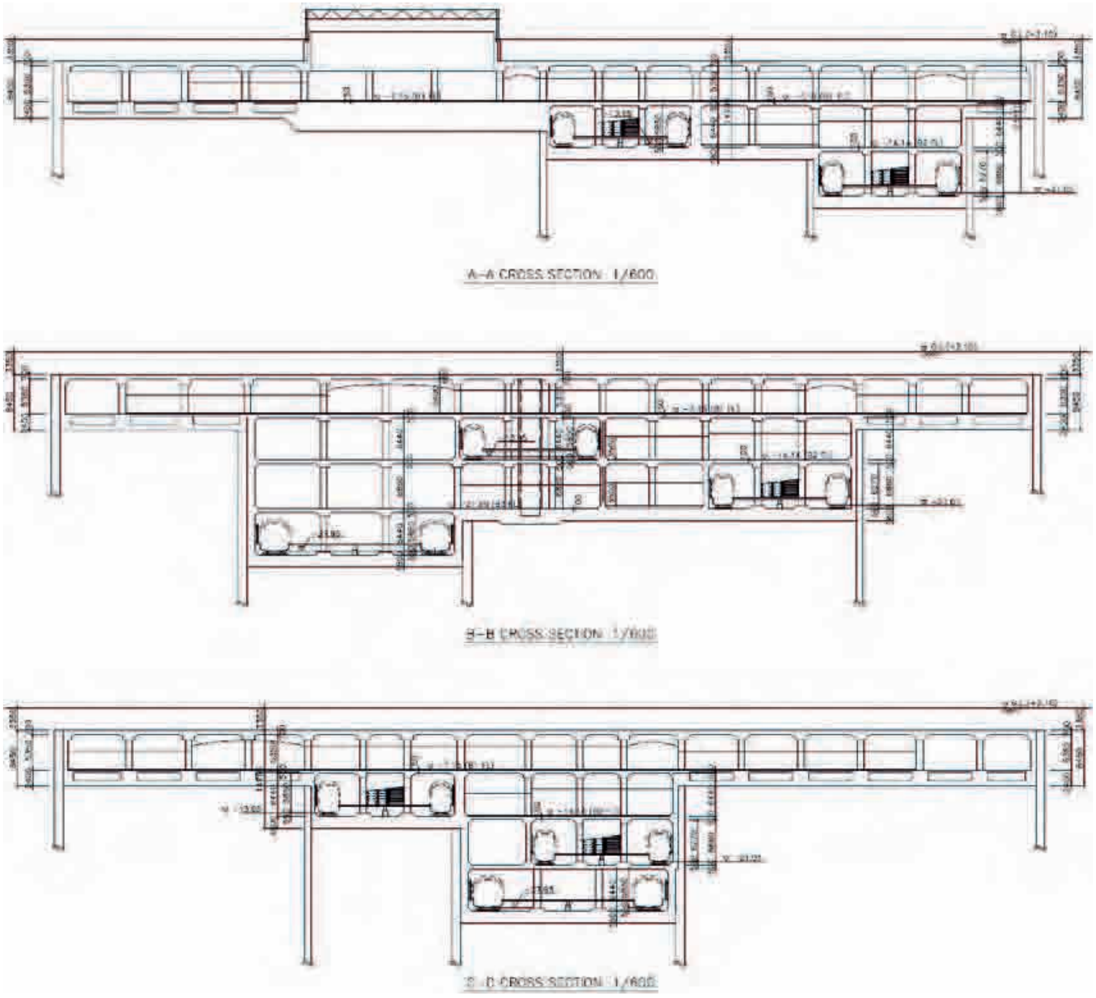


Figure 4.109 Typical Cross Section, Ben Thanh Central Station

2) Study of Phased Construction

Ben Thanh Central Station is planned as the complex station including the individual station for Line 1, Line 2 & Line 4 and USM.

Besides, the preliminary design of "HCMC Urban Railway Construction Project (Line 1)" was already completed and the facilitation of the Project progress is seriously required in HPC. Accordingly, the construction plan of Ben Thanh Central Station (including Line 1 structures) shall be coordinated with the current status of Lien 1 Project, and shall not induce the delay of the construction and the commencement of the commercial operation of Line 1.

Two options, "Unified Construction" and "Phased Construction" were studied.

All of the stations for Line 1, Line 2 & Line 4 and USM are constructed simultaneously in "Unified Construction".

In another option, "Phased Construction", the early completion of the construction of Line 1 Station (in 1st Phase) precedes the other stations and USM which will be constructed in subsequent 2nd Phase. Furthermore, "Phased Construction" is categorized in two detail options, related to the area of the partial construction of Line 2 Station locating under Line 1 Station. In the 1st option, whole structure of Line 2 Station (only civil structures and not including architectural works and E&M) beneath Line 1 Station is planned to be constructed. In the another option, only the part of station structure of Line 2 directly under Line 1 Station will be constructed together with Line 1 Station in Phase 1.

The results of the comparison study of above options are described in Section 4.2.2, and it was concluded to adopt "Phased Construction" for the early commencement of the commercial operation of Line 1 as the first priority, because of the indefiniteness of the construction plan & schedule of USM and Line 4.

About the construction of Line 2 Station in the 1st Phase, "construction of whole structure of Line 2 Station" was selected to avoid the following risks assumed during the construction of Line 2 structures in 2nd Phase:

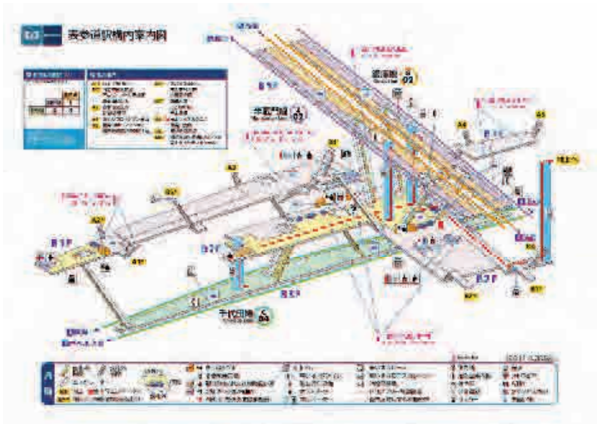
i) Noise and Vibration in Line 1 Station Area caused by the demolition & removal of RC Diaphragm Walls of Line 1 Station
ii) Subsidence of Line 1 Station caused by Cut & Cover Construction of Line 2 Station
iii) Water leaking from Construction Joints between Line 2 structures constructed in 1st Phase and 2nd Phase

In addition to the above, the construction of whole structure of Line 2 Station will contribute the application of common standards for disaster prevention (fire etc.) for Line 1 and Line 2 Stations. In the preliminary design of Line 1 Project, the disaster prevention policy was defined based on Clause 29 of "Japanese Ministerial Ordinance providing the technical standards on railways with commentary enacted by the Japanese Ministry of Land, Infrastructure, Transportation and Tourism", and approved by HCMC. Simultaneous construction of Line 1 and Line 2 Stations applying the common standards for disaster prevention is indispensable to guarantee the safety of underground stations and railways.

<Similar Project> Construction Project of Omote-sando central station, Japan

1. Introduction

Omote-sando metro station locates beneath the intersection of Omote-sando street of Meiji Jingu shrine and Aoyama-Dori street. The commercial operation of this station (as the terminal station) commenced at Nov. 1938 when “Ginza Line” was opened between “Toranomon” and “Aoyama 6 tyo-me”. At Dec. 1938, Ginza Line was extended to Shibuya and the station changed as the intermediate station. In this beginning time, the station located slightly near to Shibuya side than the current location. At Aug. 1978, the station removed to the current location. At Oct. 1972, Omote-sando Station of “Chiyoda Line” was opened, and subsequently, Omote-sando Station of “Hanzo-mon Line” was opened and those stations were merged to compose the Central Station.



(General Layout of Omote-sando Central Station)

Source: http://www.tokyometro.jp/station/omote-sando/yardmap/index.html

(Location of Omote-sando Metro Station

Source: http: http://www.tokyometro.jp/station/omote-sando/map/index.html

2. Brief of Construction

Cut & Cover Construction Method for large areas was applied to construct “Omote-sando Metro Station” of “Hanzo-mon Line” between the stations of “Ginza Line” and “Chiyoda Line”. The Site locates around Omote-sando Intersection with National Highway 246 (Aoyama Dori Street) and Local Road 413 (Inogasira Dori Street). Those are major roads in Tokyo Metropolitan Area with large traffic volume. Many Utilities also exist under the ground.

Ginza Line locates along and under the center of National Highway 246. Under Omote-sando Intersection, Chiyoda Line crosses over Ginza Line.

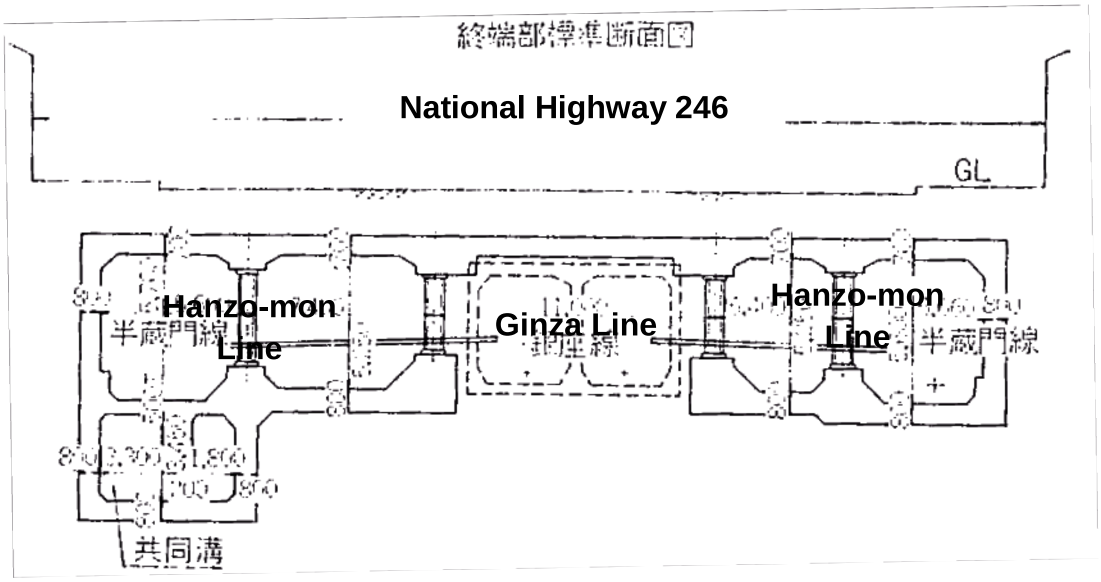
Because of the above mentioned conditions, Hanzo-mon Line was designed and constructed at the same level with Ginza Line at the both sides (refer to cross section below).

The 1st Section for construction is 377m length including the following work items;

- Construction of box type tunnel for single track
- Demolition & removal of the existing Omote-sando Station of Ginza Line

- Demolition & removal of the existing inner walls of Station of Ginza Line for the construction of transition floor
- Construction of Hanzo-mon Line

The 2nd Section for construction includes the construction work of new Omote-sando station of Hanzo-mon Line with Ginza Line, as shown in the following cross section.



Source: Sumio Sikada, Takeo Takayama, Cut & Cover Construction Method under Major Highways – Ginza, Chiyoda, Hanzo-mon Lines Omote-sando Central Station, pp31-41, Tunnel & Underground, 96, Vol. 9, No.8, 1978. 8

3) Study of Retaining Walls

The requirements for the retaining walls for the construction at the study area are as follows:

- High impermeability to prevent the fall down of underground water level
- High rigidity to prevent the settlement of surrounding grounds and neighbor buildings
- Low vibration and noise during construction
- Availability for large and deep excavation

"Diaphragm wall" was adopted to satisfy the above requirements.

4) Study of Excavation Method

Two excavation methods, "Bottom up" and "Top down" are applicable for the Cut & Cover Construction of USM, and "Bottom up" method is categorized in "strut support type" and "ground anchor type".

Based on the results of Preliminary Design of Line 1 Project, "Bottom up" method was adopted for Phase 1 of Option 2, the construction of Line 1 and Line 2 Stations.

For Phase 2, the construction of Line 4 Station and USM, the application of "Top down" method was recommended because of the following disadvantages of "Bottom up" method.

(1) The excavation for the study area is large and deep, about 140m (width) x 240m (width) x 32m (depth). If "Bottom up" method with strut support is applied for this area, many steel struts are necessary for long spans. Installation and removal of many long span

struts makes the rate of work decline, and it also causes the disadvantage for construction cost.

(2) Steel deck slabs are required for large areas to maintain the public traffic around the excavation area, and it causes the increase of cost.

(3) If "Bottom up" method with ground anchor is applied, several anchors are installed beneath the neighbor buildings. Even if the special type of anchors (removal type) are applied, parts of anchors remain under the buildings. Those remained parts may be the obstacles for the development of the underground infrastructure in the future.

In Figure 4.110, the image of "Top down" method is indicated. The advantages of "Top down" method are as follows:

- Traffic diversion is necessary only during the construction of retaining walls and top slabs.
- After the top slab is constructed, construction yards is available at the underground level.

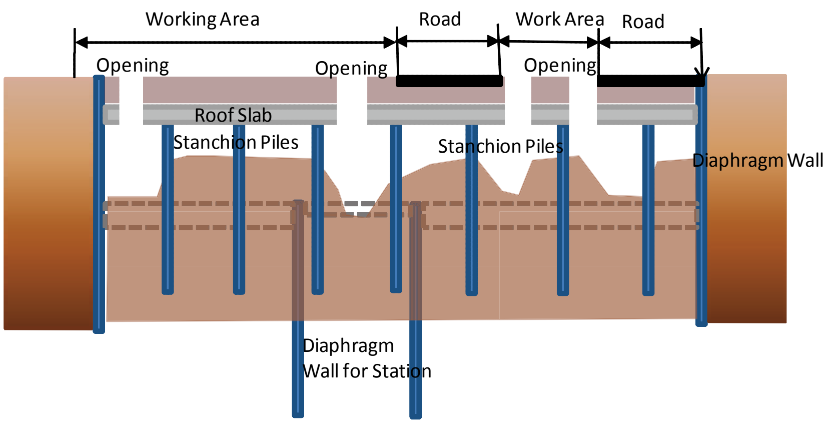


Figure 4.110 Image of "Top down" method

5) Study of Construction Method for Important Points

(1) Crossing Points of Station Structures

Line 2 station structure crosses with and locates beneath Line 1 and Line 4 station structures, and the arrangements of retaining walls at those crossing points become complicated, as shown in Figure 4.111. The retaining walls are constructed from the ground surface level, and the portion of retaining wall from ground surface level to slab at the crossing points shall be casted with lean concrete (or filled by crushed stones).

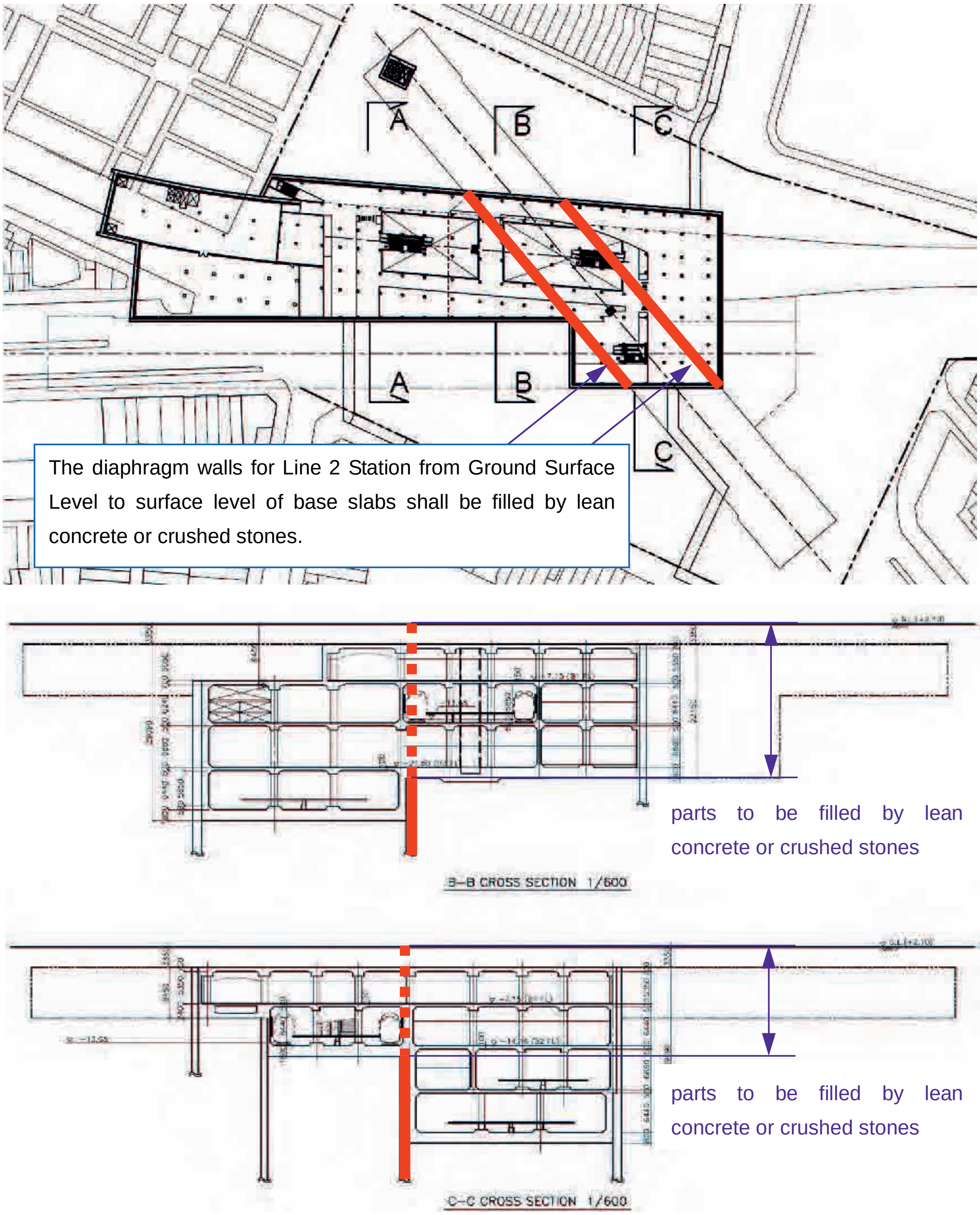


Figure 4.111 Arrangement of Retaining Walls for Line 1 & Line 2 Stations, Phase 1 of Option 2

(2) Preparation for TBM Arrival

Ben Thanh Central Station is the terminal station with Line 1, Line 2, Line 3a and Line 4, and Line 2 and Line 4 tunnels are planned to be constructed by TBM to connect to the constructed central station. Accordingly, the preparation for the arrival of TBMs is necessary to be considered for the central station structure.

Two methods, "Removal of temporary wall" method (conventional method) and "Direct removal of retaining wall" method can be the alternatives for preparation work for TBM arrival. (Refer to Table 4.32.) For the deep excavation with high water pressure, diaphragm walls are commonly adopted as the retaining walls, and recently "Direct removal of retaining wall" method is adopted for diaphragm walls in many cases, because of the advantages for shorter durations, safety and economic aspects.

Table 4.32 Preparation Method for TBM Arrival

Method	Removal Works	Details
"Removal of temporary wall"	By man-power or breaking machines	Removal: Hand-breaker, Hydraulic Breaker, Hydraulic static demolition method, etc. Stability of tunnel face and waterstop: Chemical injection method, Jet grouting method, Freezing method
"Direct removal of retaining wall"	By TBM	Application of specific material for retaining wall to be removed: SEW method, NOMST method Removal of core piles of retaining wall: Specific material for core piles to be removed by electrolytic corrosion method

For the Project, "Direct removal of retaining wall" method shall be adopted. (Refer to Figure 4.112.)

The following issues shall be studied for the construction planning of "Direct removal of retaining wall" method:

- Characteristics and shapes of Shield Cutter Bits, bit arrangement in different levels, preparation of spare bits, etc. to resist the wear and damage by cutting hard walls
- Countermeasure against noise and vibration during cutting of retaining walls
- Waterstop and prevention of soil inflow at TBM arrival

For waterstop and prevention of soil inflow at TBM arrival, installation of partition wall inside of the retaining walls is necessary. (Refer to Figure 4.113.) Partition wall shall be fabricated by steel materials to resist the driving force of TBM, and installed at the concrete entrance of TBM arrival. The core piles of retaining walls at TBM arrival shall be the material available to be cut by TBM.

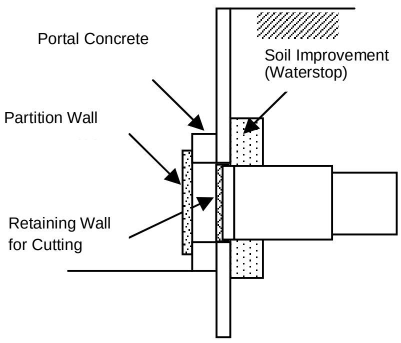


Figure 4.112 Direct Removal of Retaining Wall

Figure 4.113 Partition Wall

6) Protection and Maintenance of Underground Utilities during Construction

Please refer to Section 4.5.2, 6).

7) Construction Sequence and Traffic Management during Construction

Figure 4.115 – Figure4.138 indicate the construction sequence (cross sections and plan) of Ben Thanh Central Station. In Phase 1, Line 1 & Line 2 stations will be constructed, and Line 4 station & USM will be constructed subsequently in Phase 2.

For Phase 2, "Top down" method was adopted, and its construction sequences were shown in Figure 4.114. The entrances for mobilization & demobilization of construction materials & equipments are allocated on the slabs, and closed at the final stage of the construction works.

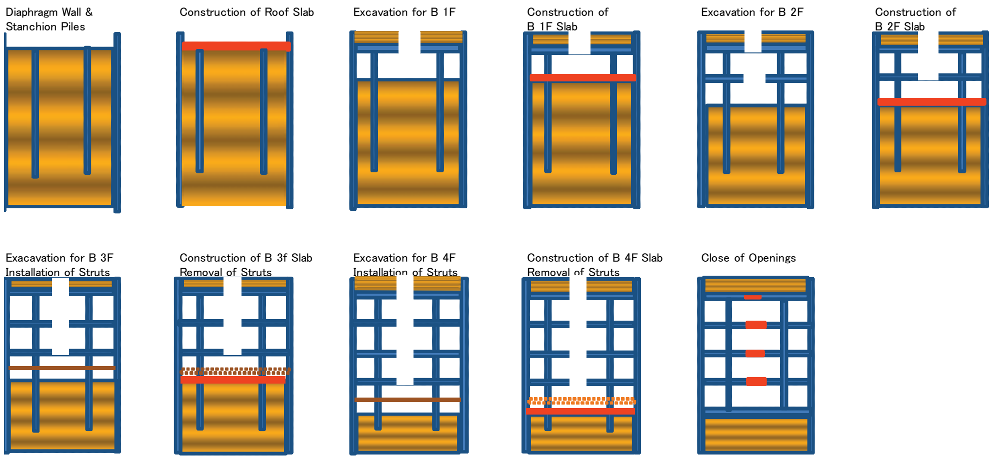


Figure 4.114 Construction Sequences of "Top Down" Method (Cross Sections)

The traffic diversion plans are also indicated in these Figurs. Traffic diversion plans were established considering the current tcondition of the public traffic around the rotary in front of Ben Thanh Market.

8) Preliminary Construction Schedule

The preliminary construction schedule of Ben Thanh Central Station of Option 2, "Phased Construction" is shown in Table 4.33.

STEP 1-1: Commencement of Construction, Ben Thanh Central Station (Phase 1, Bottom up Method)

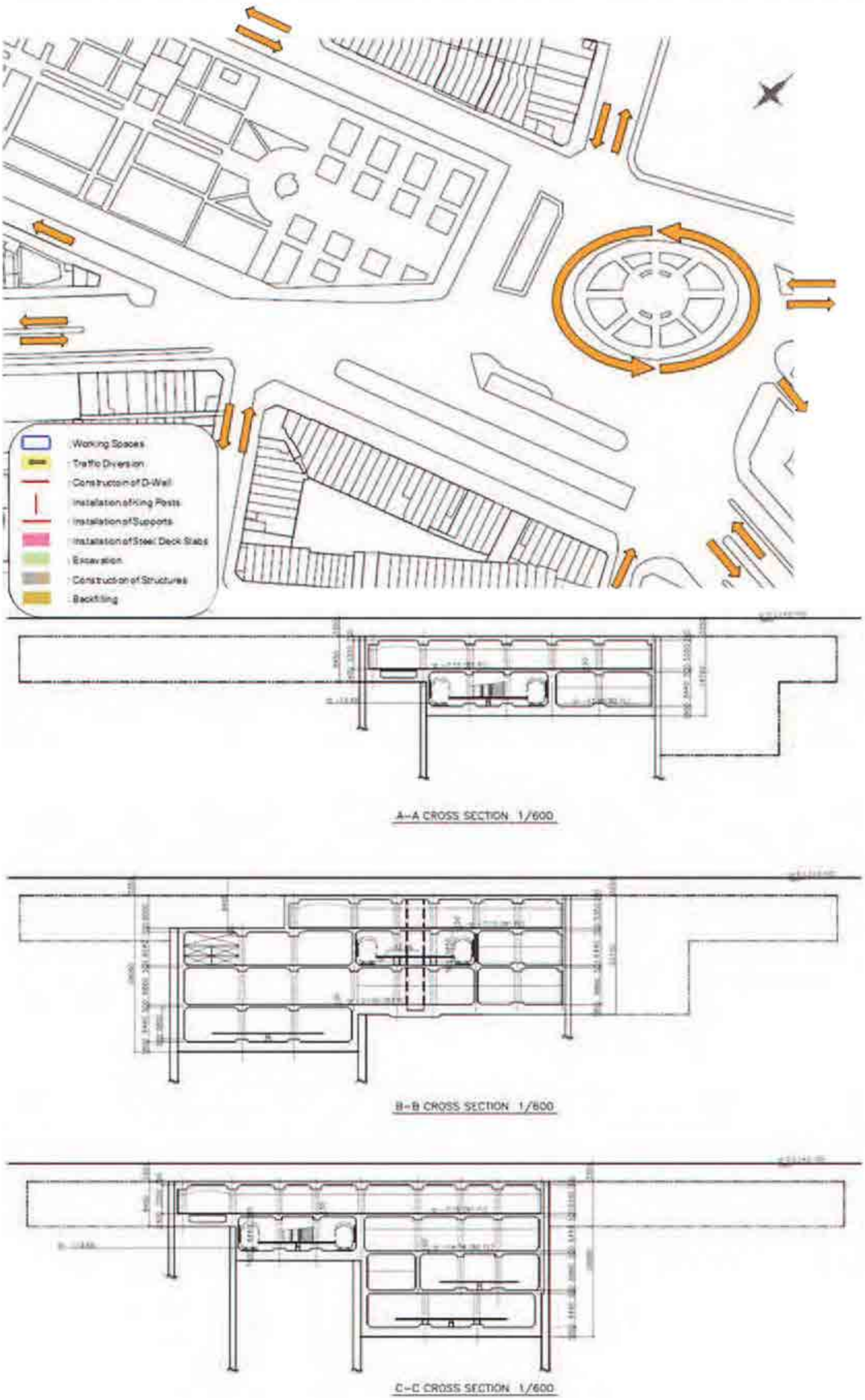


Figure 4.115 Construction Sequences of Ben Thanh Central Station (1/24)

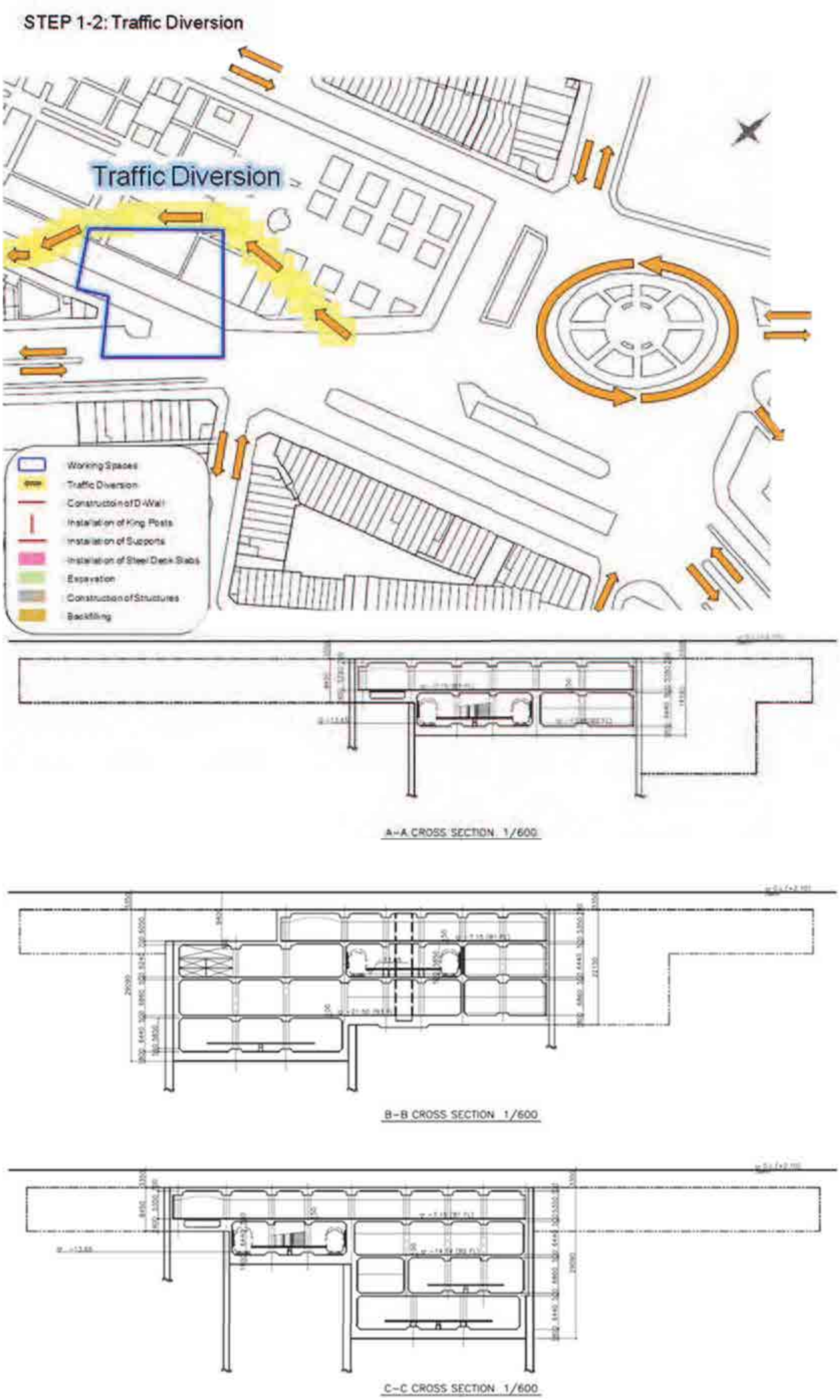


Figure 4.116 Construction Sequences of Ben Thanh Central Station (2/24)

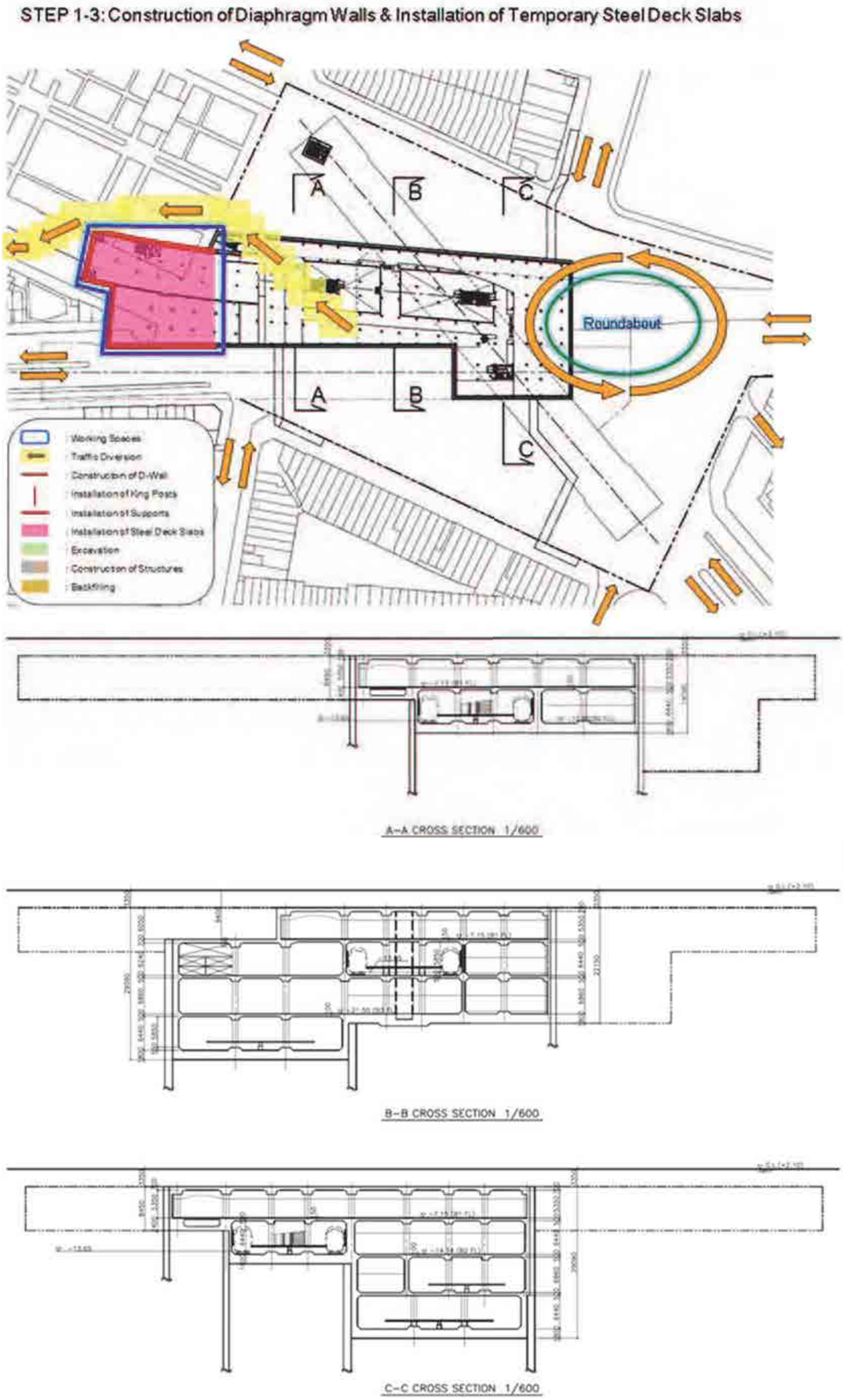


Figure 4.117 Construction Sequences of Ben Thanh Central Station (3/24)

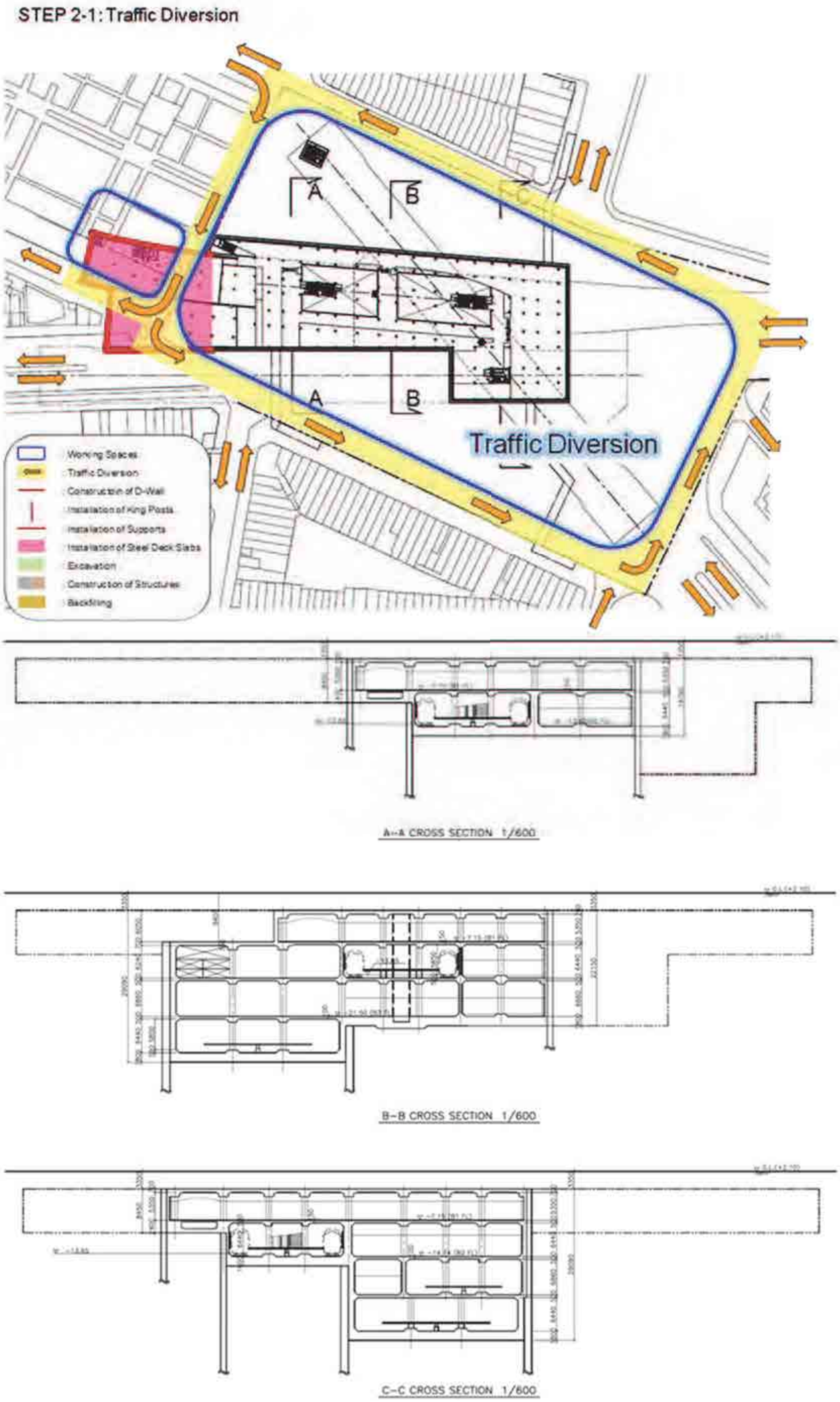


Figure 4.118 Construction Sequences of Ben Thanh Central Station (4/24)

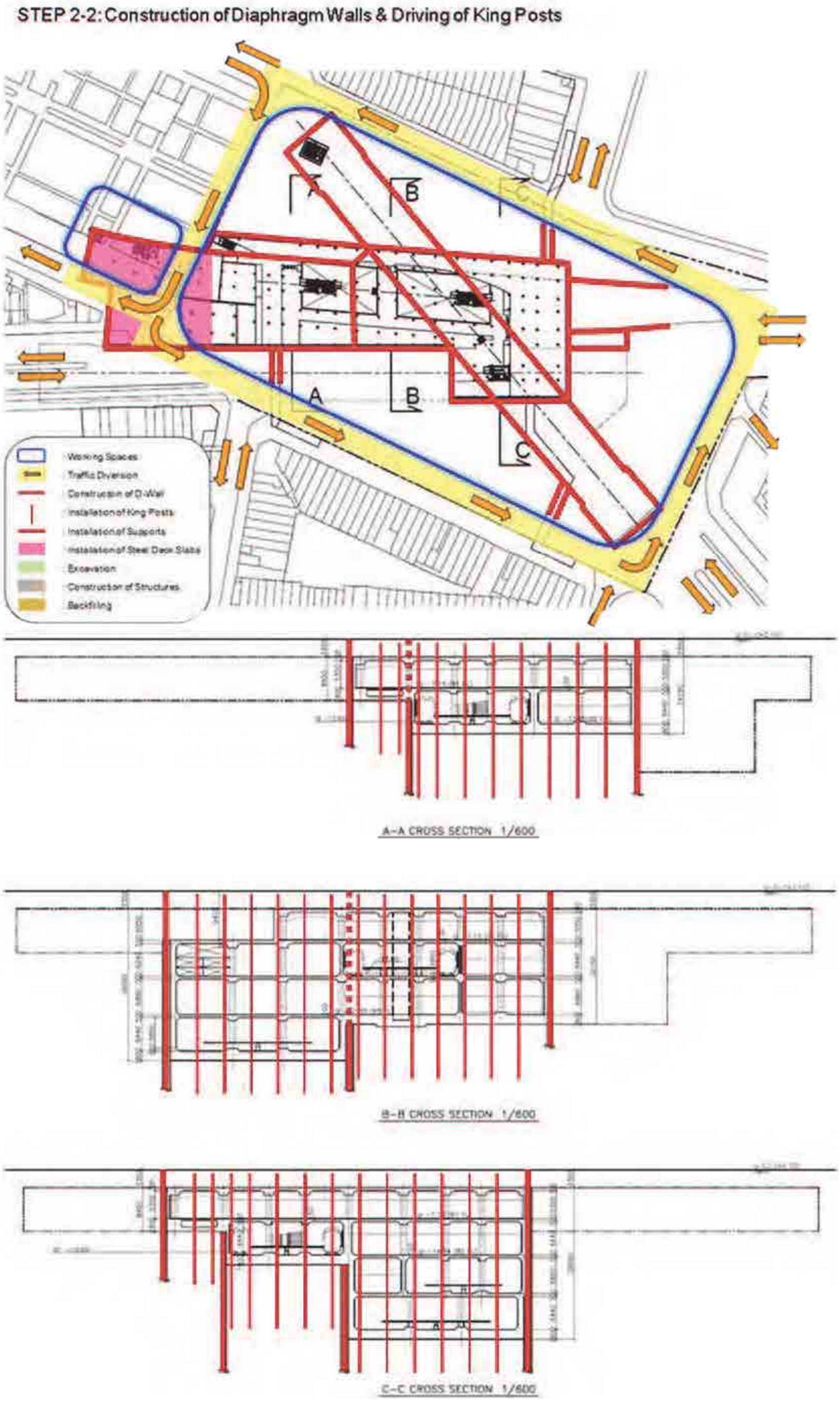


Figure 4.119 Construction Sequences of Ben Thanh Central Station (5/24)

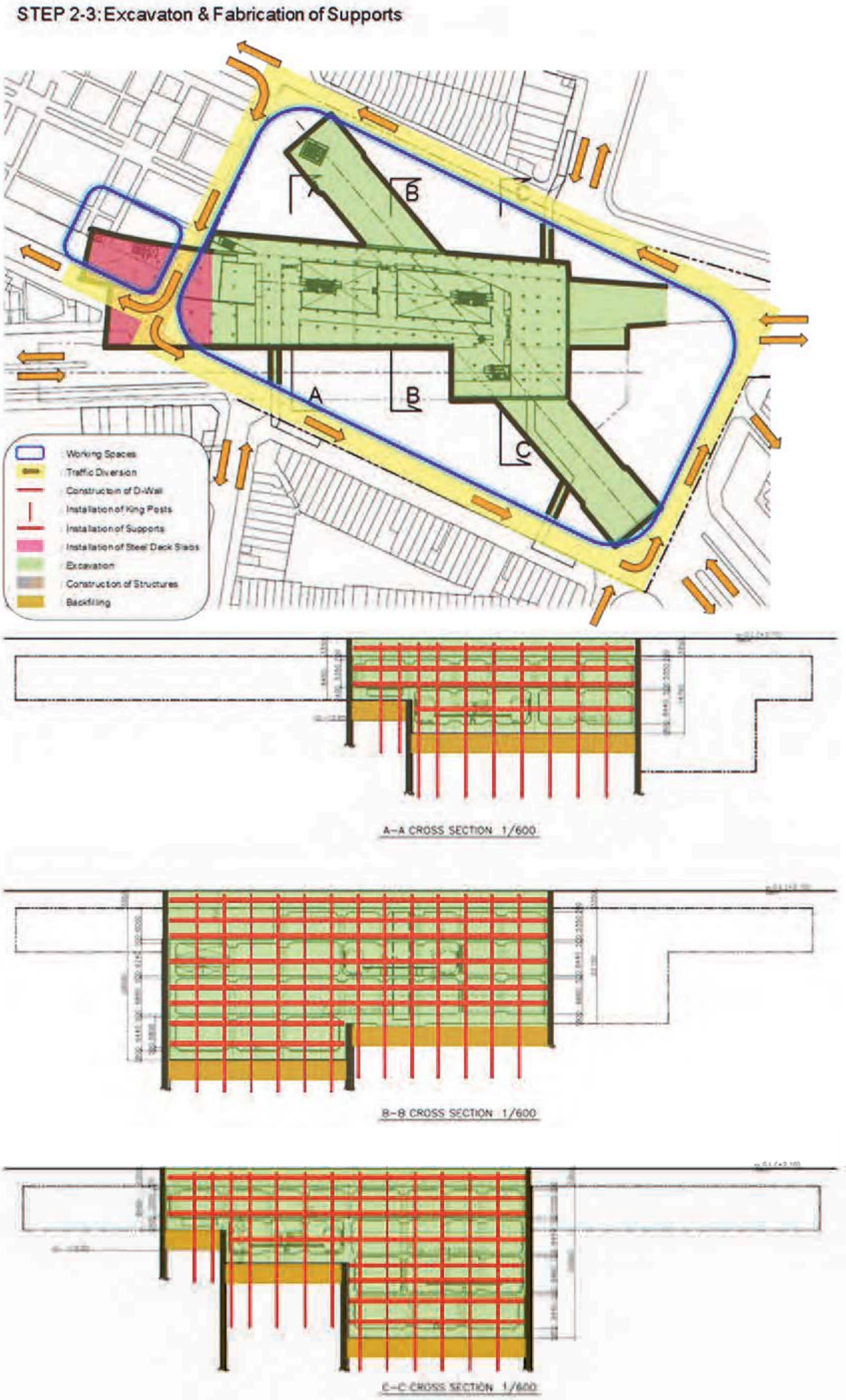


Figure 4.120 Construction Sequences of Ben Thanh Central Station (6/24)

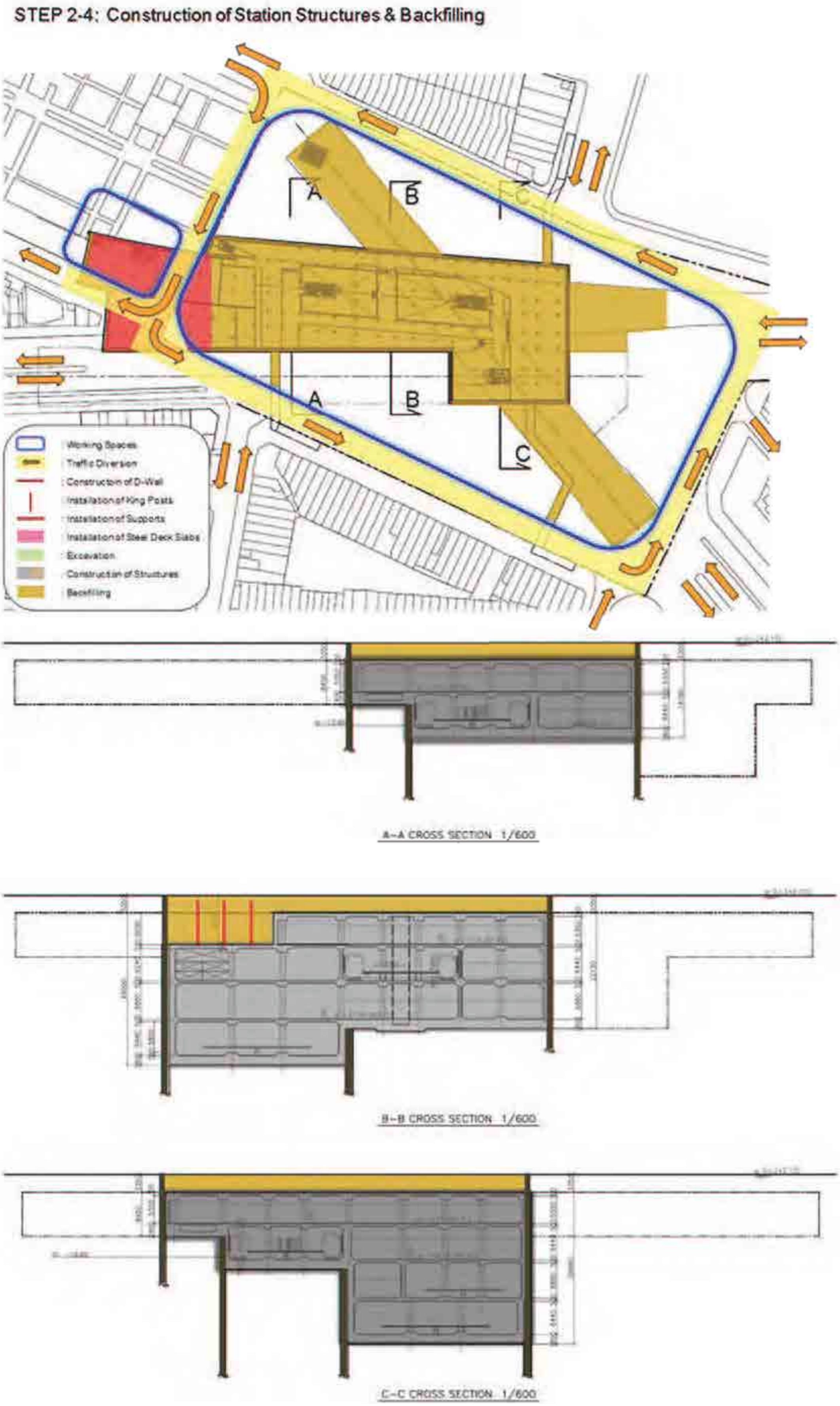


Figure 4.121 Construction Sequences of Ben Thanh Central Station (7/24)

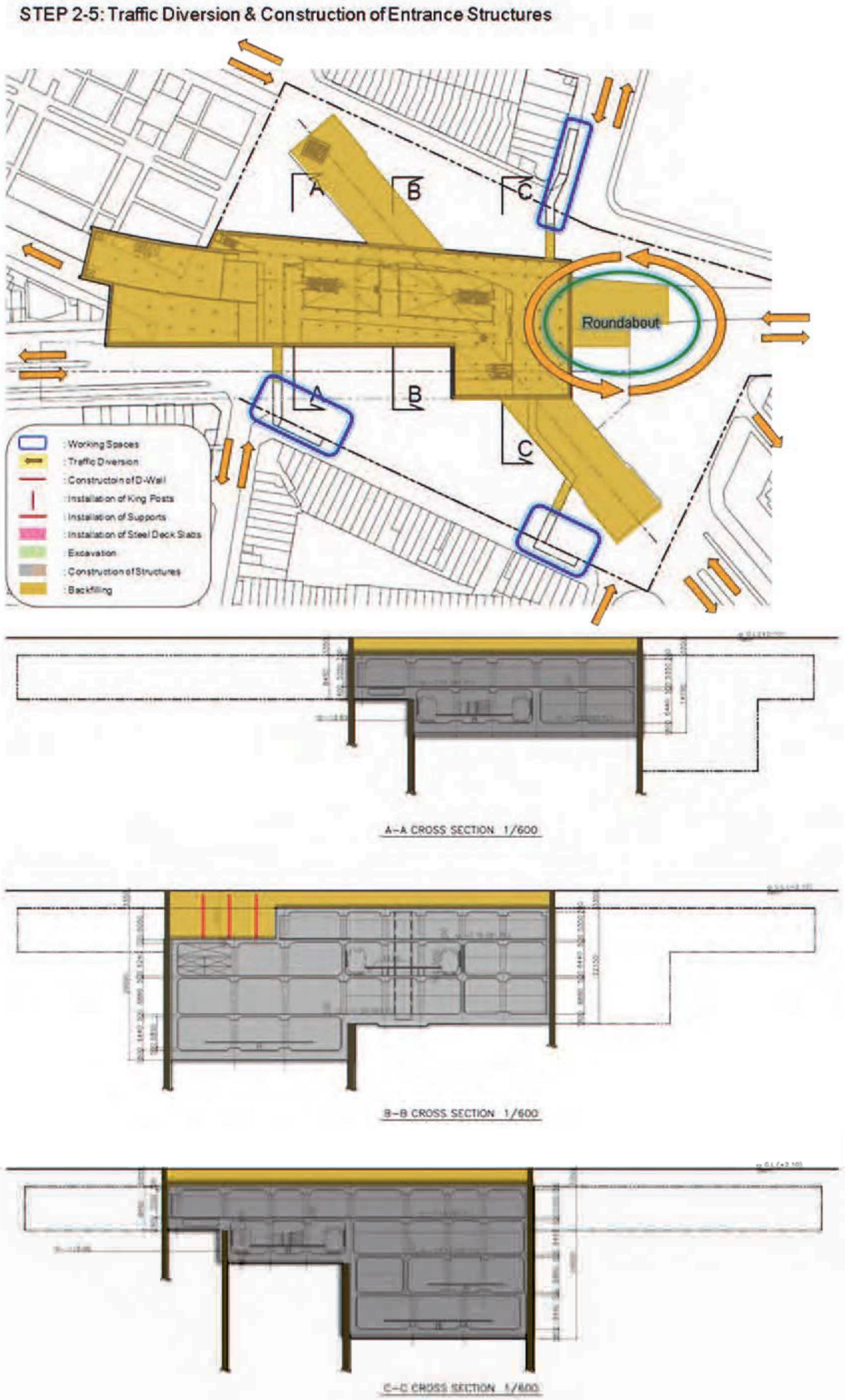


Figure 4.122 Construction Sequences of Ben Thanh Central Station (8/24)

STEP 2-6: Commencement of Commercial Operation of Line 1

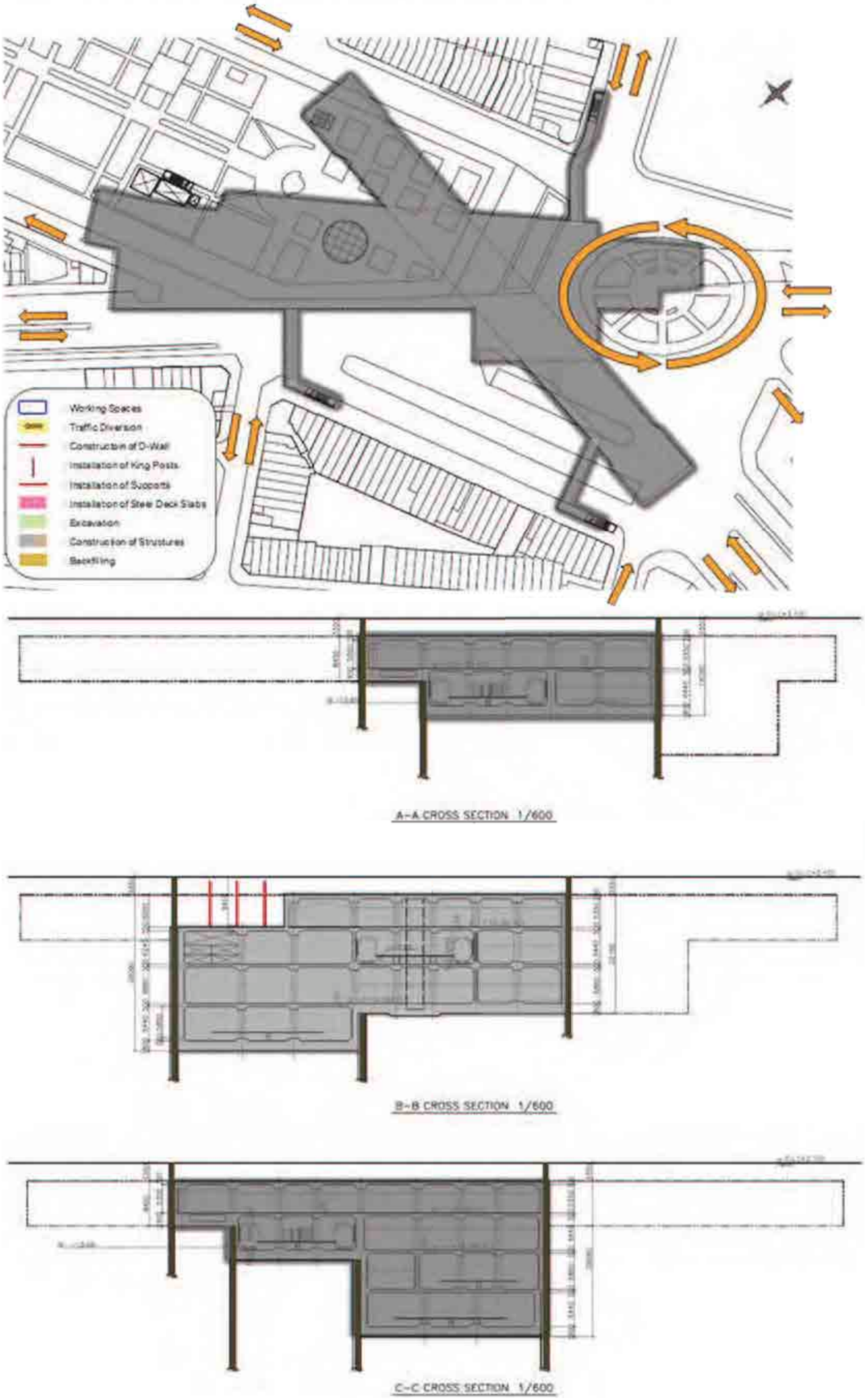


Figure 4.123 Construction Sequences of Ben Thanh Central Station (9/24)

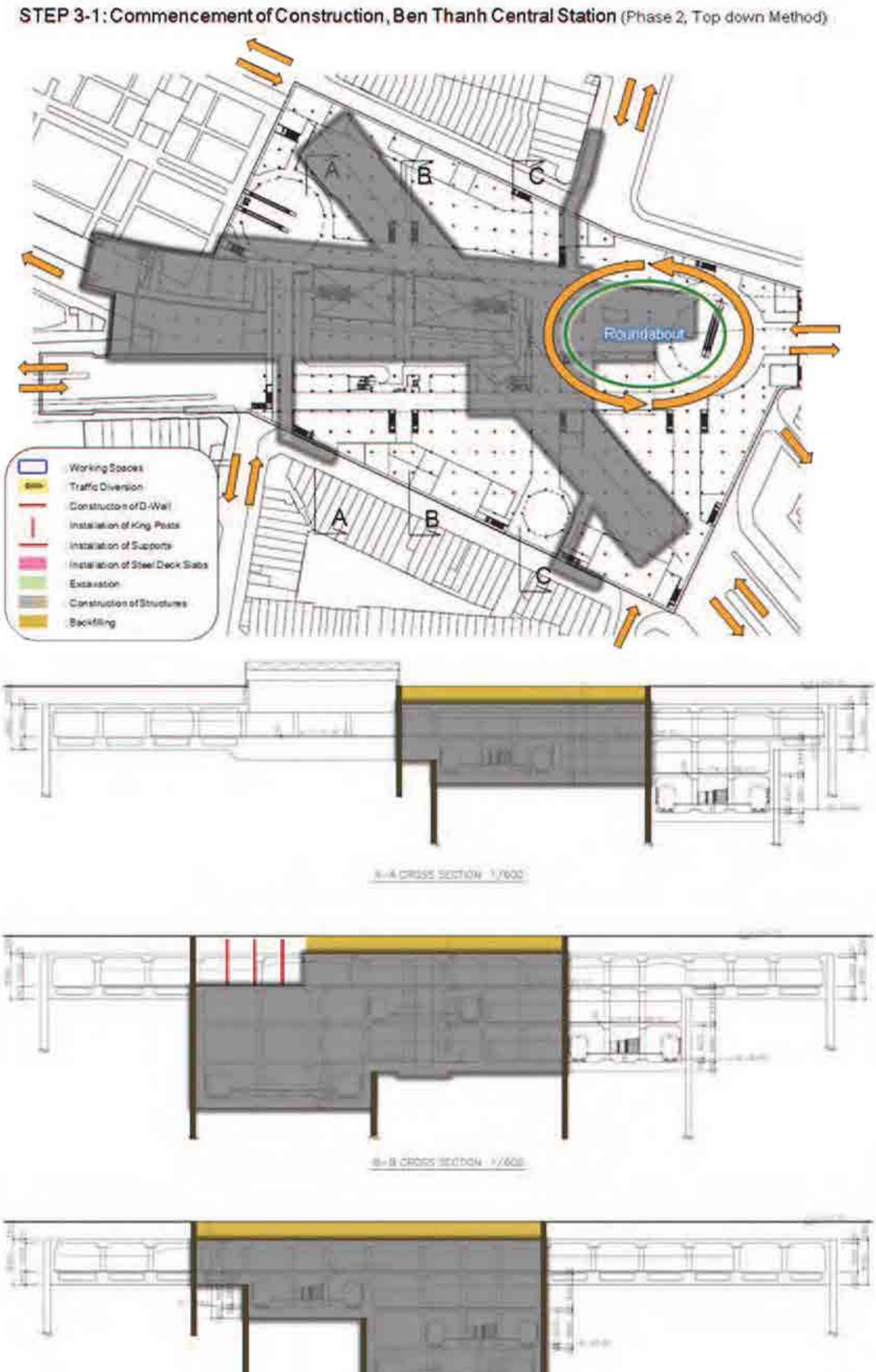


Figure 4.124 Construction Sequences of Ben Thanh Central Station (10/24)

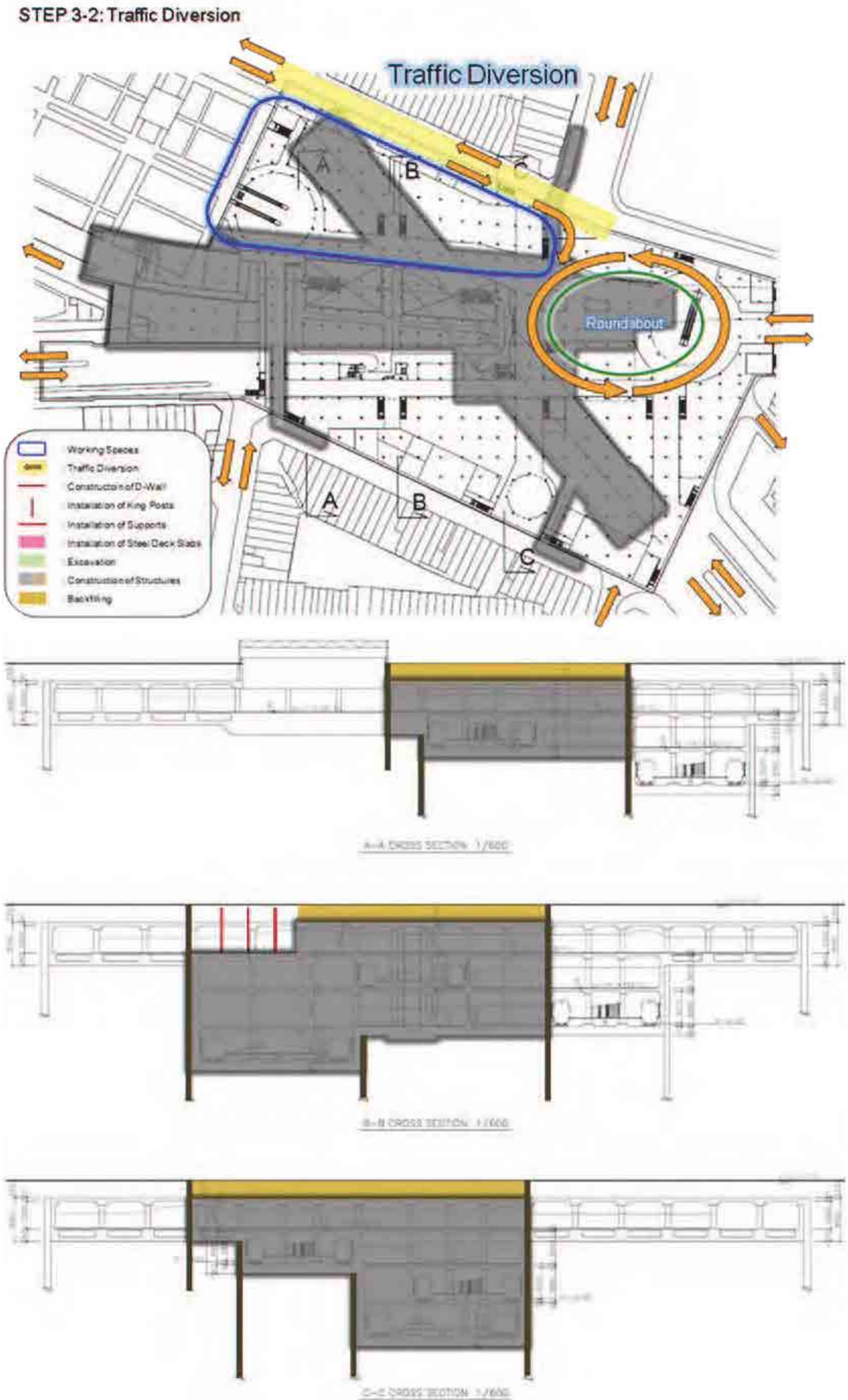
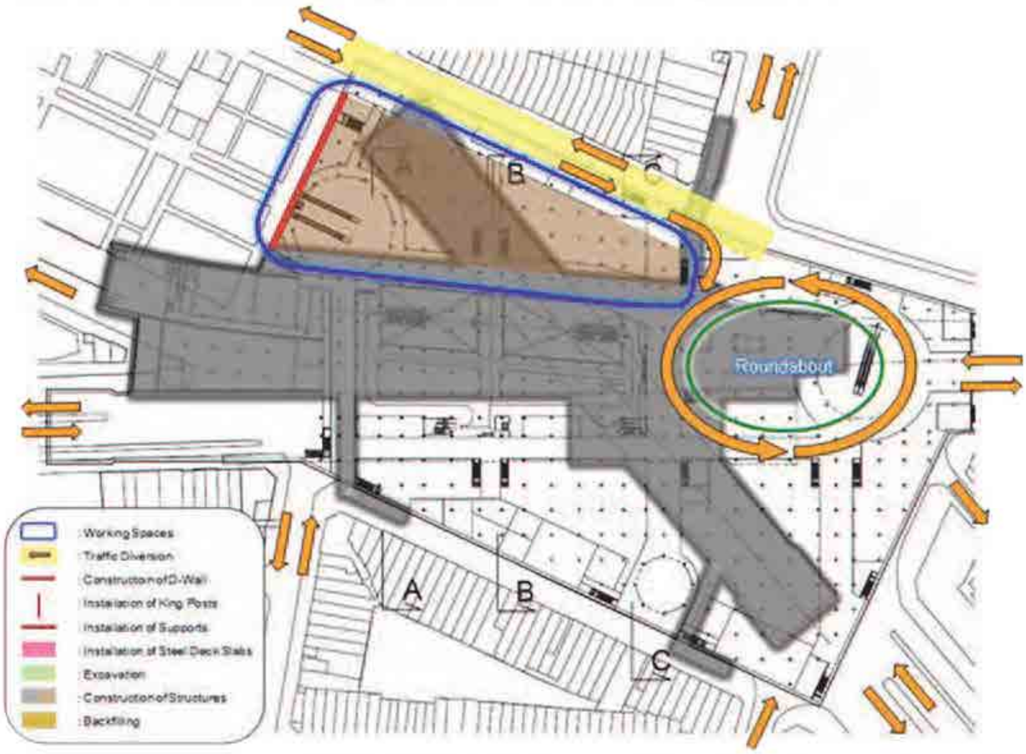


Figure 4.125 Construction Sequences of Ben Thanh Central Station (11/24)

STEP 3-3: Construction of Diaphragm Walls & Construction of Roof Slabs



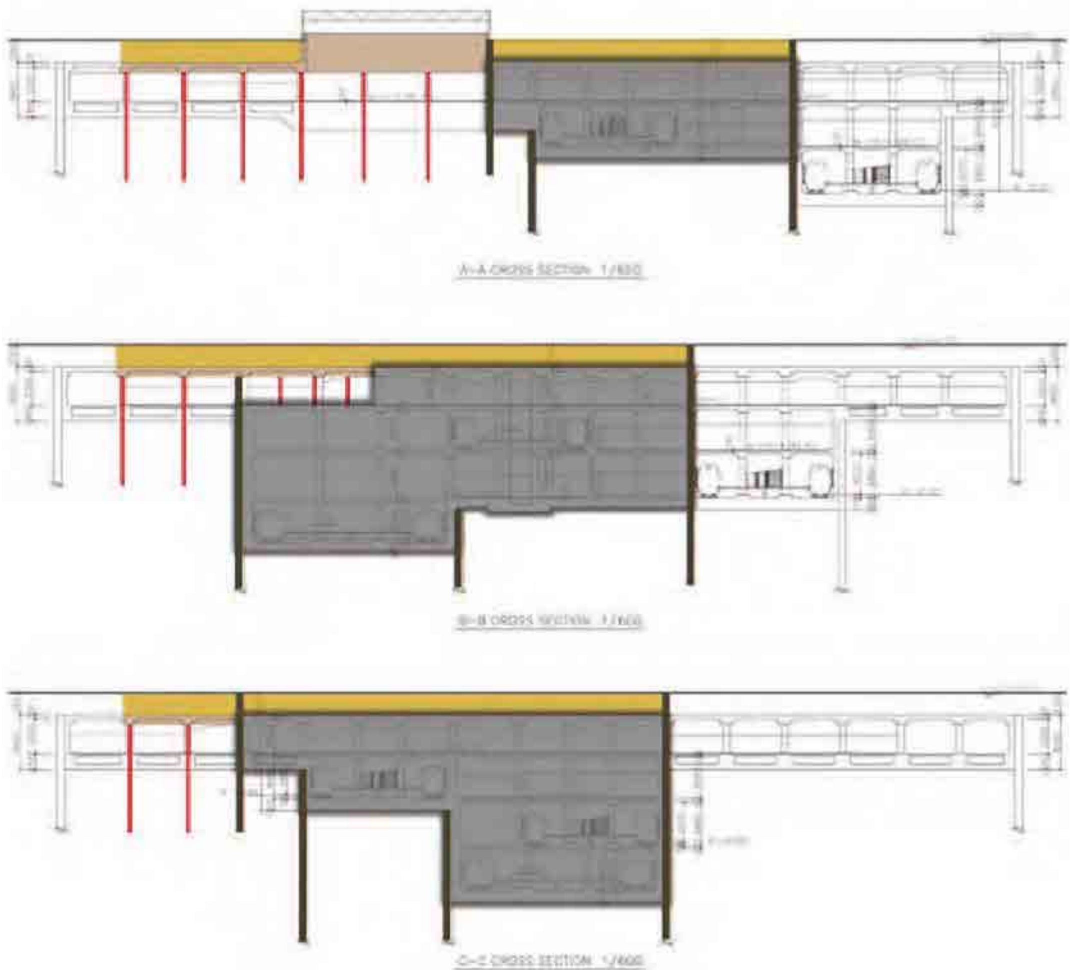


Figure 4.126 Construction Sequences of Ben Thanh Central Station (12/24)

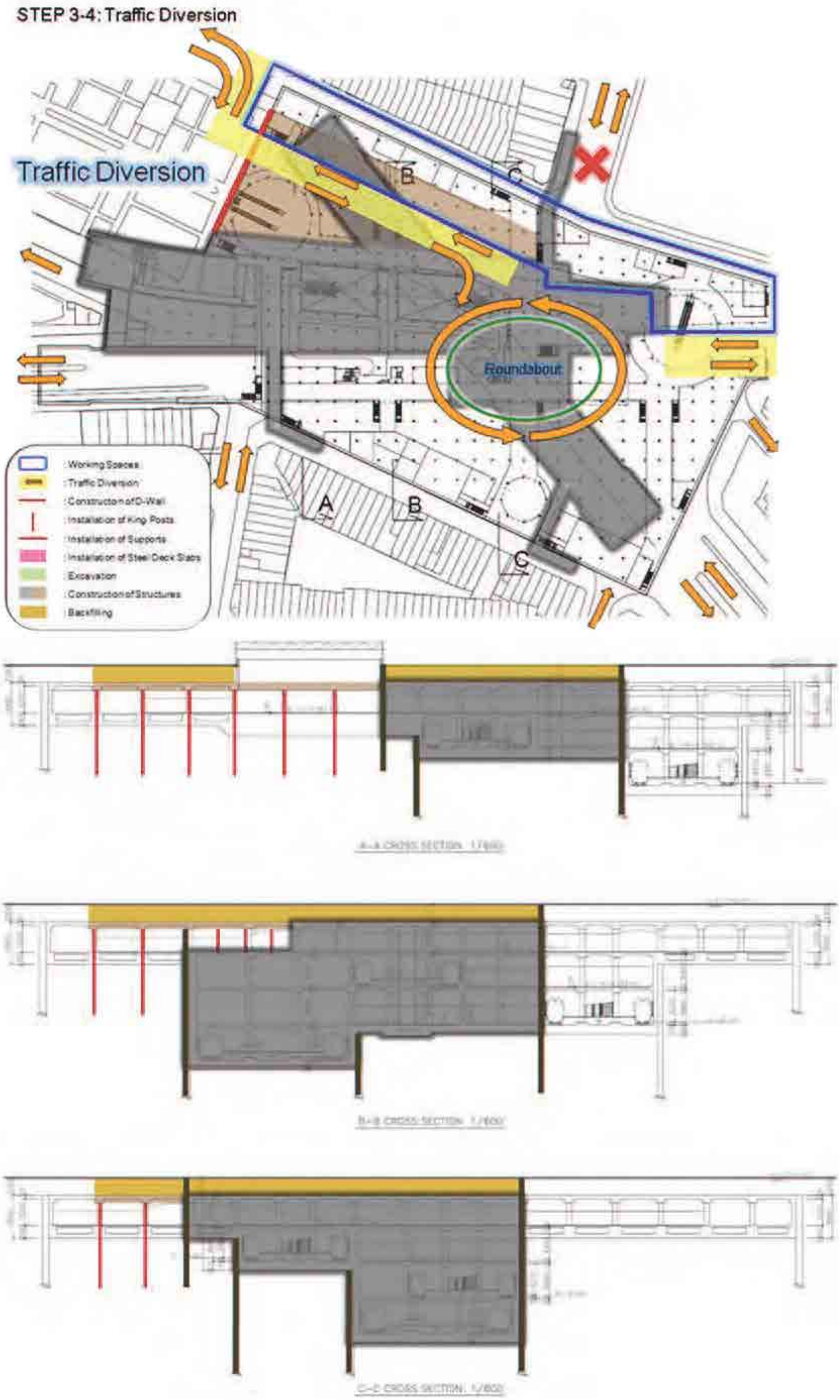


Figure 4.127 Construction Sequences of Ben Thanh Central Station (13/24)

STEP 3-5: Construction of Diaphragm Walls & Construction of Roof Slabs

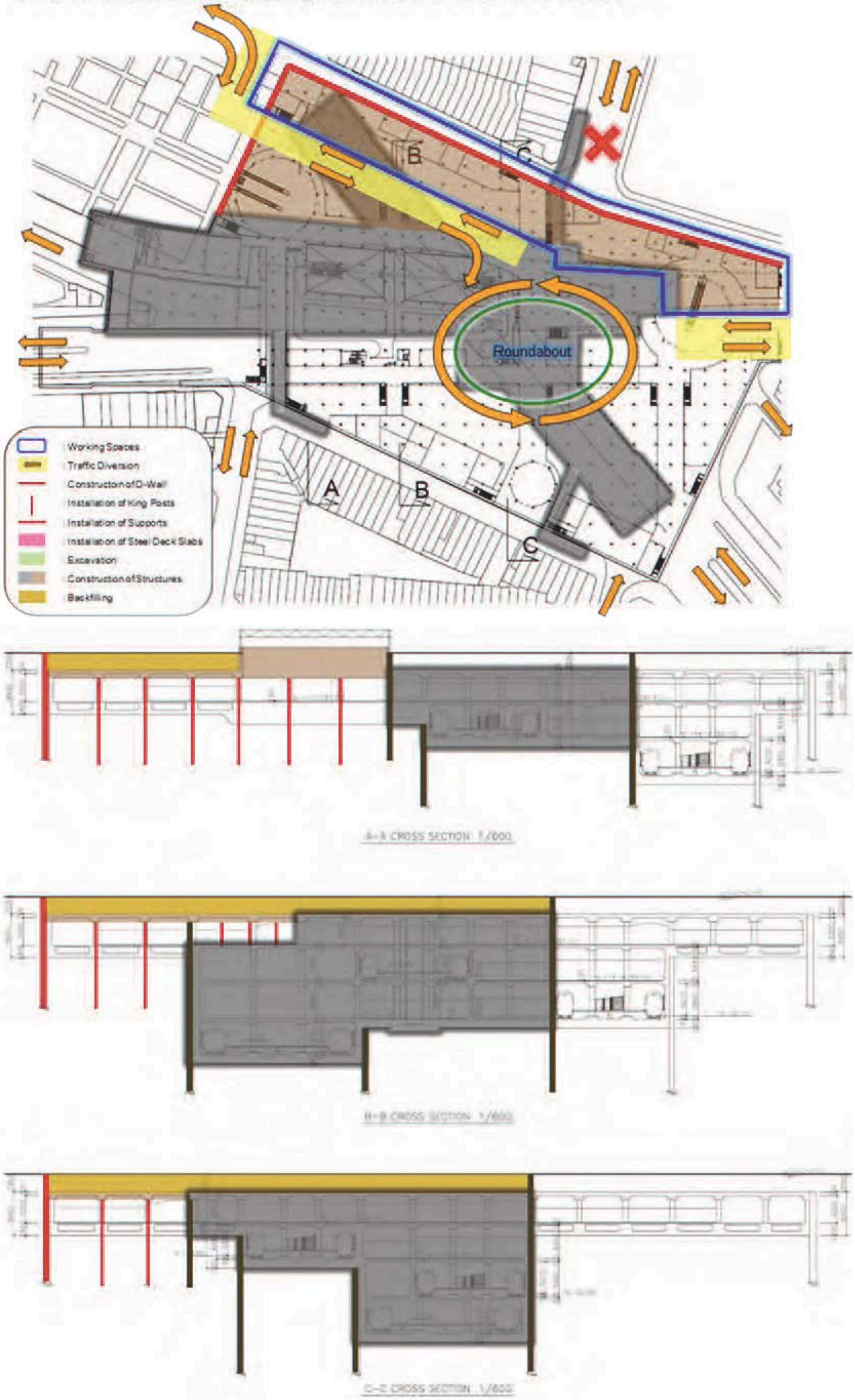


Figure 4.128 Construction Sequences of Ben Thanh Central Station (14/24)

STEP 3-6: Traffic Diversion

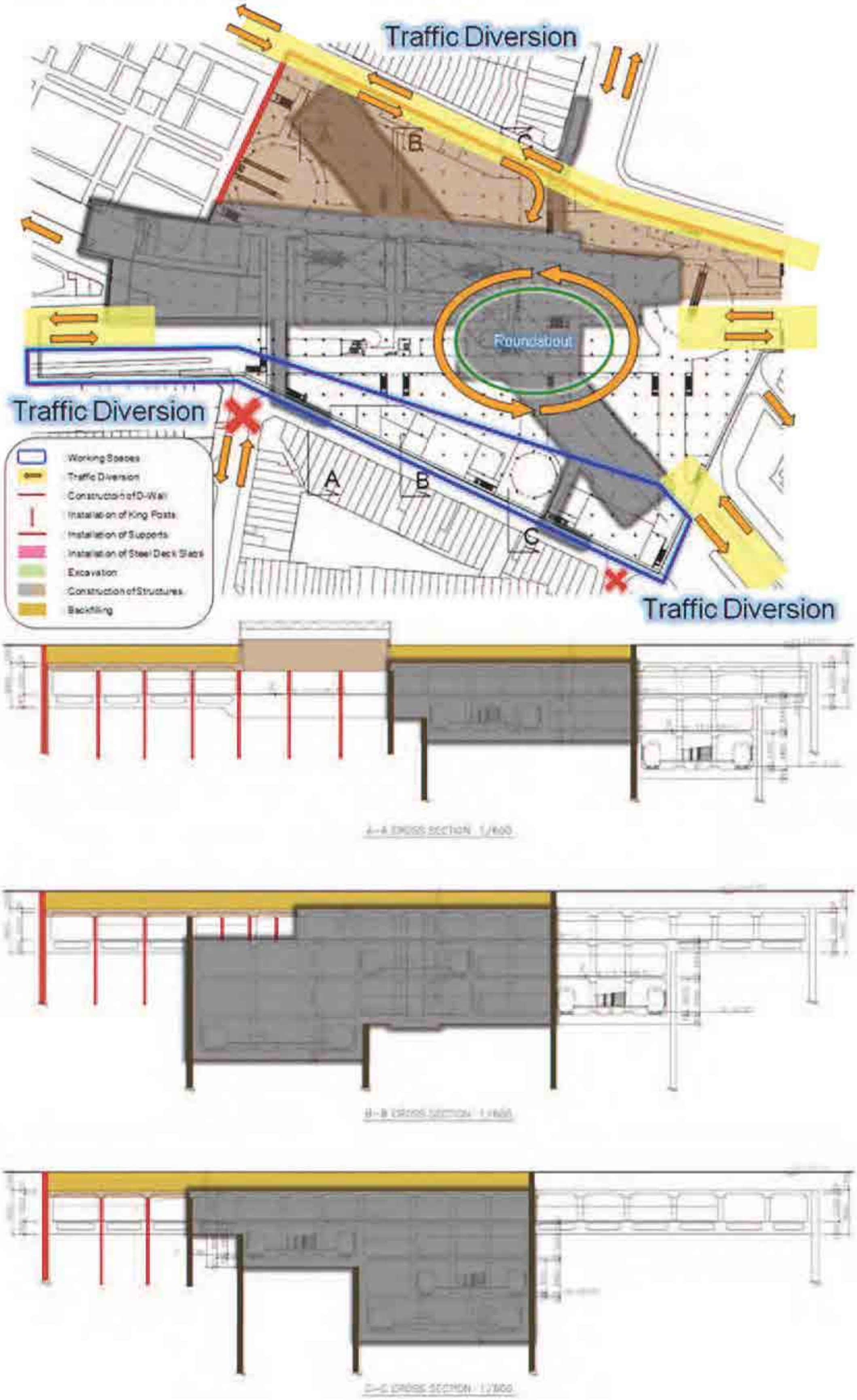


Figure 4.129 Construction Sequences of Ben Thanh Central Station (15/24)

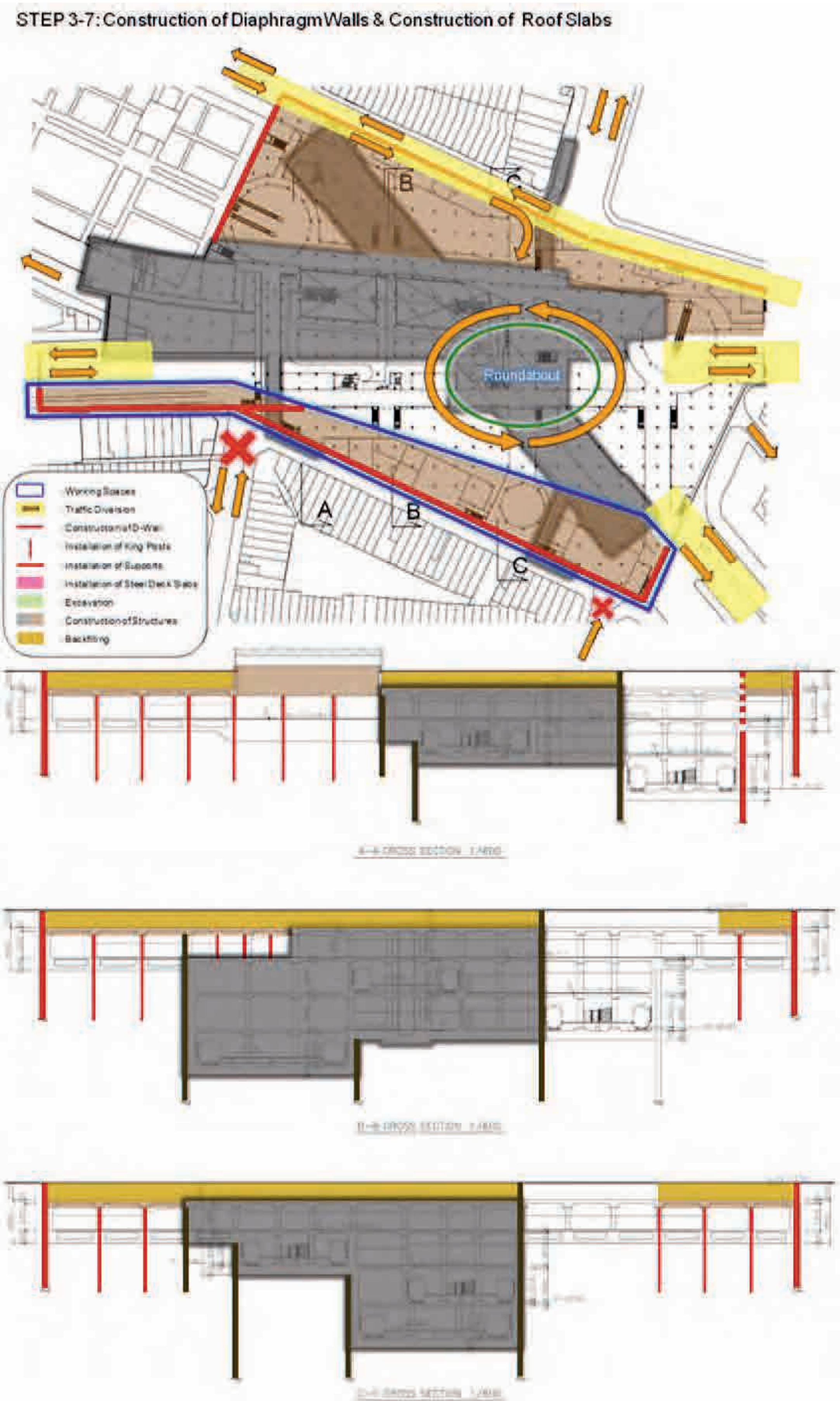


Figure 4.130 Construction Sequences of Ben Thanh Central Station (16/24)

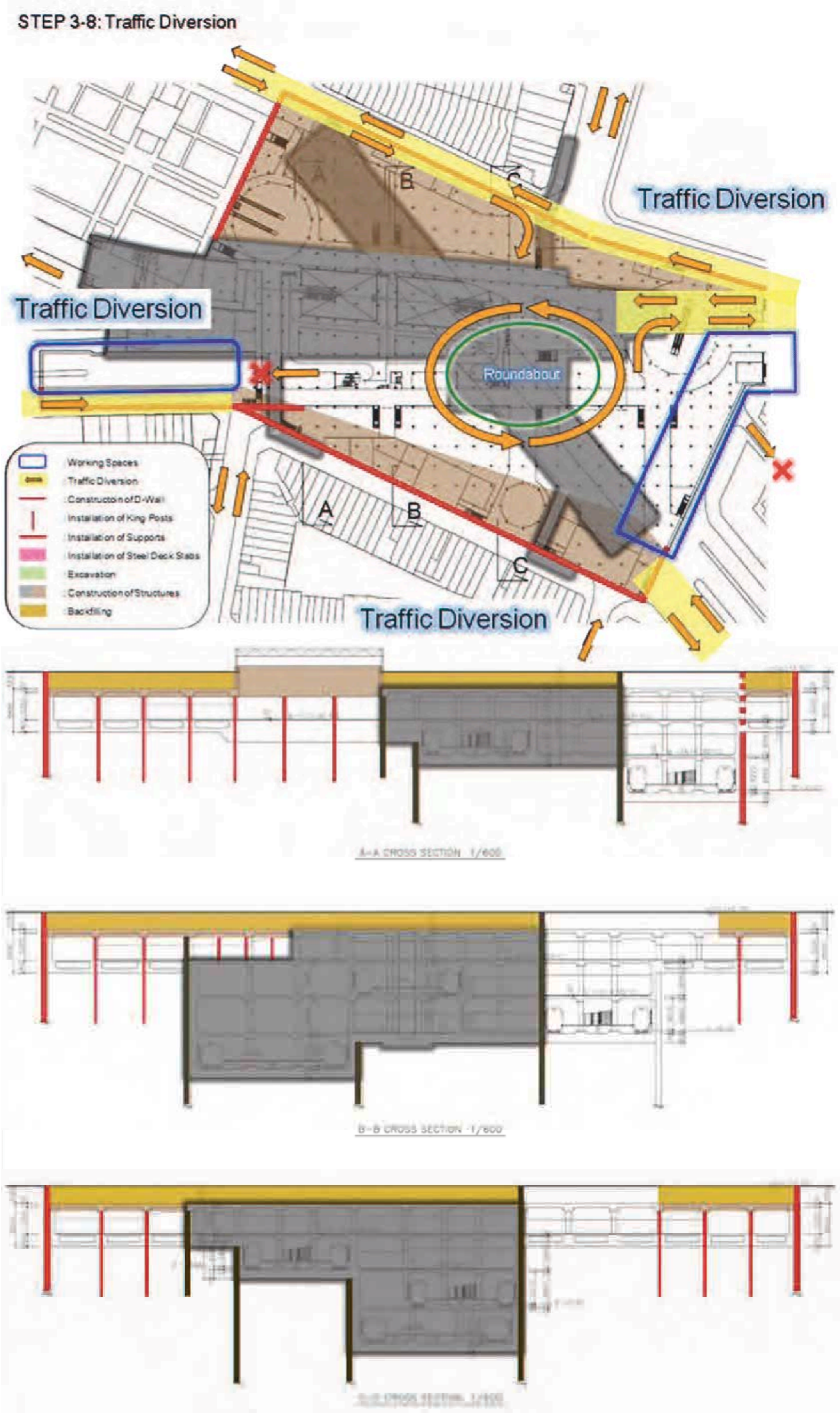


Figure 4.131 Construction Sequences of Ben Thanh Central Station (17/24)

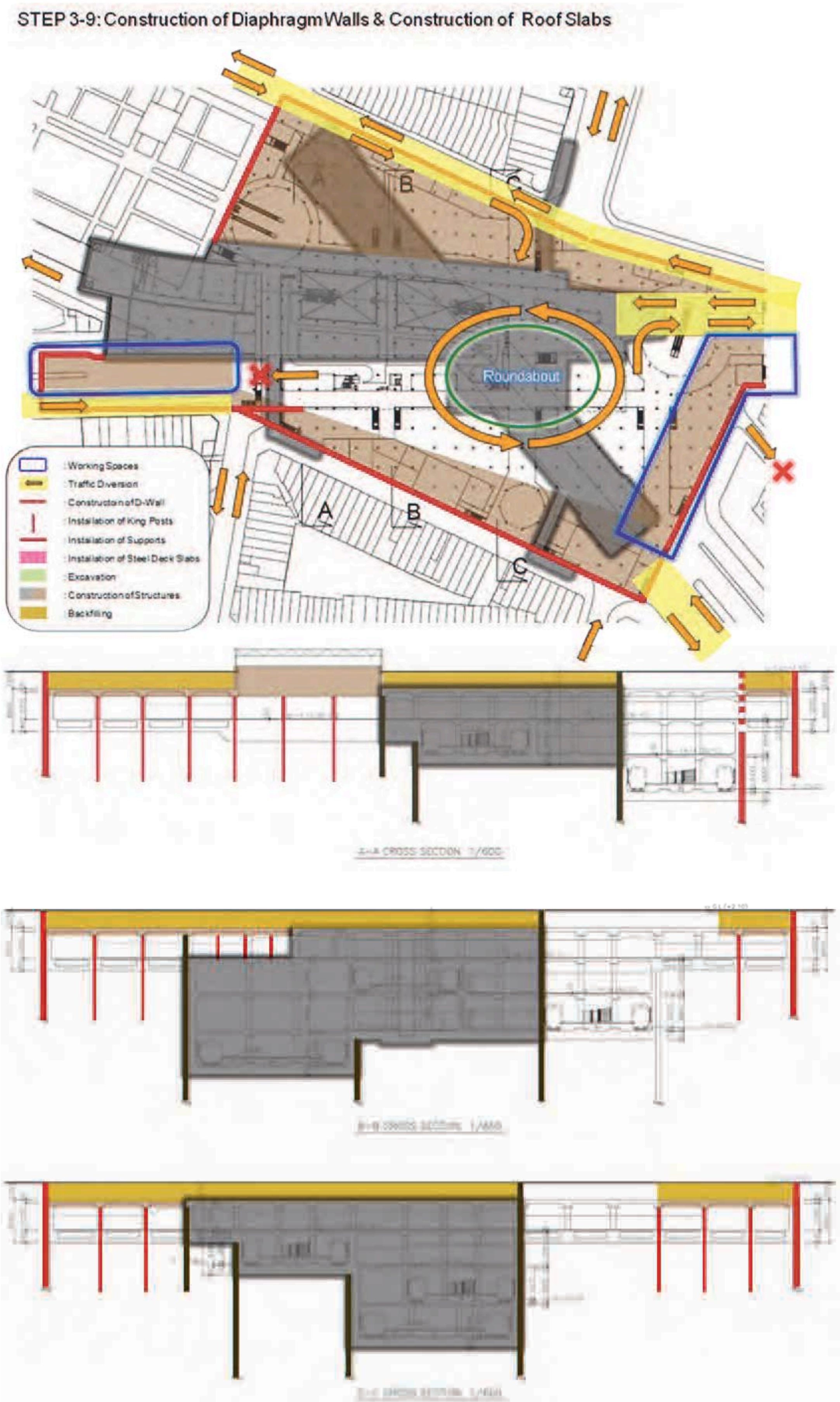


Figure 4.132 Construction Sequences of Ben Thanh Central Station (18/24)

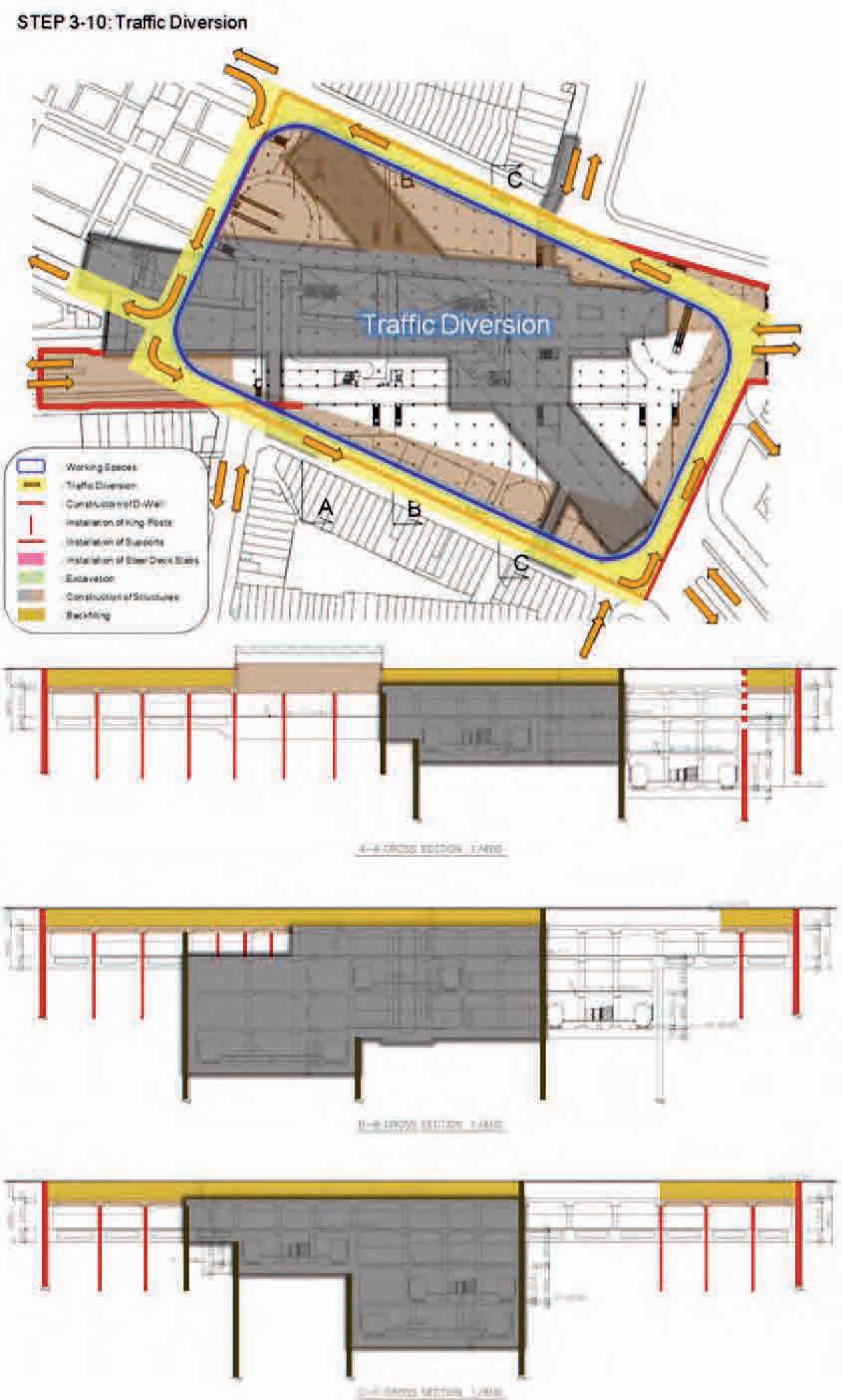


Figure 4.133 Construction Sequences of Ben Thanh Central Station (19/24)

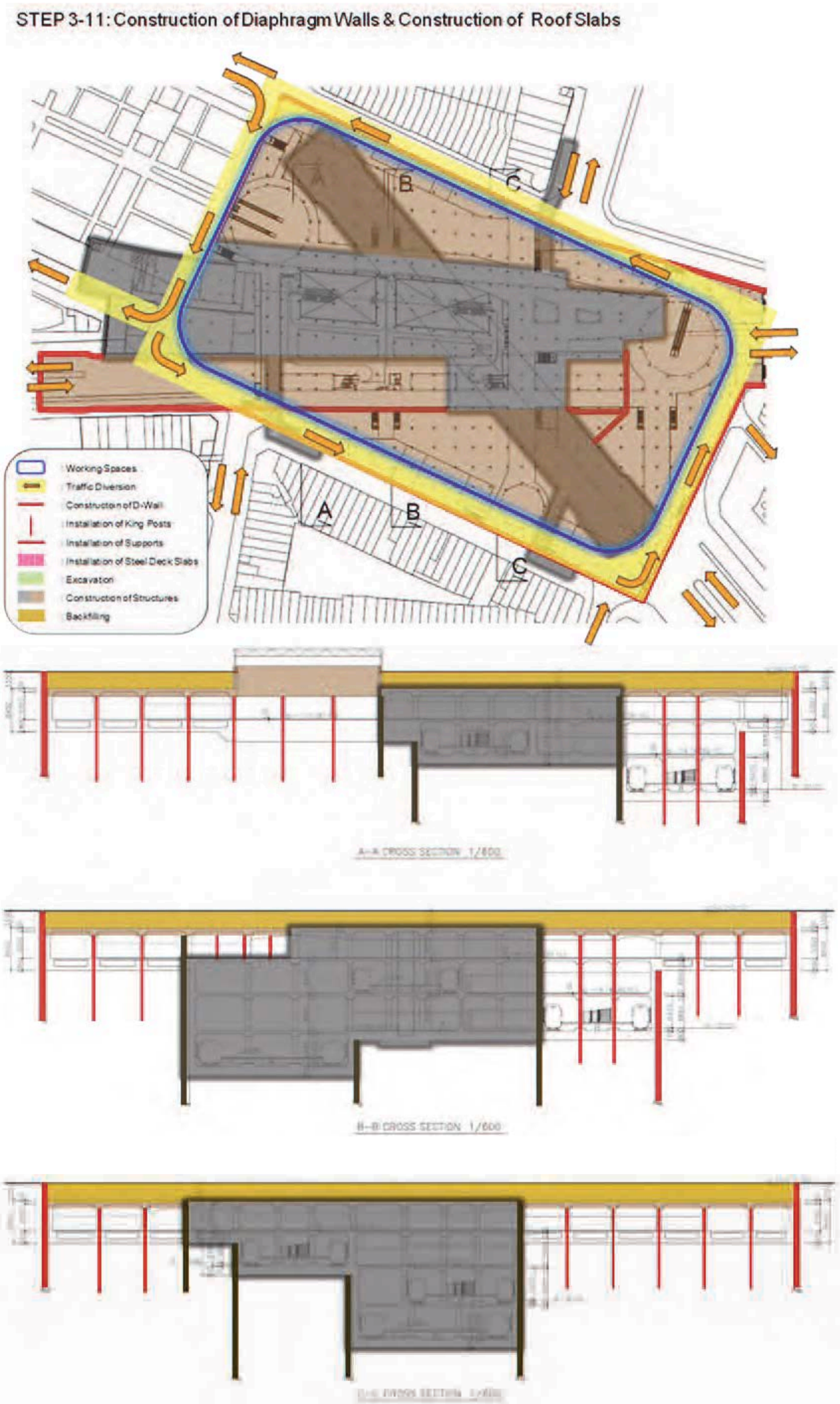
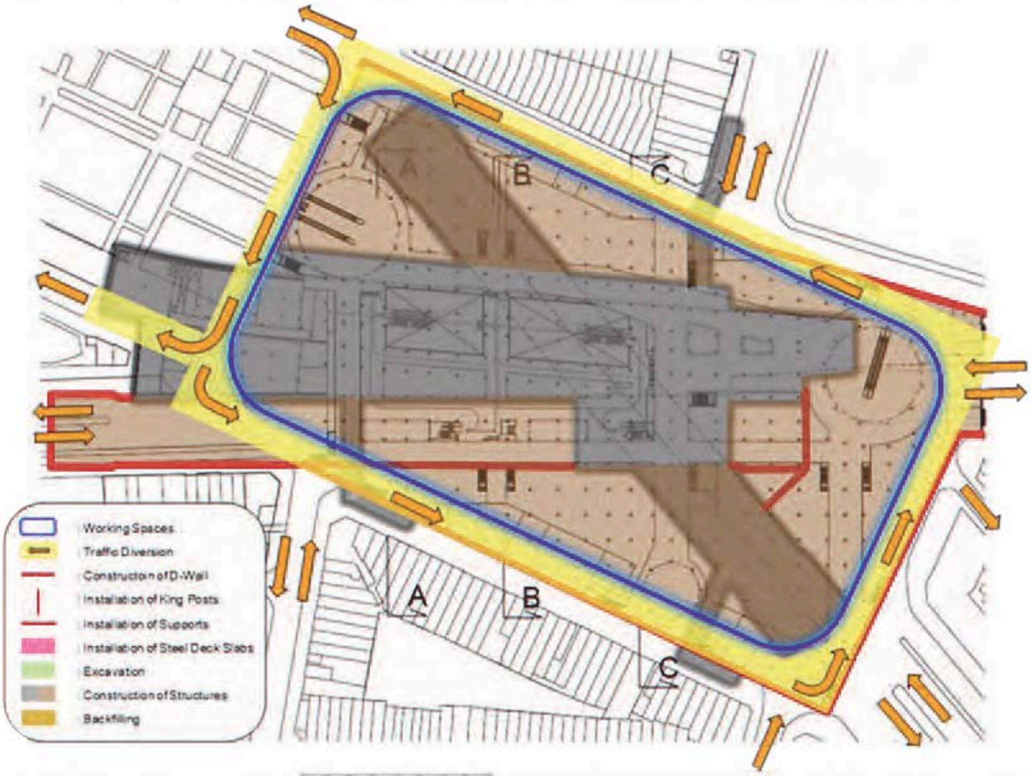
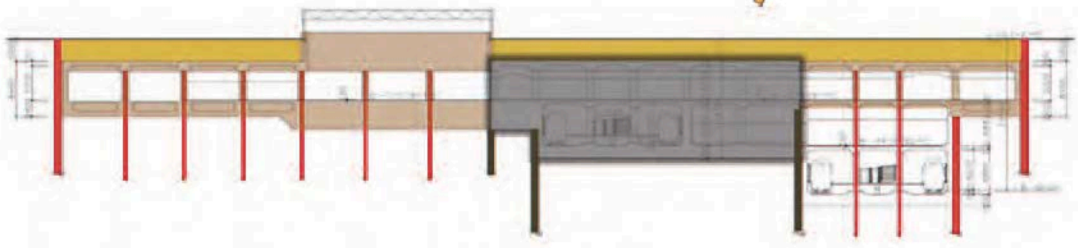
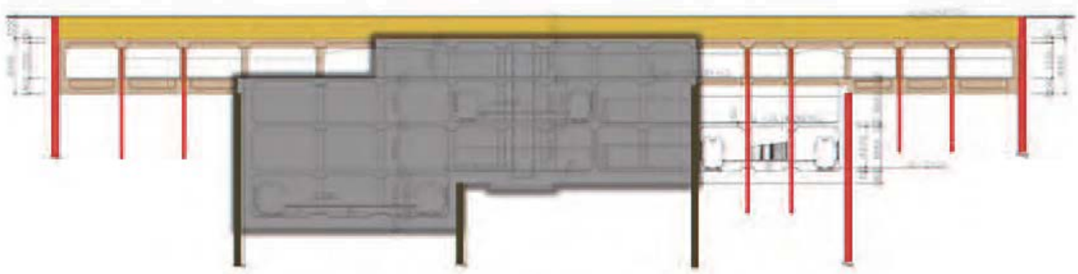


Figure 4.134 Construction Sequences of Ben Thanh Central Station (20/24)

STEP 4-1: Construction of Bottom Slab of USM & Intermediate Slabs of Line 4 Station







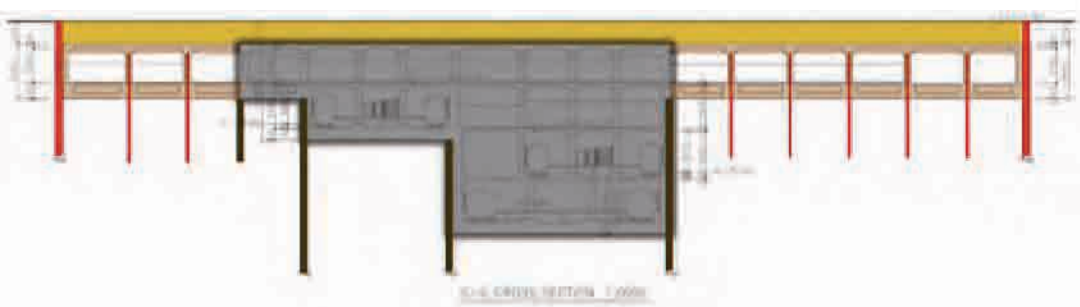


Figure 4.135 Construction Sequences of Ben Thanh Central Station (21/24)

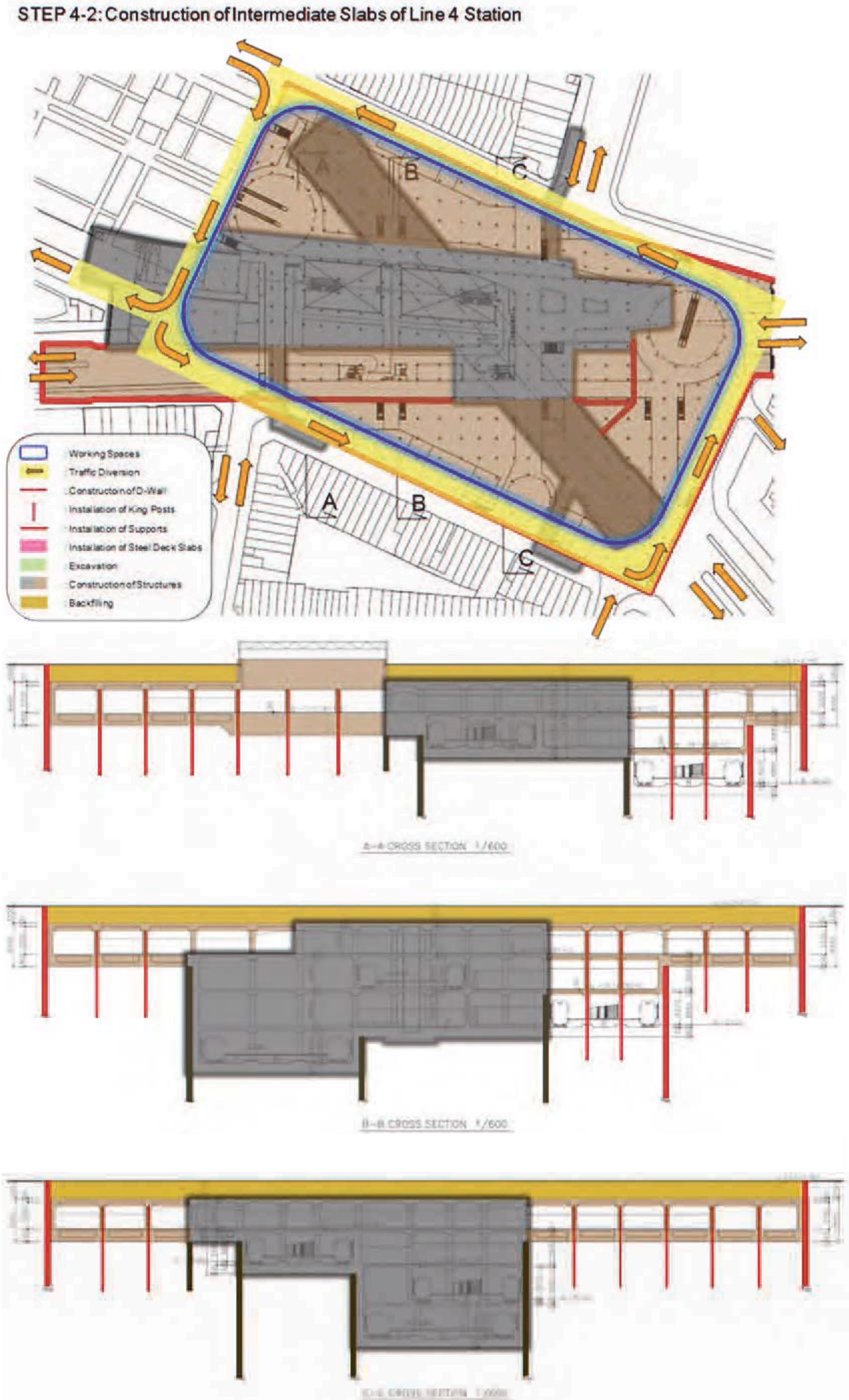


Figure 4.136 Construction Sequences of Ben Thanh Central Station (22/24)

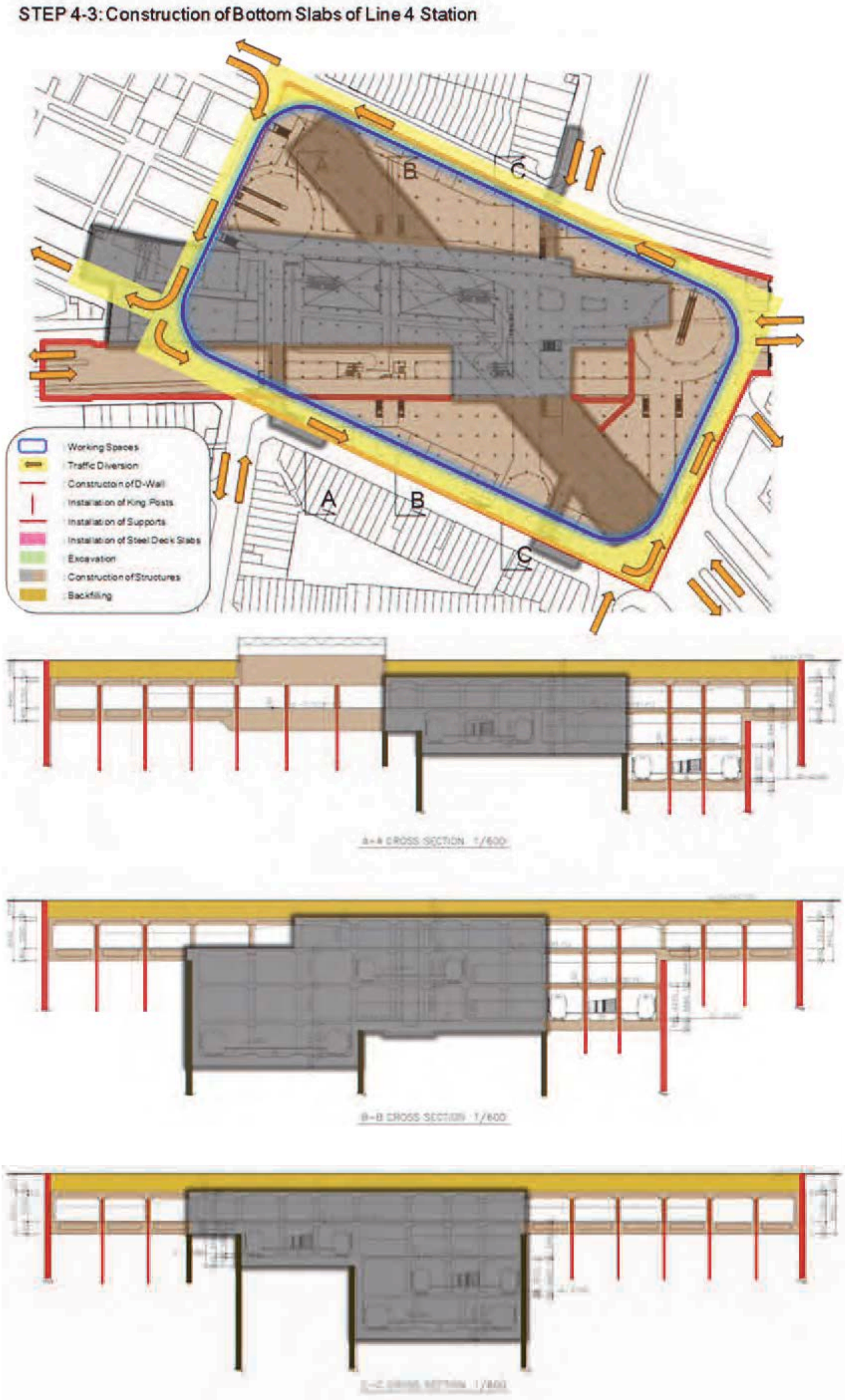


Figure 4.137 Construction Sequences of Ben Thanh Central Station (23/24)

STEP 4-4: Completion of Construction, Ben Thanh Central Station

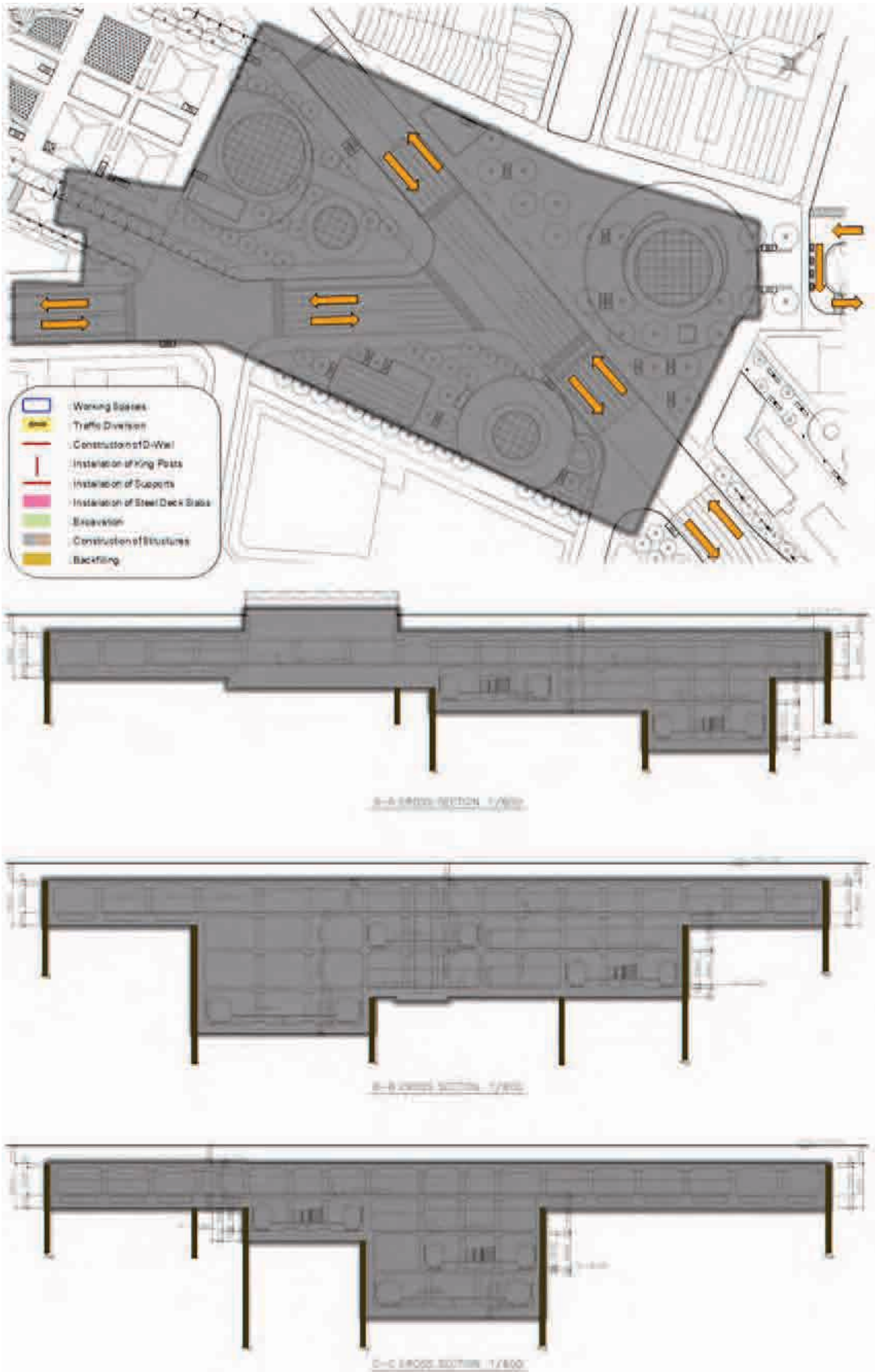
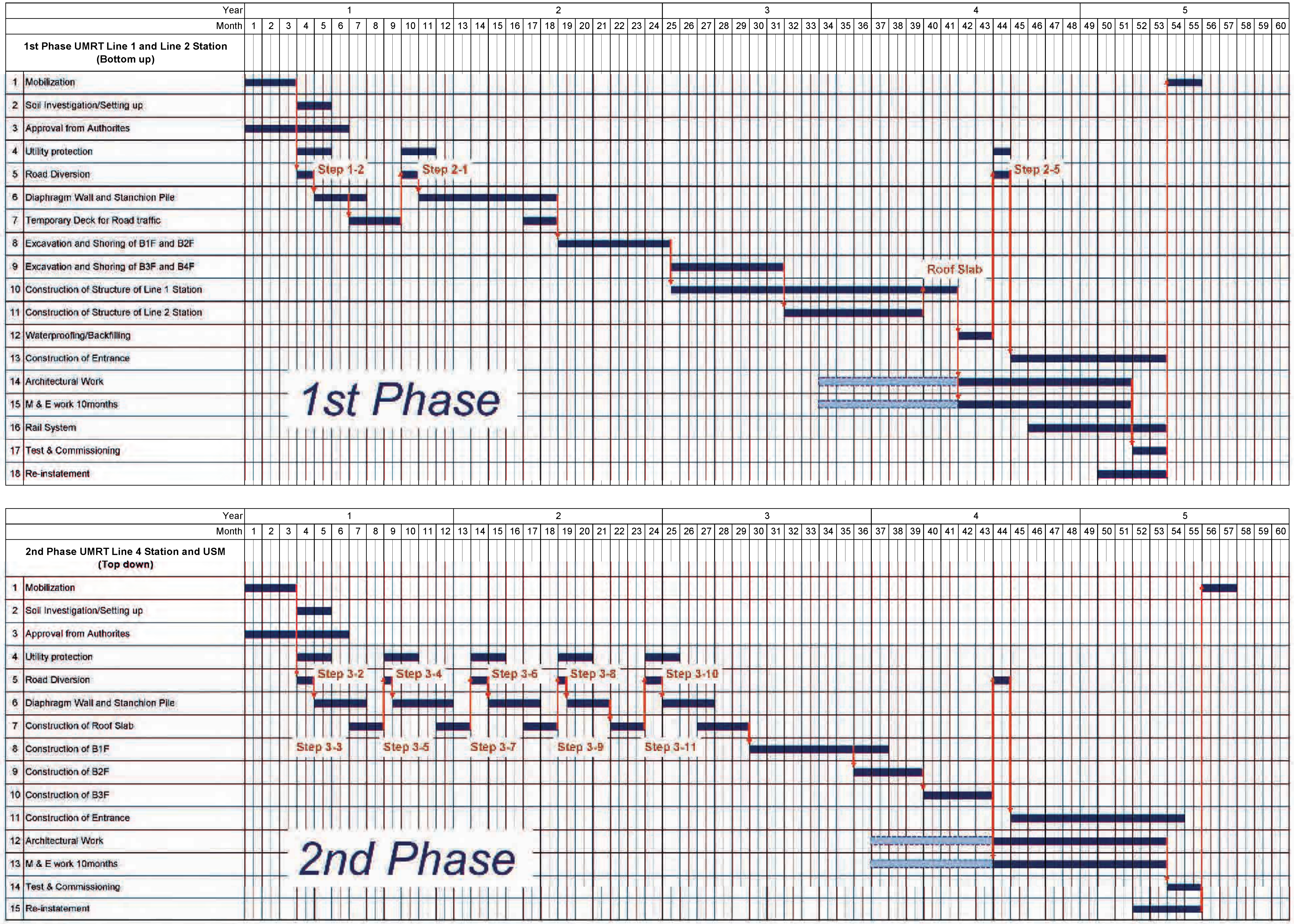


Figure 4.138 Construction Sequences of Ben Thanh Central Station (24/24)

Table 4.33 Preliminary Construction Schedule of Ben Thanh Central Station



4.6 PRELIMINARY COST ESTIMATE

4.6.1 Demarcation for Preliminary Cost Estimate

The Project Cost was estimated for the following 2 main parts.

1) **Underground Shopping Mall (USM)**, including;

   (1) Underground Shopping Mall (USM) at Ben Thanh Station Area
   (Civil, Architecture and Facilities)

   (2) Underground Shopping Mall (USM) beneath Le Loi Street
   (Civil, Architecture and Facilities)

2) **Ben Thanh Central Station**, including;

   (1) Ben Thanh Line 1 Station (Civil, Architecture and Facilities)
   ~ Overlapped with the Scope of Line 1 Project

   (2) Ben Thanh Line 2 Station
   (Civil Structure only, not including Architecture and Facilities)

   (3) Ben Thanh Line 4 Station
   (Civil Structure only, not including Architecture and Facilities)

   (4) Line 1 Tunnel beneath Le Loi Street (Civil Structure only)
   ~ Overlapped with the Scope of Line 1 Project

“1) Underground Shopping Mall (USM)” is the Study Area of the Project and the estimated Project Cost was utilized for Economical & Financial Analysis.

“2) Ben Thanh Central Station” is not included in the Economical & Financial Analysis of the Project, but its construction is closely related with the construction of USM.

The preliminary design of Line 1 Project including Ben Thanh Station and the underground tunnels was already completed, and their modifications were proposed for the Integrated Design, as described in Chapter 4 and other chapters of this Study.

Furthermore, the structures of Line 2 and Line 4 Ben Thanh Stations are also planned in the Study Area, and they shall be also coordinated.

Considering the above conditions, the Project Cost for Ben Thanh Central Station was estimated just as the “Reference”, because the estimated cost had not been coordinated & adjusted with the budget of Line 1 Project. Those coordination & adjustments shall be commenced in the subsequent stage, after the HPC’s official approval on this Study.

4.6.2 Summary of Cost Estimate, Underground Shopping Mall (USM)

The Project Cost and Construction Cost for Underground Shopping Mall (USM) were summarized in Table 4.34 and Table 4.35;

The cost allocation of Construction Cost between Public and Private was studied and decided in Financial Analysis, and the details were described in Chapter 7.

Table 4.34 Summary of Project Cost, Underground Shopping Mall (USM)

Exchange Rate: 1VND=0.0037JPY

Item			Cost		Equivalent Total Amount	
			Mil. JPY	Mil. VND	in Mil. JPY	in Mil. VND
A. ELIGIBLE PORTION						
Ⅰ)	**Procurement / Construction**	**a)=d)+e)+f)**	**11,085**	**7,299,629**	**38,095**	**10,295,671**
	I. Ben Thanh Central Station Area	**b)=b1+b2**	**4,634**	**1,736,352**	**11,059**	**2,988,841**
	i) Civil Structures (Public)	b1	*731*	*1,699,603*	*7,020*	*1,897,171*
	ii) Facility (Public)	b2	*3,903*	*36,749*	*4,039*	*1,091,670*
	II. Le Loi Street Area	**c)=c1+c2**	**4,307**	**1,493,774**	**9,834**	**2,657,898**
	i) Civil Structures (Public)	c1	*1,720*	*1,469,417*	*7,157*	*1,934,282*
	ii) Facility (Public)	c2	*2,587*	*24,357*	*2,677*	*723,616*
	Base cost for JICA financing	**d)=b)+c)**	**8,941**	**3,230,126**	**20,893**	**5,646,739**
	Price escalation	**e)**	**1,136**	**3,405,900**	**13,738**	**3,712,896**
	Physical contingency	**f)**	**1,008**	**663,603**	**3,464**	**936,036**
Ⅱ)	**Consulting services**	**g)=g1 to g5**	**1,325**	**688,791**	**3,872**	**1,046,900**
	1-1) Project Management Consultant	g1	222	145,992	762	205,992
	1-2) Technical Design of USM (Public)	g2	443	291,984	1,523	411,714
	1-3) Construction Supervision of USM (Public)	g3	333	218,988	1,143	308,988
	2-1) Technical Design of USM (Private)	g4	187	18,187	254	68,728
	2-2) Construction Supervision of USM (Private)	g5	140	13,640	190	51,478
Total (Ⅰ + Ⅱ)		**h)=a)+g)**	**12,410**	**7,988,420**	**41,967**	**11,342,571**

B. NON ELIGIBLE PORTION						
a	**Procurement / Construction**	**i)=l)+m)+n)**	**4,678**	**454,639**	**6,360**	**1,718,918**
	I. Ben Thanh Central Station Area	**j)=j1+j2**	**2,375**	**122,210**	**2,827**	**764,045**
	i) Architecture (Private)	j1	*2,081*	*119,444*	*2,523*	*681,876*
	ii) Facility (Private)	j2	*294*	*2,766*	*304*	82,169
	II. Le Loi Street Area	**k)=k1+k2**	**1,394**	**78,318**	**1,684**	**455,005**
	i) Architecture (Private)	k1	*1,199*	*76,485*	*1,482*	400,539
	ii) Facilities (Private)	k2	*195*	*1,833*	*202*	54,466
	Base cost	**l)=j)+k)**	**3,769**	**200,528**	**4,511**	**1,219,050**
	Price escalation	**m)**	**482**	**212,776**	**1,269**	**343,128**
	Physical contingency	**n)**	**427**	**41,335**	**580**	**156,740**
b	**Land Acquisition**	**o)=o1+o2+o3**	**0**	**0**	**0**	**0**
	Base cost	o1	0	0	0	0
	Price escalation	o2	0	0	0	0
	Physical contingency	o3	0	0	0	0
c	**Administration cost**	**p)**	**0**	**653,087**	**2,416**	**653,087**
d	**VAT**	**q)**	**0**	**1,306,176**	**4,833**	**1,306,176**
e	**Import Tax**	**r)**	**0**	**0**	**0**	**0**
Total (a+b+c+d+e)		**s)=i)+o)+p)+q)+r)**	**4,678**	**2,413,902**	**13,609**	**3,678,181**
TOTAL (A+B)		t)=h)+s)	**17,088**	**10,402,322**	**55,576**	**15,020,752**
C1.	**Interest during Construction (Public)**	u)=u1+u2	**255**	**0**	**255**	**68,919**
	Interest during Construction(Const. Public)	u1	255	0	255	68,919
	Interest during Construction (Consul. Public)	u2	0	0	0	0
C2.	**Interest during Construction (Private)**	v)	**4,002**	**0**	**4,002**	**1,081,622**
D.	**Commitment Charge**	w)	**506**	**0**	**506**	**136,757**
GRAND TOTAL (A+B+C1+C2+D)		x)=t)+u)+v)+w)	**21,851**	**10,402,322**	**60,339**	**16,308,050**
E.	**JICA finance portion (A+C1+D)**	y)=h)+u)+w)	**13,171**	**7,988,420**	**42,728**	**11,548,247**

Table 4.35 Summary of-Construction Cost, Underground Shopping Mall (USM)

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			yen	VND	yen	VND	yen
I. Ben Thanh Central Station Area							
i) Civil Structures (Public)							
Preparation & General Items	LS	1	148,439,873	102,435,396,000	148,439,873	102,435,396,000	527,450,838
Traffic Diversion	LS	1	2,194,064	9,883,171,000	2,194,064	9,883,171,000	38,761,797
Removal of Road Pavement	m2	26,600	51	229,000	1,356,600	6,091,400,000	23,894,780
Construction of Diaphragm Walls	m2	16,093	5,124	19,347,000	82,460,532	311,351,271,000	1,234,460,235
Installation of King Posts	m	59,120	1,338	6,028,000	79,102,560	356,375,360,000	1,397,691,392
Concrete for Slabs	m3	67,440	5,126	10,100,000	345,697,440	681,144,000,000	2,865,930,240
Concrete for Walls & Columns	m3	3,527	7,742	9,538,000	27,306,034	33,640,526,000	151,775,980
Excavation	m3	270,802	95	429,000	25,726,190	116,174,058,000	455,570,205
Backfilling & Reinstatement of Road Surfaces	m2	22,500	814	3,667,000	18,315,000	82,507,500,000	323,592,750
Sub Total					**730,598,293**	**1,699,602,682,000**	**7,019,128,217**
ii) Facility (Public)							
Electrical System	m2	26,573	61,513	579,000	1,634,584,949	15,385,767,000	1,691,512,287
Air Conditioning & Ventilation System	m2	26,573	61,513	579,000	1,634,584,949	15,385,767,000	1,691,512,287
Water Supply & Drainage System	m2	26,573	17,224	162,000	457,693,352	4,304,826,000	473,621,208
Lift (Load 1,600kg)	set	1	9,842,103	92,656,000	9,842,103	92,656,000	10,184,930
Lift (Load 1,600kg)	set	1	9,842,103	92,656,000	9,842,103	92,656,000	10,184,930
Lift (Load 1,600kg)	set	1	9,842,103	92,656,000	9,842,103	92,656,000	10,184,930
Escalator (b=1,000mm, Rise: 5,500mm)	set	1	15,993,417	150,566,000	15,993,417	150,566,000	16,550,511
Escalator (b=1,000mm, Rise: 9,500mm)	set	1	36,907,886	347,460,000	36,907,886	347,460,000	38,193,488
Escalator (b=1,000mm, Rise: 11,500mm)	set	2	46,749,989	440,116,000	93,499,978	880,232,000	96,756,836
Sub Total					**3,902,790,840**	**36,732,586,000**	**4,038,701,407**
Total I. Ben Thanh Central Station Area					**4,633,389,133**	**1,736,335,268,000**	**11,057,829,624**

II. Le Loi Street Area							
i) Civil Structures (Public)							
Preparation & General Items	LS	1	126,733,010	77,895,183,000	126,733,010	77,895,183,000	414,945,187
Traffic Diversion	LS	1	3,841,274	17,303,034,000	3,841,274	17,303,034,000	67,862,500
Removal of Road Pavement	m2	19,700	51	229,000	1,004,700	4,511,300,000	17,696,510
Construction of Diaphragm Walls	m2	17,875	57,864	20,862,000	1,034,319,000	372,908,250,000	2,414,079,525
Construction of SMW & Jet Grouting (for USM)	m2	5,000	27,853	4,406,000	139,265,000	22,030,000,000	220,776,000
Installation of King Posts	m	44,000	1,301	5,860,000	57,244,000	257,840,000,000	1,011,252,000
Installation of Temporary Steel Deck Slabs	m2	1,014	33,056	2,015,000	33,518,784	2,043,210,000	41,078,661
Concrete for Slabs	m3	58,038	4,613	9,601,000	267,729,294	557,222,838,000	2,329,453,795
Concrete for Walls & Columns	m3	3,865	7,428	8,870,000	28,709,220	34,282,550,000	155,554,655
Excavation	m3	221,900	95	426,000	21,080,500	94,529,400,000	370,839,280
Backfilling & Reinstatement of Road Surfaces	m2	19,600	327	1,472,000	6,409,200	28,851,200,000	113,158,640
Sub Total					**1,719,853,982**	**1,469,416,965,000**	**7,156,696,753**
ii) Facility (Public)							
Electrical System	m2	18,444	61,513	579,000	1,134,545,772	10,679,076,000	1,174,058,353
Air Conditioning & Ventilation System	m2	18,444	61,513	579,000	1,134,545,772	10,679,076,000	1,174,058,353
Water Supply & Drainage System	m2	18,444	17,224	162,000	317,679,456	2,987,928,000	328,734,790
Sub Total					**2,586,771,000**	**24,346,080,000**	**2,676,851,496**
Total II. Le Loi Street Area					**4,306,624,982**	**1,493,763,045,000**	**9,833,548,249**

I. Ben Thanh Central Station Area							
i) Architecture (Private)							
(Interior Work) Passageway & Plaza	m2	11,352	93,900	6,725,000	1,065,952,800	76,342,200,000	1,348,418,940
(Interior Work) Store	m2	10,584	0	0	0	0	0
(Interior Work) Staircase	m2	537	3,318	14,945,000	1,781,766	8,025,465,000	31,475,987
(Interior Work) Toilet Room	m2	147	5,529	24,908,000	812,763	3,661,476,000	14,360,224
(Interior Work)Disaster Prevention Room	m2	260	1,659	7,472,000	431,340	1,942,720,000	7,619,404
(Interior Work) Mechanical Room	m2	2,934	553	2,491,000	1,622,502	7,308,594,000	28,664,300
(Interior Work) Electrical Room	m2	759	1,106	4,982,000	839,454	3,781,338,000	14,830,405
Atrium Work	m2	2,220	239,000	6,227,000	530,580,000	13,823,940,000	581,728,578
Entrance Work	m2	880	264,434	1,868,000	232,701,920	1,643,840,000	238,784,128
Elevator Shaft Work-4	set	3	18,564,322	373,613,000	55,692,966	1,120,839,000	59,840,070
Ventilation Tower Work-2	m2	480	396,859	3,736,000	190,492,320	1,793,280,000	197,127,456
Sub Total					**2,080,907,831**	**119,443,692,000**	**2,522,849,492**
ii) Facility (Private)							
Electrical System	m2	26,573	4,630	44,000	123,032,990	1,169,212,000	127,359,074
Air Conditioning & Ventilation System	m2	26,573	4,630	44,000	123,032,990	1,169,212,000	127,359,074
Water Supply & Drainage System	m2	26,573	1,296	12,000	34,438,608	318,876,000	35,618,449
Lift (Load 1,600kg)	set	1	740,803	6,974,000	740,803	6,974,000	766,607
Lift (Load 1,600kg)	set	1	740,803	6,974,000	740,803	6,974,000	766,607
Lift (Load 1,600kg)	set	1	740,803	6,974,000	740,803	6,974,000	766,607
Escalator(b=1,000mm, Rise: 5,500mm)	set	1	1,203,806	11,333,000	1,203,806	11,333,000	1,245,738
Escalator(b=1,000mm, Rise: 9,500mm)	set	1	2,778,013	26,153,000	2,778,013	26,153,000	2,874,779
Escalator(b=1,000mm, Rise: 11,500mm)	set	2	3,518,817	33,127,000	7,037,634	66,254,000	7,282,774
Sub Total					**293,746,450**	**2,781,962,000**	**304,039,709**
Total I. Ben Thanh Central Station Area					**2,374,654,281**	**122,225,654,000**	**2,826,889,201**

II. Le Loi Street Area							
i) Architecture (Private)							
(Interior Work) Passageway & Plaza	m2	8,829	93,900	6,725,000	829,043,100	59,375,025,000	1,048,730,693
(Interior Work) Store	m2	7,543	0	0	0	0	0
(Interior Work) Staircase	m2	460	3,318	14,945,000	1,526,280	6,874,700,000	26,962,670
(Interior Work) Toilet Room	m2	122	5,529	24,908,000	674,538	3,038,776,000	11,918,009
(Interior Work) Disaster Prevention Room	m2	0	0	0	0	0	0
(Interior Work) Mechanical Room	m2	1,276	553	2,491,000	705,628	3,178,516,000	12,466,137
(Interior Work) Electrical Room	m2	214	1,106	4,982,000	236,684	1,066,148,000	4,181,432
Entrance Work	m2	800	264,434	1,868,000	211,547,200	1,494,400,000	217,076,480
Ventilation Tower Work-2	m2	390	396,859	3,736,000	154,775,010	1,457,040,000	160,166,058
Sub Total					**1,198,508,440**	**76,484,605,000**	**1,481,501,479**
ii) Facilities (Private)							
Electrical System	m2	18,444	4,630	44,000	85,395,720	811,536,000	88,398,403
Air Conditioning & Ventilation System	m2	18,444	4,630	44,000	85,395,720	811,536,000	88,398,403
Water Supply & Drainage System	m2	18,444	1,296	12,000	23,903,424	221,328,000	24,722,338
Sub Total					**194,694,864**	**1,844,400,000**	**201,519,144**
Total II. Le Loi Street Area					**1,393,203,304**	**78,329,005,000**	**1,683,020,623**

4.6.3 Summary of Cost Estimate, Ben Thanh Central Station

The Project Cost and Construction Cost for Ben Thanh Central Station were summarized in Table 4.36 and Table 4.37, as the reference;

Because the budget procurements for Line 2 and Line 4 Projects have not been defined, the costs for those lines were categorized in "B. Non-Eligible Portion", as shown in Table 4.34.

Table 4.36 Summary of Project Cost, Ben Thanh Central Station

Exchange Rate: 1VND=0.0037JPY

Item			Cost		Equivalent Total Amount	
			Mil. JPY	Mil. VND	in Mil. JPY	in Mil. VND
A. ELIGIBLE PORTION						
Ⅰ)	**Procurement / Construction**	a)=d)+e)+f)	**6,179**	**4,864,698**	**24,178**	**6,534,698**
	(1) Line 1 Station	b)=b1+b2+b3	**2,936**	**1,550,868**	**8,674**	**2,344,382**
	i) Civil Structures	b1	*668*	*1,451,905*	*6,040*	*1,632,446*
	ii) Architecture	b2	*517*	*81,601*	*819*	*221,331*
	iii) Facility	b3	*1,751*	*17,362*	*1,815*	*490,605*
	(2) Line 1Tunnel beneath Le Loi Street (Civil)	c)	**2,258**	**1,199,595**	**6,697**	**1,809,865**
	Base cost for JICA financing	d)=b)+c)	**5,194**	**2,750,463**	**15,371**	**4,154,247**
	Price escalation	e)	**424**	**1,671,988**	**6,611**	**1,786,582**
	Physical contingency	f)	**561**	**442,247**	**2,197**	**593,868**
Ⅱ)	**Consulting services (Line 1 Only)**	g)=g1+g2	**947**	**170,945**	**1,579**	**426,891**
	(1) Integrated Design of BT Station	g1	677	27,921	780	210,894
	(2) Additional Task for C/S	g2	270	143,024	799	215,997
Total (Ⅰ+Ⅱ)		h)=a)+g)	**7,126**	**5,035,643**	**25,757**	**6,961,589**
B. NON ELIGIBLE PORTION						
a	**Procurement / Construction**	i)=l)+m)+n)	**2,444**	**3,902,436**	**16,883**	**4,562,977**
	(1) Line 2 Station (Civil Only)	j)	**1,770**	**1,172,346**	**6,108**	**1,650,724**
	(2) Line 4 Station (Civil Only)	k)	**266**	**775,142**	**3,134**	**847,034**
	Base cost	l)=j)+k)	**2,036**	**1,947,488**	**9,242**	**2,497,758**
	Price escalation	m)	**186**	**1,600,181**	**6,107**	**1,650,451**

	Physical contingency	n)	**222**	**354,767**	**1,535**	**414,767**
b	**Land Acquisition**	o)	**0**	**0**	**0**	**0**
c	**Administration cost (Line 1, 2 & 4)**	p)	**0**	**576,214**	**2,132**	**576,214**
d	**VAT**	q)=q1+q2	**0**	**1,152,432**	**4,264**	**1,152,432**
	(1) VAT for Construction Cost (Line 1, 2 & 4)	q1	0	1,109,743	4,106	1,109,743
	(2) VAT for Consulting Service (Line 1 Only)	q2	0	42,689	158	42,689
e	**Import Tax**	r)	**0**	**0**	**0**	**0**
Total (a+b+c+d+e)		s)=i)+o)+p)+q)+r)	**2,444**	**5,631,082**	**23,279**	**6,291,623**
TOTAL (A+B)		t)=h)+s)	**9,570**	**10,666,725**	**49,036**	**13,253,212**
C1. Interest during Construction (Eligible Portion)		u)=u1+u2	**190**	**0**	**190**	**51,351**
	Interest during Construction (Const. Line 1)	u1	190	0	190	51,351
	Interest during Construction (Consul. Line 1)	u2	0	0	0	0
C2. Interest during Construction (Non Eligible Portion)		v)=v1+v2	**116**	**0**	**116**	**31,351**
	Interest during Construction (Const. Line2)	v1	72	0	72	19,459
	Interest during Construction (Const. Line 4)	v2	44	0	44	11,892
D1. Commitment Charge (Line 1)		w)	**234**	**0**	**234**	**63,243**
D2. Commitment Charge (Line 2 & Line 4)		x)	**167**	**0**	**167**	**45,135**
GRAND TOTAL (A+B+C1+C2+D1+D2)		y)=t)+u)+v)+w)+x)	**10,277**	**10,666,725**	**49,743**	**13,444,292**
E. JICA finance portion (A+C1+D1)		z)=h)+u)+w)	**7,550**	**5,035,643**	**26,181**	**7,076,183**

Note: In the above Project Cost, the original budget for "Line 1 Project" is not considered.

Table 4.37 Summary of Construction Cost, Ben Thanh Central Station

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			yen	VND	yen	VND	yen
A. Line 1 Station and Tunnels, (1) Line 1 Station							
i) Civil Structures							
Preparation & General Items	LS	1	63,224,732	74,423,610,000	63,224,732	74,423,610,000	338,592,089
Traffic Diversion	LS	1	2,270,358	10,226,838,000	2,270,358	10,226,838,000	40,109,659
Removal of Road Pavement	m2	12,150	51	229,000	619,650	2,782,350,000	10,914,345
Construction of Diaphragm Walls	m2	37,033	5,083	17,421,000	188,238,739	645,151,893,000	2,575,300,743
Installation of King Posts	m	21,150	1,319	5,942,000	27,896,850	125,673,300,000	492,888,060
Installation of Temporary Steel Deck Slabs	m2	3,500	33,056	2,015,000	115,696,000	7,052,500,000	141,790,250
Excavation	m3	204,946	96	435,000	19,674,816	89,151,510,000	349,535,403
Support System for Diaphragm Walls	ton	4,304	8,624	38,846,000	37,117,696	167,193,184,000	655,732,477
Concrete for Slabs	m3	24,961	3,952	8,861,000	98,645,872	221,179,421,000	917,009,730
Concrete for Walls & Columns	m3	5,026	9,794	9,863,000	49,224,644	49,571,438,000	232,638,965
Entrance	m	205	291,547	160,592,000	59,767,135	32,921,360,000	181,576,167
Backfilling & Reinstatement of Road Surfaces	m2	11,300	522	2,352,000	5,898,600	26,577,600,000	104,235,720
Sub Total i)					**668,275,092**	**1,451,905,004,000**	**6,040,323,607**
ii) Architecture							
(Interior Work) Paid Concourse & Platform	m2	2,934	47,033	3,736,000	137,994,822	10,961,424,000	178,552,091
(Interior Work) Free Concourse	m2	3,065	47,033	3,736,000	144,156,145	11,450,840,000	186,524,253
(Interior Work) Temporary Entrance	m2	1,167	47,033	3,736,000	54,887,511	4,359,912,000	71,019,185
(Interior Work) Station Office	m2	2,863	1,659	7,472,000	4,749,717	21,392,336,000	83,901,360
(Interior Work) Staircase	m2	245	3,318	14,945,000	812,910	3,661,525,000	14,360,553
(Interior Work) Toilet Room	m2	200	5,529	24,908,000	1,105,800	4,981,600,000	19,537,720
(Interior Work) Mechanical Room	m2	2,894	553	2,491,000	1,600,382	7,208,954,000	28,273,512

(Interior Work) Electrical Room	m2	2,397	1,106	4,982,000	2,651,082	11,941,854,000	46,835,942
Atrium Work	m2	320	239,000	6,227,000	76,480,000	1,992,640,000	83,852,768
Entrance Work	m2	154	264,434	1,868,000	40,722,836	287,672,000	41,787,222
Elevator Shaft Work -1	set	1	13,283,928	373,613,000	13,283,928	373,613,000	14,666,296
Ventilation Tower Work-1	set	2	13,311,575	498,151,000	26,623,150	996,302,000	30,309,467
Cooling Tower	set	1	12,323,245	1,992,602,000	12,323,245	1,992,602,000	19,695,872
Sub Total ii)					**517,391,528**	**81,601,274,000**	**819,316,242**
iii) Facilities							
Electrical System	m2	15,765	18,520	174,000	291,967,800	2,743,110,000	302,117,307
Environmental Control System	m2	17,265	52,915	498,000	913,577,475	8,597,970,000	945,389,964
Tunnel Ventilation System	LS	1	302,938,459	2,864,365,000	302,938,459	2,864,365,000	313,536,610
Pumping System	LS	1	27,777,365	249,075,000	27,777,365	249,075,000	28,698,943
Fire Protection System	m2	15,765	8,611	137,000	135,752,415	2,159,805,000	143,743,694
Lift (Load 1,600kg)	set	1	10,582,906	99,630,000	10,582,906	99,630,000	10,951,537
Escalator (b=1,000mm, Rise: 5,500mm)	set	4	17,197,223	161,899,000	68,788,892	647,596,000	71,184,997
Sub Total iii)					**1,751,385,312**	**17,361,551,000**	**1,815,623,051**
Total A (1)					**2,937,051,932**	**1,550,867,829,000**	**8,675,262,899**

A. Line 1 Station and Tunnels, (2) Line 1Tunnel beneath Le Loi Street							
Preparation & General Items	LS	1	73,531,697	53,123,101,000	73,531,697	53,123,101,000	270,087,171
Traffic Diversion	LS	1	3,694,140	16,640,271,000	3,694,140	16,640,271,000	65,263,143
Removal of Road Pavement	m2	5,000	48	215,000	240,000	1,075,000,000	4,217,500
Construction of Diaphragm Walls	m2	36,500	14,744	16,781,000	538,156,000	612,506,500,000	2,804,430,050
Installation of King Posts	m	9,000	1,260	5,677,000	11,340,000	51,093,000,000	200,384,100
Installation of Temporary Steel Deck Slabs	m2	3,420	31,096	1,895,000	106,348,320	6,480,900,000	130,327,650
Excavation	m3	115,500	91	409,000	10,510,500	47,239,500,000	185,296,650
Support System for Diaphragm Walls	ton	2,426	8,112	36,542,000	19,675,656	88,632,621,000	347,616,354
Concrete for Slabs	m3	15,635	4,416	9,093,000	69,041,952	142,164,509,000	595,050,635
Concrete for Walls & Columns	m3	11,385	9,804	8,662,000	111,620,501	98,618,602,000	476,509,328
Demolition of Diaphragm Walls of Line 1	m2	4,600	283,483	8,302,000	1,304,021,800	38,189,200,000	1,445,321,840
Backfilling & Reinstatement of Road Surfaces	m2	5,390	1,805	8,132,000	9,728,950	43,831,480,000	171,905,426
Total A (2)					**2,257,909,516**	**1,199,594,684,000**	**6,696,409,847**
B. Line 2 Station (Civil Only)							
Removal of Road Pavement	m2	5,100	51	229,000	260,100	1,167,900,000	4,581,330
Construction of Diaphragm Walls	m2	33,519	46,045	17,822,000	1,543,386,960	597,377,400,000	3,753,683,340
Installation of King Posts	m	9,180	1,325	5,969,000	12,163,500	54,795,420,000	214,906,554
Excavation	m3	189,133	92	415,000	17,400,236	78,490,195,000	307,813,958
Support System for Diaphragm Walls	ton	3,972	8,624	38,846,000	34,252,803	154,288,543,000	605,120,412
Concrete for Slabs	m3	22,193	3,750	9,026,000	83,223,750	200,314,018,000	824,385,617
Concrete for Walls & Columns	m3	7,466	10,029	9,127,000	74,878,520	68,144,007,000	327,011,346
Backfilling & Reinstatement of Road Surfaces	m2	5,100	773	3,484,000	3,942,300	17,768,400,000	69,685,380
Total B					**1,769,508,169**	**1,172,345,883,000**	**6,107,187,936**

C. Line 4 Station (Civil Only)							
Removal of Road Pavement	m2	5,500	51	229,000	280,500	1,259,500,000	4,940,650
Construction of Diaphragm Walls	m2	16,093	4,479	15,900,000	72,078,308	255,870,750,000	1,018,800,083
Installation of King Posts	ton	513	69,866	314,714,000	35,841,258	161,448,282,000	633,199,901
Excavation	m3	139,364	93	418,000	12,960,852	58,254,152,000	228,501,214
Concrete for Slabs	m3	25,449	3,796	9,781,000	96,602,886	248,912,757,000	1,017,580,087
Concrete for Walls & Columns	m3	4,433	10,385	9,209,000	46,039,821	40,826,260,000	197,096,983
Demolition of Walls (between B2 and B3 Floor Slabs, Line 2)	m3	1,188	350	1,578,000	415,730	1,874,348,000	7,350,818
Backfilling & Reinstatement of Road Surfaces	m2	3,600	413	1,860,000	1,486,800	6,696,000,000	26,262,000
Total C					**265,706,154**	**775,142,049,000**	**3,133,731,735**

4.6.4 Basis and Conditions for Preliminary Cost Estimate

The basis and conditions for Preliminary Cost Estimate are listed as follows;

< Basis and Conditions for Preliminary Cost Estimate >

(1) Base Year & Month for Cost Estimate: Oct. 2011

(2) Exchange Rate: 1VND = 0.0037JPY

1USD = 77.2 JPY = 20,628VND

(3) Price Escalation Rate:

Foreign Currency Component (FCC), Japanese Yen: 1.60%

Local Currency Component (LCC), Vietnamese Dong: 9.91%

(4) Physical Contingency (Construction) 10%
(Consultant) 5%

(5) Interest during Construction

<Public> (Construction)*1: 0.20%
(Consultant)*1: 0.01%

<Private> (Construction): 15.00%
(Consultant): 0.01%

(6) Tax and VAT: VAT for FCC & LCC: 10%
Tax on Consulting Services: 15%

(7) Rate of Commitment Charges*1: 0.1%

(8) Reference:
Cost Estimate Report, Preliminary Design of HCMC Urban Railway Construction Project, Ben Thanh - Suoi Tien Section (Line 1), Revision -3, May 14, 2010 ~ provided by MAUR

* The Project Cost of "Line 1 Project" was estimated in the Reference, including the Study Area of the Project (Ben Thanh Central Station and Line 1 Tunnel between Ben Thanh Station and Opera House Station).
The estimated Project Cost was approved by HPC's Decision No.4480/QD-UBND dated Sep. 21, 2011.

Note: *1 Rates in case of ODA Loan

Generally, (8) Reference was utilized as the basis of the Preliminary Cost Estimate of this Study. The Study Team reviewed the Reference in detail, and updated the basic prices (material, labor and equipment operation prices) etc. as of Oct. 2011.

The rates for items (2) to (7), Exchange Rate, Price Escalation Rate for FCC, Physical Contingency Rate, Interest during Construction, Tax & VAT and Rate of Commitment Charge were defined based on the values applied in "JICA FF Mission for HCMC MRT Line 1 Project held on October 2011". Price Escalation Rate for LCC was defined with the similar method with the "Reference", based on the fluctuation of two price indices in the latest ten years in Vietnam, as described in Sub Clause 4.6.6.
The JICA format of Project Cost Estimate was also referred.

Cost allocation of Construction Cost of USM between Public and Private was summarized as shown in Table 4.38, based on Public-Private Division of Roles described in Chapter 6.
Cost allocation of Facility for Private was decided as 7% which will derive approx. 20% of VND based Equity IRR in the base case (Loan funded by Vietnamese Domestic Bank, with; Loan Period to Maturity: 15years, Grace Period: 5 years, Interest Rate: 15%) in the economic (financial?) analysis described in in Chapter 7.

Table 4.38 Construction Cost Allocation of USM between Public and Private

Sector	Work Category	Work Items
Public Portion	Civil Structures	Preparatory & Temporary Works
		Traffic Diversion
		Retaining Walls
		Excavation
		USM Structures
		Backfilling
Private Potion	Architecture	Interior work
		Atrium work
		Entrance & Staircases
		Elevator Shaft
		Ventilation & Cooling Tower
Public/Private Shared Portion	Facility	Electrical System
		Air Conditioning & Ventilation System
		Water Supply & Drainage System
		Lifts & Escalators

4.6.5 Construction Cost

1) Composition of Construction Cost

The Construction Cost consists of the items in Figure 4.139 and Figure 4.140. Generally, those compositions were similar with the Reference, “Cost Estimate Report, Preliminary Design of HCMC Urban Railway Construction Project, Ben Thanh - Suoi Tien Section (Line 1), Revision -3, May 14, 2010”.

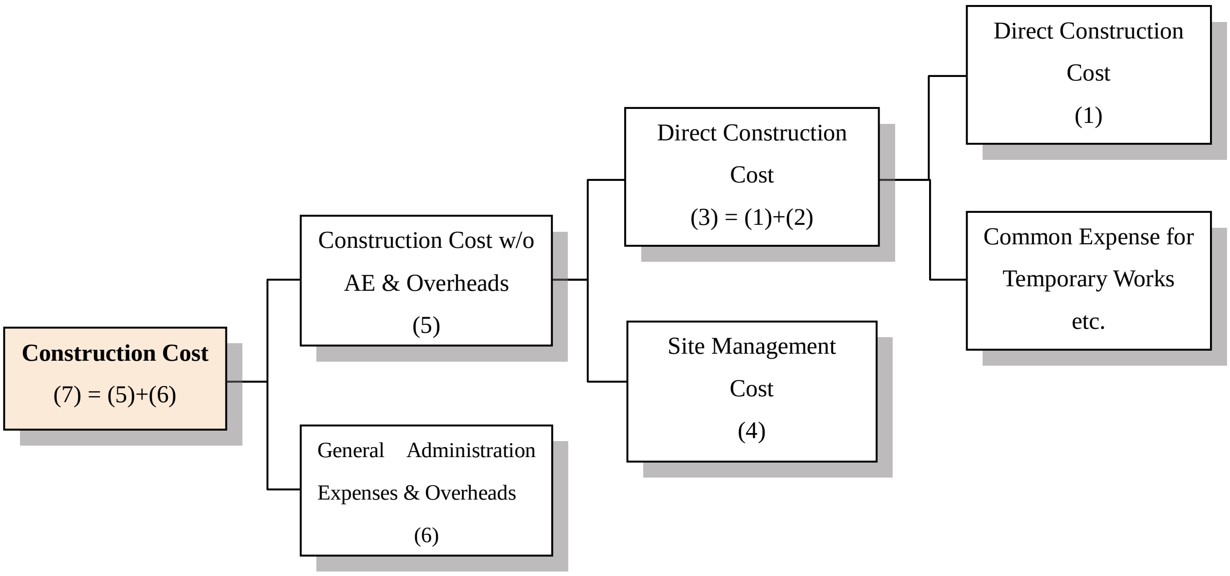


Figure 4.139 Components of Construction Cost (1/2)

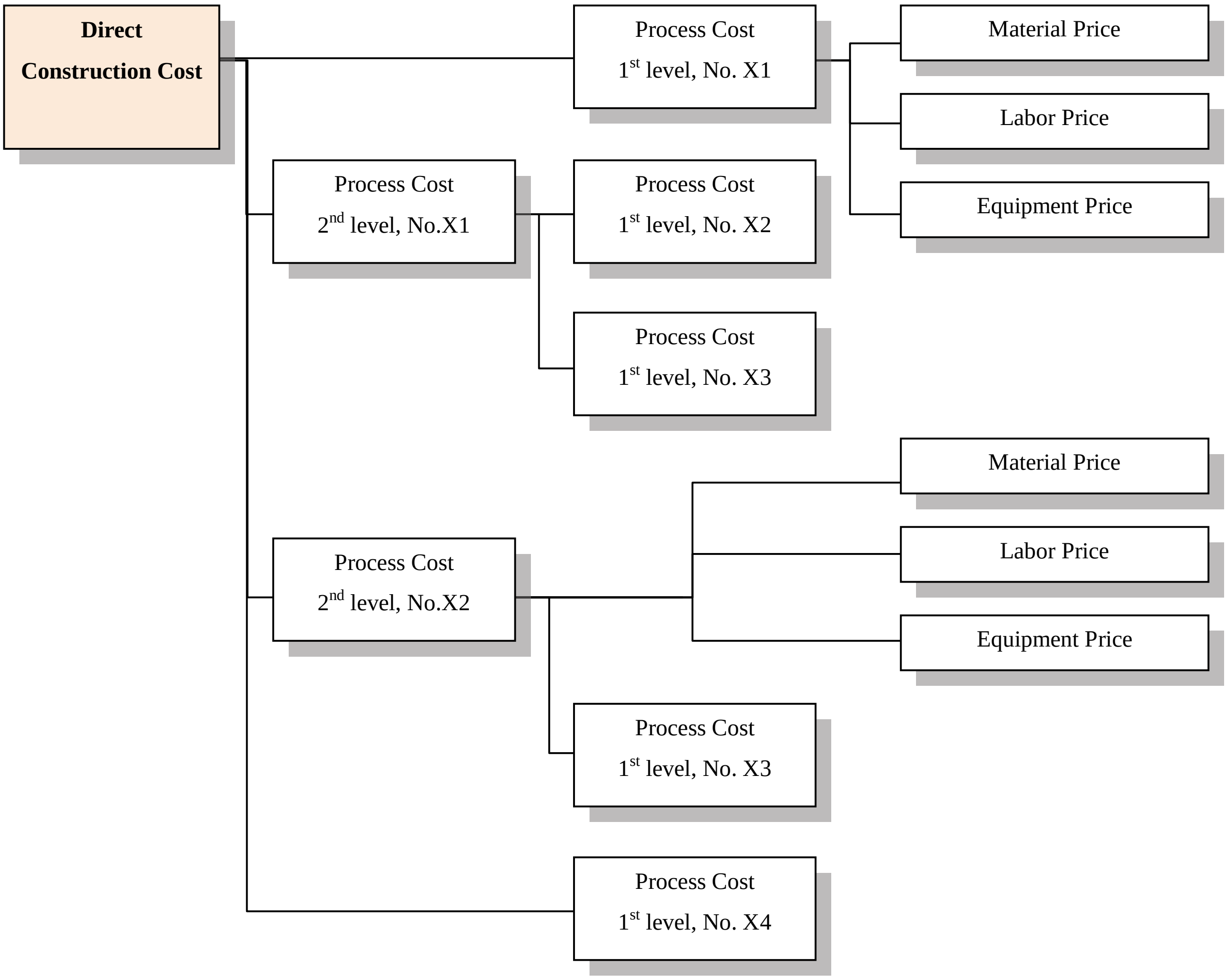


Figure 4.140 Components of Construction Cost (2/2)

(1) Direct Construction Cost

The calculation method of Direct Construction Cost was briefly described in the following Table 4.38.

Table 4.38 Calculation Method of Direct Construction Cost

<Civil Works>
i) General The Construction Costs are calculated the quantities of major construction works multiplied by the unit prices. The quantities of major construction works were calculated in the Study, and unit prices were set up based on the norms announced by Ministry of Construction with the basic prices (material, labor, equipment and fuel as of October 2011), referring to the "Reference". For several construction works, the unit prices were assumed with referring to the supplier's quotations or the data of the similar projects etc. ii) Material Prices Prices of major materials are collected from suppliers in Ho Chi Minh City, in general. For several materials not available in Vietnam, the import prices from Japan were surveyed. For some auxiliary materials for which the quotation collection was not available, the construction unit price book announced by Department of construction of Ho Chi Minh City was applied. iii) Labor Prices Labor cost (for Vietnamese) was calculated base on Decrees "No. 205/2004/ND-CP dated December 14, 2004", "No. 98/2009/ND-CP dated October 30, 2009" and Minimum Monthly Basic Wage for Vietnamese workers (2,000,000 VND/month) defined by "Decree No.70/2011/ND-CP dated 22/8/2011". Salary of Foreign Expatriate was based on Japanese Norm. iv) Equipment Prices Equipment cost: was calculated base on Circular No. 06 /2010/TT-BXD dated May 26, 2007 of the Ministry of Construction guiding method for making Equipment unit price on construction of works and fuel price on October 2011 and labor salary calculate above.
<Architectural Works>
The construction cost for Architectural Works was estimated by total floor area (m2) multiplied by the unit prices estimated for individual purposes including Passageway & Plaza, Store, Disaster Prevention Room, Mechanical Room, etc. The costs for the specific structures like Ventilation Tower, Entrance and Atrium were individually calculated.

<Facilities>
Based on the cost of the Reference, 3 major items of facilities for USM and Stations, "Electrical System", "Air Conditioning & Ventilation System" and "Water Supply & Drainage System" were defined and their unit prices per m2 of floor area were estimated. The costs for the lifts (elevators) and escalators were individually calculated.

(2) Indirect Construction Cost

The following indirect costs were estimated as percentage multiplied to the construction costs generally based on the Japanese standards for construction cost estimate.

- Common Expense for Temporary Works
- Site Management Cost
- General Administration Expenses & Overheads

(3) Items estimated in FCC and LCC

The major items which costs were estimated in Foreign Currency Component (FCC, in Japanese Yen) and in Local Currency Component (LCC, in Vietnamese Dong) were summarized in the following:

< Items estimated in FCC (Foreign Currency Components in Japanese Yen) >			
1)	Construction Cost:	-	Material, Labor and Equipment to be imported
		-	General Administration Expenses & Overheads in Construction Cost
2)	Interest during Construction for Construction & Consulting Services		
3)	Commitment Charge		
< Items estimated in LCC (Local Currency Components in Vietnamese Dong) >			
1)	Construction Cost:	-	Material, Labor and Equipment to be procured in Vietnam
2)	Land Acquisition Cost		
3)	Administration Cost		
4)	VAT		

The ratios of cost of FCC and LCC were summarized in Table 4.39 in the following. The percentages of the Procurement eligible for STEP requirements was also described as the reference.

Table 4.39 Summary of Cost of FCC and LCC

	Cost			STEP Eligible Percentage
	F.C.C. (mil. JPY)	L.C.C. (mil. VND)	Total in mil. JPY	
<1> Underground Shopping Mall				
I. Ben Thanh Central Station Area	**7,009 (50.5%)**	**1,858,561 (49.5%)**	**13,886**	**-**
i) Civil Structures (Public)	731 (10.4%)	1,699,603 (89.6%)	7,020	24.0%
ii) Architecture (Public)	0	0	0	
iii) Architecture (Private)	2,081 (82.5%)	119,444 (17.5%)	2,523	-
iv-1) Facility (Public)	2,728 (96.6%)	25,684 (3.4%)	2,823	-
iv-2) Facility (Private)	1,469 (96.6%)	13,830 (3.4%)	1,520	-
II. Le Loi Street Area	**5,701 (49.5%)**	**1,572,093 (50.5%)**	**11,518**	**-**
i) Civil Structures (Public)	1,720 (24.0%)	1,469,417 (76.0%)	7,157	24.0%
ii) Architecture (Public)	0	0	0	
iii) Architecture (Private)	1,199 (80.9%)	76,485 (19.1%)	1,482	-
iv-1) Facility (Public)	1,808 (96.6%)	17,024 (3.4%)	1,871	-
iv-2) Facility (Private)	974 (96.6%)	9,167 (3.4%)	1,008	-
TOTAL				-

4.6.6 Price Escalation and Physical Contingency

1) Price Escalation

As described in Section 4.6.4, the applied price escalation rate for FCC was defined as the value applied in "JICA FF Mission for HCMC MRT Line 1 Project held on October 2011", and the rate for LCC was defined based on the fluctuation of two price indices in the latest ten years in Vietnam as shown in the following Table 4.40.

Foreign Currency Component (FCC), Japanese Yen: 1.60%

Local Currency Component (LCC), Vietnamese Dong: 9.91%

Table 4.40 Fluctuation of Vietnamese Price Indices

Year	Consumer Price index		Corporate Goods & Services Price Index	
	Value of Index*	Fluctuation from Previous Year	Value of Index*	Fluctuation from Previous Year
2002	104.30	-	103.90	-
2003	107.60	103.16%	106.20	102.21%
2004	115.90	107.70%	114.40	107.72%
2005	125.50	108.30%	119.50	104.46%
2006	134.90	107.50%	124.50	104.18%
2007	146.30	108.50%	133.10	106.91%
2008	179.60	122.80%	162.10	121.79%
2009	192.00	106.90%	174.10	107.40%
2010	209.64	109.20%	196.10	112.64%
2011	248.59	118.58%	232.24	118.43%
Average:	-	**110.29%**	-	**109.53%**
Average Rate above:		**109.91%**		

Source: Web Site of General Statistics Office of Vietnam (http://www.gso.gov.vn/default_en.aspx?tabid=491)

In the Reference, the rate for LCC was defined as "10.6% per year" based on the five years average rate (2004 to 2008) of "Producers price index of industrial products in Vietnam" and "Consumer price index by month of the year in Vietnam".

Considering the current inflation in Vietnam, the applied rate in this time, 9.91% is not too high.

Besides, the estimated amount of price escalation reached relatively high level, about 100% of the construction cost estimated as of October 2011. This is because of the long duration necessary prior to the commencement of the construction stage. The commencement of the construction was assumed at Year 2017.

In the further cost estimate in the subsequent stages, the rates for Price Escalation shall be reviewed and updated.

2) Physical Contingency

As described in Section 4.6.4, the applied rates of price escalation were defined based on the values applied in "JICA FF Mission for HCMC MRT Line 1 Project held on October 2011", as follows:

Physical Contingency	(Construction)	10%
	(Consultant)	5%

4.6.7 Consulting Service Fee

The assumed Consulting Services in the Project Cost were summarized in the followings:

<1> Consulting Service for Underground Shopping Mall (USM)

<Public Sector>

1) Project Management Consultant, including
   - Coordination of design and construction between Public and Private
   - Project Management and Advisory Services for the Employer
2) Technical Design of USM (Public)
3) Construction Supervision of USM (Public)

<Private Sector>

1) Technical Design of USM (Private)
2) Construction Supervision of USM (Private)

<2> Consulting Service for Ben Thanh Central Station

1) Integrated Design of Ben Thanh Central Station
   - The Stations for Line 1, Line 2 & Line 4 and also USM will be coordinated and adjusted in this Integrated Design which will be funded from the budget of Line 1 Project.
2) Additional Task for Construction Supervision of Ben Thanh Line 1 Station
   - Because the Integrated Design of Ben Thanh Line 1 Station will be completed prior to the Tendering Stage of Line 1 Underground Section, the Contract Type of Line 1 Underground Section will be also modified from “Design & Build” to “Design, Bid & Build”.
     Consequently, the construction supervision works will be conducted by the Engineer, not by the Contractor.

4.6.8 Other Costs

The brief of other costs in Project Cost (shown in Table 4.32 and Table 4.34) are explained in the following:

Table 4.41 Brief of Other Costs

Cost Item	Description
1) Interest during Construction	This item was estimated based on the balances of "Construction Cost" and "Consulting Service Fee", referring to the calculation method in JICA format of Project Cost Estimate with the rates applied in JICA FF Mission for Line 1 Project held in Oct. 2011.
2) Commitment Charge	This item was estimated referring to the calculation method in JICA format of Project Cost Estimate with the rates applied in JICA FF Mission for Line 1 Project held in Oct. 2011.
3) Counterpart Funds	
(1) Land Acquisition	Because no additional land acquisition is required for USM and also related Metro Lines, land acquisition cost was not necessary for the estimation of the Project Cost.
(2) Administration Cost	This item was estimated referring to the calculation method in JICA format of Project Cost Estimate with the rates applied in JICA FF Mission for Line 1 Project held in Oct. 2011.
(3) VAT for Construction Cost and Consulting Service	This item was estimated based on "Construction Costs" and "Consulting Service Fee" with their "Price Escalation" and "Physical Contingency", referring to the calculation method in JICA format of Project Cost Estimate with the rates applied in JICA FF Mission for Line 1 Project held in Oct. 2011.

CHAPTER 5 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

5.1 LEGAL AND INSTITUTIONAL FRAMEWORK ON ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

5.1.1 Laws and regulations on environmental protection

1) Environmental policy and national plans

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 was modified, amended in 2005 before became effective since July 2006.

In addition, the Government of Vietnam (GOV) has issued Decree 80/2006/ND-CP, and then Decree 21/2008/ND-CP as the instructive guidance for implementation of LEP. Furthermore, as shown in Table 5.1 - 5.6, many regulations on environmental protection have been issues, such as Circular 26/2011/TT-BTNMT that states principal issues on Strategic Environmental Assessment (SEA), Environmental Impact Assessment (EIA), etc.

Table 5.1 Main laws and regulations on environmental protection

Issuance date	Code/Number	Title
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-BKHCNMT	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** (Note *)
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.	Sanctioning of Administrative Violation in the Domain of

Issuance date	Code/Number	Title
	81/2006/ND-CP	Environmental Protection
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
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 organizational structure of Vietnam Environmental Protection Administration under MONRE
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
2011/04/18	**Decree No. 29/2011/ND-CP**	**Stipulation on strategic environmental assessment (SEA), environmental impact assessment (EIA), and environmental protection commitment (EPC)** (Note *)
2011/07/18	**Circular No. 26/2011/TT-BTNMT**	**Detailed stipulation on several articles of Decree No. 29/2011/ND-CP** (Note *)

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

Table 5.2 Law and regulations relating to water resources

Issuance date	Code/Number	Title
1998/05/20	TSRVN NA No. 08/1998/QH10	**Law on Water Resources**
2004/07/27	Decree No. 149/2004/ND-CP	Issuance of Permits for Water Resource Exploration, Exploitation and Use, or for Discharge of Wastewater into Water Source
2005/06/24	Circular No. 02/2005/TT-BTNMT	Guiding the Implementation of the Government's Decree No.149/2004/ND-CP of July 27, 2004, on the Issuance of Permits for Water Resource Exploration, Exploitation and Use, or for Discharge of Wastewater into Water Source

Table 5.3 Law and regulations relating to sewage and drainage

Issuance 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

Table 5.4 Law and regulations on solid waste

Issuance 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

Table 5.5 Law and regulations relating forest, biodiversity, natural environment

Issuance date	Code/Number	Title
2004/12/14	No. 29/2004/Q11	Law on Forest Protection and Development
2006/03/03	Decree No.23/2006/ND-CP	Implementation of the Law on Forest Protection and Development
2009/07/01	No. 20/2008/QH12	**Law on Biodiversity** (came into effect on July 1, 2009, stipulates biodiversity conservation and sustainable development)

Table 5.6 Law and regulations relating to climate change

Issuance 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

Besides, GoV 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). Table 5.7 lists main international conventions/agreements/treaties relating to environmental protection which Vietnam has engaged.

Table 5.7 List of international environmental conventions/agreements/treaties which Vietnam engaged to

No	Name	Effective Date in Vietnam	Manage-ment Body
1.	Cartagena Protocol on Biosafety	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
	UN Convention to Combat Desertification	23/11/1998 Ac	MARD
5.	Basel Convention on the Control of Trans boundary Movements of Hazardous Wastes and their Disposal	13/03/1995 Ac	VEPA, MONRE
6.	Agreement on Cooperation for the Sustainable Development of the Mekong River Basin	1995 S	MFA
7.	United Nations Convention on the Law of the Sea (UNCLOS)	25/07/1994 R	MFA
8.	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
9.	United Nations framework Convention on Climate Change	16/11/1994 R	MONRE
10.	Convention on Biological Diversity (CBD)	16/11/1994 R	VEPA, MONRE

No	Name	Effective Date in Vietnam	Manage-ment Body
11.	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	20/01/1994 R	MARD
12.	MARPOL International Convention for the Prevention of Pollution from Ships	29/08/1991 S	VNMB, MOT
13.	Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar)	20/9/1988	MONRE, MARD
14.	Convention Concerning the Protection of the World Cultural and Natural Heritage	10/10/1987 At	MOCI
15.	International Commitment on spray and utilize pesticide, FAO	1985	
16.	Convention on the Conservation of Migratory Species of Wild Animals (CMS)	Under discussion	
17.	Convention on abandon the development, production and storage of chemical weapons, microorganisms		
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
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.

S: Signed, R: Ratification, At: Accepted, Ap: Approval, Ac: Accession

2) Law on Environmental Protection (LEP 2005)

LEP 2005 amended in 2005 has fifteen (15) chapters and 136 articles as shown in Table 5.8.

Table 5.8 Structure of the Vietnam Law on Environmental Protection (LEP 2005)

Chapter	Name	Included articles
Chapter I	General Provisions	Article 1 ~ Article 7
Chapter II	Environmental Standards	Article 8 ~ Article 13
Chapter III	Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Undertakings	Article 14 ~ Article 27
Chapter IV	Conservation and Rational Utilization of Natural Resources	Article 28 ~ Article 34
Chapter V	Environmental Protection in Manufacturing, Business and Services Activities	Article 35 ~ Article 49
Chapter VI	Environmental Protection in Urban Centers and Residential Areas	Article 50 ~ Article 54
Chapter VII	Protection of Marine, River and Other Water Source Environments	Article 55 ~ Article 65
Chapter VIII	Waste Management	Article 66 ~ Article 85
Chapter IX	Prevention of and Response to Environmental Incidents; Remedying Environmental Pollution and Rehabilitation of Environment	Article 86 ~ Article 93
Chapter X	Environmental Monitoring and Information	Article 94 ~ Article 105
Chapter XI	Resources for Environmental Protection	Article 106 ~ Article 117
Chapter XII	International Co-operation in Protection of Environment	Article 118 ~ Article 120
Chapter XIII	Responsibilities of State Administrative Bodies and of Vietnam Fatherland Front and its Member Organizations for Environmental Protection	Article 121 ~ Article 124
Chapter XIV	Inspections, Dealing with Breaches, Resolution of Complaints and Denunciations Related to Environment, and Compensation for Environmental Damage	Article 125 ~ Article 134
Chapter XV	Implementing Provisions	Article 135 ~ Article 136

In addition, GoV has issued Decree 80/2006/ND-CP on August 9, 2006, to provide guidance for the implementation of the LEP 2005. Issues on environmental impact assessment are stated as followings in this Decree.

- Environmental Standards;
- Strategic Environmental Assessment (SEA);
- Environmental Impact Assessment (EIA);
- Environmental Protection Commitment (EPC);
- Environmental Protection in manufacture, production, business and services;

- Hazardous waste management;
- Environmental data and information disclosure.

The Decree includes two (02) annexes:

Annex 1: List of project subject to prepare the EIA reports.

Annex 2: List of inter-sector and inter-provincial projects with EIA reports to be appraised and approved by the Ministry of Natural Resources and Environment (MONRE)

Two years later, on February 28, 2008, the GoV issued Decree 21/2008/ND-CP that includes several modifications, amendments of Decree 80/2006/ND-CP. Particularly, the following articles are modified by Decree 21/2008/ND-CP.

- List of projects subjected to prepare EIA report
- Public consultation
- Appraisal, approval of EIA report
- Implementation of the project after the approval of the EIA report
- EIA for projects in industrial parks, processing zones, high tech parks
- Inspection

In addition, on April 18, 2011, the GoV issued Decree 29/2011/ND-CP which stipulates in detail the contents and procedure for formulation, submission and approval of SEA report, EIA report, and EPC.

As a guidance for Decree 29/2011/ND-CP, on July 18, 2011, the Ministry of Natural Resources and Environment (MONRE) issued Circular 26/2011/TT-BTNMT providing detailed stipulations on several articles of the Decree.

3) Environmental Impact Assessment (EIA)

Vietnam legal framework on EIA has two characteristics as followings:

Firstly, the projects which are obligated to make EIA report are defined in detail and listed up. Decree 29/2011/ND-CP (issued on April 18, 2011) lists up 146 projects which are obligated to make and submit the concerned EIA report for approval.

Secondly, the concept on Strategic Environmental Assessment (SEA) is introduced and incorporated. Consequently, 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. Categorization of plan/program which should make the SEA report is stated in the amended LEP 2005.

Furthermore, each ministry / central government authority has also issued technical guidelines or standards relating to EIA implementation, based on LEP and concerned regulations. Table 5.9 shows main technical guidelines issued by ministries/central government relating to environmental protection or EIA implementation for infrastructure development projects.

Table 5.9 Technical guidelines on environmental protection or EIA implementation issued by individual ministry/ central government

Ministry/ central government	Guidelines	Year of issuance
Ministry of Transportation (MOT)	Sector standard 22TCN 242-98 on EIA procedure during F/S and D/D for the transportation infrastructure development projects	1998
Ministry of Natural Resources and Environment (MONRE)	Guidelines for preparation of an EIA report of a transportation project	1999
Prime Minister (based mainly on recommendation of MPI)	Guidelines on preparation of F/S report for the ODA projects financed by international bank (ADB、AFD、JBIC、KfW、WB）(Decision No. 48/2008/QD-TTg)	2008
Ministry of Transportation (MOT）	Regulation on environmental protection for the transportation infrastructure development projects （Circular 09/2010/TT-BGTVT）	2010

4) Legal framework on land acquisition, compensation, resettlement

The Law on Land (issued in 1993 and revised in 2003) is the umbrella law that regulates issues on land administration, in general, and land acquisition, in particular. Besides, as shown in Table 5.10, there are many laws and regulations relating to the issues on land acquisition for development projects. In addition, each People's Committee of local province/city has to stipulate its own regulations to govern issues of land acquisition in its own territory. Table 5.11 shows regulations issued by Ho Chi Minh City on land administration and land acquisition.

Table 5.10 Laws and regulations relating to land administration, land acquisition, and compensation, resettlement for loss of land

Date of issuance	Law / Regulation	Content
1993/02	Circular No. 05-BXD/DT	Classification of houses
1993/09/27	Decree No. 64/CP	Allocation of agricultural land to citizens for long-term use
1994/07/05	Decree No. 60/CP	Property ownership and the right to use urban residential land
1994/08/17	Decree No. 91/CP	Urban Planning Management
1998/12/02	Law of Grievance and Accusing	
2003/11/26	New Land Law 2003	(Came into effect on 1 July 2004, replacing the Land Law 1993)
2003/12/10	Construction Law	
2004/06/15 2006/11/29	Revised Law of Grievance and Accusing	
2004/10/29	Decree No. 181/2004/ND-CP	Implementation guidelines for the Land Law

Date of issuance	Law / Regulation	Content
2004/10/29	Decree No. 182/2004/ ND-CP	Administrative management of violations in the land use rights
2004/11/16	Decree No. 188/2004/ ND-CP	On setting of prices (price frames) for different categories of land
	Circulation No. 114/2004/TT-BTC	Implementation guidelines for Decree No 188/2004/ND-CP
2004/12/03	Decree No. 197/2004/ ND-CP	On compensation, assistance and resettlement when the State recovers land for use in national defense, security, national interests and public interests (replacing Decree No. 22/CP)
2004/12/03	Decree No. 198/2004/ ND-CP	Collection of land use fee
2004/12/07	Circular No. 116/2004/TT-BTC	Issued by Ministry of Finance, on implementation guide-lines for Decree 197/2004/CP
2004	Circulation No. 117/ 2004/TT-BTC	Implementation guidelines for Decree No 198/2004/ND-CP
2005/03/18	Decree No37/2005/ ND-CP	Procedures for application of measures enforcing implementation of decision on administrative violation
2005/04/06	Decision No. 74/2005/QD-TTg	On the use of land use right transferred budget, the budget got from selling house, workshop and other structures when an economic unit has to relocate its office and estates, business in accordance with planning
2005/09/15	Circular No. 80/2005/ TT-BTC	Guidelines for organization of a network for conducting statistics of and surveying, investigating of the land prices in accordance with Decree No 188/2004/ND-CP (16 November 2004)
2006/01/27	Decree No. 17/2006/ ND-CP	On amendments to some provisions of some Decrees on implementation guidelines for the Land Law and Decree 187/2004/ND-CP on shifting the state companies into stock ones.
2006/02/18	Circular No. 69/2006/ TT-BTC	Amendment to Circular No116/2004/TT-BTC
2007/05/25	Decree No. 84/2007/ ND-CP	Additionally stipulating the grant of land use right certificates, recovery of land, exercise of land use rights, order and procedures for compensation, support and resettlement upon land recovery by the State, and settlement of land related complaints.
2007/07/02	Circular No. 06/2007/ TT-BTNMT	Guidance for implementation of a number of articles of Decree No. 84/2007/ND-CP.
2008/01/31	Circular No. 14/2008/ TTLT/BTC-BTNMT	Joint circular on guidance for implementation of a number of articles of Decree No. 84/2007/ND-CP.
2009/08/13	Decree No. 69/2009/ ND-CP	Additional stipulation on land use planning, land use price, land acquisition, compensation, support and resettlement.
2009/10/23	Notice No. 181/DC-CP	Amendment of Decree No. 69/2009/ND-CP.
2009/10/01	Circular No. 14/2009/TT- BTNMT	Detailed stipulations on compensation, supports, resettlement, and procedure for land acquisition, land hand-over, land lease.

Table 5.11 Regulations on land acquisition, resettlement, etc. issued by Ho Chi Minh City

Regulation number and date of issuance	Title
Decision 106/2005/QĐ-UBND, June 16, 2005	Issuance of regulations on compensation, support and resettlement when the State acquire lands in the territory of HCM City
Decision 02/2006/CT-UBND, January 16, 2006	On reinforce of tasks to implementing the Law on Land issued in 2003.
Decision 74/2006/QĐ-UBND, May 17, 2006	On compulsory procedure to carrying out the inventory on actual conditions of houses, lands and properties attached with lands, for compensation, support and resettlement when the State acquire land.
Decision 13/2006/QĐ-UBND, February 6, 2006	On organizational structure and functions of the Appraisal Committee of Compensation, Land Clearance of HCM City.
Decision 11/2006/QĐ-UBND, January 25, 2006	On the revision, addition to Article 10, and Article 9 of the provisions attached to Decision 106/2005/QD-UBND issued on 16/06/2005 on compensation, support and resettlement when the State acquire lands in the territory of HCM City

5.1.2 Relevant authorities

Table 5.12 describes functions and responsibilities of several central ministries/authorities relating to environmental protection as stipulated by LEP 2005 (Article 121).

Talbe 5.12 Functions/responsibilities of central ministries/authorities relating to environmental protection

Ministry / authority	Functions / responsibilities
Ministry of Natural Resources and Environment (MONRE)	a/ To submit to the Government legal documents on environmental protection; b/ To submit to the Government for decision national policies, strategies and plans on environmental protection; c/ To assume the prime responsibility for settling or propose the Government or Prime Minister for settlement inter-branch or inter-provincial environmental issues; d/ To formulate and issue systems of environmental standards according to regulations of the Government; e/ To direct the construction and management of the national environment monitoring system and perform unified management of environment monitoring data; f/ To direct and organize the assessment of the national environment status to serve the formulation of environmental protection policies and solutions; g/ To perform uniform management of the evaluation and approval of strategic environment assessment reports and environmental impact assessment reports and registration of environmental protection commitments nationwide; h/ To guide, supervise, inspect and handle violations of the environmental protection law; settle disputes, complaints, denunciations and petitions related to environmental protection in accordance with the provisions of law on complaints and denunciations and other relevant laws; i/ To propose the Government the participation in international organizations, conclusion of or accession to treaties on environmental protection; take the prime responsibility for activities of international cooperation in environmental protection with other countries and international organizations;

Ministry / authority	Functions / responsibilities
	j/ To direct and supervise the observance of the environmental protection law by People's Committee at all levels; k/ To meet environmental protection requirements in national land use planning and plans, national strategy on water resources and integrated planning on inter-provincial river basins, national master plan on basic inventory, exploration, exploitation and processing of minerals.
Ministry of Planning and Investment (MPI)	Assume the prime responsibility for, and coordinate with ministries, ministerial-level agencies, Government-attached agencies and provincial-level People's Committees in ensuring that environmental protection requirements are met in socio-economic development strategies, master plans and plans of the whole country, regions as well as in important projects and works decided by the National Assembly, Government and Prime Minister.
Ministry of Agriculture and Rural Development (MARD)	Coordinate with the MONRE, concerned ministries, ministerial-level agencies, Government-attached agencies and provincial level People's Committees in: a/ directing, guiding and supervising the observance of the environmental protection law and other relevant laws in production, import and use of chemicals, plant protection drugs, fertilizers and agricultural waste; b/ management of genetically modified plant varieties and livestock breeds and products thereof; c/ management of dyke and irrigation systems, forest conservation zones and clean water for daily life in rural areas.
Ministry of Industry (MOI)[1]	Coordinate with MONRE, concerned ministries, ministerial-level agencies, Government-attached agencies and provincial-level People's Committees in: a/ directing, guiding and supervising the observance of the environmental protection law and other relevant laws in industries; b/ handling of seriously polluting industrial establishments under its management; c/ directing the development of the environment engineering industry.
Ministry of Fishery	Coordinate with MONRE, concerned ministries, ministerial-level agencies, Government-attached agencies and provincial-level People's Committees in: a/ directing, guiding and supervising the observance of the environmental protection law and other relevant laws in aquaculture; b/ exploitation and processing of aquatic resources, genetically modified aquatic organisms and products thereof, and marine conservation zones.
Ministry of Construction	Coordinate with MONRE, concerned ministries, ministerial-level agencies, Government-attached agencies and provincial-level People's Committees in directing, guiding and supervising the observance of the environmental protection law and other relevant laws in the construction of : a/ infrastructure works of water supply and drainage, b/ solid and liquid waste treatment in urban centers, c/ concentrated production and service zones, d/ construction material production establishments; e/ craft villages and concentrated rural residential areas.
Ministry of	Coordinate with MONRE, concerned ministries, ministerial-level agencies,

[1] Former Ministry of Industry and former Ministry of Trade have been integrated in July 2007 to be the Ministry of Industry and Trade.

Ministry / authority	Functions / responsibilities
Transportation	Government-attached agencies and provincial-level People's Committees in directing, guiding and supervising the observance of the environmental protection law and other relevant laws in the construction of transport infrastructure works and transport activities.
Ministry of Health	Direct, guide and supervise the management of medical waste and environmental protection work in medical establishments, food safety and hygiene, and burial services.
Ministry of National Defense, and Ministry of Public Security	Mobilize forces to respond to environmental incidents and remedy their consequences; direct, guide, supervise and inspect environmental protection work in armed forces under their respective management.
Other ministries, ministerial-level agencies and Government-attached agencies	Perform tasks specified in the LEP and coordinate with MONRE in directing, guiding and supervising the observance of the environmental protection law under their respective management.

MONRE was established mainly based on the restructure of the National Environment Agency (NEA, established in 1993) which was an agency under Ministry of Science, Technology and Environment (MOSTE, established in 1992). In 2002, with aim to strengthen governmental function for environmental protection, NEA was detached from MOSTE and integrated with several relevant agencies, and led to the establishment of MONRE.

The Vietnam Environment Protection Agency (VEPA), an organization under MONRE, was responsible for preparing policies relating to environmental protection, monitoring the observance of LEP, regulations, standards, etc., settling problems of disputes, accidents on environment, instructing local authorities and agencies on the tasks to protect environment, etc.

In 2008, the Environmental Department and the EIA Department under MONRE were integrated into VEPA, and VEPA was restructured and renamed to be "Vietnam Environment Administration" (VEA) with furthermore functions and staffs.

Besides, in regional areas, the provincial-level people's committees are in charge of pollution control in its jurisdiction. According to LEP 2005 (Article 122), provincial-level people's committees are responsible for the following tasks:

a/ To promulgate according to their competence environmental protection regulations, mechanisms, policies, programs and plans;

b/ To direct and organize the implementation of environmental protection strategies, programs, plans and tasks;

c/ To direct the construction and management of local environment monitoring systems;

d/ To direct periodical environmental status assessments;

e/ To organize the evaluation and approval of EIA reports under their competence;

f/ To organize propaganda and education about the environmental protection law;

g/ To direct the supervision, inspection and handling of violations of the environmental protection law; settle disputes, complaints, denunciations and petitions related to environment; and coordinate with other provincial-level People's Committees in dealing with inter-provincial environmental issues.

In 2002, agencies in charge of environmental protection in regional areas were also restructured similarly to what were done in central government. Consequently, the former Department of Science, Technology and Environment (DOSTE) under provincial-level people's committee was restructured, and the Department of Natural Resources and Environment (DONRE) was newly established. DONRE's main functions are: issuance of operation permit for factories, carrying out environmental monitoring of river water, air ambient, carrying out inspections to factories and waste water / solid waste treatment plants, exposing activities which violate law and regulations on environmental protection.

5.1.3 Project implementation procedure

1) Procedure relating to EIA preparation and appraisal

The following 3 sections of Chapter III of the LEP 2005 stipulate issues on environmental assessment.

Section 1: Strategic Environmental Assessment (SEA)
Section 2: Environmental Impact Assessment (EIA)
Section 3: Environmental Protection Commitments (EPC)

Section 2 has 6 articles (from Article 18 to Article 23) that define projects to be prepared EIA reports, elaboration and contents of the EIA report, appraisal and approval of the EIA report, implementation of the EIA report's commitments.

Besides, MONRE and other ministries have also issued several legal documents related to EIA. Table 5.13 lists up main regulations on EIA issued by MONRE and MOC (Ministry of Construction).

Table 5.13 Regulations on EIA issued by MONRE and MOC

Issuance date	Code/Number	Title
2000/08/08	Circular No. 10/2000/TT-BXD	Guiding the formulation of EIA report for a construction project
2006/09/09	Circular No. 08/2006/TT-BTNMT	Guiding the preparation of Strategic Environmental Assessment, Environmental Impact Assessment and Environmental Protection Commitment
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
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
2008/12/08	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
2011/07/18	**Circular No. 26/2011/TT-BTNMT**	**Detailed stipulation on several articles of Decree 29/2011/ND-CP on SEA, EIA, and EPC**

2) Major issues relating to the preparation, appraisal, and approval of the EIA report

Circular 26/2011/TT-BTNMT issued by MONRE on July 18, 2011 is the most important regulation on the preparation, appraisal and approval of the strategic environmental assessment (SEA) report, the environmental impact assessment (EIA) report, and the environmental protection commitment (EPC). Table 5.14 shows structure of the Circular.

Table 5.14 Structure of Circular 26/2011/TT-BTNMT

No	Title	Content
I	General Provisions	1 The Circular stipulates in detail some articles of Decree 29/2011/ND-CP with focus on: (a) strategic environmental assessment (SEA); (b) environmental impact assessment (EIA); (c) environmental protection commitments (EPC); 2 Subjects of applications
II	SEA	3 Objects subject to elaboration of SEA and method of elaboration of SEA 4 Elaboration of SEA Report 5 Dossiers of request for appraisal of SEA Report 6 Entity in charge of appraising SEA Report 7 Responsibilities of the project owner after the appraisal of SEA Report 8 Report on result of appraisal of SEA Report 9 Responsibilities of agencies appraising, approving the strategy, planning, plan after receiving report on result of appraisal of SEA Report
III	EIA	10 Objects subject to elaboration of EIA Report and responsibilities of the project owner on elaboration of EIA Report 11 Re-elaboration and submission for appraisal, and approval of EIA Report 12 Public consultation during the process of elaboration of EIA Report 13 Dossiers of request for appraisal, approval of EIA Report 14 Entity in charge of appraising EIA Report 15 Procedure and period for appraising, approving an EIA Report 16 Responsibilities of the agency approving the EIA Report and project owner after the EIA Report is approved
IV	Organization structure and activities of SEA Appraisal Committee, EIA Appraisal Committee	17 Establishment of SEA Appraisal Committee, EIA Appraisal Committee 18 Members and structure of SEA Appraisal Committee, EIA Appraisal Committee 19 Functions and working principles of SEA Appraisal Committee, EIA Appraisal Committee 20 Conditions and criteria for selection of members of SEA Appraisal Committee, EIA Appraisal Committee 21 Responsibilities of members of SEA Appraisal Committee, EIA Appraisal Committee 22 Rights of members of SEA Appraisal Committee, EIA Appraisal Committee 23 Responsibilities and rights of chairman of Appraisal Committee 24 Responsibilities and rights of vice-chairman of Appraisal Committee 25 Responsibilities and rights of rebut members of Appraisal Committee 26 Responsibilities and rights of secretary member of Appraisal Committee 27 Responsibilities and rights of representative of DONRE who participates the Appraisal Committee established by a ministerial-level agencies 28 Responsibilities and rights of a permanent Appraisal Committee 29 Obtain opinions of DONRE when an Appraisal Committee established by ministerial-level agency has not member as representative of DONRE 30 Conditions for proceeding a formal meeting of Appraisal Committee 31 Participants of a formal meeting of Appraisal Committee 32 Content and procedure of a formal meeting of Appraisal Committee 33 Content of conclusion of Appraisal Committee 34 Format and content of record of a formal meeting of Appraisal Committee
V	Inspection and confirmation of environmental protection facilities/ measures before bringing the project to operation	35 Responsibilities of project owner before bringing the project to operation 36 Inspection, confirmation of environmental protection facilities/measures before bringing the project to operation 37 Trial operation of waste treatment facilities 38 Dossiers of request for inspection, confirmation of environmental protection facilities/measures using in operation phase of the project 39 Inspection, confirmation of environmental protection facilities/measures using in operation phase of the project 40 Establishment of the team to inspect environmental protection facilities/measures using in operation phase of the project 41 Working principles of the inspection team 42 Responsibilities and rights of members of the inspection team 43 Content and format of report on results of inspection 44 Re-inspection of environmental protection facilities/measures
VI	EPC	45 Objects subject to elaboration and registration of EPC and content of an EPC 46 Dossiers for registration of EPC 47 Procedure of registration of EPC 48 Responsibilities of project owner and authorities after the EPC is registered

No	Title	Content
VII	Implementation of the Circular	49 Implementing ministries/agencies/organizations 50 Implementation of the Circular (the Circular shall become effective from September 02, 2011. Circular 05/2008/TT-BTNMT, and Circular 13/2009/TT-BTNMT shall lose effect after the Circular becomes effective)

Circular 26/2011/TT-BTNMT has 41 appendices providing sample formats of the SEA Report, EIA Report, EPC document, etc.

3) Standards relating to environmental protection

Many Viet Nam Standards (TCVN) were made during the 1990 decade and now are being gradually revised. A number of Vietnam Standards have been replaced by the Technical Regulations (QCVN). The following Table 5.15 lists up major environmental standards and technical regulations, and its relevant Vietnam regulations.

Table 5.15 Vietnam regulations on standards/technical regulations, and major environmental standards/technical regulations

Issuance date	Code/Number	Title
2002/06/25	Decision No.35/2002/ QD-BKHCNMT	Issuance the list of obligatory application of Vietnamese environment standards
2006/12/18	Decision No.22/2006/ QD-BTNMT	Obligatory application of Vietnamese standards on environment.
2008/07/18	Decision No. 04/2008/QD-BTNMT	Issuance of environmental regulations
2008/12/31	Decision No. 16/2008/QD-BTNMT	Issuance of environmental regulations
2009/11/16	Circular No. 25/2009/TT-BTNMT	Issuance of national technical regulation on environment
	Noise and vibration	
	TCVN 3985-1985	Limiting the maximum noise level in working area
	TCVN 5949-1998	Limiting the maximum noise level in public and residential areas
	TCVN 6962-2001	Allowable vibration limits in constructive and industrial production
	Water quality	
	QCVN 08:2008/BTNMT	The national technical regulation on surface water quality
	QCVN 09:2008/BTNMT	The national technical regulation on ground water quality
	QCVN 10:2008/BTNMT	The national technical regulation on coastal water quality
	Air quality	
	QCVN 05:2009/BTNMT	The national technical regulation on hazardous substances in ambient air (replace TCVN 5937:2005 – Air quality - Standards for quality of ambient air)
	QCVN 06:2009/BTNMT	The national technical regulation on hazardous substances in ambient air (replace TCVN 5938:2005 – Air quality – Permitted maximum level of a number of toxic and hazardous

Issuance date	Code/Number	Title
		substances in ambient air)
	QCVN 19:2009/BTNMT	Replace TCVN 5939:2005 – Air quality – Industrial emission standards for dusts and inorganic substances
	QCVN 20:2009/BTNMT	The national technical regulation on industrial emission of organic substances (replace TCVN 5940:2005 – Air quality – Industrial emission standards for a number of organic substances)
	QCVN 22:2009/BTNMT	The national technical regulation on emission of thermal power industry (replace TCVN 7440:2005 – Emission standards for thermal power industry)
	Soil	
	QCVN 03:2008/BTNMT	The national technical regulation on heavy metals in soil
	Wastewater discharge	
	TCVN 6773: 2000	Water Quality - Water quality guidelines for irrigation
	TCVN 6774: 2000	Water Quality - Freshwater quality guidelines for protection of aquatic sites
	TCVN 6980: 2001	Water Quality - Standards for industrial effluents discharged into rivers used for domestic water supply.
	TCVN 6981: 2001	Water Quality - Standards for industrial effluents discharged into lakes used for domestic water supply
	TCVN 6982: 2001	Water Quality - Standards for industrial effluents discharged into rivers used for water sports and recreation.
	TCVN 6983: 2001	Water Quality Standards for industrial effluents discharged into lakes used for water sports and recreation.
	TCVN 6984: 2001	Water Quality - Standards for industrial effluents discharged into rivers used for protection of aquatic life.
	TCVN 6985: 2001	Water Quality - Standards for industrial effluents discharged into lakes used for protection of aquatic life.
	TCVN 6986: 2001	Water Quality - Standards for industrial effluents discharged into coastal waters used for protection of aquatic life.
	TCVN 6987: 2001	Water Quality Standards for industrial effluents discharged into coastal waters used for water sports and recreation
	TCVN 7222:2002	General Environmental Requirements for Central Domestic (Municipal) Wastewater Treatment Plants
	QCVN 14:2008/BTNMT	The national technical regulation on domestic wastewater
	QCVN 24:2009/BTNMT	The national technical regulation on industrial wastewater
	Solid waste	
	TCVN 6696-2000	Requirements for environmental protection for sanitary landfills.
	TCVN 6705-2000	Requirements for separation of non-hazardous waste.
	TCVN 6706-2000	Requirements for separation of hazardous wastes.
	TCVN 6707-2000	Prevention and warning signs for hazardous waste.
	TCXDVN 261:2001	Landfill – Standard for designing
	QCVN 07:2009/BTNMT	The national technical regulation on hazardous waste thresholds

4) Procedure for the preparation, appraisal and approval of an EIA report

Figure 5.1 summarizes the procedure to prepare, appraise and approve an EIA report, as stipulated by Decree 80/2006/ND-CP, Decree 21/2008/ND-CP, Decree 29/2011/ND-CP and Circular 26/2011/TT-BTTMT. A competent agency should have responsibility for the whole procedure of appraising and approving the EIA report. Based on the scope of work and the total project cost, MONRE or another ministry, or a ministerial level agency, or a governmental body or a provincial level People's Committee will be assigned as the competent approval agency.

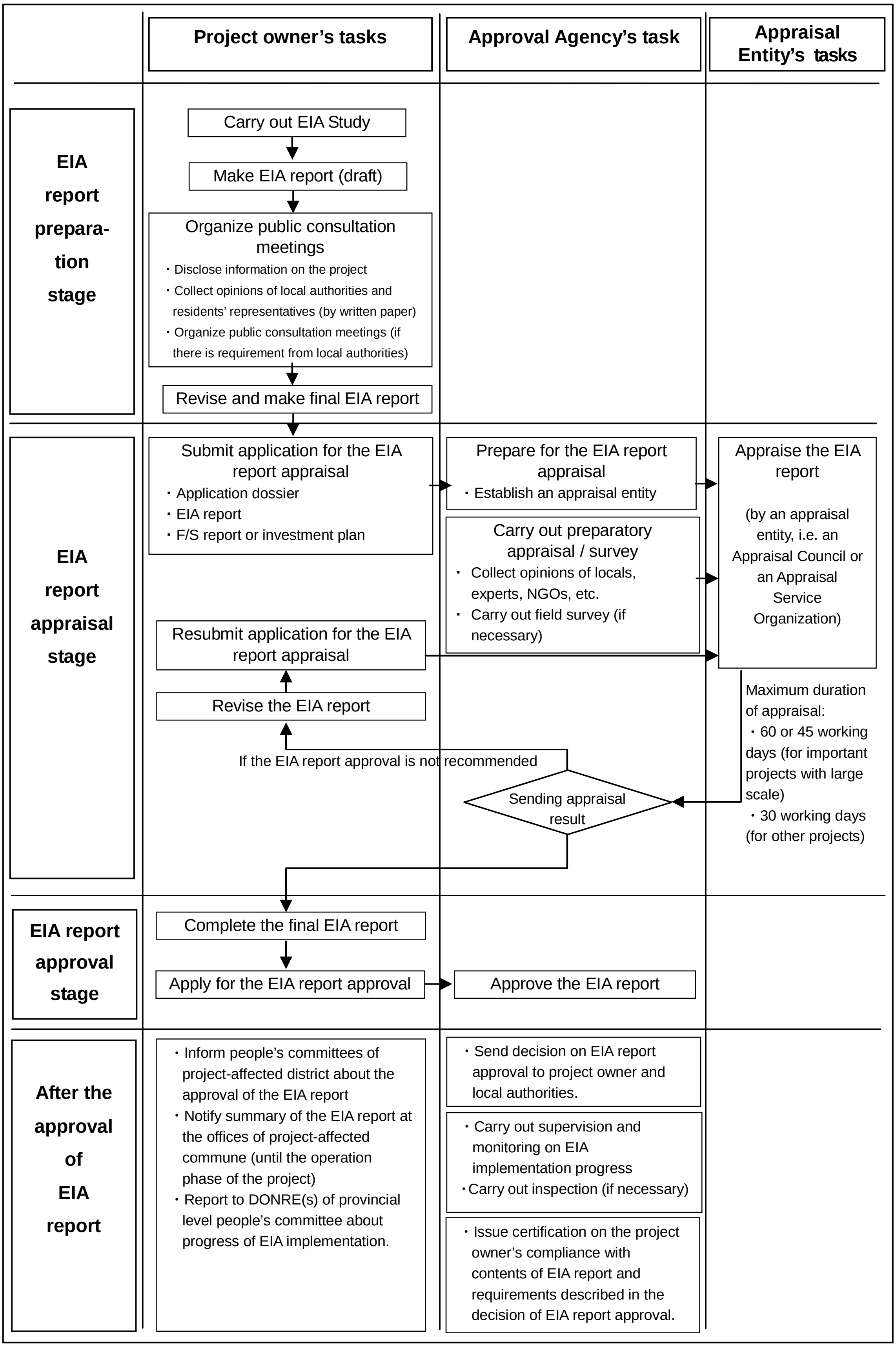
After receiving application for appraisal and approval, the competent approval agency shall make decision to establish or assign an independent entity to take role as the entity in charge of appraising the EIA report.

The EIA appraisal entity is an external entity independent to the EIA approval agency. Director of the EIA approval agency may examine the specificity, the technical characteristic of the project, the complication of surrounding environment, etc. and determine to assign an Appraisal Council, or an Appraisal Service Organization to appraise the EIA report. Duration for appraisal is fixed to be 30 or 45 or 60 working days. The EIA approval agency may determine the duration, after examining the project scope, the complication of the task, etc.

The EIA approval agency will then inform the project owner about result of EIA report appraisal. The project owner shall revise the EIA report and submit it again if there is such requirement from the EIA approval agency. Since then, the EIA approval agency shall issue the decision to approve the EIA report within 15 working days.

The EIA approval agency is nominated based on the project scope and the estimated project cost described in the F/S report. If the project cost is estimated to exceed 35 trillion VND (about 1.2 billion US$), then its investment plan should be approved by the National Assembly, and its EIA report should be appraised and approved by MONRE (refer to Decision 49/2010/QH-12 approved by National Assembly on June 19, 2010). If the project cost is estimated not exceed 35 trillion VND, then its investment plan is commonly approved by ministerial level agency or provincial level people's committee, and its EIA report is commonly appraised and approved by relevant Department of Environment of ministerial level agency or Department of Natural Resources and Environment (DONRE) of provincial level people's committee.

Figure 5.1 Flow-chart of procedure for preparation, appraisal, and approval of EIA report



5.1.4 Deviation 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.

(1) Local economy such as employment, livelihood, etc.
(2) Utilization of land, local resources, etc.
(3) Social institutions, local decision-making institutions
(4) Vulnerable social groups (the poors, indigenous peoples, etc.)
(5) Equality of benefits and losses, equality in the development process
(6) Gender, children's rights
(7) Local conflicts of interest

The following Table 5.16 lists up major deviations between Vietnam's impact assessment legal framework and JICA Guidelines for Environmental and Social Considerations (April 2010).

Table 5.16 major deviations between Vietnam's impact assessment legal framework and JICA Guidelines for Environmental and Social Considerations

JICA Guidelines	Vietnam's EIA institutional framework
1. Principle: 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.	At the project level, environmental impacts are assessed and examined only from the stage of F/S. IEE or Environmental Scoping is not compulsory in the environmental assessment procedure. In an EIA report, alternatives should be examined, and all anticipated impacts caused by the project should be assessed without the scoping process.
2. Ensuring accountability and transparency	There is no provision on accountability and transparency in Vietnam regulations on environmental assessment.
3. Ensuring meaningful participation of stakeholders - In principle, project proponents etc. consult with local stakeholders through means that induce broad public participation to a reasonable extent, in order to take into consideration the environmental and social factors in a way that is most suitable to local situations, and in order to reach an appropriate consensus. - (In the case of Category A projects,) JICA encourages project proponents etc. to consult with local stakeholders about their understanding of development needs, the likely adverse impacts on the environment and society, and the analysis of alternatives at an early stage of the project, and assists project proponents as needed. - The outcome of such consultations must be incorporated into the contents of project plans.	According to Decree 29/2011/ND-CP, in the process of making the EIA report, the project owner should carry out consultation by the following method: - Send a written request for consultation and a document outlining the main project items, environmental issues, and measures to mitigate environmental impacts to people's committees (PCs) of communes, wards or townships where the project is to be implemented and representatives of communities and organizations directly affected by the project; - Request the above-mentioned PCs and representatives of communities and organizations to give comments on the document sent. - In case of necessity, the commune-level PCs shall organize a dialogue with the project owner and representatives of organizations and communities directly affected by the project. - After receiving the written request for consultation, the commune-level PCs shall reply the project

	owner in writing and publicize such reply. Past this time limit, if a consulted PC fails to send a written reply to the project owner, it is regarded as agreeing with the project owner's investment plan. As described above, consultation is limited to commune-level PCs and representatives of affected organizations and communities. The concept on "local stakeholders" has not been widely recognized in Vietnam yet. And main purpose of consultation is likely to obtain agreeing or disagreeing opinions of local authorities, instead of to promote local residents' understanding and participation.
4. 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. - (In the case of Preparatory Survey,) 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. - 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.	According to Decree 29/2011/ND-CP (Article 22), after the EIA report is approved, the project owner shall formulate, approve and publicize the Environmental Management Plan at the offices of the commune-level PCs where consultation had been conducted to enhance people's awareness about the project, and enable people's participation in the supervision and monitoring of the project. However, it seems that the process and method to disclose such information are not properly undertaken in actuality. Therefore, in general, the project-affected people are not easy to access to information such as the EIA report or the EMP of the project, and present their opinions on the project.
5. Project categorization: JICA classifies projects into four categories (A ~ C, and FI) according to the extent of environmental and social impacts, taking into account an outline of project, scale, site condition, etc.	The system of environmental assessment in Vietnam is consisted of: (1) Strategic Environmental Assessment (SEA), (2) Environmental Impact Assessment (EIA), and (3) Environmental Protection Commitment (EPC). Objects subject to elaboration of SEA are socio-economic development strategies, plannings and plans at national level, regional level, provincial level, key economic regions, and inter-provincial river watersheds. At the project level, projects are categorized into two groups: group has to elaborate an EIA report, and group has not to elaborate an EIA report but only has to submit an EPC. Decree 29/2011/ND-CP lists up 146 groups of projects which have to elaborate and submit an EIA report for approval.
6. Impacts to be assessed: 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	According to Circular 26/101/TT-BTNMT (stipulating in detail a number of articles of Decree 29/2011/ND-CP), impacts in pre-construction phase, construction phase, and operation phase should be anticipated and assessed. In pre-construction phase, alternatives on project location, and without-the-project option should be examined, and impacts caused by land acquisition, relocation, and resettlement 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,

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. Items to be addressed in the specific project are narrowed down to the needed ones through the scoping process.	extent of impact, occurrence frequency of impact, recovering possibility, etc. However, it seems that the following impacts are not properly considered: impacts to local economy (employment, livelihood, utilization of land, etc.), local resources, social institutions, local decision-making institutions, vulnerable social groups (the poors, indigenous peoples, etc.), equality of benefits and losses, equality in the development process, gender, children's rights, and local conflicts of interest.
7. 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.	There is no provision on concern about human rights in the legal framework on project impact assessment in Vietnam.
8. Involuntary Resettlement People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported by project proponents etc. in a timely manner. Prior compensation, at full replacement cost, must be provided as much as possible. Host countries must make efforts to enable people affected by projects and to improve their standard of living, income opportunities, and production levels, or at least to restore these to pre-project levels. Measures to achieve this may include: providing land and monetary compensation for losses (to cover land and property losses), supporting means for an alternative sustainable livelihood, and providing the expenses necessary for the relocation and re-establishment of communities at resettlement sites. ... In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance.	In Vietnam, issues on land acquisition, compensation, resettlement, etc. are regulated by the law and regulations on land administration (such as the New Land Law 2003, Decree 69/2009/ND-CP, Circular 14/2009/TT-BTNMT, etc.). If a development project needs to acquire some lots of land, then these above-mentioned law and regulations will be applied, an inventory-of-loss (IOL) will be carried out, and people who loses lands, properties, means of livelihood, etc. will be compensated and/or supported in relocation and resettlement. Measures to help project-affected people in restoring livelihood, improving living standard, etc. after resettlement have not been properly considered for a long time in the past. Only in the recently-issued Decree 69/2009/ ND-CP, the livelihood restoration plan has been stated for the first time as a measure to help affected people in obtaining sustainable livelihood. However, it needs further efforts to improve legal framework on involuntary resettlement and strengthen capacity of local agencies responsible for planning and implementing the livelihood restoration plan.
9. Indigenous Peoples Any adverse impacts that a project may have on indigenous peoples are to be avoided when feasible by exploring all viable alternatives.	There is no particular provision on indigenous peoples in Vietnam's legal framework on project impact assessment.
10. Monitoring Project proponents etc. should make efforts to make the results of the monitoring process available to local project stakeholders. 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	According to Decree 29/2011/ND-CP (Article 22), after the EIA report is approved, the project owner shall formulate, approve and publicize the Environmental Management Plan at the offices of the commune-level PCs where consultation had been conducted. However, in the legal framework on impact assessment in Vietnam, there is no provision on the project owner's obligation to publicize results of

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.	monitoring process, and the procedure to settle complaints raised by the public on environmental issues relating to the project.

5.2 EXAMINATION OF ENVIRONMENTAL AND SOCIAL IMPACTS

5.2.1 Examination of alternatives

1) Development area proposed by the UMRT Line 1

Figure 5.2 shows the development area of Ben Thanh Station as planned in the Basic Design Study of the HCMC UMRT Line 1 Project, and Table 5.17 shows its construction scale.

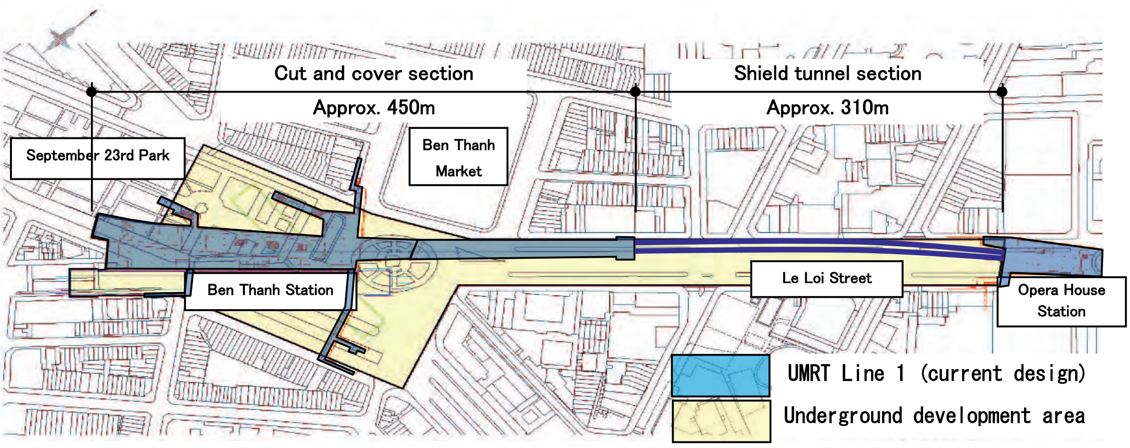


Figure 5.2 Development area of UMRT Line 1 Ben Thanh Station

Table 5.17 Rough construction scale of UMRT Line 1 Ben Thanh Station

Construction scale (Ben Thanh Station)	Station, stairs, exits, others, totally 15,300m^2 in space

2) Alternatives

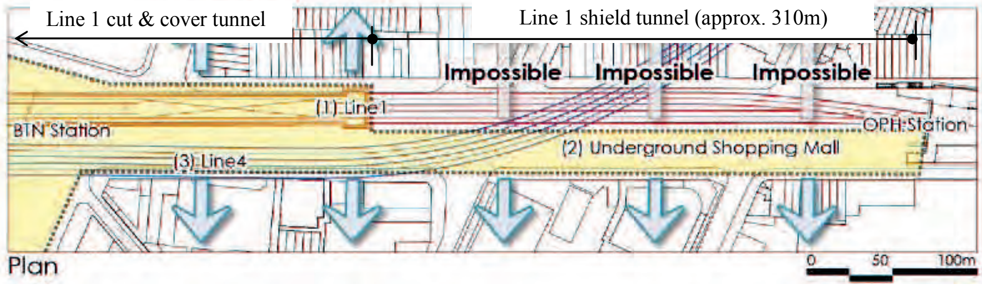
The following two alternative studies on UMRT Line 1 project are currently being examined by JICA study Team.

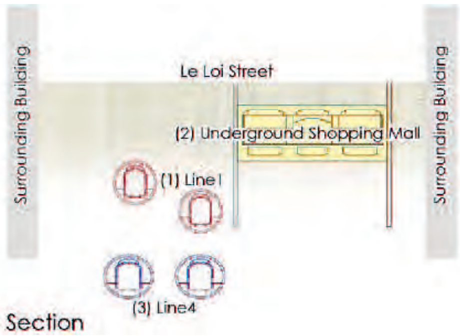
- Construction method of underground shopping mall and Line 1 tunnel beneath Le Loi Street
- Construction method of Ben Thanh Central Station

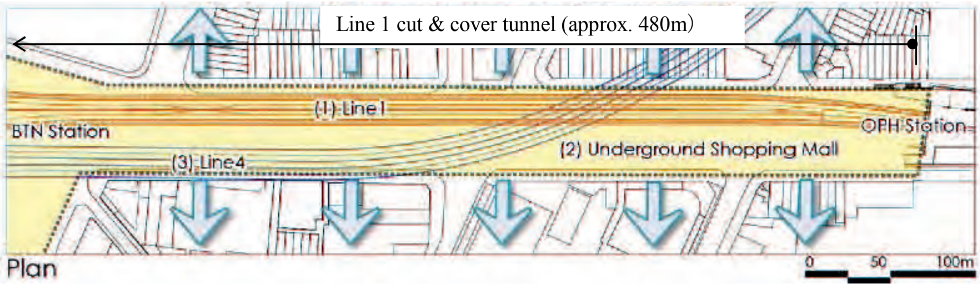
(1) Alternatives on construction method of the tunnel of Line 1 and the underground shopping mall beneath Le Loi Street

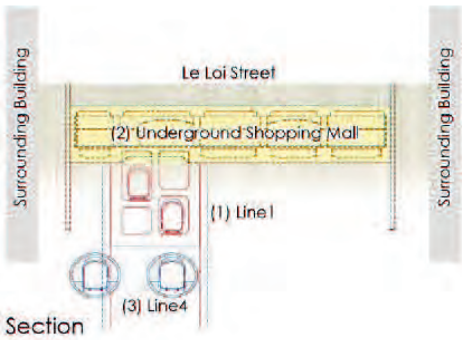
In this section, several alternatives on construction method for the tunnel section of UMRT Line 1 and shopping mall beneath Le Loi Street are examined. The shield tunnel is adopted in the current UMRT Line 1 design for a part of tunnel beneath Le Loi Street. However, in this shield tunnel section, the tunnel structure interferes with the underground shopping mall structure, so the underground shopping mall cannot be constructed above the Line 1 tunnel and the area of the underground development decreases. On the other hand, in case that the tunnel structure is changed from the shield tunnel to the cut & cover tunnel, the underground shopping mall can be constructed above the Line 1 tunnel. Consequently, the area of the underground development expands and the underground shopping mall can be connected with the basement of surrounding buildings, and this will enable the appropriate development of underground space of urban newly constructed area, and contribute to the development of the local district. Advantages and disadvantages of the alternatives are described as followings. Figure 5.18 shows the current construction method for Line 1 and the underground shopping mall beneath Le Loi Street, and Table 5.19 shows comparison between the alternatives.

Table 5.18 Construction method for tunnel of Line 1
and the underground shopping mall beneath Le Loi Street

<table>
<tr><th></th><th>Outline of alternative</th></tr>
<tr><td>Alternative A</td><td>



・Construction method Line 1: shield tunnel
Line 4: shield tunnel
USM: cut & cover tunnel
・No design change for Line 1 tunnel
・The area of USM becomes small</td></tr>
<tr><td>Alternative B</td><td>



・Construction method Line 1: cut & cover tunnel
Line 4: shield tunnel
USM: cut & cover tunnel
・Design change for Line 1 tunnel
・The area of USM becomes large</td></tr>
</table>

Table 5.19 Comparison between construction methods for the tunnel of Line 1 and the underground shopping mall beneath Le Loi Street

Comparison item	Comparison between alternatives
Technical viewpoint	1) In case of Alternative A, there is no need for change in construction method for Line 1, and thus it will not affect current schedule of Line 1. However, the area of USM will be small, and the connectivity of the underground development with the buildings along the northeast wide of Le Loi Street cannot be ensured, and consequently it is expected that the creation of comfortable and attractive urban space, and the harmonized development planned under PPP scheme are difficult to be realized. 2) In case of Alternative B, it needs to change current plan. However, the area of USM can be expanded largely, and the underground development can be connected with the buildings located along the project site. Consequently, it is expected that the comfortable and attractive urban space can be created and contribute to the development of local district. However, it will need to carry out measures such as removal of the temporary soil retaining walls.
Environmental and social viewpoint	1) In case of Alternative A, due to the introduction of the shield construction method, environmental and social impacts are expected slighter than the ones in case of cut & cover construction method, especially for the tunnel section deep under the ground. In the area where the cut & cover construction work is carried out, it needs to perform traffic management and safety control for the road traffic on ground. 2) In case of Alternative B, due to the cut & cover construction method, a larger number of issues to be concerned (such as the decline of groundwater level, the management for road traffics on ground during construction phase, etc.) comparing to the case of shield construction method. In addition, the area with high possibility in occurring of ground deformation and inequitable ground subsidence will be larger. Impacts caused by the cut & cover construction method for the USM section are similar for both alternatives.
Recommendation of optimum alternative and its reason	Recommended alternative: Alternative B 1) In case of Alternative B, construction cost may be relatively high, but from the viewpoint of urban planning, it is considered as an optimum alternative, due to its rationality and its efficiency in investment for the USM development. 2) With respect to issues on environmental and social consideration, it needs to carefully carry out planning, design, construction, and supervision, including impact mitigation measures and impact monitoring (such as the ones describing in the following sections).

(2) Methods of design and construction of Ben Thanh Station

In this Project, it needs to make integration of a number of plans with different implementation progress. Currently, there are many undefined factors remaining. Line 1 is under the bidding process to select contractors for the design-and-build contract. F/S for Line 2 has just been completed. Initial examination for Line 4 has just been completed. And under this F/S stage of the Project, USM development plan is now being studied as a PPP project. Therefore, it needs to compare and examine: (1) the alternative under which design and construction are carried out separately one by one to meet its own implementation progress, and (2) the alternative under which areas surrounding Ben Thanh Station are comprehensively designed and integrally constructed with harmonization between the plans and differences between the implementation progress of the plans are also taken into consideration (Table 5.20).

- Alternative A: project designs are done separately, and constructions are commenced one by one at different timings depending on each project implementation progress.
- Alternative B: integral construction is done based on comprehensive design of all planned projects.

Table 5.20 Comparison between methods of design and construction of Ben Thanh Station

Comparison item	Comparison between alternatives
Technical viewpoint	1) In Alternative A, each project is designed separately with the others. Therefore, rationality of an integrated development of underground space cannot be ensured, and there is high possibility that the design will be inconvenient for users. In addition, construction cost will become high with high difficulty in construction, due to the one-by-one separate constructions. 2) In Alternative B, the integrated construction is possible with the comprehensive design. There is high possibility that the urban space will be well developed to effectively serve users of the station, railways, facilities, etc. especially in transferring between different railways. Moreover, the construction cost can be saved, because the construction of station, platforms, facilities, etc. can be done at one time.
Environmental and social viewpoint	1) In Alternative A, construction plan of each project will be carried out one by one and separately with the others. Therefore, it is expected that construction duration will become very long, and the surroundings will suffer adverse impacts caused by the projects during a relatively long time. Furthermore, construction sites will be changed depending on each project plan, and therefore, it will cause many different impacts with longer duration to traffic on the roads on ground.

	2) In Alternative B, construction of the station and platforms, facilities, etc. is carried out at once, therefore, the total duration of construction can be shortened, and duration of impacts to surroundings can be also shortened. In addition, impacts to traffic on the roads may be mitigated due to the rational setting up of the construction site for all construction works.
Recommendation of optimum alternative and its reason	Recommended alternative: Alternative B 1) From the viewpoint of urban development, Alternative B is recommended because it enables the rational development of comfortable and attractive urban space, which includes the rational development of station facilities. Alternative B is also expected as a cost saving alternative. 2) Construction will be carried out according to a comprehensive plan, thus it is expected that construction duration will be shortened, and construction works will be efficiently carried out, and consequently, impacts to surrounding areas will be mitigated.

3) Differences with UMRT Line 1

The area targeted by the Project is larger than the area targeted by the on-going HCMC UMRT Line 1 Construction Project, because the Project plans to develop not only Ben Thanh Station but also the underground space of its surrounding areas (such as the underground shopping mall beneath Le Loi Street). In this section, differences between the Project scope and the one planned by the Line 1 Project are described as a comparison between the with-project alternative and the without-project alternative.

Figure 5.3 and Table 5.21 show differences between construction plan of Ben Thanh Station described in the HCMC UMRT Line 1 Project, and contents of plan in this Project.

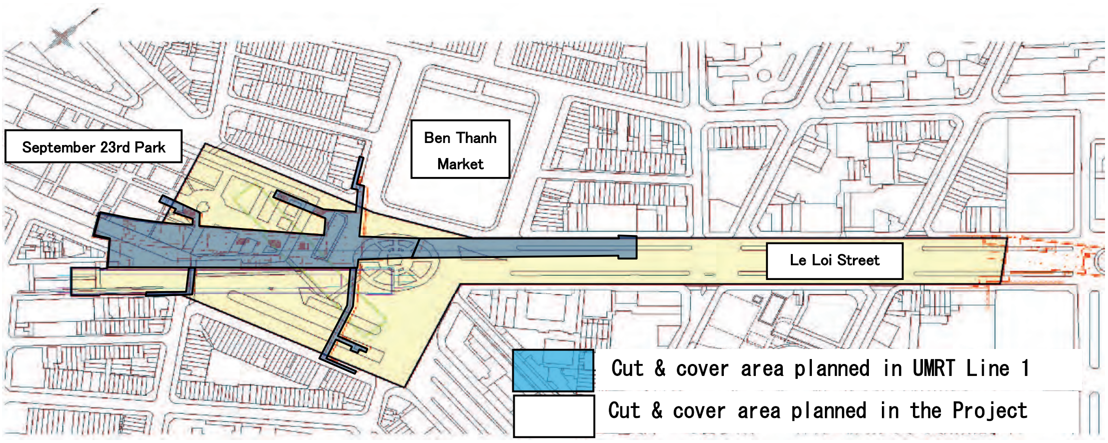


Figure 5.3 Difference between the cut & cover area planned in Line 1 Project and the one planned in the Project

Table 5.21 Comparison between construction plan of Ben Thanh Station under the Line 1 Project and contents planned in the Project

Main difference	Construction plan of Ben Thanh Station under the HCMC UMRT Line 1 Project	Contents planned in the Project
Development area	An area of 15,300m^2 in total is planned for station, stairways, exits, etc.	An area of 59,000m^2 in total is planned for not only station, stairways, exits, etc. as planned in Line 1 Project, but also for the underground square, transfer pathways, underground shopping mall, etc.
Attached facilities	Attached facilities (electric rooms, control rooms, elevators, emergency exits, fire prevention facilities, etc.) are planed with target limited to the railway operation and UMRT users.	In addition to the left, attached facilities are also planned to serve users of the underground shopping mall (i.e. air conditioner, ventilation facilities, fire prevention facilities, etc. should be increased in quantity and strengthened in capacity).
Area of cut & cover works	Area of cut & cover works is limited to the station and its facilities.	Area of cut & cover works will cover the area for the underground shopping mall that will be expanded to Opera House Station.
Increased users in operation phase	Users are mainly UMRT's users.	Convenience of means of transportation planned by the Project will lead to the increase in number of UMRT's users. And in addition, there will be users of the underground shopping mall, tourists, etc.

Due to the differences in content of construction plans, in addition to anticipated impacts that may be caused by the construction of Ben Thanh Station under UMRT Line 1 Project, it is expected that the Project here will cause a number of additional impacts as shown in Table 5.22.

Table 5.22 Additional impacts that may be caused by the Project in comparison with the construction plan of Ben Thanh Station under the UMRT Line 1 Project

Difference	Additional impact
Larger development area	1) Area affected by noise, vibration, air pollution, sand dust, etc. in construction phase becomes larger.
	2) Area affected by traffic congestion and passage impediment during construction phase becomes larger.
	3) More larger number of underground utilities which are to be relocated.
	4) More larger number of trees, electric poles, and other establishments along the road sides which are to be relocated.
Increased number of attached facilities with more electric power consumption	5) Increased number of the attached facilities which more electric power consumption will lead to the increase of heat generation around the project site.
Larger cut & cover area	6) Larger cut & cover area will lead to the increase in quantity of excavated/waste soils. In addition, impacts to environment surrounding the construction material exploitation sites will be more significant.
	7) Larger cut & cover area will lead to more significant impacts to groundwater environment (groundwater level, water vein, etc.),

	and larger number of buildings which are likely to be affected by inequitable ground subsidence.
Increased number of users in operation phase	8) A larger volume of piped water will be required.
	9) A larger volume of waste water volume will be generated.
	10) A larger quantity of solid waste will be generated.

5.2.2 Local stakeholders consultation plan and progress of implementation

According to Vietnam law and regulations on environmental assessment, after the EIA report is approved, projects owner should send a summary of the EIA report to people's committees of project- affected communes/wards and representatives of project-affected communities/ organizations and request their comments. Comments obtained from project-affected communes/wards and communities/organizations should be described in the EIA report (Law on Environmental Protection, Article 20, and Decree 21/2008/ND-CP, Article 1-4). Method to carrying out this consultation is stated as following (Decree 29/2011/ND-CP, Article 15).

- Project owner sends a written request for consultation and a document outlining the main project items, environmental issues, and measures to mitigate environmental impacts to people's committees (PCs) of communes, wards or townships where the project is to be implemented and representatives of communities and organizations directly affected by the project;
- Request the above-mentioned PCs and representatives of communities and organizations to give comments on the document sent.
- In case of necessity, the commune-level PCs shall organize a dialogue with the project owner and representatives of organizations and communities directly affected by the project.
- After receiving the written request for consultation, within 15 working days, the commune-level PCs shall reply the project owner in writing and publicize such reply. Past this time limit, if a consulted PC fails to send a written reply to the project owner, it is regarded as agreeing with the project owner's investment plan.

Thus, the consultation with project-affected people is not strictly obligatory for project owner during the EIA preparation process in accordance with Vietnam law and regulations. However, in this Preparatory Survey, MAUR had been explained about the need for organizing consultation with local stakeholders in accordance to JICA Guidelines for Environmental and Social Considerations (April 2010, Section 2-4), and discussions had been organized between MAUR's staff and the Survey Team to make a rough plan for implementing the local stakeholder consultation in line with above-mentioned JICA Guideline.
The proposed rough plan for organizing local stakeholder consultation is as following. MAUR will be discussed on the details of the plan (such as: time and venue of consultation meeting, method to dismiss information, list of candidate participants, consultation content, etc.).

Rough plan for implementing local stakeholder consultation

1) Purpose of local stakeholder consultation : (a) to identify and address all potential negative impacts that may be caused by the project to natural and social environment; (b) to foresee and/or resolve potential obstacles, constraints and conflict, especially between the existing on-ground commercial entities (shops, stores, etc.) and the planned underground shopping mall; (c) to collect local stakeholders' opinions on the Project and reflect them into the project plan/design thus to improve the Project's relevance and sustainability; (d) to promote awareness, understanding and consent of stakeholders, especially of owners of the on-ground commercial entities.

(2) Stakeholder analysis: Stakeholder analysis had been initially discussed between MAUR and the Survey Team during the Preparatory Survey.

(3) List of local stakeholders: staff in charge in MAUR will take responsibility to make the list and update it regularly.

(4) Establish a two-way communication between MAUR and local stakeholders: MAUR will assign a staff to be in charge of a contact person/ coordinator between local stakeholders and JICA Team and MAUR.

(5) Pamphlet to introduce about the Project: In the next stage of the Project, a pamphlet introducing the Project plan, summary of environmental scoping, method to contact with the Project owner, etc. shall be made, printed and distributed widely to local stakeholders and residents around the Project site.

(6) Meeting with key stakeholders should be organized in the next stage of the Project, to discuss with them about the plan of local stakeholder consultation and promote their consent/cooperation.

(7) Organizing the local stakeholder meeting (in the next stage of the Project)

At the present time, identified local stakeholders are grouped as following

	Group of stakeholder	Group members
1	Local authorities	- HCMC, District 1 Urban Management Division - HCMC, District 1 Economy Management Division - HCMC, Department of Culture, Sports and Tourism - HCMC, Department of Planning and Architecture - People's Committee of Ben Thanh Ward, District 1, HCMC
2	Local resident organizations	- Fatherland Front of District 1, HCMC - Woman Organization of District 1, HCMC - Youth Association of District 1, HCMC - Veterans Association of District 1, HCMC
3	Owners/users of the buildings/ lands	- Saigon Tourist - Vietnam Railways Company, South Branch - Department of Health, HCMC (for the hospitals) - SaiGon Trade - Other land/properties developers, real estate agents

4	Managements of hotels, stores, offices, etc.	- Hotel managements - Renting office managements - Restaurant/ coffee shop/ shop managements - Bus management agency/ operator/ cooperative - Taxi companies - Cooperatives of cyclo, bike-taxi (to be confirmed)
5	Representatives of residents	- Neighborhood associations - Representatives of residents of apartments
6	Owners of small shops	- Representatives of owners of shops in Ben Thanh Market - Representatives of owners of night-booths around Ben Thanh Market

Staff in charge in MAUR are now making the list of local stakeholders based on the above-described groups, which includes name, address, telephone number, contact person, etc. of each stakeholder.

In addition, the printing of a pamphlet introducing the Project, the exhibition of Project plan, etc. are being examined as means to dismiss information on the Project to stakeholders. These means to dismiss Project information, the stakeholder analysis and other preparations in advance to the stakeholder consultation should be examined in detail in the next stages of the Project.

5.2.3 Examination of environmental and social impacts (environmental scoping)

1) Outline of the project and its surrounding environment

(1) Outline of the project construction plan

The construction plan of the Project has aim to construct an underground shopping mall associated with underground squares, underground pathways, underground shopping areas, mainly at the same level with the concourse of Ben Thanh Station planned by the UMRT Line 1 Project. The planned development area will cover the underground space starting from the area in front of Ben Thanh Station to Opera House Station of UMRT Line 1. A part of its surface area is placed on the September 23rd Park and the others are placed on the public roads (including the roundabout in front of Ben Thanh Market and Le Loi Street). The Project will not need to acquire any private land and will not cause any affect to private structure.

- Rough scale of facilities : First underground floor: approx. 59,000m^2
  (including USM, and a number of station facilities)
  Extension: approx. 780m Width: 44m ~ 140m
- Depth of the USM : First underground floor: approx. GL-9m
  Excavation depth: approx. GL-12m

(2) Usage of the buildings surrounding the project site

The project site is located in the urban center of Ho Chi Minh City, where there are many houses and business structures assorted with market, hotels, offices, hospitals, etc. (Figure 5.4). Characteristics of the project site may be described as followings.

- Plan to construct Ben Thanh Station on UMRT Line 1 is under implementing.
- It is an urban center with a historic market attracting many people to visit every day.
- It has high concentrations of people and urban functions, serving as a core of economy, tourism, history, culture, and commerce.
- It is a transportation hub adjacent to the inner-city trunk roads and a city bus terminal, into which the UMRT Line 2, 3a, and 4 are planned to link together.
- However, its surrounding areas are assorted and facing many problems such as traffic congestion, due to the poorly improved road network, and other infrastructure.

Ben Thanh Market was built by a French construction company in 1914, and is one of the most ancient structures remaining in Sai Gon. In 1985, it was repaired totally and became this current appearance. Nowadays, it becomes a good landmark that attracts many tourists to visit and ramble around every day.

At the front of the south main gate of Ben Thanh Market, there is the Quach Thi Trang roundabout, and here there is the statue of General Tran Nguyen Han, a Vietnamese hero, and the figure of Quach Thi Trang, a woman who sacrificed her life in the war against America.

Any development project sited at this roundabout may cause affects to these statue and figure, and the relocation of these statue and figure should be carefully planned with close coordination with competent agencies.

Besides, Table 5.23 and Figure 5.4 show a number of relatively large-scaled structures located closely to the project site.

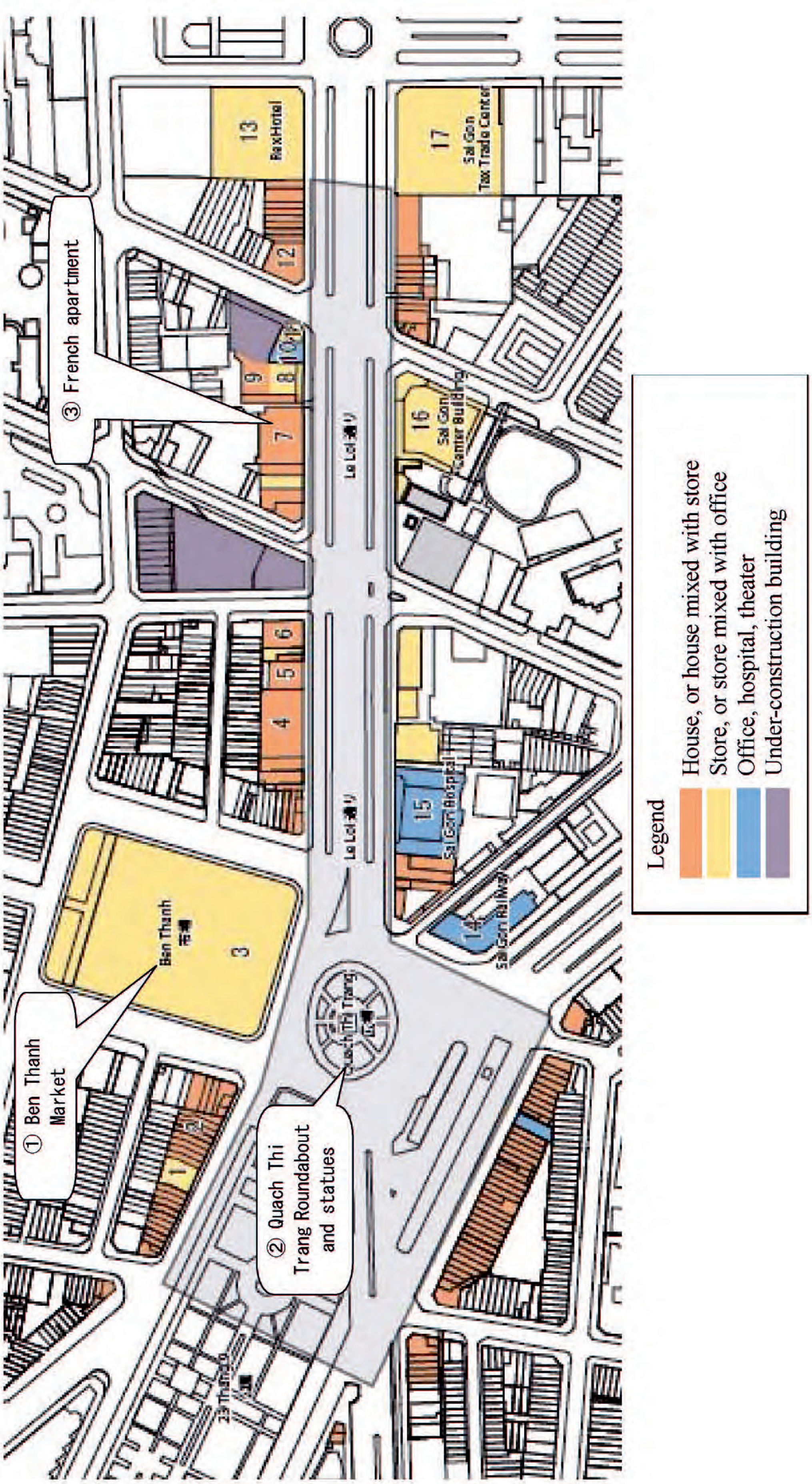


Figure5.4 Buildings adjacent to the project site

Table 5.23 Relatively-large scaled structures located close to the project site

No.	Name of the structure	Usage	Construction period	Repaired or not	Number of floor / under-ground floor	Construc-tion materials
1	QUEEN ANH BUILDING	S	-	-	13/0	-
2	TAN HAI LONG HOTEL	H	-	-	11/0	RC
3	Cho Ben Thanh	S	Fr	Repaired	1/0	RC
4	Yen Hung	S/R	Fr	Repaired	3/0	Brick
5	Sapa	S/R	Fr	Repaired	3/0	Brick
6	Kim Dung Doanh Nghiep Tu Nhan	S/R	Fr	Repaired	5/0	Brick
7	Apartment	S/R	Fr	Repaired	3/0	Brick
8	Xuong,Kimdo,Lotus Gallery,Jazz Club	S	Fr	Repaired	2/0	Brick
9	Unknown	R	Fr	Repaired	4/0	Brick
10	Sea Bank	O	Mo	Not	7/0	RC
11	Bach Bang	S	Po	-	7/0	RC
12	NHG	S/R	Am	Repaired	5/0	RC
13	Rex Hotel	H	Am	Repaired	5/0	RC
14	Saigon Railway	O	-	-	3/0	RC
15	Saigon Hospital	S/R	-	-	3/0	RC
16	Sai Gon Center Building	S/O	Mo	-	-	RC
17	Saigon Tax Trade Center	S	Fr	Repaired	4/0	RC

Legend [Usage] R: resident, S: shop, O: office, H: hotel, T: theatre, cinema
[Construction period] Fr: French period (1850-1929), Wa: was against French (1930-1959), Am: war against America (1960-1975), Po: post war (1976 - 1900), Mo: modern period (1991-)
Source: Data abstracted from the NJPT Study (HCMC UMRT Line1 Building Investigation Report), and revised and edited partly by the JST.

Table 5.24 Current situation of the project site

Item		Content
Title of the study		Preparatory Survey on Ben Thanh Central Station Project in Ho Chi Minh City, Viet Nam
Social environ-ment	Local resident (residents/ opinions on the project, etc.)	The project is sited in the center of District 1, where many government offices, exclusive hotels, shops, etc. are densely located. The site has high concentrations of citizens and urban functions, but its road network and other infrastructure are poorly improved, and it results the problems such as traffic congestion. Consequently, there is a rising need to develop the station square, the access roads, the underground pedestrian way, etc. together with the development of the central junction station for the planned UMRT (Line 1, 2, 3a, and 4).
	Land use (urban, rural, relic, landscape, hospital, etc.)	The buildings in the area around the project site are used as house mixed with store, hotel, office, hospital, etc. In the north of the project site, there is Ben Thanh Market, and in the center of the project site there is the Quach Thi Trang Roundabout (where the statue of General Tran Nguyen Han is standing in

		the middle). The Office of Ho Chi Minh City People Committee, and the Opera House (two beautiful structures built in the French colonial period) are a little far from the project site in the east. And in the south, there is the Saigon General Hospital.
	Economy, transportation (commerce, agriculture, fishery, industrial zone, bus terminal, etc.)	Around the project site, there are Ben Thanh Market, and many stores, hotels, recreation facilities, etc. that attract not only citizens but also foreign visitors. In the south of the Quach Thi Trang Roundabout, there is the largest scale inner-city bus terminal in the City which is under relocation to make land for the on-going UMRT Line1 Project.
Natural environ-ment	Topography, geology (land with steep slope, soft ground, land slide, fault, etc.)	The project is sited on the flat land with no slope and with average altitude of about 2m. Its soft ground is found commonly in the basin of Saigon River. Ground water level is generally found at about 2 m of depth from the ground surface. A number of hotels are using water from the wells in substitute for piped water when there is suspension of piped water supply. It needs to pay attention on the decline of ground water level, and the inequitable ground subsidence when carrying out the soil works in this area.
	Precious plants and animals, their habitat (natural park, habitat of specified species, etc.)	Surrounding areas of the project site have been urbanized since long time ago, and are occupied mainly by many houses, stores, business facilities, etc. Natural environment of the areas is strongly affected by human activities, and is not suitable for natural plants and animals to inhabitant.
Pollution	Complaint raising situation (kinds of pollution which are concerned by the public)	There are usually heavy traffic flows consisted of buses, cars, motorbikes, etc. on the roads surrounding the project site. Air pollution, excessive noise, traffic accident, etc. are the most concerned problems in the City. In addition, it is high possibility for soil excavation works in Ho Chi Minh City to cause impacts to the adjacent buildings. Therefore, in this Project, it needs to consider the application of proper construction methods proposed in the existing EIA reports, as described in Table5.27.
	Implementation of counter-measures (institutional measure, assistance, etc.)	Ho Chi Minh City PC is trying to promote the use of mass transportation with aim to reduce traffic congestion, traffic accident, air pollution, excessive noise in the City.
Other special mentions		Drainage system in the City is poorly developed, and cannot function effectively due to the improperly-disposed garbage. Therefore, inundations are occurred in many places in the City when there is heavy rain.

2) Confirmation of environmental impacts

(1) Extents of environmental impacts (checklist)

Table 5.25 shows the identified environmental items that should be concerned in the project, referring to the JICA Environmental Checklist (Railway Sector).

Table 5.25 Initial environmental checklist (as of the end of November 2011)

Major checked items	Check results
1: Permits, explanation	
(1) EIA and environmental permits	
(a) Have EIA reports been already prepared in official process? (b) Have EIA reports been approved by authorities of the host country's government? (c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? (d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	(a) EIA reports for HCMC UMRT Line 1 and Line 2 have been already prepared and approved. EIA report for the Project has not been prepared yet. (b) EIA report for UMRT Line 1 has been prepared by a consultant entrusted by Ho Chi Minh City PC, and it has been approved in November 2006 by MONRE (Ministry of Natural Resources and Environment). EIA report for UMRT Line 2 has been prepared during F/S carried out by ADB, and it has been approved in May 2009 by Ho Chi Minh PC Department of Natural Resources and Environment (DONRE) (c) EIA report for the Project is expected to be prepared during the next coming studies. If conditions are imposed on the approval of EIA report, these conditions should be met during the next coming studies. (d) Generally in Viet Nam, only the submission and approval of the EIA report is required for a development project. There is no requirement for obtaining other environmental permit.
(2) Explanation to the local stakeholders	
(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders? (b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?	(a) According to Viet Nam regulations, disclosure of summary of the EIA report is obligatory, but public consultation meeting is organized only when there is requirement from the people's committee(s) of commune affected by the project. In this project, MAUR is to take initiative in organizing the meetings with local stakeholders with supports from the JICA Study Team. (b) Comments raised in the local stakeholder meetings or public consultation meetings will be reflected in the project planning.
(3) Examination of alternatives	
(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) In this Preparatory Survey, several alternatives on construction method for the crossing section of Line 1 and Line 4 under Le Loi Street, and phasing of construction are examined. Environmental and social considerations are taken into account in the examination of these alternatives (See Section 5.2.1 Examination of alternatives).
2 : Pollution control	
(1) Water quality	
(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas? (b) Do effluents from the station and the shopping mall comply with the country's effluent standards and ambient water quality	(a) In the project site, there will be no cutting or filling that expose topsoil during construction phase. Therefore, it is anticipated that possibility of topsoil runoff will be negligible, and impact to surface water quality in the downstream is considered negligible. (b) In operation phase, waste water generated from the station and the shopping mall should be estimated, and appropriately treated in accordance with Vietnam regulations and standards on

Major checked items	Check results
standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	waste water.
(2) Wastes	
(a) Are wastes generated from the station and shopping mall, properly treated and disposed of in accordance with the country's regulations?	(a) During construction phase, construction debris, and solid waste from worker camps should be properly treated as described in the following Table 5.27. In addition, a part of soil generated from the excavation work may not be reusable and should be properly treated as waste soil. In operation phase, waste generated from the station and shopping mall should also be properly collected, treated, and disposed by authorized company in accordance with Ho Chi Minh City regulations.
(3) Noise and vibration	
(a) Do noise and vibrations from the station and shopping mall (in construction phase and in operation phase) comply with the country's standards?	(a) In construction phase, noise and vibration will be generated from the operation of construction machinery, trucks, etc. It is necessary to take appropriate measures to mitigate impact of noise and vibration as shown in Table5.27. In operation phase, buildings located near by the project site may be affected by vibration generated by the moving train. Therefore, damages caused by vibration to these buildings should be properly monitored.
(4) Ground subsidence	
(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence? (especially in case of subways)	(a) Earth works such as excavation would lead to the decline of groundwater level and then subsidence of ground. As recommended in Table5.27, appropriate construction method, such as installation of watertight soil retaining walls, should be applied to avoid impact to groundwater. In addition, in operation phase, subsidence of buildings adjacent to the project site should be monitored.
3 : Natural environment	
(1) Protected areas	
(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) In the areas around the project site, there is not any protected area designated by Vietnam laws or international treaties and conventions.
(2) Ecosystem	
(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? (d) Are adequate protection measures taken to	(a) The project is sited in the center of a highly-urbanized metropolitan city, where there is not any primeval forest, tropical rain forest, ecologically valuable habitat. (b) The project site does not encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions (c) The project site is located in a densely-populated urban center which is not suitable for valuable species to inhabitant. (d) The project site is located in a densely-populated urban center which is not suitable for a migration route of wild

Major checked items	Check results
prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? (e) Is there a possibility that installation of station and shopping mall will have impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? (f) In cases the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	animals and domestic animals. (e) The project site is located in a densely-populated urban center where there is no large green area for wild animals to inhabitant. Impact to ecosystem is negligible. (f) The project does not aim to construct the railway but to develop an underground station and shopping mall. Impact to natural environment is negligible.
3) Hydrology	
(a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a) Earth works such as excavation may partly affect groundwater level. Impact to groundwater movement and water flows of Sai Gon River and Dau Hu Canal is now under confirming. According to staff in charge of HCM PC DONRE, HCM University of Technology is carrying out a study on groundwater in the area around Ben Thanh Market. In the Preparatory Survey, information on the above-mentioned study and other relevant information had been collected partly. Thus, it needs to carry out further detailed examination on impacts caused by earth works to groundwater in the next stage of the Project.
(4) Topography and geology	
(a) Is there a soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? (b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? (c) Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	(a) The project is sited in the flat area, therefore occurrence of slope failure or landslide is not expected. (b) The project is sited in the flat area, therefore occurrence of slope failure or landslide is not expected. (c) Soil runoff from the waste soil dumping site may be expected. It needs to introduce appropriate measures to prevent this soil runoff.
4 : Social environment	
(1) Resettlement	
(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compensation with full replacement costs,	(a) The project will use only the underground space of public lands (Quach Thi Trang roundabout, September 23rd Park, Le Loi Street) where there is not any house, store, shop, etc. As described in the EIA report of UMRT Line 1, land acquisition and resettlement are not required for the construction of Ben Thanh Station. The Study Team also carried out field reconnaissance surveys, and confirmed that land acquisition and resettlement are not required for the Project. In order to make land for the on-going UMRT Line 1 Project,

Major checked items	Check results
restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Are the compensations going to be paid prior to the resettlement? (e) Are the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Are any plans developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	the bus terminal in front of Ben Thanh Market, and its attached gasoline stand, ticket counter, shop located inside the bus terminal are being relocated to the site in the western area of the September 23rd Park. According to person in charge in DOT, construction of the new bus terminal facilities is going to start in December 2011 and will be completed in about March 2012. Small shops in the existing bus terminal will be relocated to the new terminal in about March 2012. Relocation of these shops shall be followed up during the implementation of the Project. In addition, no any street stall has been found in the project site during the field surveys carried by the Study Team.
(2) Living and livelihood	
(a) Where railways are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts? (b) Is there any possibility that the project will adversely affect the living conditions of inhabitants other than the affected inhabitants? Are adequate measures considered to reduce the impacts, if necessary? (c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to public health, if necessary? (d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., by causing increases in traffic congestion and traffic accidents)?	(a) The Project has aim to contribute to the smooth transfer between the railway and other transportation means, such as to mitigate congestion of buses which is the sole mean of public transportation in the City. Therefore, basically the Project will not cause adverse impact to existing means of transportation. In addition, house, store, shop are not found exist in the project site, thus alteration of existing land uses, changes in sources of livelihood, or unemployment, etc. are not expected. (b) The Project is expected to contribute to improve citizen's accessibility to Ben Thanh area. Adverse impact to other residents is not anticipated. (c) During construction phase, it is anticipated that a considerable number of temporary construction workers will come to the project site. Therefore, it needs to carry out sanitary health education to workers, and measures to prevent spread of infectious diseases such as HIV/AIDS, as recommended in Table5.27. d) During construction phase, a part of roads around the project site may be temporarily blocked and cause traffic congestion at some sections. In addition, accidents accompanied with excavation works, construction machinery, fall down from high places, etc. may occur. Therefore, it needs to implement accident prevention measures as recommended in Table5.27. (e) Underground station and shopping mall are expected not cause impedance to traffic and movement of people on ground. It is expected that accessibility to the buildings near by the project site will be improved with the use of the underground pathways. Construction work will cause adverse impacts to

Major checked items	Check results
(e) Is there any possibility that the station and shopping mall will impede the movement of inhabitants? (f) Is there any possibility that structures associated with station and shopping mall will cause a sun shading and radio interference?	residents in the surrounding areas, due to the removal of electric poles, electric cables, water supply pipes, drainage pipes. However, in operation phase, positive impacts such as improvement of accessibility to the urban center are expected. (f) The Project will utilize underground spaces, and will not cause impacts of sun shading or radio interference.
(3) Heritage	
(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a) In the north of the project site, there are Ben Thanh Market and apartment which are built in the French colonial period. In addition, there are statues in the center of the roundabout in front of Ben Thanh Market. In construction phase, it appears the need to temporarily remove these statues. In the UMRT Line 1 Project, persons in charge of HCM PC are being consulted on how to remove these statues appropriately. In this Preparatory Survey, discussions with relevant authorities will be continued to make agreement on the issue. Furthermore, with respect to the impacts to the surrounding buildings such as Ben Thanh Market, French apartment, etc., basic investigation of the buildings located near by the station and railway, and survey on maintenance conditions of these buildings have been carried out under the D/D Study of the UMRT Line 1 Project. In this Preparatory Survey, results of the investigation and survey mentioned above will be reviewed, and proper mitigation measures will be recommended in case that significant impacts caused by the Project to these establishments are identified. Besides, it will need to take proper actions in accordance with relevant Vietnam regulations if archaeologically-valuable remains are found during the excavation works.
(4) Landscape	
(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)The Project aims mainly to develop the underground facilities, and therefore, structures to be constructed on land surface are limited to small-scaled entrances/exits, ventilation towers, and atriums, These on-land structures will be designed in harmonization with surrounding landscape and in accordance with the architectural guideline which is being prepared by the City. In construction phase, it will need to relocate a number of trees along the sides of Le Loi Street (about 200 trees with 5m~30m of height). Relevant HCM City authorities should be consulted on the relocation of these trees. In addition, in operation phase, high trees may not be replanted in some sections of Le Loi Street, where the thickness of the ground is reduced to 2~3 meters due to the appearance of the underground shopping mall.
(5) Ethnic Minorities and Indigenous Peoples	
(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples? (b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources respected?	The Project is sited in the center of the urban area, and impact to culture and lifestyle of ethnic minorities and indigenous peoples is not expected.
(6) Working conditions	

Major checked items	Check results
(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials? (c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.? (d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?	(a) Contractors should be obligatory to perform construction works in accordance with Vietnam laws and regulations on working environment. Besides, it needs to monitor the contractors' work to ensure their compliance with Vietnam laws and regulations on working environment. Method of monitoring, identification of organization in charge of monitoring, and its feasibility should be examined in detail in the next coming studies.
5 : Others	
(1) Impacts during construction	
(a) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts? (b) Is there the need to remove the existing facilities on the ground or underground (such as electric pole, water supply pipe, sewage pipe, telephone cable)?	(a) In construction phase, it is expected that traffic congestion will be increased, and levels of air pollution, noise, vibration will also temporarily rise. Therefore, it needs to take measures to mitigate these impacts as recommended in Table5.27. (b) In construction phase, it needs to temporarily relocate or remove the Quach Thi Trang roundabout, the statues stood in the center of the roundabout, trees and electric poles along Le Loi Street, etc. In addition, it also needs to carry out survey on the underground water supply pipes, drainage pipes, electric cables, etc. and remove these underground existing utilities. In the UMRT Line 1 Project, relevant authorities are consulted on the relocation/removal of these items. In this Preparatory Survey, consultation will be continued in order to facilitate the relocation/ removal of these items in a proper manner.
(2) Monitoring	
(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? (b) What are the items, methods and frequencies of the monitoring program? (c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	In this Preparatory Survey, environmental considerations are limited at IEE level, and only main items of the monitoring plan are described. In the next coming stages of the Project, the EIA report, as well as the environmental monitoring program should be prepared..

Major checked items	Check results
6 : Note	
(1) Reference to Checklist of Other Sectors	
(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation). (b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	(a) Not available (b) Not available
(2) Note on Using Environmental Checklist	
(a) If necessary, the impacts to trans boundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as trans boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) Not available

(2) Environmental scoping (draft)

Table 5.26 shows main environmental items and assessments of impacts during each phase of construction, and operation. These assessments should be done in further detail in the next coming stages of the Project.

Table 5.26 Initial environmental scoping (draft)

No.	Environmental item	Assessment		Basis of assessment
		Con-struction	Opera-tion	
[Social environment]				
1	Involuntary resettlement	D	D	The Project will use only the underground space of public lands (roundabout, park, and road). Acquisition of private land, relocation of house, shop, etc. are not required.
2	Local economy such as employment and livelihood	B-	A+	Business activities of shops, hotels, factories, companies, etc. located close to the planned stations may be disturbed temporarily during construction phase. In operation phase, accessibility to the area will be improved and economic activities around the newly-constructed stations may become more active. However, in operation phase, it needs to take into consideration the coexistence of the underground shops and the small shops on the ground adjacent to the project site.
3	Land use and utilization of local resources	D	A+	In construction phase, impact to land use and local resources is not expected. In operation phase, it is anticipated that lands around the project site will be used in more effective manner.
4	Social capitals,	D	A+	In operation phase, land use in the urban center areas will

No.	Environmental item	Assessment		Basis of assessment
		Con-struction	Opera-tion	
	local organizations, such as authorities to make decisions			be more advanced. Positive impacts are expected because users of the railway, tourists, residents who run small business around the station, local residents, and people who use other means of transportation different to the railway, etc. will be more convenient in transportation.
5	Existing social infrastructures and services	B-	B+	In construction phase, it needs to relocate/ remove the statues, trees, electric poles and underground utilities such as water supply pipes, drainage pipes, electric cables, etc. In operation phase, the Project will contribute to the effective use of underground spaces in Ben Thanh area.
6	The poor, indigenous and ethnic people	D	D	The Project is sited in the center of the urban area, and impact to culture and lifestyle of ethnic minorities and indigenous peoples is not expected.
7	Misdistribution of benefit and damage	C-	C-	It is expected that the Project will not cause distribution of benefit and damage. However, it needs to confirm the impacts that may be caused by the underground shopping mall to the shops existing on ground during the consultation meetings with local stakeholders.
8	Cultural heritage	B-	B-	In construction phase, it needs to discuss with relevant authorities of HCM City on the temporary relocation of the statues in the roundabout in front of Ben Thanh Market. Besides, in both construction phase and operation phase, Ben Thanh Market and the apartment built in the French colonial period may be affected by vibration and inequitable ground subsidence.
9	Local conflict of interests	C-	C-	Results of the interview survey to railway users, local residents, etc. will be reflected during the Project planning, and therefore, conflict of interests between residents in the local area is not expected. However, it is expected that owners of the buildings adjacent to the project site may have conflicting opinions on the location of the pathways linking the station and shopping mall with the adjacent buildings, the stairs, the exits, etc. Therefore, it needs to organize meetings and to make consensus among the local stakeholders on this issue.
10	Water usage or water rights and rights of common	D	D	Not available.
11	Sanitation	C-	D	In construction phase, sanitary condition around the project site may be temporarily deteriorated. In operation phase, adverse impact to sanitation is not expected.
12	Hazards (risk), infectious diseases such as HIV/AIDS	B-	D	During construction phase, it is anticipated that a considerable number of temporary construction workers will come to the project site and cause the spread of infectious diseases such as HIV/AIDS. Therefore, it needs to implement appropriate counter-measures as recommended in Table5.27.

No.	Environmental item	Assessment		Basis of assessment
		Con-struction	Opera-tion	
[Natural environment]				
13	Topography and geographical features	D	D	The project site is located on the flat ground, and therefore, the change of topological or geographical features of the area is not anticipated.
14	Soil erosion	C-	D	Soil runoff from the disposal sites of waste soils generated from the excavation works is expected, and therefore, it needs to implement prevention measures as recommended in Table5.27.
15	Groundwater	A-	B-	In construction phase, excavation works may cause decline of groundwater level. It needs to implement measures as recommended in Table5.27 to avoid impact to groundwater level.
16	Hydrological situation	D	D	Impact to hydrological situation is not expected
17	Coastal zone (mangroves, coral reefs, tidal flats, etc.)	D	D	The project site is far from the seashore/ coastal zone, and impact to seashore/ coastal zone is not expected.
18	Flora, fauna and biodiversity	B-	D	The Project is sited in the center of urban area, and it will not cause affect to wild animals and plants, and ecosystem. However, in construction phase, it needs to temporarily relocate a number of trees along the sides of Le Loi Street (about 200 trees with 5m~30m of height).
19	Meteorology	D	D	Impact caused by the Project to meteorology is expected negligible.
20	Landscape	B-	B-	In construction phase, landscape of Le Loi Street may be damaged due to the relocation of the trees (5m~30m of height) along the sides of this street. In operation phase, high trees may not be replanted in some sections of Le Loi Street, due to the appearance of the underground shopping mall and the thickness of the ground is reduced to 2~3 meters.
21	Global warming	D	B-	In operation phase, the Project is expected to contribute to the improvement of traffic congestion in the area around the project site, and then lead to the reduction of exhausted gas from vehicles and motorbikes. However, adverse impacts caused by heat generated from the station, underground concourse, shopping mall, etc. are expected.
[Pollution]				
22	Air pollution	B-	B+	In construction phase, it is anticipated that concentrations of dust and exhausted gas will increase temporarily, due to traffic congestion, earth works, and the operation of construction machinery. In operation phase, the Project is expected to contribute to the mitigation of traffic congestions, and reduction of air pollution.
23	Water pollution	C-	B-	In both construction phase and operation phase, waste water generated from the station and underground shopping mall will be discharged to the existing sewerage system of the City. Relevant authorities of

No.	Environmental item	Assessment		Basis of assessment
		Con-struction	Opera-tion	
				HCM PC are being consulted on the connection (volume of waste water, location of connection, number of connections, etc.) with the existing sewerage system. However, it needs to carry out monitoring of water quality of water courses surrounding the Project site to ensure that they are not affected by the Project operation. .
24	Soil contamination	D	D	The Project will not use poisonous chemicals, and therefore, soil contamination is not expected.
25	Waste (including waste soil)	B-	C-	In construction phase, generation of construction debris and solid wastes from the worker camps is expected. In addition, a part of soil generated from the excavation works may not be reusable and should be treated as waste soil. As described in the EIA report for the UMRT Line 2 Project, there is a plan to use excavated soil to fill in low grounds in Cu Chi District in the north of Ho Chi Minh City. In this project, a similar disposal method may be introduced. Anyway, wastes should be properly collected, transported, and disposed by authorized company in accordance with relevant regulations issued by Ho Chi Minh City PC. In operation phase, it needs to follow up the works of the company who is entrusted to collect, treat, and dispose wastes generated from the station and shopping mall, to ensure that these works are properly carried out y in accordance with Ho Chi Minh City regulations.
26	Noise and vibration	B-	B-	In construction phase, noise and vibration will be generated from the operation of construction machinery, trucks, etc. In operation phase, the railway may contribute to the reduction of motorbike and vehicle traffic volume, and it is expected that noise level in the area will be decreased. However, in operation phase, buildings located near by the project site may be affected by vibration generated by the moving train, and therefore, it needs to monitor the damage condition of these buildings.
27	Ground subsidence	A-	B-	Earth works such as excavation would lead to the decline of groundwater level and then subsidence of ground. As recommended in Table5.27, appropriate construction method, such as installation of watertight soil retaining walls, should be applied to avoid impact to groundwater. In addition, in operation phase, subsidence of buildings adjacent to the project site should be monitored.
28	Offensive odor	D	D	There is no project component or activity that may cause offensive odor.
29	Bottom sediment	D	D	The project site is flat and far (more than 700 m) from the river and canal. Impact of bottom sediment is negligible
30	Accidents, traffic congestion	B-	B-	In construction phase, a part of roads around the project site may be temporarily blocked, and it may cause traffic congestion at some sections. In addition, accidents accompanied with excavation works, construction machinery, fall down from high places, etc. may occur.

No.	Environmental item	Assessment		Basis of assessment
		Con-struction	Opera-tion	
				In operation phase, fire may occur from the facilities that use electric power or gas, and accidents accompanied with flood may also occur when there is abnormal heavy rain. Therefore, it needs to carefully examine fire and flood prevention measures during the phases of planning, design and construction of the Project.

注) *A+/- : Serious impact is expected (positive/negative).*
B+/- : Some impact is expected (positive/negative)
C+/- : Extent of impact (positive/negative) is unknown. Further examination would be necessary.
D : No or negligible impact is expected

(3) Impact mitigation measures

Table5.27 shows environmental items which are assessed as serious negative impact (A-), or some negative impact (B-), or impact with unknown extent (C-) according to the initial scoping described in the previous section. Measures to mitigate impacts are also described in the table.

Table5.27 Potential negative impacts and relevant mitigation measures

No.	Negative impact	Mitigation measure
2	Local economy such as employment and livelihood	In order to mitigate impedance to business activities of stores, offices, hotels, etc., around the project site during construction phase, contractors should make traffic management plan which includes the items such as: schedule for operation of construction vehicles and machinery; identification of roads blocked by construction activities; covering of cut & cover sections with road deck plates; arrangement of detouring roads for pedestrians and vehicles; arrangement of signboards, signals, etc. to guide people on the detouring roads; deployment of personnel for traffic distribution direction; etc.
5	Existing social infrastructures and services	The relocation or removal of Quach Thi Trang Roundabout, statues, trees, electric poles, and underground utilities such as water supply pipes, sewerage pipes and electric cables should be carefully planned and properly implemented, under coordination with relevant authorities of HCM City PC.
8	Cultural heritage	In the UMRT Line 1 Project, relevant authorities of HCM City PC are being consulted on the relocation/removal of the statues stood in front of Ben Thanh Market. In the next phases of the Project, consultation shall be continued to facilitate these relocation/ removal in a proper manner. Furthermore, with respect to the impacts to the surrounding buildings such as Ben Thanh Market, French apartment, etc., basic investigation of the buildings located near by the station and railway, and survey on maintenance conditions of these buildings have been carried out under the D/D Study of the UMRT Line 1 Project. In this Preparatory Survey, results of the investigation and survey mentioned above will be reviewed, and proper mitigation measures will be recommended in case that significant impacts caused by the Project to these establishments are identified. Besides, it will need to take proper actions in accordance with relevant Vietnam regulations if archaeologically-valuable remains are found during the excavation works.
9	Local conflict of interests	The project owner (MAUR) should make efforts to organize local stakeholder meetings, disclose information on the Project, discuss with owners of the adjacent buildings, users/tenants of the buildings, etc. to promote consensus and

No.	Negative impact	Mitigation measure
		cooperation of local residents
11	Sanitation	Contractors should make sanitation management plan, and duly implement this plan. Particularly, sanitary facilities (trash bins, toilets, etc.) should be appropriately placed at construction sites, and staff in charge of sanitary management should be deployed appropriately at every construction site, etc.
12	Hazards (risk), infectious diseases such as HIV/AIDS	Contractors should duly implement measures to prevent working accidents, to carry out regular medical examinations for workers, education and instruction on sanitary health and infectious diseases. In case of necessary, education on sanitary health and HIV/AIDS prevention program should be implemented.
14	Soil erosion	The stockpiling, reuse, and disposal of excavated soils should be carefully examined. Excavated waste soils should be collected and disposed by authorized company in accordance with HCM City PC regulations. However, contractors should monitor the process of waste soil transportation and disposal to ensure that soils are disposed properly in accordance with the contract. Contractors should also follow up the tasks of soil disposal to ensure that the sites for temporary storage of excavated soils, and the sites for disposing waste soils are properly managed.
15	Groundwater	In advance to the commencement of construction, it needs to carry out survey on groundwater level, to estimate impacts that may be caused by the excavation works to groundwater level, and examine measures to avoid or mitigate these impacts. In construction phase, in order to avoid impact to groundwater in the area surrounding the project site, it should apply appropriate construction method such as the use of soil retaining walls with high impermeability or installation of waterproof walls until the deep impermissible layer. In addition, during construction phase, it should carry out the continuous monitoring as recommended in the EIA report for UMRT Line 1. In operation phase, groundwater level and ground subsidence in the areas surrounding the project site should be periodically monitored.
18	Flora, fauna and biodiversity	Contractors should co-work with agency in charge of management of parks and green trees under Department of Transportation of HCM City PC to appropriately relocate / remove trees along the sides of Le Loi Street.
20	Landscape	Contractors should co-work with agency in charge of management of parks and green trees under Department of Transportation of HCM City PC to appropriately relocate / remove trees along the sides of Le Loi Street.
22	Air pollution	In construction phase, contractors should implement measures to reduce impacts of dust and exhausted gases , such as: build temporary walls around the construction sites; use construction equipment and vehicles which comply with the latest regulations on exhaust gas control; periodically inspect and maintain construction equipment and vehicles; periodically clean and water the project sites; use cover sheets for trucks carrying soil; etc.
23	Water pollution	In construction phase, waste water generated from construction sites should not be discharged directly to drainage system or surrounding surface water bodies. Waste water should be settled and preliminarily treated before discharged, in accordance with Vietnam standards on waste water. Contractors should make sanitation management plan for construction sites, and duly implement this plan. Particularly, sanitary facilities (trash bins, toilets, etc.) should be appropriately placed at construction sites, and staff in charge of sanitary management should be deployed appropriately at every construction site, etc. In operation phase, waste water generated from the station and shopping mall, etc. should be collected and discharged to the sewerage system of the City. And water quality of water courses around the Project site should be periodically monitored.
25	Waste	In construction phase, contractors should bear efforts to reduce construction

No.	Negative impact	Mitigation measure
	(including waste soil)	waste, and to separately collect, re-use these wastes. Excavated soils should be utilized in filling in low grounds, or used as materials for the embankments, construction site developments, etc. Unusable construction wastes, garbage generated from worker camps, and waste soils should be properly collected, treated, and disposed by authorized company in accordance with HCM City regulations. As described in the EIA Report for the HCMC UMRT Line 2, the low lands in Cu Chi District in the north of HCMC are planned for dumping excavated waste soils. These lands may also be used for dumping excavated waste soils generated by the Project. In the next coming studies, impacts caused by transportation and disposal of these excavated waste soils should be assessed, and mitigation measures as well as monitoring program should be examined in case of necessity. In operation phase, works of company who is entrusted to collect, treat, and dispose solid wastes generated from the station and shopping mall should be followed up to ensure that it is properly carried out in accordance with HCM City regulations.
26	Noise and vibration	In construction phase, contractors should bear efforts to reduce noise from the construction sites by installing the temporary walls around the construction sites, using construction machinery and vehicles which reduces noise and vibration. Construction machinery and vehicles should be periodically inspected and maintained to be able to use in best condition. Operation of vehicles should be properly managed to avoid concentration of vehicles at a same time and in the same place. Operators of construction machinery and drivers of vehicles transporting equipment and materials should be instructed and trained appropriately. In operation phase, it needs to confirm possibility of damages caused by vibration from the moving train to the buildings in the adjacent areas. In case of necessity, it should monitor the solidity and damage situation of the buildings around the project site which is sensitive to vibration.
27	Ground subsidence	In construction phase, in order to avoid impact to groundwater, it should apply proper construction method such as installation of waterproof soil retaining walls around the excavation site, etc. In addition, it should also carry out continuous monitoring on groundwater level, leakage of groundwater to underground structures, inequitable subsidence of buildings located closely to the project site. In operation phase, it should periodically monitor the groundwater level, the leakage of groundwater to underground structures, and the inequitable subsidence of buildings located closely to the project site.
30	Accidents, traffic congestion	In construction phase, 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. Drivers of vehicles bringing equipment and materials should be properly trained to ensure that they observe the driving rules, driving routes, etc. In addition, measures to prevent groundwater and rain water flowing into the underground facilities, counter-measures to flood accidents when there is abnormal heavy rain, and fire prevention measures should be appropriately considered and reflected in the phases of planning, design, and construction of facilities of the Project.

5.3 RECOMMENDED DRAFT OF TOR FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

5.3.1 Outline of TOR for environmental and social considerations

Ben Thanh Station is planned as a central station where there is a junction of HCMC UMRT Line 1, Line 2, Line 3a, and Line 4. EIA report for Line 1 has been approved by Ministry of Natural Resources and Environment (MONRE), and EIA report for Line 2 has been approved by Department of Natural Resources and Environment (DONRE) of HCM City PC. Assessment of impacts caused by the construction of Ben Thanh Station is briefly described in these EIA reports.

In this Project, construction of the underground square, shopping mall, pathways linking the platforms, and pathways linking the station with the nearby buildings are planned, in addition to the construction plan for Ben Thanh Station. The area (totally about 52,000 m^2) targeted by the Project includes the space beneath Le Loi Street which expands from Quach Thi Trang Roundabout to Opera House Station. The area covered by the Project is larger than the station area planned by UMRT Line 1 and Line 2. Therefore, according to Viet Nam regulation on EIA (Decree 29/2011/ND-CP issued on April 18, 2011, Article 15), it needs to prepare an EIA report and obtain its approval from competent authority.

In the next coming studies of the Project, an EIA report should be prepared in accordance with Vietnam regulations on EIA, and with “JICA Guidelines on Environmental and Social Considerations (April 2010)”.

Recommended TOR for the EIA Study to be carried out under the next coming studies is as following.

a) Review of existing documents and information, and carry out field reconnaissance survey:

Collect and review basic information on social environment and natural environment, EIA reports associated with HCMC UMRT projects. Carry out field reconnaissance surveys to grasp current conditions of social environment and natural environment.

Collect and analyze documents and information on legal framework and institution relating to EIA in Viet Nam.

b) Grasp of project contents

Examine the following project contents for preparing the EIA study for the Project.

- Project objective
- Location and structure of station platforms, underground shopping mall, passenger pathways, station facilities, etc. of Ben Thanh Station
- Facility operation & maintenance plan
- Facility construction plan and construction schedule

c) Studies in Viet Nam

Carry out the following studies and field surveys to confirm potential environmental issues identified in the scoping.

(1) Socio-economic condition, employment and livelihood
(2) Existing social infrastructure and services
(3) Local conflict of interest

(4) Public sanitation
(5) Condition of domestic water usage
(6) Survey on natural environment and social environment around the exploitation sites for construction materials (rock, sand, etc.)
(5) Hazards, risk, infectious diseases (HIV/AIDS)
(6) Soil erosion
(7) Groundwater movement, groundwater usage
(8) Flora, fauna, and ecosystem
(9) Landscape
(10) Air pollution
(11) Water pollution
(12) Solid waste
(13) Noise and vibration
(14) Ground subsidence
(15) Accident

d) Assessment of environmental impacts

Based on information collected in Japan and in Viet Nam during the field surveys, examine and analyze content and extent of environmental impacts that may be caused by the Project during construction phase and operation phase respectively.

e) Preparation of impact mitigation measures, environmental management program, and environmental monitoring program

Based on result of environmental impact assessment, examine mitigation measures for impacts which are expected to be significant. Content and method of mitigation measure, as well as time, cost, and institutional arrangement necessary for implementation of mitigation measures should also be examined and summarized in the environmental management program.

In addition, examine the environmental monitoring program to confirm the changes of environment conditions during construction phase and operation phase, and results of impact mitigation measures. Items to be monitored and monitoring method, frequency, site, as well as necessary budget and support institution should also be examined.

f) Stakeholder meeting

Method to organize the stakeholder meetings, and the corresponding time schedule, place, number of participants, questions and answers raised in the meetings, etc. should be described in the EIA report.

g) Preparation of the EIA report

Prepare an EIA report in line with Viet Nam regulations on EIA and JICA Guidelines on Environmental and Social Considerations (April 2010). The EIA report should have contents as instructed by Circular 26/2011/TT-BTNMT. And results of the stakeholder meetings should be included in the EIA report.

5.3.2 Environmental Management Program and Environmental Management Plan（EMP）

An Environmental Management Program shall be formulated in the stage of EIA study, as a part of the EIA Report to ensure the environmental commitments made at the EIA study are implemented in an efficient and effective manner. In addition, an Environmental Management Plan shall be formulated after the approval of the EIA Report (according to Article 22 of Decree 29/2011/ND-CP).

1）Design Phase Environmental Management Plan

<Preparation of the Design Phase Environmental Management Plan>

The Design Phase EMP is designed to ensure and assure the environmental protection and pollution prevention and control designs are able to comply with the approved Environmental Impact Assessment (EIA) Study report's recommendations, DONRE's requirements and conditions, as well as endorsed public comments on the Project. The Design Phase EMP will outline, *inter alia*, its objectives and the means to achieve these objectives as:

(a) Management framework of the Design Phase EMP;

(b) Project organization for the design activities, including the designation of responsibility for each design function and level;

(c) Works program for the design and the deliverables arising from the translation of EIA, DONRE and other requirements/commitments into the project design;

(d) Systematic design protocols; to increase efficiency in use of resources (i.e. materials and energy); minimize pollution from chosen materials/form of design; reduce impacts associated with the disposal of materials; encourage the recovery, reuse and recycling of materials; as well as minimize potential nuisances, such as, noise, smell and vibration, etc.;

(e) Scope and content of design environmental monitoring and audit, and duty of the design engineer;

(f) Design audit procedure and duty of an Independent Checker (Environmental);

(g) Systematic protocols to ensure all requirements are translated from the EIA process to design, contract and subsequent tendering documentation, with the aim to ensure the implementation of all the project's environmental requirements, in a coherent, consistent and timely manner;

(h) Protocol/procedures to deal with any environmental design changes and the necessary actions to achieve the required or enhanced project environmental performance, including the implementation of the environmental auditor's recommendations.

<Preparation of environmental auditing>

The audit procedure shall be prepared to validate compliance with the environmental protection conditions, and EIA process recommendations and requirements. The audit is required to confirm no resultant secondary or unforeseen or cumulative impacts arising due to the design or design changes, etc. has been introduced into the project implementation process.

<Documentation>

The reporting requirement and the frequency of reporting will be stated in the EMP. A Design Phase EMP report shall be prepared to conclude the environmental design work at the end of each audit period.

2）Construction Phase Environmental Management Plan

<Preparation of the Construction Phase Environmental Management Plan>

The Construction Phase EMP shall contain the following.

(a) Duties of the Environmental Team (ET) Leader, the Independent Checker (Environment) (ICE), Engineer's Representative and Contractor, in relation to the Project's environmental monitoring and audit requirements during construction;
(b) Information on the project organization and programming of construction activities;
(c) The project construction schedule and the necessary environmental monitoring and audit programme to track the environmental impacts;
(d) Traffic Management Plan
(e) Requirements for the review of pollution sources and working procedures in the event of non-compliance of the project's environmental performance criteria;
(f) Environmental monitoring protocols and their technical requirements;
(g) Environmental auditing procedures;
(h) Requirements for the documentation of environmental monitoring and audit data, and appropriate reporting procedures; and
(i) Complaint resolution procedures.

<Preparation of site surveillance plan>

The site surveillance plan shall be prepared as a means to assess and ensure the project's environmental protection and pollution control measures are in compliance with the construction contract specifications.

<Complaint procedure>

The complaint procedure shall be prepared with includes the following items.

(a) Log complaint and date of receipt onto the complaint database and inform the ICE immediately;
(b) Investigate the complaint to determine its validity, and to assess whether the source of the problem is due to project works;

(c) If a complaint is valid and due to project works, identify mitigation measures in consultation with the ICE;
(d) If mitigation measures are required, advise the Contractor accordingly;
(e) Review the Contractor's implementation of the identified and required mitigation measures, and the current situation;
(f) Undertake additional monitoring and audit to verify the complaint if necessary, and ensure that any valid reason for complaint does not recur through proposed amendments to work methods, procedures, machines and/or equipment, etc.
(h) Report the investigation results and the subsequent actions to the complainant; and
(i) Log a record of the complaint, investigation, the subsequent actions and the results in the monthly EMP reports.

<Rules for documentation>

All documentation shall be filed in a traceable and systematically manner. Site document, such as, monitoring field records, laboratory analysis records, meeting minutes, correspondences etc., shall be cross-referenced by the ET leader and be ready for inspection upon request. All Construction Phase EMP results and findings shall be documented in the Construction Phase EMP reports prepared by the ET and endorsed by ICE prior to disseminate to the MAUR and JICA.

The content and frequency of the EMP reporting shall be determined in the detail design stage.

3）Operation Phase Environmental Management Plan

<Clarification of an Environmental Policy>

The Operation Phase EMP shall include an Environmental Policy statement represents a commitment by the railway/station operation and management authority to carry out his activities in a sustainable manner and with the aim of protecting the environment.

<Preparation of the Operation Phase EMP>

The environmental protection conditions, including, all statutory limits for project operation, all EIA study recommendations and requirements, DONRE’s comments and any endorsed public comments related to the operation phase of the development project shall be clearly defined in the Operation Phase EMP. The various measures for implementation by the railway/station operation and management authority shall be in a tabulated format for easy reference.

<Recommendation on the environmental organization>

The Operation Phase EMP shall include the recommendation on environmental organization to be integrated into the railway/station operation and management authority, and the appropriate institutional arrangements in order to implement the EMP in an effective manner.

<Rule for Documentation>

The Operation Phase EMP shall include the rules for collection of information and preparation of reports, report submission frequency, etc. It shall also provide statement on the content and the appendices of the EMP reports.

5.3.3 Environmental Monitoring Plan (EMoP)

Table 5.28 describes items to be monitored, as well as its indicators, frequency, and sites, during the design phase, construction phase, and operation phase. However, contents of this table shall be reviewed and revised during the stages of EIA study and detail design.

Table 5.28 Environmental Monitoring Plan (draft)

Item	Indicators	Frequency			Site
		Design Phase	Construction Phase	Operation Phase	
Air ambient	SPM, CO, NO2, SO2, Carbohydrates, microclimate parameters	1 time 1day/time	4times/year 1day/time (during all construction phase)	4times/year 1day/time (during 2 years)	to be defined in F/S
Noise and vibration	Leq, L10, L90	1 time 1day/time	4times/year 1day/time (during all construction phase)	4times/year 1day/time (during 2 years)	to be defined in F/S
Ground water level	Ground water level	1 time 1day/time	All the time (during all construction phase)	All the time (during 2 years)	to be defined in F/S
Ground subsidence	Deformation of ground	1 time 1day/time	All the time (during all construction phase)	All the time (during 2 years)	to be defined in F/S
Surface water quality	Temperature, pH, Turbidity, EC, BOD, COD, DO, Total-P, Total-N, Oil-grease, Coliform	1 time 1day/time	3times/year 1day/time (during all construction phase)	6times/year 1day/time (during 2 years)	to be defined in F/S

5.3.4 Estimated cost, financial sources, and implementation framework for environmental and social considerations

After the Preparatory Survey, and before submission for approval of the investment plan for the Project, it should carry out an EIA study and obtain the approval of the EIA Report in accordance with Vietnam regulations on EIA.

Recommended TOR for the EIA study for the Project was described in Section 5.3.1. It consists of the following main components.

(1) Review of Vietnam's legal framework on EIA, existing documents and information, and carrying out field reconnaissance surveys
(2) Analysis of project contents
(3) Field surveys (local conflict of interest, piped water usage, groundwater movement, groundwater usage, air pollution, noise and vibration, ground subsidence, others)
(4) Examination of impacts (anticipation and assessment of impacts during design phase, construction phase, operation phase of the Project)
(5) Preparation of impact mitigation measures, environmental management program, environmental monitoring program
(6) Organization of local stakeholder consultation
(7) Preparation of the EIA report

Regarding the framework to carrying out the EIA study, it is a common practice in Vietnam under which a local environmental consultant is contracted to carry out the EIA study under the supervision of an international environmental expert. It is estimated that at least 4 months will be needed to prepare an EIA report for the Project and obtain its approval. Consequently, it is estimated that at least 16M/M of local personnel and 5 million Yen will be needed for this EIA report preparation and approval.

5.4 ESTIMATED COST, FINANCIAL SOURCES, AND IMPLEMENTATION FRAMEWORK FOR ENVIRONMENTAL AND SOCIAL CONSIDERATIONS FOR THE OVERALL PROJECT

In order to ensure the effective implementation of environmental and social considerations, the following agencies/organizations should actively involve.

- International Cooperation Agency（JICA）
- Hochiminh City People’s Committee (PC), Department of Natural Resources and Environment, (HCMC DONRE), and Environment Division of Ben Thanh District People’s Committee (DPC)
- MAUR
- Design / Construction Supervision Consultant
- Contractors
- Independent Environmental Consultant

Proposed organizational chart for implementing environmental and social considerations for the Project is shown in Figure 5.5.

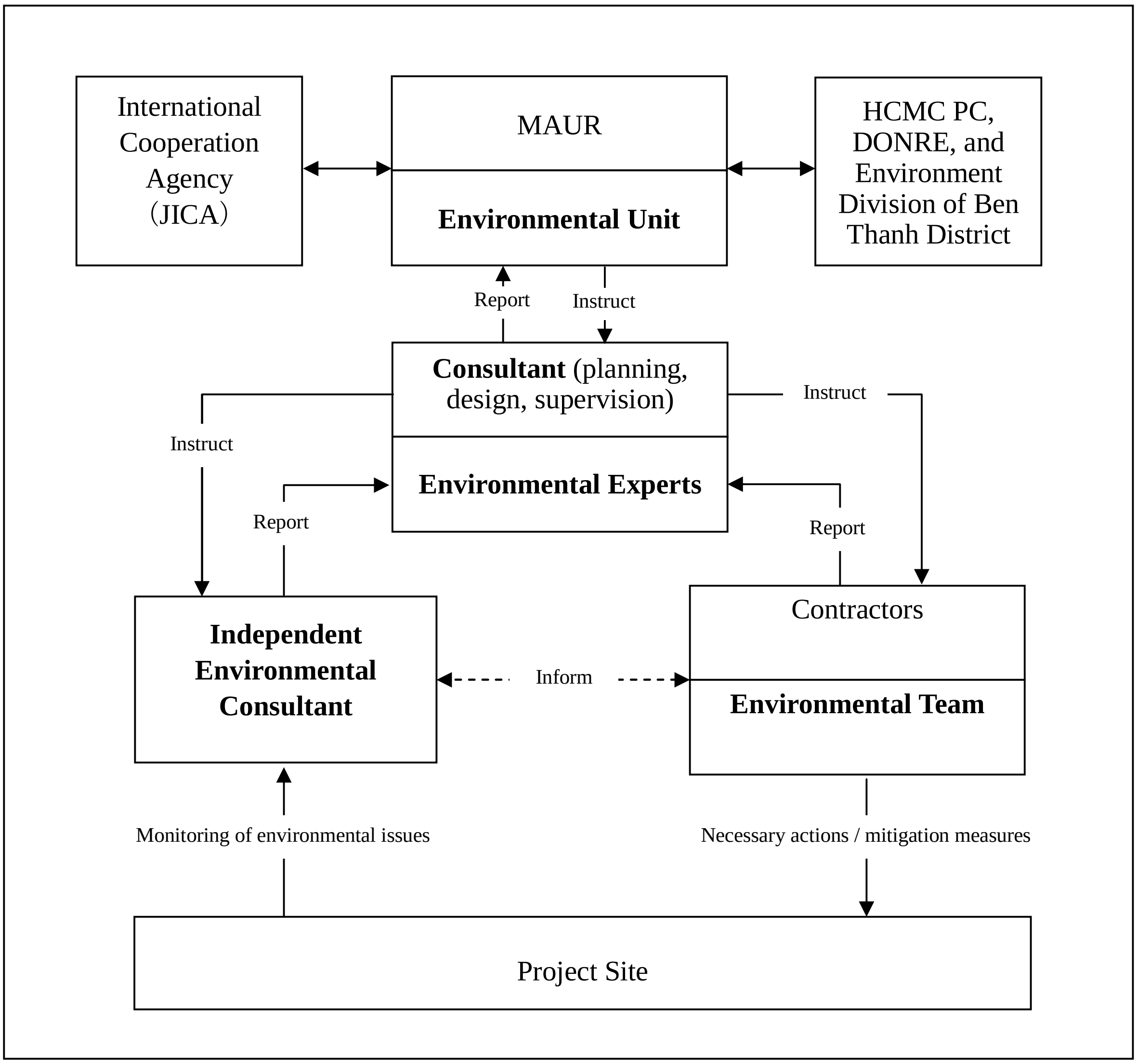


Figure 5.5 Organizational chart for implementing environmental and social considerations (design phase and construction phase)

Table 5.29 describes main functions of each agency/organization involved.

Table 5.29 Main functions of agency/organization involving in the implementation of environmental and social considerations

Agency/organization	Main functions
Hochiminh City PC	- Instruct DONRE, Environment Division of Ben Thanh District, and other relevant agencies in implementing the Project.
HCMC DONRE and Environment Division of Ben Thanh DPC	- Coordinate between relevant agencies, supervise the implementation of EMP - Collect and coordinate residents' opinions, and collaborate with consultant in responding to residents' complaints if any.

Agency/organization	Main functions
MAUR	- Taking role as Project implementing agency, have the ultimate responsibilty for environmental performance of the Project from the stages of project design and investment preparation. - In the stages of project design and investment preparation, supervise the preparation of EIA report, and submit the EIA report to eligible agency (DONRE) for approval. - After the approval of the EIA report, collaborate with the construction supervision consultant in supervising the implementation of EMP and EMoP. - Keep close communication with local agencies, local stakeholders, JICA, and other relevant entities, ensure them the full knowledge about the project progress, potential issues, and mitigation actions. - Listen and respond to stakeholders' concerns, suggestions, and demands for environmental and community protection. - Receive and review monitoring reports from construction supervision consultant and contractors, timely initiate necessary actions to the unexpected accidents, fires, etc.
Design / construction supervision consultant	- Take charge of ultimate supervision of all activities relating to environmental management of the Project. - In design phase, ensure the incorporation of environmental protection and impact mitigation into project planing and engineering design. - In construction phase, supervise the contractors' activities for environmental protection, and ensure that the requirements in the EMP and contract specifications are fully complied with.
Independent Environmental Consultant (selected through a bid, and work under a contract with construction supervision consultant)	- Supervise contractors' activities to ensure that they are complied with content of EMP and the construction contract. - Carry out monitoring of environmental changes, in order to be able to quickly discover unexpected accidents and work out appropriate measure to respond to these accidents. - In design stage, prepare training documents on environmental protection, guides on environmental management, etc. and carry out training programs to strengthen capacity in environmental management and supervision of relevant authorities and entities. - Collect local residents' opinions on environmental issues around the construction sites, and feed back them in the measures to avoid/mitigate adverse impacts to local environment. - Carry out regular site inspections, supervise non-compliance of

Agency/organization	Main functions
	environmental quality performance and the effectiveness of corrective measures. - Carry out regular monitoring of environmental changes around construction sites, and report to the construction supervision consultant. - Upon request by the construction supervision consultant when necessary, conduct public complaint investigation and assessment.
Contractors	- Strictly implement the impact mitigation measures listed in EMP. - Work within the scope of contractual requirements and other tender conditions, collaborate with the supervision consultants for mitigation implementation, site inspection, and any corrective actions instructed by the supervision consultants.

MAUR should establish an Environmental Unit under its organization, who will be in charge of a day-to-day environmental supervision and management for the Project, including coordination between stakeholders. Necessary budget for the Environmental Unit's activities should be included in MAUR's total budget. In principle, cost for preparation and approval of EIA report should also be paid by MAUR.

Generally, a design / construction supervision consultant will be contracted to prepare / carry out EMP and EMoP. In D/D stage, a design consultant may be entrusted to prepare an EMP and an EMoP. In construction phase, an independent environmental consultant may be entrusted by the construction supervision consultant to supervise the implementation of EMP and to implement EMoP. Necessary budget for supervision of EMP implementation and for implementation of EMoP should be included in the budget for consultancy contract.

Necessary budget for contractors to carry out activities relating to environmental protection should be included in the total construction contract cost.

CHAPTER 6 STUDY OF PROJECT SCHEME

In order to promote a modal shift toward public transportation and make more effective use of the city's valuable urban spaces, it is necessary to build facilities for highly convenient transfers, improve comfort and amenities in the area of Ben Thanh Station, and increase the power of this area to attract customers, as described above.

Meanwhile, there are limits to the ability of a public works project to achieve this alone, since integrated above-ground and underground development requires enormous investment and close collaboration with surrounding private facilities. Therefore, it is necessary to use a public-private partnership (PPP) scheme with role sharing between the public and private sectors in facility development in order to reduce the public financial burden and make use of private expertise, thereby promoting more attractive and efficient facility development as well as effective maintenance, management, and operation.

A PPP scheme is needed in this project for the following reasons.

- In conventional development of public facilities, the phases of planning, design, execution, maintenance & management, and operation have been individually implemented in many cases, and little consideration has been given to ultimate usability by the operator.
- Adoption of a PPP scheme makes it possible to reflect the operator's wishes starting at the initial stages of planning. This can enable the construction and operation of facilities that offer a high level of convenience and satisfaction to city residents, who are the facility users.
- Meanwhile, it is desirable for the station plaza and underground passageway to be developed as a public portion, since these have the characteristics of a transportation terminal facility.
- In order for public spaces such as the station plaza and underground passageway to provide a sense of continuity and unity with the commercial facilities to be owned by the PPP business operators, the interior design and outfitting should be completed by PPP business operators in an integrated manner; and after control of the public portions has been transferred to the public authorities, the comprehensive handling of overall maintenance and management should be consigned to the PPP business operators. This approach can support the kind of development, management, and operation that will contribute to a high level of quality and longevity for the facilities.

6.1 PUBLIC-PRIVATE DIVISION OF FACILITIES

6.1.1 Approach to Public-Private Division of Roles

We have considered the public and private handling of items [1] to [3] below with regard to the planned infrastructure facilities.

[1] Portion to be implemented in the UMRT Line 1 Ben Thanh Station Plan

[2] Portion of this project to be implemented with public investment

[3] Portion of this project to be implemented with private investment

In this division of roles, it is anticipated that the underground structural frame will basically be developed with public investment, while the interior spaces will be developed with private investment.

However, detailed consultations are needed regarding the allocation of services and funds between the public and private sectors in some areas; for example, coordination is needed regarding the public-private allocation of investment for aspects such as furnishings related to interior decoration of the underground mall. Therefore, at the present time, we have decided to handle this in terms of sensitivity analysis.

We have established the following basic aims for the public-private division of roles.

Regarding item [1] above:

- The metro portion will be treated as external to the present project.

Regarding items [2] and [3] above:

- The underground structural frame of the metro portion will basically be of the public sector.
- The underground commercial facilities will be allocated to the role of the private sector.
- It is thought that the underground station plaza and underground passageway will be allocated to the role of the public sector. However, to create a sense of unity in the underground mall as a whole, it is assumed that the development, management, and operation of the interior decoration of the underground mall, including the underground station plaza and underground passageway, will be allocated to the role of the private sector. (Following integrated development by the private sector of the interior decoration of the underground mall, including the underground station plaza and underground passageway, it is assumed that control of public portions will be transferred to the public authorities, while the public sector will commission the private sector on a long-term basis for the maintenance and management of those portions.)

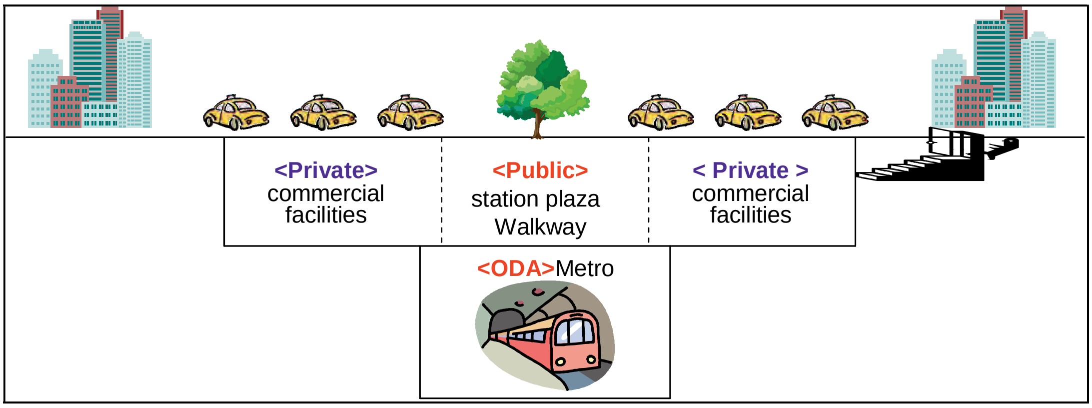


Figure 6.1 Diagram of Public-Private Division of Roles

6.1.2 Public-Private Division of Roles

Considering the above, based on plan content at the present time with respect to the division of roles between the public and private sectors, we have identified a private investment portion, a public investment portion, and a portion where allocation is needed between the public and private sectors. The plan view and cross-sectional view are presented in Figures 6.2 and 6.3.

Table 6.1 shows the division of roles between the public and private sectors in line with the actual process.

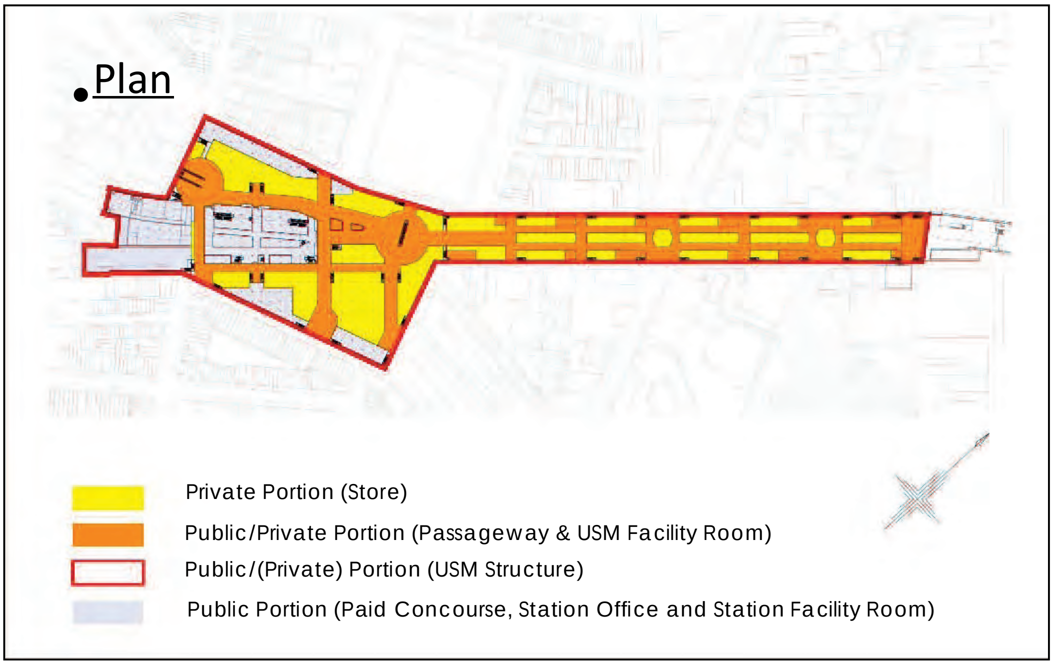


Figure 6.2 Public-Private Division of Roles (Plan View)

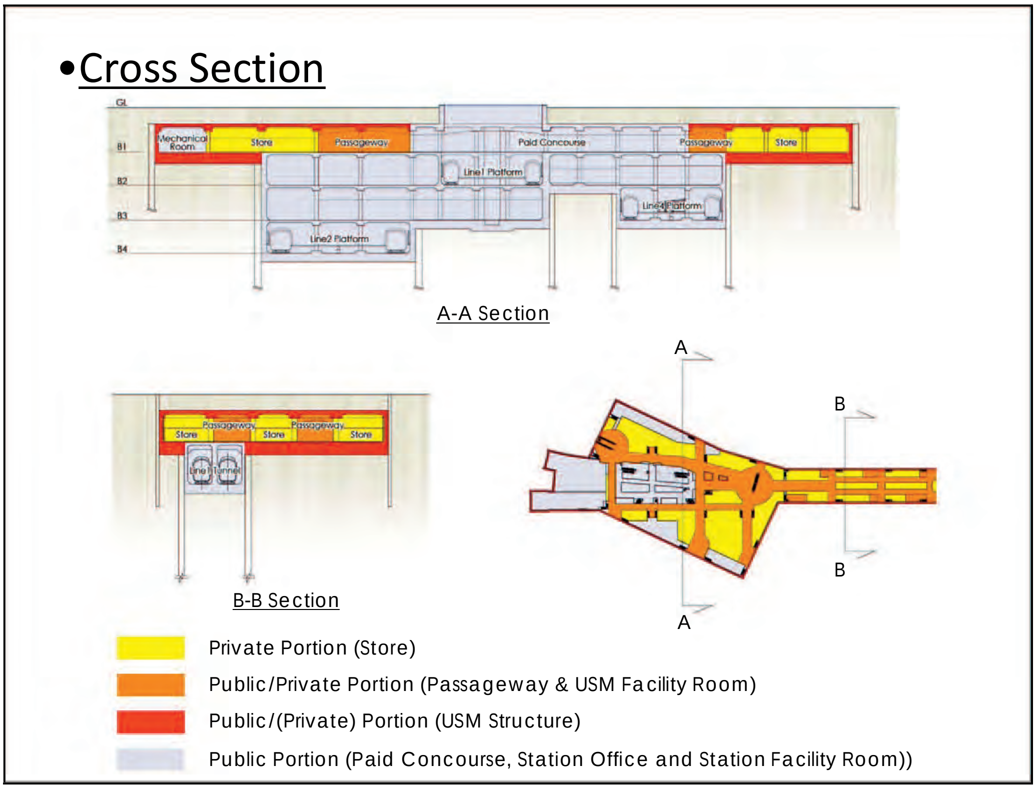


Figure 6.3 Public-Private Division of Roles (Cross-Sectional View)

Table 6.1 Public-Private Division of Roles

Facilities		Planning and Baseline design	FS	Obtaining Approval	Obtaining Certificate of Land use Right	Finance	Technical design	Construction	Maintenance and Operation
Architecture	**Store**	Public	Private	Private	Private	Private	Private	Private	Private
	Passageway And Underground Plaza	Public	Public	Public	Public	Public／ODA／Private	Public／Private	Public／Private	Private (consignment)
Facility	**USM Facility**	Public	Public	Public	Public	Public／ODA／Private	Public／Private	Public／Private	Private (consignment)
Structure	**USM Structure**	Public	Public	Public	Public	Public／ODA／(Private)	Public／(Private)	Public	Public
Metro station And Station Facility		Public	Public	Public	Public	Public／ODA	Public	Public	Public

6.1.3 Area and Project Cost of the Underground Mall

With respect to the area and cost of the underground mall, the figure below shows the results of our allocation of roles between the public and private sectors, based on the results of studies in Chapter 4 (Project Implementation Plan). The station portion is not included.

Table 6.2 Public-Private Division of Roles: Area and Cost

USM (Area)

Description		Sub Total(m2)		
Private Protion	Store	18,127	18,127	40%
Public Protion	Passageway	20,181	21,447	48%
	Rest Room	269		
	Stairs	997		
Private/Public Shared Protion	Disaster Prevention Room	260	5,443	12%
	Machinary Room	4,210		
	Electric Room	974		
Total		45,017	45,017	100%

USM (Cost)

Description		Sub Total(in mil. VND)	
Private Protion	Architecture	1,082,415	16%
Public Protion	Civil Structures	3,831,453	56%
Private/Public Shared Protion	Facility	1,951,921	28%
Total		6,865,789	100%

As for the division of the construction cost among Architecture, Civil Structure, and Facility shown in above table, that detail is described in the following table.

Table 6.3 Detail Division of Construction Cost

Item	Construction Work	Detail
Architecture	Interior Work	Underground Passageway & Plaza, Staircase, Toilet, Disaster Prevention Room, Facility Room
	Atrium Work	Interior & Exterior Work, Structure of Atrium
	Entrance Work	Interior & Exterior Work of Entrance, Roof
	Elevator Shaft Work	
	Ventilation Tower Work	Exterior Work above Grade
Civil Structures	Preparation & General Items	
	Traffic Diversion	
	Diaphragm Walls	
	Excavation	Removal of Road Pavement, Excavation, Installation of King Post
	Concrete for Structure	
	Backfilling	Backfilling, Reinstatement of Road Surfaces
Facility	Electrical System	Receiving and Transformer Facilities, Electrical Generators, Lighting Equipment, Disaster Prevention Equipment, etc.
	Air Conditioning & Ventilation System	Heat Source Machine, Air Conditioning & Ventilation Equipment, etc.
	Water Supply & Drainage System	Water supply Equipment, Hot Water Equipment, Wastewater Equipment, Fire Extinguishing Equipment, etc.
	Lift & Escalator	

6.2 IMPLEMENTATION PROGRAM

6.2.1 Setting up Options for Implementation Program

To implement the USM project in coordination with the UMRT construction project, possibility of ODA loan procurement and risk and responsibility allocation between the public and the private sector are analyzed. When ODA loan procurement is expected, its necessity and appropriateness will be examined.

The following three options as illustrated in the following Figure6.2 are assumed:

Option 1: BOT/PPP Route
Option 2: MAUR Owner Route
Option 3: Public Company Owner Option

1) Option 1: BOT/PPP Route

This option is to implement the USM project on the basis of current BOT and PPP legal framework. HPC is to separate the project from the UMRT Line 1project and implement this USM project independently as a BOT or PPP project. Project implementer is the private sector and the public sector will hold a position to extend public support to the project. This option is to be implemented on the basis of the on-going BOT law (Decree 108). Due to its project size (over VND 1.5 trillion), Prime Minister’s approval would be necessary.

2) Option 2: MAUR Owner Route

As the USM owner, MAUR will construct the structure of the USM utilizing ODA fund through HPC and give the SPC established by the private sector the usage right of this structure (underground space). In turn the SPC, based on this special usage right, will construct the private sector portion of the USM and operate and maintain the total USM. MAUR and SPC will enter into a usage or master leasing contact. This option is to be implemented on the basis of the procedure applied for normal large scale urban development project. However, considering its importance of the project, in-principle approval by HPC and the Prime Minister would be necessary for both basic investigation and implementation of F/S for the project (Please refer Chapter 2 for more detailed procedure).

3) Option 3: Public Company Owner Route

HPC will establish 100% owned company for the project. The company will be managed by the management board or management committee composed of major stakeholders of the USM project, namely DPA, DOT, DPI, MOF and so on. This public company will construct the structure of the USM utilizing ODA fund through HPC and give the SPC established by the private sector the usage right of this structure (underground space). In turn the SPC, based on this special usage right, will construct the private sector portion of the USM and operate and maintain the total USM. The public company and the SPC will enter into a usage or master leasing contract. Its implementation procedure would be very similar to that of the Option 2 described above.

This public company will plan the commercial development along the UMRT Line 1 corridor without limiting itself to the USM project only, and promote the development on the basis of the partnership with the private sector. This company will promote the commercial development along other UMRT lines by applying similar development model as experienced with the development of UMRT Line 1.

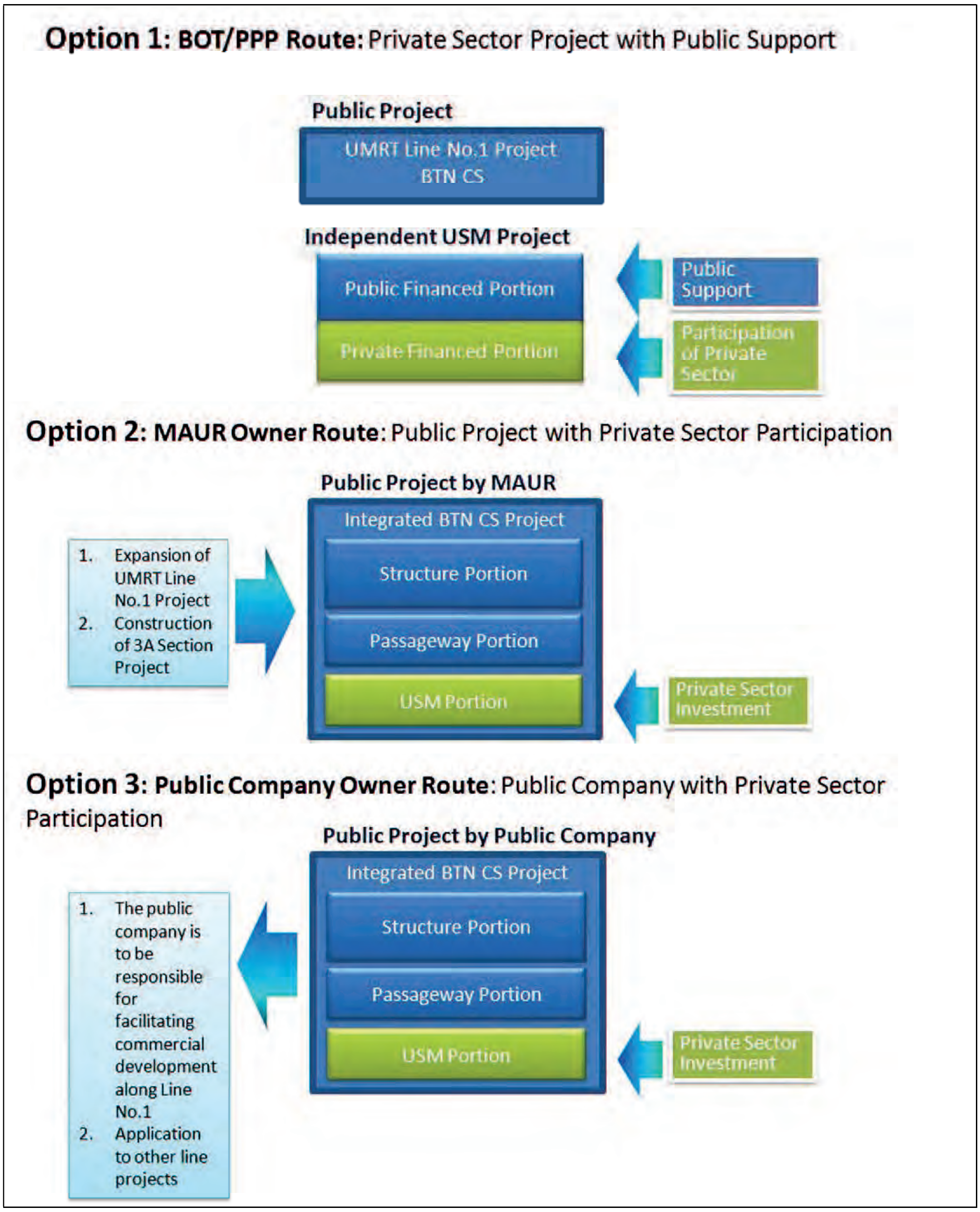


Figure 6.2 Implementation Options

6.2.2 Evaluation of Options

These three options were evaluated in the following aspects:

① Applicability for current legal framework
② Project implementation
③ Financing
④ Private sector participation

Result of the evaluation is shown in the Table 6.4. Based on the preliminary financial analysis of the project, if the project implementation is based on the current BOT and PPP legal framework, amount of the public support will exceed 50% of the total project cost, which is not consistent with the limitation of public support stipulated in these legal framework. Therefore, Option 1 is not a feasible option when considering the current BOT/PPP legal framework.

There is no much difference between Option 2 and Option 3, but Option 3 may be evaluated higher in the following aspects: (1) Mission of the public company is limited to commercial development and easier for coordination since it will be managed by the board of major stakeholders of the USM project (DPA, DOT, DPI, MOF and so on), (2) It is feasible to plan and promote the commercial development along the all UMRT network of the HCM city in the future in terms of the city's future master plan, (3) Expertise and know how/ resources for the development could be accumulated and concentrated.

Table 6.4 Evaluation of Implementation Options

	Option 1 BOT/PPP Route	Option 2 MAUR Owner Route	Option 3 Public Co. Owner Route
1. Applicability for Current Legal Framework	- USM is not categorized as public service which is subject of BOT/PPP law and regulations - Amount of public support may become larger than the limit stipulated by law (e.g. Public support must be less than 49% of total project cost)	- Could implement within current legal framework of urban development and be treated as private investment	- Could implement within current legal framework of urban development and be treated as private investment - Could not create contradiction with the " railway mission" of UMAUR
	C	**B**	**A**
2. Project Implementation	- Integration is not necessary and simple to prepare two projects separately	- It may require more effort to integrate BTN CS project and USM project . It may require more adjustment with UMRT Line 1 project	- It may be able to separate the USM project from "railway project" as the public company is limited to promoting commercial development along the UMRT lines
	A	**B**	**B**
3. Financing	- Independent USM project may not be financed by ODA as it is viewed as a commercial project	- It is easier to procure ODA funding when structured as "public project"	- It is easier to procure ODA funding when structured as "public project"
	C	**A**	**A**
4. Private sector Participation	- Due to legal constraints, private sector investor may not be able to receive sufficient public support	- It is easier and less riskier for private sector to participate in "the portion of public project"	- It is easier and less riskier for private sector to participate in "the portion of public project"
	B	**A**	**A**

6.2.3 Implementation Scheme

For implementing the project, construction, operation and maintenance organization were examined in the following manner.

Figure 6.4 is implementation scheme to be applied for either Option 2 or Option 3. With either MAUR or the public company being the project owner will construct the structure of the USM utilizing the ODA fund through HPC and will give its usage right to the SPC based on either the usage contract or master leasing contract.

SPC, given the usage right of the underground space of the USM, will construct the underground shopping mall, passageway, plaza, etc and operate and maintain them, and generate its revenue by sub-leasing the space to the tenants. SPC will try to maximize the functionality of the USM space and the under-ground passageway as an integrated central station by coordinating with neighboring developers and land owners to let them share the cost and to promote inter connection with their premises. Maintenance of the public space such as the under-ground passageway of the USM and the facilities/equipments of the USM will be outsourced to SPC who will receive the fee from MAUR/ the public company or directly from HPC.

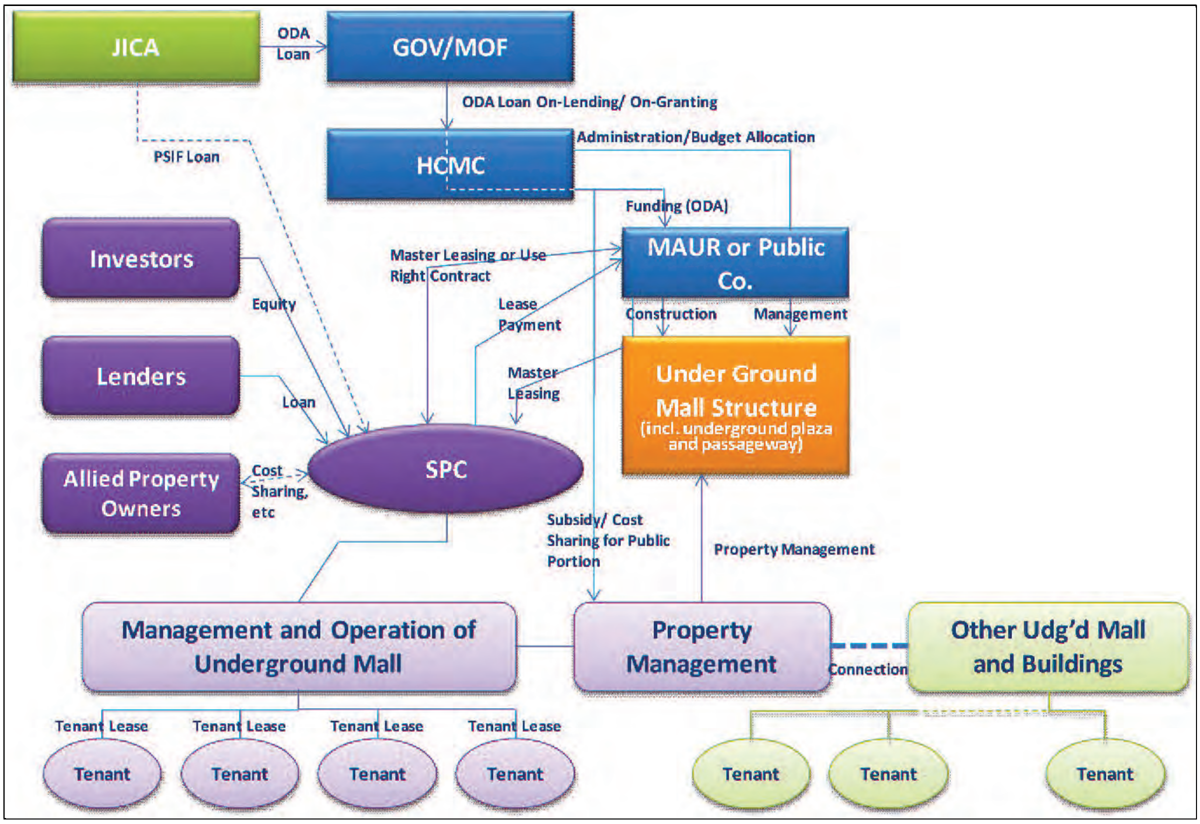


Figure 6.4 Implementation Scheme (Option 2 or Option 3)

6.2.4 Project Schedule

Because this project is linked to a metro development project, it is necessary to study the project schedule with consideration for the schedule of the metro development project.

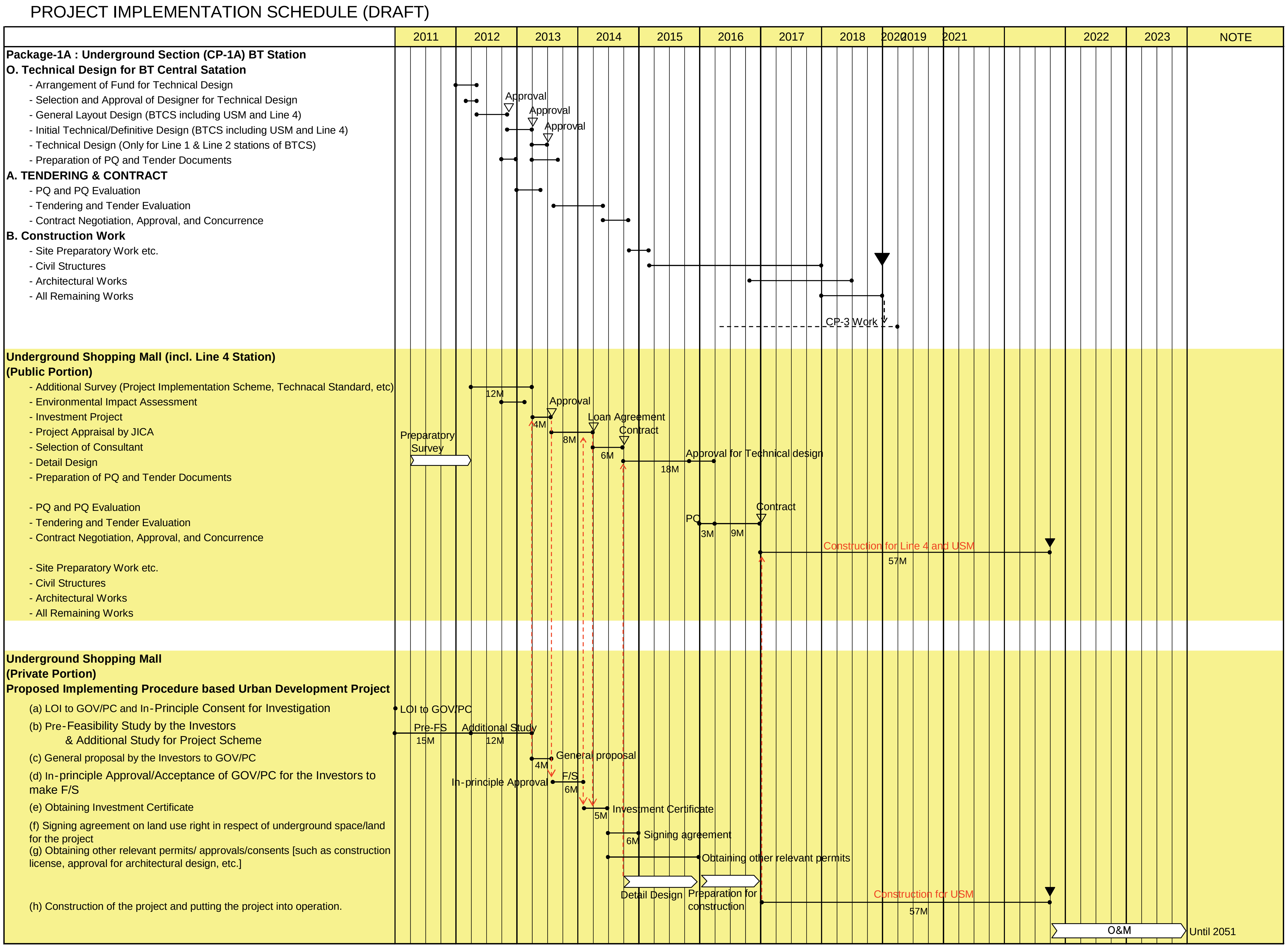
We have worked out a proposed project schedule in view of the schedule of portions of the metro development project which are related to the current project.

This proposed project schedule is indicated in Table 6.5, including scheduling for the following portions.

- For reference: Metro development project (portions related to the present project)
- Public portions of the present project
- Private portions of the present project

Concerning the private portions of the present project, we have worked out a schedule of permits and licensing for an urban development project, as detailed in section 2.4 (Related Legislation).

Table 6.5 Proposed Project Schedule



6.3 FINANCING PLAN

Financing plan is examined for the portion implemented by the public sector and by the private sector. Applicability of the Japanese ODA funding through HPC is also examined. The structure portion the USM is considered and positioned as a part of integrated Ben Thanh Central Station Project.

The private sector portion is the store part, the passageway (including the plaza), and a part of the facility cost which will be shared between the public and the private based on the proposal of the private sector. Therefore, those items are subject for private sector financing.

Potential funding sources for this private sector financing

① Equity and Loan of Foreign Investors
② Equity and Loan of Local Investors
③ Equity and Loan of Foreign Commercial Banks and Institutional Investors
④ Equity and Loan of Domestic Commercial Banks (including State Owned Banks)
⑤ Equity and Loan of Infrastructure Funds
⑥ PSIF Loan of JICA and Banks Loan
⑦ Private Sector Loan of International Aid Organization

Basic assumptions of financing conditions are as follows: (1) construction of the structure portion which the public sector is responsible will be financed by ODA loan, (2) the private sector portion will be financed by the equity of both foreign and local investor, and by commercial project loan by foreign and local commercial bank. Regarding capital structure, sensitivity analysis will be conducted to analyze impact on project profitability of different financing conditions.

6.4 FINANCIAL SITUATION

6.4.1 Financial Situation

We have gathered information on the financial situation of the implementing organization in project implementation, based on "English Annual Report 2011" of Sumitomo Realty & Development Co., Ltd. (http://www.sumitomo-rd.co.jp/english/ir/annual_report.html)

Table 6.6 shows a financial summary, and Tables 6.7 – 6.9 show the balance sheet, profit and loss statement, and cash flow. Last, Table 6.10 shows the financial audit report.

These financial statements have been audited, resulting in the determination that there are no particular problems with their adherence to Japan's accounting principles.

Table 6.6 Financial Summary

Consolidated Financial Highlights

Sumitomo Realty & Development Co., Ltd. and its consolidated subsidiaries
Years ended March 31

	Millions of yen			Thousands of U.S. dollars*1
	2011	2010	2009	2011
For the Year				
Revenue from operations	¥ 744,756	¥ 719,636	¥ 695,240	$ 8,956,777
Operating income	138,463	133,979	146,366	1,665,220
Ordinary profit*2	106,296	100,464	113,582	1,278,364
Net income	50,908	52,662	46,205	612,243
At Year-end				
Total assets	¥ 3,234,203	¥ 3,168,098	¥3,006,412	$38,896,007
Shareholders' equity*3	526,227	488,896	436,667	6,328,647
Interest-bearing debt	2,021,599	1,935,166	1,847,627	24,312,675
Per Share Data (Yen and U.S. dollars)				
Net income	¥ 107.35	¥ 111.04	¥ 97.39	$ 1.29
Shareholders' equity	1,109.78	1,030.93	920.74	13.35
Cash dividend applicable to the year	20.00	20.00	20.00	0.24

*1 U.S. dollar amounts in this report are translated, for convenience only, at the rate of ¥83.15=U.S. $1, the prevailing exchange rate at March 31, 2011.
*2 Ordinary profit, which equals operating income after adjustment for non-operating gains / losses, is a management index that is widely used in Japan.
Due to differences in accounting standards, ordinary profit is not broken out in the Company's English-language financial statements, but it is included here because it plays an important role in the calculation of incentive payments for directors.
*3 Shareholders' equity = Net assets – Minority interests

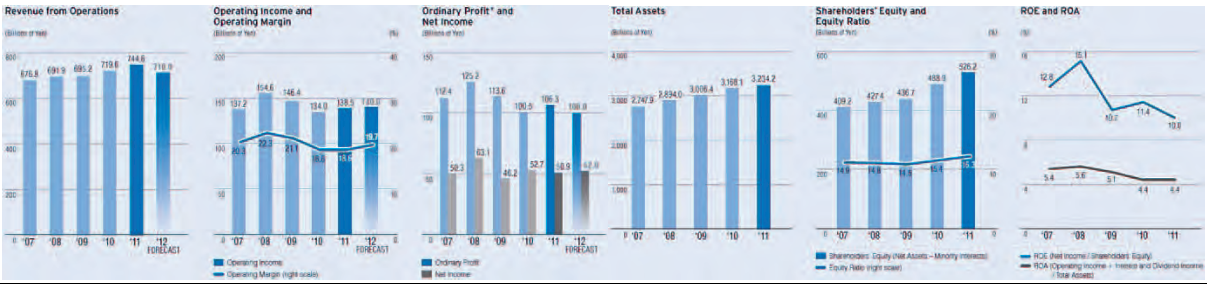


Table 6.7 Balance Sheets

Consolidated Balance Sheets

Sumitomo Realty & Development Co., Ltd. and its consolidated subsidiaries
As of March 31, 2011 and 2010

Assets	Millions of yen 2011	Millions of yen 2010	Thousands of U.S. dollars (Note 1) 2011
Current assets:			
Cash, time and notice deposits (Notes 3 and 7)	¥ 119,749	¥ 149,313	$ 1,440,156
Marketable securities (Notes 7 and 8)	—	2,705	—
Investments in SPEs holding properties for sale (Notes 7 and 8)	69,850	62,885	840,048
Notes and accounts receivable–trade (Note 7)	14,284	17,232	171,786
Allowance for doubtful accounts (Note 7)	(947)	(681)	(11,389)
Inventories (Note 4)	558,091	521,871	6,711,858
Deferred income taxes (Note 18)	12,823	13,743	154,215
Other current assets	32,108	35,625	386,146
Total current assets	805,958	802,693	9,692,820
Investments and loans:			
Investments in and loans to unconsolidated subsidiaries and affiliates (Notes 5 and 7)	5,699	5,779	68,539
Investments in securities and other (Notes 7 and 8)	239,666	244,760	2,882,333
Allowance for doubtful accounts	(15,471)	(14,960)	(186,061)
Total investments and loans	229,894	235,579	2,764,811
Property and equipment:			
Land (Notes 4, 6 and 24)	1,523,347	1,490,605	18,320,469
Buildings and structures (Notes 4, 6 and 24)	587,659	523,544	7,067,456
Machinery and equipment (Notes 4, 6 and 24)	19,052	17,741	229,128
Leased assets	1,804	1,222	21,696
Construction in progress (Notes 4 and 24)	64,252	60,051	772,724
	2,196,114	2,093,163	26,411,473
Accumulated depreciation	(217,451)	(196,752)	(2,615,165)
Net property and equipment	1,978,663	1,896,411	23,796,308
Other assets:			
Guarantee and lease deposits paid to lessors (Note 7)	145,707	166,571	1,752,339
Leasehold rights and other intangible assets	51,815	51,363	623,151
Deferred income taxes (Note 18)	11,605	8,802	139,567
Other	10,561	6,679	127,011
Total other assets	219,688	233,415	2,642,068
Total assets	¥3,234,203	¥3,168,098	$38,896,007

See accompanying notes.

Liabilities and Net Assets	Millions of yen 2011	Millions of yen 2010	Thousands of U.S. dollars (Note 1) 2011
Current liabilities:			
Short-term debt (Notes 7 and 9)	¥ 215,739	¥ 328,225	$ 2,594,576
Long-term debt due within one year (Notes 6, 7 and 9)	374,792	273,621	4,507,420
Notes and accounts payable–trade (Note 7)	31,756	54,171	381,912
Accrued income taxes (Note 18)	17,109	20,902	205,761
Accrued bonuses	3,184	2,760	38,292
Allowance for loss on disaster (Note 12)	1,930	—	23,211
Deposits received (Notes 7 and 19)	169,719	187,537	2,041,118
Other current liabilities	76,112	78,009	915,359
Total current liabilities	890,341	945,225	10,707,649
Long-term liabilities:			
Long-term debt due after one year (Notes 6, 7 and 9)	1,431,068	1,333,320	17,210,679
Guarantee and deposits received (Notes 7 and 19)	332,304	370,326	3,996,440
Allowance for employees' severance and retirement benefits (Note 10)	4,882	4,970	58,713
Other long-term liabilities	30,279	6,857	364,150
Total long-term liabilities	1,798,533	1,715,473	21,629,982
Contingent liabilities (Note 26)			
Net assets (Note 20):			
Shareholders' equity			
Common stock:			
Authorized – 1,900,000 thousand shares			
Issued – 476,086 thousand shares	122,805	122,805	1,476,909
Capital surplus	132,748	132,748	1,596,488
Retained earnings	290,260	248,836	3,490,800
Treasury stock	(3,645)	(3,543)	(43,836)
Total shareholders' equity	542,168	500,846	6,520,361
Accumulated other comprehensive loss			
Net unrealized holding losses on securities	(6,701)	(3,393)	(80,589)
Net deferred losses on hedges	(1,925)	(2,591)	(23,151)
Foreign currency translation adjustments	(7,315)	(5,966)	(87,974)
Total accumulated other comprehensive loss	(15,941)	(11,950)	(191,714)
Minority interests	19,102	18,504	229,729
Total net assets	545,329	507,400	6,558,376
Total liabilities and net assets	¥3,234,203	¥3,168,098	$38,896,007

Table 6.8 Income Statements

Consolidated Statements of Income

Sumitomo Realty & Development Co., Ltd. and its consolidated subsidiaries
For the years ended March 31, 2011, 2010 and 2009

	Millions of yen 2011	Millions of yen 2010	Millions of yen 2009	Thousands of U.S. dollars (Note 1) 2011
Revenue from operations	¥744,756	¥719,636	¥695,240	$8,956,777
Costs and expenses:				
Cost of revenue from operations	551,364	534,270	496,547	6,630,956
Selling, general and administrative expenses	54,929	51,387	52,327	660,601
	606,293	585,657	548,874	7,291,557
Operating income	138,463	133,979	146,366	1,665,220
Other income (expenses):				
Interest expense, net	(29,789)	(29,591)	(29,718)	(358,256)
Dividend income	3,344	2,339	3,053	40,216
Gain on sale of property and equipment	120	53	10	1,443
Loss on sale of property and equipment	(19)	—	(657)	(229)
Loss on impairment of fixed assets (Note 11)	(7,602)	(7,826)	(165)	(91,425)
Loss on disposal of property and equipment	(2,188)	(93)	(1,035)	(26,314)
Gain on sale of investments in securities	4	1	28	48
Loss on sale of investments in securities	(33)	(56)	(235)	(397)
Loss on devaluation of investments in securities	(6,710)	(1,837)	(14,188)	(80,698)
Dividend to partnership investors	(3,043)	(2,944)	(3,135)	(36,597)
Gain on prior periods adjustment (Note 14)	413	—	1,023	4,967
Gain on adjustment of accrued rent payable (Note 13)	—	645	—	—
Compensation income	78	147	—	938
Loss on devaluation of inventories (Note 15)	—	—	(13,770)	—
Loss on devaluation of common stocks of affiliates	—	(10)	(3,545)	—
Provision for allowance for loss on disaster	(1,930)	—	—	(23,211)
Repair expenses for prior periods construction (Note 16)	—	—	(1,641)	—
Other, net	(3,350)	(3,599)	(3,137)	(40,287)
	(50,705)	(42,771)	(67,112)	(609,802)
Income before income taxes and minority interests	87,758	91,208	79,254	1,055,418
Income taxes (Note 18):				
Current	35,138	35,137	29,362	422,586
Deferred	(128)	1,805	2,686	(1,540)
Total	35,010	36,942	32,048	421,046
Income before minority interests	52,748	54,266	47,206	634,372
Minority interests	1,840	1,604	1,001	22,129
Net income	¥ 50,908	¥ 52,662	¥ 46,205	$ 612,243

Table 6.9 Cash Flow Statements

Consolidated Statements of Cash Flows

Sumitomo Realty & Development Co., Ltd. and its consolidated subsidiaries
For the years ended March 31, 2011, 2010 and 2009

	Millions of yen			Thousands of U.S. dollars (Note 1)
	2011	2010	2009	2011
Cash flows from operating activities:				
Income before income taxes and minority interests	¥ 87,758	¥ 91,208	¥ 79,254	$ 1,055,418
Depreciation and amortization	23,705	18,065	17,886	285,087
Loss on impairment of fixed assets (Note 11)	7,602	7,826	165	91,425
Provision for allowance for loss on disaster	1,930	—	—	23,211
Provision for (Reversal of) allowance for doubtful accounts	776	325	(1,086)	9,333
Increase (Decrease) in allowance for employees' severance and retirement benefits	(87)	(17)	342	(1,046)
Loss on devaluation of inventories (Note 15)	—	—	13,770	—
Loss (Gain) on sale of property and equipment, net	(101)	(53)	647	(1,215)
Loss on disposal of property and equipment	2,188	93	1,035	26,314
Loss on sale of investments in securities, net	29	55	207	349
Loss on devaluation of investments in securities	6,710	1,837	14,188	80,698
Loss on devaluation of common stocks of affiliates	—	10	3,545	—
Interest and dividend income	(3,525)	(2,560)	(3,735)	(42,393)
Interest expense	29,969	29,812	30,400	360,421
Increase in investments in SPEs holding properties for sale	(6,965)	(12,800)	(11,090)	(83,764)
Decrease (Increase) in notes and accounts receivable–trade	2,935	(5,671)	2,519	35,298
Increase in inventories	(30,830)	(5,190)	(106,778)	(370,776)
Decrease (Increase) in loans receivable	528	604	(3,108)	6,350
Increase (Decrease) in notes and accounts payable–trade	(22,407)	14,478	612	(269,477)
Increase (Decrease) in advances received	(2,936)	10,876	(2,510)	(35,310)
Other, net	(17,457)	7,543	(25,450)	(209,947)
Total	79,822	156,441	10,813	959,976
Proceeds from interest and dividend income	3,525	2,560	3,735	42,393
Payments for interest	(30,261)	(29,142)	(30,638)	(363,933)
Payments for income tax and other taxes	(38,644)	(36,057)	(36,583)	(464,750)
Net cash provided by (used in) operating activities	14,442	93,802	(52,673)	173,686
Cash flows from investing activities:				
Payments for purchases of property and equipment	(98,059)	(114,060)	(84,620)	(1,179,302)
Proceeds from sale of property and equipment	1,040	54	20,245	12,508
Payments for purchases of investments in securities	(7,301)	(15,243)	(16,586)	(87,805)
Proceeds from sale of investments in securities	7,074	2,713	17,657	85,075
Payments for guarantee and lease deposits paid to lessors	(2,241)	(1,445)	(3,231)	(26,951)
Proceeds from guarantee and lease deposits paid to lessors	21,642	4,125	12,709	260,277
Payments for guarantee and lease deposits received	(26,385)	(23,319)	(15,060)	(317,318)
Proceeds from guarantee and lease deposits received	20,156	15,382	22,212	242,405
Receipts of deposits from partnership investors	88,996	30,907	47,455	1,070,307
Restitution of deposits from partnership investors	(78,133)	(65,487)	(112,336)	(939,663)
Other, net	(2,301)	(1,220)	1,408	(27,674)
Net cash used in investing activities	(75,512)	(167,593)	(110,147)	(908,141)
Cash flows from financing activities:				
Increase (Decrease) in short-term debt, net	(112,486)	(117,645)	161,650	(1,352,808)
Proceeds from issuance of bonds	60,000	90,000	—	721,587
Redemption of bonds	(80,000)	(40,000)	(15,000)	(962,117)
Proceeds from long-term loans payable	413,300	279,000	135,700	4,970,535
Repayment of long-term loans payable	(194,381)	(123,816)	(99,756)	(2,337,715)
Increase (Decrease) in assignment of receivables	(20,090)	6,711	1,139	(241,612)
Increase in treasury stocks, net	(102)	(52)	(756)	(1,227)
Cash dividends paid	(10,334)	(10,334)	(10,508)	(124,281)
Other, net	(24,072)	14,573	964	(289,500)
Net cash provided by financing activities	31,835	98,437	173,432	382,862
Effect of exchange rate changes on cash and cash equivalents	(331)	(230)	(1,150)	(3,981)
Net increase (decrease) in cash and cash equivalents	(29,566)	24,416	9,462	(355,574)
Cash and cash equivalents at beginning of year	149,315	124,897	116,536	1,795,730
Increase in cash and cash equivalents of newly consolidated subsidiaries	—	2	479	—
Decrease in cash and cash equivalents resulting from exclusion of subsidiaries from consolidation	—	—	(1,580)	—
Cash and cash equivalents at end of year (Note 3)	¥ 119,749	¥ 149,315	¥ 124,897	$ 1,440,156

Table 6.10 Financial Audit Report

Independent Auditors' Report

KPMG

To the Board of Directors of
Sumitomo Realty & Development Co., Ltd.:

We have audited the accompanying consolidated balance sheets of Sumitomo Realty & Development Co., Ltd. and its consolidated subsidiaries as of March 31, 2011 and 2010, the related consolidated statements of income and comprehensive income for the years in the two-year period ended March 31, 2011, statement of income for the year ended March 31, 2009, and statements of changes in net assets and cash flows for each of the years in the three-yea period ended March 31, 2011, expressed in Japanese yen. These consolidated financial statements are the responsibility of the Company's management. Our responsibility is to independently express an opinion on these consolidated financial statements based on our audits.

We conducted our audits in accordance with auditing standards generally accepted in Japan. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significan estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the consolidated financial statements referred to above present fairly, in all material respects, the financial position of Sumitomo Realty & Development Co., Ltd. and its consolidated subsidiaries as of March 31, 2011 and 2010, and the results of their operations and their cash flows for each of the years in the three-year period ended March 31, 2011, in conformity with accounting principles generally accepted in Japan.

Without qualifying our opinion, we draw attention to the following.
As discussed in Note 2(5) to the consolidated financial statements, effective from the year ended March 31, 2009, Sumitomo Realty & Development Co., Ltc and its consolidated subsidiaries adopted the new accounting standard for measurement of inventories.

The U.S. dollar amounts in the accompanying consolidated financial statements with respect to the year ended March 31, 2011 are presented solely for con venience. Our audit also included the translation of yen amounts into U.S. dollar amounts and, in our opinion, such translation has been made on the basis described in Note 1 to the consolidated financial statements.

KPMG AZSA LLC

Tokyo, Japan
June 29, 2011

6.4.2 Profitability Analysis

Profitability analysis is conducted by calculating project cash flow during a certain project period (based on the project contract of the private sector) of the investment for the USM project such as the structure, the store, the passageway and plaza, the facility and so on.

For doing this the project is divided by the public portion and the private portion as a PPP project, and profitability of each portion are analyzed.

Main revenue source of the private sector is the revenue from the sub-leasing tenant rent of the under-ground shops. The level of the rent is set on the basis of interview results at the market level. Levels of various expenditure items are also set at the current market price level based on the various interviews with the players in the HCM market. Tax items are set in the same manner and particularly for the corporate income tax, special treatment for the special project approved by the Prime Minister is applied on the basis of Circular No. 130/2008/TT-BTC of December 26, 2008 Circular No. 130/2008/TT-BTC of December 26, 2008.

The size of commercial floor of this USM project is over 1,8000m2, which is far exceeding that of the neighboring Ben Thanh Market (about 10,000m2) and the Saigon Center I (about 12,000m2). Location potential of the project is that of the First Class Grade in HCM city, therefore it is obvious that the project has commercial sustainability based on its location potential. Details of its location potential as commercial project is further analyzed in the Economic Analysis of the Chapter 7 of this report.

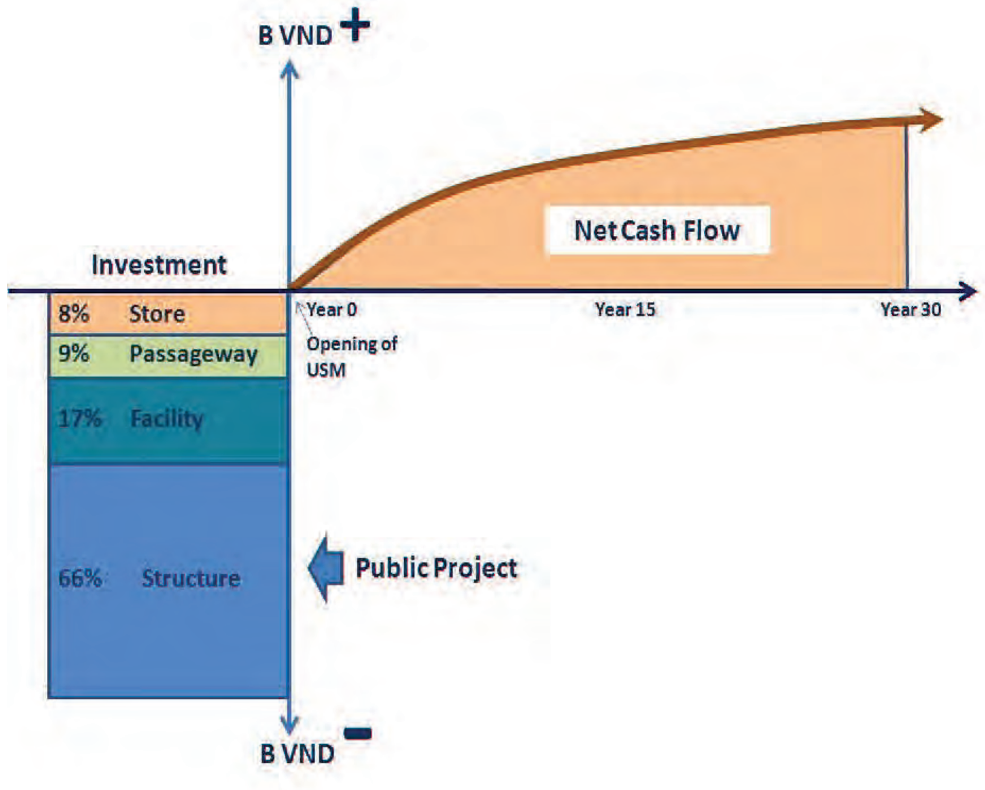


Figure 6.4 Framework of Cash Flow Analysis

6.5 REFERENCE: RESULTS OF INTERVIEWS ON UNDERGROUND MALL OPERATION

An important perspective in this project is that business operators who are planning future development in the vicinity could, for example, contribute funds for underground connection costs or contribute sponsorship funds in order to become involved in the present underground development. It is also anticipated that actual operations may deviate from the initial plans.

For the purpose of advance reference in relation to this aspect, the results of an interview with the business operator of an existing underground mall in Japan are provided below.

A) Handling of Connecting Passageways to Surrounding Private Buildings

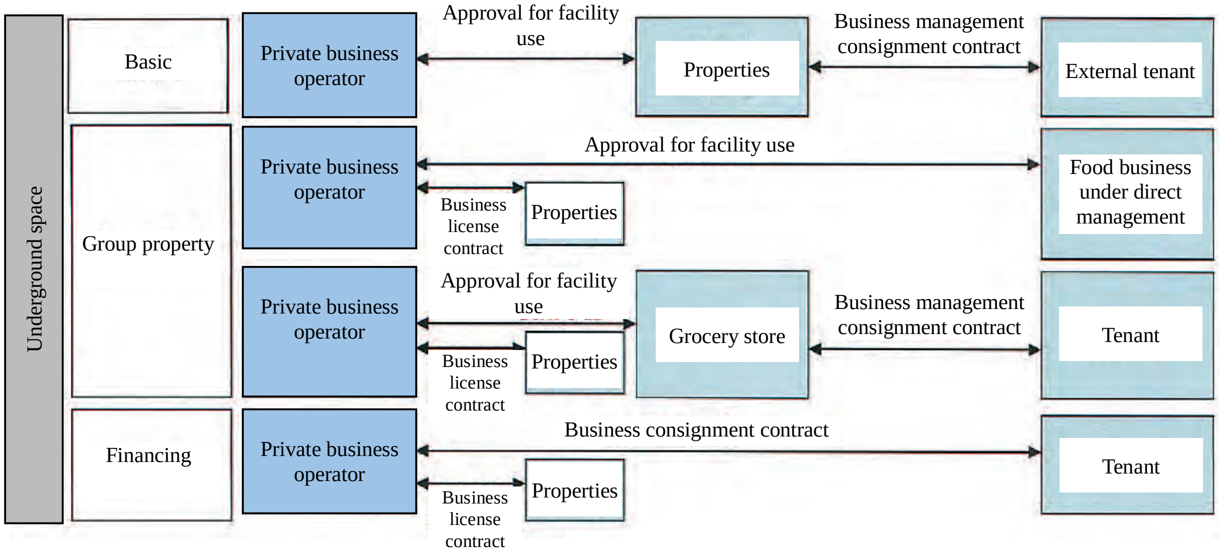
[1] In the case of a metro station, as a general rule, one passageway connecting to the surface above ground is provided at the front and another at the back.

[2] In the case of simultaneous development, connecting passageways are determined through consultations. The basic approach is that the allocation of both development and investment extends to the site boundaries.

[3] In the case of construction after the station has been completed, the basic approach is that the surrounding business owners are responsible for development and investment.

B) General Scheme for Underground Mall Tenant Contracts

- In cases where contracts are handled by way of a property management company, tenants are continuously provided with business advice.



C) Approach to Setting Tenant Rents

[1] The basic approach to setting tenant rents is a fixed amount plus a percentage of sales, but at present, the approach being used is a percentage of sales. Rent is equal to 14% of initial sales, and when sales exceed a certain threshold, 10% of sales go to rent. (The threshold value is unknown.)

[2] There are some variations in individual negotiations in accordance with socioeconomic variables. In the case of a large shopping center, rent is the formula in item [1] above plus some additional amount, and tenants are also required to pay common service fees.

[3] The rent levels paid by underground tenants are generally about 90% of the rent levels paid by above-ground tenants in the same area. However, for good locations with large volumes of passenger flow, it is also possible for underground tenants to pay the same rents as ground floor tenants above ground.

D) Approach to Tenant Revenues

[1] In general, tenant revenues are determined by the following formula:
(Unit revenue per customer) x (Storefront flow) x (Capture rate or percentage entering the store)

[2] In the case of Japan, capture rates are highly variable depending on station location, including factors such as transfers at intermediate stations. Businesses that provide daily necessities such as convenience stores have high capture rates, while fashion stores and the like tend to have lower capture rates. In general, an average capture rate is thought to be approximately 1% to 2% of the number of passengers getting on and off.

E) Trends in Tenant Revenues After Opening

[1] In general, trends in tenant revenues after opening are thought to follow this pattern: First, immediately after opening, revenues exceed the planned figure. Second, revenues return to the planned figure about three months later. Third, one year after opening, revenues remain around the planned figure. Fourth, steps are taken to improve sales, such as sales promotion activities, renovations, and store replacements.

[2] For certain tenants (Case 1), revenues are about 110% to 120% of the initially planned figure. This is because the above-ground portion is a well-known commercial space with a relatively constant number of passengers all year round, where the rate of utilization is high because of passenger turnover.

[3] For other tenants (Case 2), many customers were attracted soon after opening, but then declined to about 80% of the initially planned figure. This is because passenger turnover throughout the year is low, and most users shop on Fridays, Saturdays, and Sundays. In such cases, the original tenants are replaced with tenants that are better suited to everyday use.

F) Length of Tenant Agreements

[1] The length of a tenant agreement is generally five years for retail, apparel, and convenience stores, etc., and seven to eight years for restaurants.

[2] The basic approach by industry is as follows.
Apparel: Initial investment is low, and revenues are easily linked to rents.
Convenience stores: Profit rates are low, with high turnover and small margins. Therefore, even with high revenues, it tends to be difficult to produce rent funds.

Restaurants: Kitchens involve high initial investment, and capital recovery tends to take a longer time.

G) Business Effects of Underground Mall Development

• Above-ground department stores have reported an increase in customers due to underground malls connected to stations with high passenger flows.

CHAPTER 7 PROJECT EVALUATION

7.1 PROJECT RISK

For the project plan, we considered risks in terms of both investment and technical aspects, risks of social impacts in facility development, technical risks during facility construction, and other project risks, as well as ways to address such risks. As the policy for dealing with such risks, we have arranged the (proposed) division of risks in this project as shown in Table 7.1, with reference to existing public-private collaborative projects and existing cases in Ho Chi Minh City (such as the underground parking garage at Le Van Tam Park in District 1 of Ho Chi Minh City and public service development and construction projects).

The following is a list of our basic approaches to the division of anticipated project risks which constitute major risks, particularly those risks that could have a significant impact on the profitability of the project.

These matters will need to be updated as the content of the project is determined more fully.

i) Risks of institutional changes (legislative risk, risk of tax changes, etc.)

These are considered to be risks that should basically be assumed by the public sector. However, such risks should be assumed by the business operator in cases where [1] the subject of a legislative change is broad and general, [2] the impact of increased expenses can be controlled by creativity and ingenuity on the part of the business operator, or [3] cost increases due to legislative changes (concerning private for-profit businesses, etc.) can be transferred to general users. Meanwhile, in existing cases in Ho Chi Minh City, there are statements to the effect that the matters stated in the investment authorization document will take precedence in case of changes that are disadvantageous to investors. In the present project as well, policies in existing cases should be taken as a reference.

ii) Economic risks (fundraising risk, price fluctuation risk, interest fluctuation risk, etc.)

It is considered that the public sector should assume the risks of matters that should be secured by the public sector and risks up to a time before the facilities are opened for use. After the facilities are opened for use, these will become the risks of the business operator. Meanwhile, it is necessary to establish reasonable rules for the division of expenses with regard to large increases in the prices of materials during the construction period and price fluctuations in excess of a certain level during the maintenance and operation period.

iii) Social risks (resident response risk, environmental risk, etc.)

It is considered that the public sector should assume the risks of matters that should be secured by the public sector and risks up to a time before the facilities are opened for use. After the facilities are opened for use, these will become the risks of the business operator.

iv) Force majeure risks

Risks beyond the control of the business operator include natural disasters that are not anticipated at the planning stage, such as strong winds, heavy rains, flooding, storm surges, earthquakes, landslides, cave-ins, and lightning, as well as anthropogenic events such as wars and riots. It is generally appropriate for the public sector to assume such risks. Meanwhile, in order to promote more efficient recovery, it is desirable for the business operator to assume a portion of the risk of losses such as construction delays and damage due to *force majeure*.

v) Design and construction phases (design and investigation risks, geological and ground risks, construction and supervision risks, etc.)

It is considered that the public sector will assume the risks of investigations, instructions, changes, and construction work, etc., implemented by the public sector (including items indicated in informational materials published by the public sector). In Vietnam, in addition to water pipes and power lines, there may be objects buried underground which are unknown even to the People's Committee, including archaeological remains and unexploded ordnance. In particular, it is considered that the public sector will assume the risks of soil pollution and underground obstacles at the plan site. Risks other than the above which are attributable to the business operator are considered to be risks of the business operator.

vi) Maintenance and operation phases (risk of increases in maintenance and operation costs, risk of facility damage, risk of obsolescence, etc.)

It is considered that the public sector will assume the risks of matters attributable to the public sector. Meanwhile, there are some risks that the tenant share and the rental rate level will become lower than the assumed level. These are considered to be risks of the business operator. And, it is necessary to divide the risks of facility damage due to accidents, fire, etc., and facility damage caused by third parties (including facility users) based on attribution of responsibility. It is considered that the public sector will assume the risks of obsolescence due to technological innovations and the like in those facilities and equipment whose development was directed by the public sector, while the private sector will assume the risks of increased expenses from obsolescence of other facilities and equipment due to technological innovations and the like.

Table 7.1 Risk Allocation (Proposed)

Phase	Type of Risk		Content of Risk	Allocation: Public	Allocation: Private	Remarks
All Phases	Selection procedure risks	Selection procedure risk	Risk related to errors or changes in bid recruitment information, etc.	●		Additional costs, etc. resulting from errors in documentation prepared by the public sector and relating to selection of private business operators or errors in such procedures, etc. *It specifies in the tender documents that these are public risks.
		Application risk	Risk related to application costs of applicant business operators		●	*It specifies in the tender documents that it is a private risk
		Contract conclusion risk	Risk that applicant business operator may not receive a contract, or that contract procedures may be time consuming	●	●	Applicant business operators that do not receive a contract will be responsible for their respective expenses up to that point. *The above is specified in the tender documents.
	Institutional change risks	Legislative risk	Risk related to new or changed legislation, etc., directly affecting the project	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to new or changed legislation that is broad and general in scope and does not involve the project		●	*It specifies in the PPP contracts that these are private risks.
		Risk of tax changes	Risk related to new or changed tax regulations that directly impact the project	●		It is considered that this risk should basically be assumed by the public sector. However, such risks should be assumed by the business operator in cases where [1] the subject of a legislative change is broad and general, [2] the impact of increased expenses can be controlled by creativity and ingenuity on the part of the business operator, or [3] cost increases due to legislative changes (concerning private for-profit businesses, etc.) can be transferred to general users. *The above is specified in the PPP contracts.
			Risk related to changes in the scope of consumption tax or changes in tax rates	●		
			Risk related to other changes in tax regulations (such as new or changed corporate taxation on corporate profits)		●	
		Licensing risk	Risk related to delays in licensing (to be acquired from the public sector)	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to delays in licensing (to be acquired from other sources than the public sector)		●	*It specifies in the PPP contracts that these are private risks.
		Political risk	Risk related to change, suspension, termination, etc., of the project due to political reasons or changes in public policies	●		*It specifies in the PPP contracts that these are public risks.
		Public support risk	Risk related to increased expenses on the business operator's side if the public support specified in laws, agreements, or contracts is not implemented	●		*It specifies in the PPP contracts that these are public risks.

	Economic risks	Fundraising risk	Risk related to obtaining capital which the public sector needs to procure	●		*It specifies in the PPP contracts that it is a public risk.
			Risk related to obtaining capital which the business operator needs to procure		●	*It specifies in the PPP contracts that it is a private risk.
		Price fluctuation risk	Risk related to changed expenses of business operator due to material price fluctuations beyond a certain level during the construction period	●	●	*Cost-sharing rules are specified in the PPP contracts.
			Risk related to changed expenses of business operator due to commodity price fluctuations (inflation/deflation) beyond a certain level during the maintenance and operation period (service purchasing portion)	●	●	The service purchasing portion means the portion in which the government side has ownership rights and property management is consigned to the private sector (public passageway and plaza portion). *Cost-sharing rules are specified in the PPP contracts.
			Risk related to changed expenses of business operator due to commodity price fluctuations (inflation/deflation) during the maintenance and operation period (independent accounting portion)		●	The independent accounting portion means the portion in which the private side has ownership rights (underground mall). *It specifies in the PPP contracts that these are private risks.
		Interest fluctuation risk	Risk related to interest fluctuations before obtaining base rate	●		*It specifies in the PPP contracts that it is a public risk.
			Risk related to interest fluctuations after obtaining base rate		●	*It specifies in the PPP contracts that it is a private risk.
	Social risks	Resident response risk	Risk related to lawsuits or demands from opposition movement to establishment and operation of this facility	●		*It specifies in the PPP contracts that these are public risks.
			Risk other than the above (related to investigation, construction, or maintenance and operation by business operator)		●	*It specifies in the PPP contracts that these are private risks.
		Environmental risk	Risk related to emissions or leaks of toxic substances, noise, vibrations, ground settlement, groundwater interruption, odor emissions, etc. caused by operations conducted by the business operator		●	*It specifies in the PPP contracts that these are private risks.
		Third party indemnification and compensation risk	Risk related to third party damages due to accidents attributable to the public sector	●		The public sector, which is the facility manager, is liable for indemnification of damages. *The above is specified in the PPP contracts.
			Risk related to third party damages due to accidents attributable to operations conducted by the business operator, inadequacies in maintenance and management operations by the business operator, etc.		●	The public sector, which is the facility manager, is liable for indemnification of damages, but it will demand compensation from the business operator in cases where the business operator is at fault. *The above is specified in the PPP contracts.

	Default risks		Risk related to debt default for reasons attributable to the public sector	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to business abandonment or financial failure of the business operator		●	*It specifies in the PPP contracts that these are private risks.
			Risk related to failure by business operator to provide services of the quality level specified in the requirements document		●	*It specifies in the PPP contracts that these are private risks.
	Force majeure risks		Risk related to increased costs due to *force majeure*, increased costs due to project suspension, or other damages, beyond the scope of damages up to a certain amount or reasonably covered by insurance, etc.	●		Because *force majeure* risks are risks beyond the control of the business operator, it is generally appropriate for the public sector to assume such risks. Meanwhile, in order to promote more efficient recovery, it is desirable for the business operator to assume a portion of the risk of losses such as construction delays and damage due to *force majeure*. *Cost-sharing rules are specified in the PPP contracts.
			Risk related to increased costs due to *force majeure*, increased costs due to project suspension, or other damages, within the scope of damages up to a certain amount or reasonably covered by insurance, etc.		●	
Design and Construction	Design and investigation risks	Surveying and investigation risk	Risks due to inadequacies in surveying and investigations performed by the public sector	●		*It specifies in the PPP contracts that these are public risks.
			Risks due to surveying and investigations other than the above		●	*It specifies in the PPP contracts that these are private risks.
		Design risk	Risk related to inadequacies in basic designs, execution designs, etc., performed by the public sector	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to inadequacies in the content of facility design requirements, design preconditions, etc., by the public sector	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to inadequacies in designs performed by the business operator		●	*It specifies in the PPP contracts that it is a private risk.
			Risk related to inadequacies and changes in instructions and judgments by the public sector (cost increases and delays in completion)	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to inadequacies and changes due to other causes than the above (cost increases and delays in completion)		●	*It specifies in the PPP contracts that these are private risks.
	Land acquisition risks		Risk related to acquisition of planned construction site	●		*It specifies in the PPP contracts that it is a public risk.
			Risk related to temporary structures and material storage areas related to construction		●	*It specifies in the PPP contracts that these are private risks.

	Geological and ground risks (handling of existing buried objects)		Risk related to soil pollution, underground obstacles, unexploded ordnance, etc., at the planned site (not including soil pollution and underground obstacles which are indicated in informational materials published by the public sector, or whose presence may be reasonably predicted from such informational materials)	●		In Vietnam, in addition to water pipes and power lines, there may be objects buried underground which are unknown even to the People's Committee, including archaeological remains and unexploded ordnance. *It specifies in the PPP contracts that these are public risks.
			Risk related to soil pollution and underground obstacles, etc. at the plan site, other than the above		●	*It specifies in the PPP contracts that these are private risks.
	Construction and supervision risks	Outsourcer responsibility risk	Risk related to the content of construction contracts at the request of the public sector as well as changes in such content	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to the content of construction contracts based on orders by the business operator as well as changes in such content		●	*It specifies in the PPP contracts that these are private risks.
		Construction delay and incompletion risk	Risk related to incompletion or delays from the work schedule specified in the contract due to design changes at the request of the public sector	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to incompletion or delays from the work schedule specified in the contract due to other reasons than the above		●	*It specifies in the PPP contracts that these are private risks.
		Construction supervision risk	Risk related to problems with the content, schedule, etc. of construction work due to inadequacies in construction supervision performed by the business operator		●	*It specifies in the PPP contracts that these are private risks.
		Cost overrun risk	Risk related to increases in construction costs due to instructions from the public sector	●		*It specifies in the PPP contracts that it is a public risk.
			Risk related to increases in construction costs due to other reasons than the above		●	*It specifies in the PPP contracts that it is a private risk.
		Risk of failure to attain required performance	Risk related to non-compliance with performance requirements or faulty execution after facility completion		●	*It specifies in the PPP contracts that these are private risks.
		Risk of facility damage	Risk related to damage occurring in relation to the object of construction, materials, or other related construction work prior to use		●	*It specifies in the PPP contracts that these are private risks.
Maintenance and Operation		Risk of failure to attain required levels	Risk related to failure of the content of operation, maintenance, and management services by the business operator to satisfy the required levels		●	*It specifies in the PPP contracts that these are private risks.
		Maintenance and operation cost risk	Risk related to increases in work volume or expenses due to changes in project content or purpose, attributable to the public sector	●		*It specifies in the PPP contracts that these are public risks.

			Increases in work volume or expenses due to other reasons than the above		●	There are some risks that the tenant share and the rental rate level will become lower than the assumed level. *It specifies in the PPP contracts that these are private risks.
		Repair cost risk	Risk related to repair costs during the project period, exceeding the repair costs initially anticipated by the business operator		●	*It specifies in the PPP contracts that it is a private risk.
		Risk of facility damage	Risk due to business operator's failure to perform appropriate maintenance operations or inadequacies in maintenance with regard to facility deterioration		●	*It specifies in the PPP contracts that it is a private risk.
			Risk related to facility damage due to accidents or fire, etc.	●	●	Risk is allocated according to fault. *Cost-sharing rules are specified in the PPP contracts.
			Risk related to facility damage by third parties (including facility users)	●	●	The business operator assumes the risk of facility damage by third parties occurring due to the business operator's failure to exercise the duty of care of a good manager or neglect of its management obligations, and the public sector assumes the risk of facility damage by third parties due to other reasons. *Cost-sharing rules are specified in the PPP contracts.
	Risk of facility defects	Risk of facility defects	Risk related to discovery of hidden defects in the facility during the defect guarantee period		●	*It specifies in the PPP contracts that it is a private risk.
			Risk related to discovery of hidden defects in the facility outside the defect guarantee period	●		The business operator assumes the risk of defects which are attributable to the business operator. *It specifies in the PPP contracts that it is a public risk.
			Risk related to defects in the private facility portion		●	*It specifies in the PPP contracts that it is a private risk.
	Technological innovation risk	Risk of obsolescence	Risk related to obsolescence of facilities and equipment due to technological innovations, etc., when cost increases are due to instructions from the public sector	●		*It specifies in the PPP contracts that these are public risks.
			Risk related to obsolescence of facilities and equipment due to technological innovations, etc., when cost increases are due to other reasons than the above		●	*It specifies in the PPP contracts that these are private risks.
After End of Project	Risk of early project termination		Contract cancellation caused by failure of the public sector to fulfill its contractual obligations	●		*Rules of damages are specified in the PPP contracts.
			Contract cancellation caused by failure of the business operator to fulfill its contractual obligations (including partial cancellation)		●	*Rules of damages are specified in the PPP contracts.
	Facility performance risk		Risk related to ensuring facility performance at the time of project termination		●	*Rules of facility performance are specified in the PPP contracts.

	Transfer procedures risk	Risk related to costs of transfer procedures and business continuation and business operator liquidation procedures at the time of project contract expiration		●	*It specifies in the PPP contracts that these are private risks.

7.2 FINANCIAL AND ECONOMIC ANALYSES

We will conduct a financial analysis of the present project, based on the results of study thus far as well as the content discussed in Chapter 6 (Study of Business Scheme). We will also measure the social benefits of this project and conduct an economic analysis of the project as a whole.

7.2.1 Financial Analysis of the Project

(1) Framework of Financial Analysis

Financial analysis of the project is conducted. Profitability analysis is conducted by calculating project cash flow during a certain project period (based on the project contract of the private sector) of the investment for the USM project such as the structure, the store, the passageway and plaza, the facility and so on.

For doing this the project is divided by the public portion and the private portion as a PPP project, and profitability of each portion are analyzed.

Main revenue source of the private sector is the revenue from the sub-leasing tenant rent of the under-ground shops. The level of the rent is set on the basis of interview results at the market level. Levels of various expenditure items are also set at the current market price level based on the various interviews with the players in the HCM market.

Based on the above mentioned assumptions, a financial model is constructed for calculating such financial indicators on the VND basis as Project IRR, Equity IRR, Debt Service Coverage Ratio, Cumulative Net Cash Flow, thereby analyzing project profitability of the USM project.

Assumption sheets and calculation results will be attached to this report as back up data for this analysis.

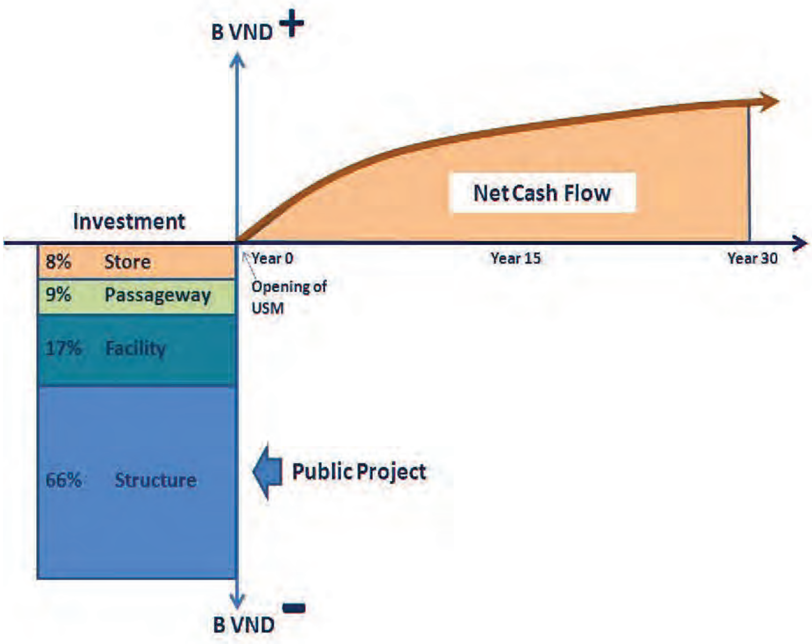


Figure7.1 Framework of Financial Analysis

(2) Assumptions of Financial Analysis

Project period based on the project contract starts from the signing of the contract with the design and construction period of 8 years and the operation period of 30 years. The period for the financial analysis is same as this period up to 2050. Capital structure of the Base Case is as shown in the following table is composed of the private equity of 30% with commercial bank loan of 70% based on the following lending conditions in the table. Economic conditions such as inflation rate assumed are also shown in Table7.2 – Table7.4. The inflation rate of VND for the short term future till 2015 is set at 7.9% which was forecasted by EIU[1]. For the medium term, an average rate[2] of 5.0% for the past period excluding those of the hyper inflation periods was set for the year 2035, and then gradual decrease was assumed to reach to 3.5% in 2046 for the long term future.

The inflation rates are used for the basis of the price escalation of the construction cost, of the revenue escalation (except for the tenant rent which is to be increased every three years based on the current market practice), and of the escalation of the expenditures.

Since project finance loan is assumed for financing the project, relatively thick equity 30% of the total project cost is set with remaining 70% financed by the project finance loan. Grace period of the loans is set as 5 years which include the construction period till the full opening of the project (2017-2021).

The depreciation rate of VND against JPY is set at 5% per year[3] which is the average of the past 10 years. In case of Tranche 1 (JICA PSIF Loan) on Financial Analysis, this depreciation rate is considered to be put on to the interest rate.

Regarding the Loan, following three Tranches are assumable and Tranche 2 (Domestic Bank Loan) is regarded as a base case. The other two Tranches are used in Analysis of Project Profitability as Public and Private Partnership mentioned later.

(i) Tranche 1: JICA PSIF Loan: Loan Period 20 years, Grace Period 5 years
Interest rate 3.0%/year + Currency, Depreciation Rate of 5.0% per year

(ii) Tranche 2: Domestic Bank Loan (Base Case): Loan Period 15 years, Grace Period 5 years
Interest rate15%/year

(iii)Tranche 3: JICA Bank Loan: Loan Period 15 years, Grace Period 5 years
Interest rate 12%/year

1 The Economic Intelligence Unit Limited, 2011
2 World Economic Outlook Database, 2010
3 http://www.world401.com/kawase/don_yen.html

Table7.2 Assumptions of Financial Analysis (Part 1)

Assumptions 1 Input Cell

General	
Study year	2011
Construction Period	7 years
Concession (O&M) Period	30 years
Unit	Billion VND
Inflation (%) during construction peri	7.9%

Inflation		
From	To	%
2016	2020	7.0%
2021	2025	6.3%
2026	2030	5.6%
2031	2035	5.0%
2036	2040	4.4%
2041	2045	3.9%
2046	2050	3.5%

Corporate income tax		
Standard tax rate		25%
- Preferential	15 yrs	10%
- exemption		
100% exemption period		4 yrs
50% exemption period		9 yrs

http://www.jetro.go.jp/world/asia/vn/invest_04/

Financial Structure	%	amount	
Senior loan Tr.1 (JICA)	0.00%	0	+IDC (Interest During Construction)
Senior loan Tr.2 (banks)	70.00%	2,360	+IDC
Senior loan Tr.3 (Sub-loan)	0.00%	0	+IDC
Equity (preferred)	0.00%	0	
Equity (ordinary)	30.00%	1,011	
Viability Gap fund 1	0.00%	0	
Viability Gap fund 2	0.00%	0	
Total	100.00%	3,371	+IDC

see "Assumptions 2" for detail of total construction cost

Private Sector Loan

[terms and conditions]

- Preferred equity: Dividend ratio 30% of outstanding amount of preferred equity

- Loan	Tr.1 (JICA PSIF)		Tr.2 (Domestic Bank)		Tr.3 (JICA PSIF Bank)	
Interest rate during const. period	3.0%		15.0%		12.0%	
Interest rate after operation	3.0%		15.0%		12.0%	
Grace period	5	years	5	years	5	years
Loan period to maturity	20	years	15	years	15	years
Repayment schedule	linear amortisation					
Provision* for Forex loss(JPY/VND	5%	of annual debt service				

* assumed immediate write-off with cash effect

ODA Loan

[terms and conditions]

- Loan	ODA (JICA)					
Interest rate during const. period	0.2%		0.0%		0.0%	
Interest rate after operation	0.2%		0.0%		0.0%	
Grace period	10	years	0	years	0	years
Loan period to maturity	40	years	0	years	0	years
Repayment schedule	linear amortisation					
Provision* for Forex loss(JPY/VND	5%	of annual debt service				

* assumed immediate write-off with cash effect

Inflation rate in Vietnam	11.8	(2010 est)

http://www.indexmundi.com/vietnam/inflation_rate_(consumer_prices).html

The construction period is 5 years from 2017 to 2021 (7 years when including the design) with the USM under the Le Loi street opening one year earlier than the full opening. The full opening is assumed in the beginning of 2022. The total project cost with both public and the private portions including inflation, the public administration cost and the VAT will be about 17 Trillion VND (about 800 million USD).

The sub lease rent to the tenants of the USM is set on the basis of interview surveys conducted to potential developers in the area. The average level has been around 80 USD/m2/month, however the rent level for financial calculation is conservatively set at 70 USD/m2/month. Other maintenance fee and so on are also set at the market level in the similar manner. The tenant occupancy rate is set as 95% based on the current figure of the Grade A commercial properties in Ho Chi Minh City.

Table 7.3 Assumptions of Fiancial Analysis (Part 2)

Assumptions 2 (area, cost & inflation)

Inflation	
Cost inflation switch (yes=1, no=0)	1

Area	m2	CS (55%)	Le Loi
Store	18,127	9,970	8,157
Passageway	21,447	11,796	9,651
Facility Room	5,443	2,994	2,449
Total	45,017	24,759	20,258

Construction	B VND			
item	Public	Private	Public	Private
A. Construction Cost	5,647	1,219		
I. Underground Shopping Mall (USM)	**5,647**	**1,219**		
(1) Construction Cost	**5,647**	**1,219**		
1) Ben Thanh Central Station Area	**2,989**	**764**		
i) Civil Structures (Public)	1,897	0	100%	0%
ii) Architecture (Public/Private)	0	682	0%	100%
iii) Facility (Public/Private)	1,092	82	93%	7%
2) Le Loi Street Area	**2,658**	**455**	0%	100%
i) Civil Structures (Public)	1,934	0	100%	0%
ii) Architecture (Public/Private)	0	401		
iii) Facility (Public/Private)	724	54	93%	7%
(2) Price Escalation				
(3) Physical Contingency				

Forex Rate			
1 USD = 20,835 VND =	JPY		9/19/11

Depreciation & Amortisation (years)			
Years for depreciation	Civil	Store	Facility
1.Hard cost (construction work)	30	30	15
Coefficients applied to linear method	0.0333	0.0333	0.067
2.Soft cost (Design & Supervision)	5		
Coefficients applied to linear method	0.2		
3.IDC ("1" for Hard or "2" for Soft)	1		

IDC: Interest payment During the Construction period

Revenue	USD/m2/mo	VND/m2/mo	
1. Commercial Property			
1) Maintenance Charge	12	250,020	
2) Rent Charge (High End)	100	2,083,500	
3) Rent Charge (BF 1)	70	1,458,450	
4) Rent Charge (Other F)	60	1,250,100	
2. Passageway			
1) Maintenance Charge	9.6	200,016	80% of CP M.C.
2) Utility Charge	2	41,670	100% of Utility Cost
3. Management Fee	5	104,175	for total floor area excluding st

Maintenance Cost	USD/m2/mo	VND/m2/mo	
1. Store Area	9.6	200,016	80% of M.C.
2. Passageway	7.7	160,013	80% of Store Area M.C.

Table 7.4 Assumptions of Financial Analysis (Part 3)

Utility Cost	USD/m2/mo	VND/m2/mo
1. Electricity and others	2	41,670

Administration Cost	USD/m2/mo	VND/m2/mo
1. Staff Salary	6,300	131,260,500
2. Direct Expense	6,300	131,260,500
Total		262,521,000

Staff C			USD/mo
4,500	2	Management	1,000
	2	Engineering	500
	5	Administration	300

Direct Expense
100% of Staff Salary

Renewal Cost		
1. Replacement of Facilities	100%	of original facility cost/15 years

Master Lease Fee	USD/m2/mo	VND/m2/mo	
1. Lease Fee	10	208,350	Charged to comercial property only

VAT rate for construction 10%

(3) Structure of Revenue and Expenditure of the Private Sector Portion (Base Case)

Structure of the revenue and the expenditure for the private sector portion is shown in the Figure7.2. The vertical bars charts below the zero level of the vertical axis (Y axis) are the initial investments and the renewal investments. The line graph is annual revenue level. The bar chart below the line graph is composition of annual cost and debt service.

Based on the Base Case (the D/E ratio is 70/30 with commercial loan and the private portion of facility investment is 7%) assumptions, the calculation result is shown in the following figure. There is a relatively large room between the line graph and the bar chart of the annual costs and debt service indicating that the project is generating sufficient level of profit as a private sector investment.

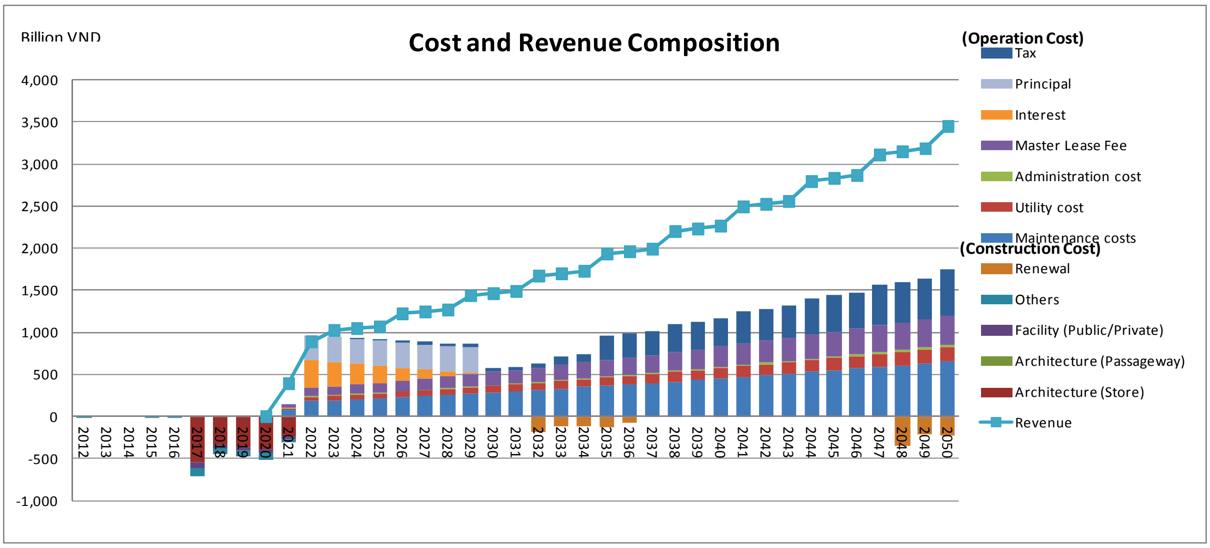


Figure 7.2 Structure od Revenue and Expenditures (Base Case)

(4) Cash Flow Analysis

The result of the cash flow analysis is shown in the Table7.5 and Figure7.3. The equity IRR which indicates the profitability of the private sector investment is calculated on the VND basis as 20.2 %, which would satisfy the expected return level for the private sector. Annual net cash flow from the beginning years is positive except the years of the renewal investments, with cumulative cash increasing steadily. The renewal investments could be covered sufficiently by the internal reserve of cash.

Repayment of the commercial loan could sufficiently be covered by annual cash flow with calculated Debt Service Coverage Ratio (DSCR) being only less than 1.0 for the first year, but 1.83 on the average which shows sufficient level of repayment capability.

Table 7.5 Cash Flow Statement (Base Case)

Annual payment schedule	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Billion VND	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
									Le Loi Open		Full Open								
Total revenue received										392	891	1,025	1,046	1,069	1,222	1,245	1,268	1,438	1,464
Maintenance costs paid										-104	-237	-252	-268	-285	-300	-317	-335	-354	-373
Mater lease fee paid										-41	-97	-104	-110	-117	-123	-130	-138	-145	-153
Net VAT payment to authority										-25	-56	-67	-67	-67	-80	-80	-80	-94	-94
Corporate income tax										0	0	0	-15	-17	-25	-27	-28	-37	-39
Cash-flow from operations	0	0	0	0	0	0	0	0	0	223	501	603	587	584	694	691	688	808	805
Capex (initial)	-0	0	0	-12	-12	-714	-447	-479	-513	-312	0	0	0	0	0	0	0	0	0
Capex (renewal)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net cash before financing	-0	0	0	-12	-12	-714	-447	-479	-513	-89	501	603	587	584	694	691	688	808	805
Project IRR:	18.6%	(cf. WACC:		16.6%)															
Capitalized financial cost of IDC for Tr.1 (JICA)			0	0	0	0	0	0	0	0									
Capitalized financial cost of IDC for Tr.2 (banks)			0	0	0	-40	-108	-172	-246	-318									
Capitalized financial cost of IDC for Tr.3 (JICA Bank Loan)			0	0	0	0	0	0	0	0									
Drawdown of senior debt Tr.1 (JICA)			0	0	0	0	0	0	0	0									
Drawdown of senior debt Tr.2 (banks)			0	0	0	527	389	455	531	441									
Drawdown of debt Tr.3 (JICA Bank Loan)			0	0	0	0	0	0	0	0									
Equity injection (ordinary)			0	12	12	226	167	195	227	189									
Equity injection (preferred)			0	0	0	0	0	0	0	0									
Viability gap funding 1																			
Viability gap funding 2																			
Cash-flow available for debt service (CFADS)	-0	0	0	0	0	0	0	0	0	223	501	603	587	584	694	691	688	808	805
Interest payment for debt Tr.1 (JICA)											0	0	0	0	0	0	0	0	0
Interest payment for debt Tr.2 (banks)											-334	-299	-264	-228	-193	-158	-123	-88	-53
Interest payment for debt Tr.3 (JICA Bank Loan)								0	0	0	0	0	0	0	0	0	0	0	0
Repayment of principal for debt Tr.1 (JICA)								0	0	0	0	0	0	0	0	0	0	0	0
Repayment of principal for debt Tr.2 (banks)											-234	-234	-234	-234	-234	-234	-234	-234	-234
Repayment of principal for debt Tr.3 (JICA Bank Loan)									0	0	0	0	0	0	0	0	0	0	0
Provision* for Forex loss(JPY/VND) of Tr.1								0	0	0	0	0	0	0	0	0	0	0	0
* assumed immediate write-off with cash effect																			
Debt service coverage ratio (DSCR)											0.88	1.13	1.18	1.26	1.62	1.76	1.93	2.51	2.80
Cash-flow before dividends	-0	0	0	0	0	0	0	0	0	223	-68	70	89	121	266	298	331	486	518
Dividends for preferred equity											0	0	0	0	0	0	0	0	0
Cash-flow in period	-0	0	0	0	0	0	0	0	0	223	-68	70	89	121	266	298	331	486	518
Cash balance at beginning of period	0	-0	-0	-0	-0	-0	-0	-0	-0	-0	222	155	224	313	435	701	999	1,330	1,815
Cash-flow in period	-0	0	0	0	0	0	0	0	0	223	-68	70	89	121	266	298	331	486	518
Cash balance at end of period	-0	-0	-0	-0	-0	-0	-0	-0	-0	222	155	224	313	435	701	999	1,330	1,815	2,334
Cash-flow for equity(ordinary) investor	-0	0	0	-12	-12	-226	-167	-195	-227	33	-68	70	89	121	266	298	331	486	518
Equity(ordinary) IRR:	20.2%	* to be deteriorated if special conditions are agreed with preferred equity holders for profit sharing of "Net cash" position at the maturity of concession.																	

Annual payment schedule	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Billion VND	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Total revenue received	1,489	1,672	1,700	1,728	1,934	1,962	1,991	2,201	2,233	2,266	2,493	2,525	2,558	2,796	2,832	2,865	3,112	3,148	3,185	3,450
Maintenance costs paid	-392	-411	-432	-453	-475	-496	-518	-541	-565	-590	-613	-637	-662	-687	-714	-739	-765	-792	-819	-848
Mater lease fee paid	-161	-169	-177	-186	-195	-204	-213	-222	-232	-242	-252	-262	-272	-282	-293	-304	-314	-325	-337	-348
Net VAT payment to authority	-94	-109	-109	-109	-126	-126	-126	-144	-144	-143	-163	-163	-162	-183	-182	-182	-203	-203	-203	-225
Corporate income tax	-41	-49	-98	-98	-291	-291	-291	-335	-335	-334	-383	-383	-382	-432	-432	-432	-484	-484	-483	-550
Cash-flow from operations	802	934	883	882	845	844	843	959	957	956	1,083	1,081	1,080	1,211	1,210	1,209	1,345	1,344	1,343	1,478
Capex (initial)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex (renewal)	0	-182	-112	-118	-123	-70	0	0	0	0	0	0	0	0	0	0	0	-350	-213	-220
Net cash before financing	802	752	771	765	722	774	843	959	957	956	1,083	1,081	1,080	1,211	1,210	1,209	1,345	994	1,130	1,258
Cash-flow available for debt service (CFADS)	802	752	771	765	722	774	843	959	957	956	1,083	1,081	1,080	1,211	1,210	1,209	1,345	994	1,130	1,258
Interest payment for debt Tr.1 (JICA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest payment for debt Tr.2 (banks)	-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest payment for debt Tr.3 (JICA Bank Loan)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Repayment of principal for debt Tr.1 (JICA)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Repayment of principal for debt Tr.2 (banks)	-234	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment of principal for debt Tr.3 (JICA Bank Loan)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Provision* for Forex loss(JPY/VND) of Tr.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Debt service coverage ratio (DSCR)	3.18	#DIV/0!	#DIV/0!	#DIV/0!																
Cash-flow before dividends	550	752	771	765	722	774	843	959	957	956	1,083	1,081	1,080	1,211	1,210	1,209	1,345	994	1,130	1,258
Dividends for preferred equity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash-flow in period	550	752	771	765	722	774	843	959	957	956	1,083	1,081	1,080	1,211	1,210	1,209	1,345	994	1,130	1,258
Cash balance at beginning of period	2,334	2,884	3,636	4,408	5,172	5,894	6,668	7,511	8,470	9,428	10,384	11,466	12,548	13,628	14,840	16,050	17,258	18,604	19,598	20,728
Cash-flow in period	550	752	771	765	722	774	843	959	957	956	1,083	1,081	1,080	1,211	1,210	1,209	1,345	994	1,130	1,258
Cash balance at end of period	2,884	3,636	4,408	5,172	5,894	6,668	7,511	8,470	9,428	10,384	11,466	12,548	13,628	14,840	16,050	17,258	18,604	19,598	20,728	21,987
Cash-flow for equity(ordinary) investor	550	752	771	765	722	774	843	959	957	956	1,083	1,081	1,080	1,211	1,210	1,209	1,345	994	1,130	1,258

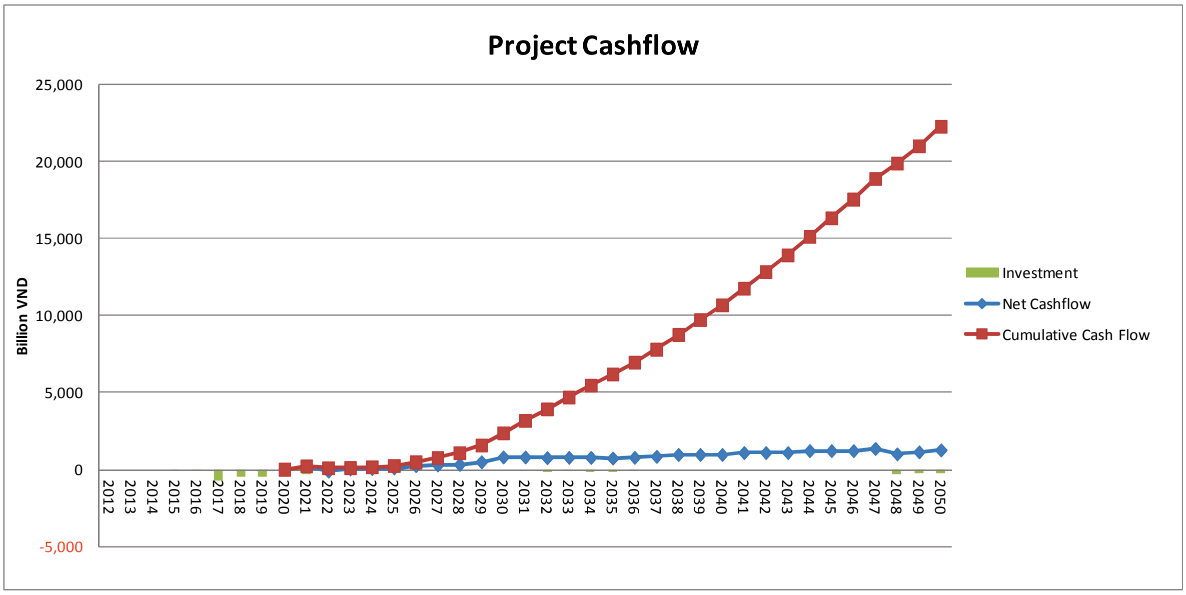


Figure 7.3 Cash Flow Profile (Base Case)

(5) Analysis of Project Profitability as Public and Private Partnership

Breakdown of the investment cost shared between the public and the private for the Base Case is shown in the Table7.6. The public sector shares the cost of the structure and 93% of the facility cost and the private sector share the investment for the store, the passageway/plaza and 7% of the facility cost. This breakdown is based on the base construction cost excluding inflation and contingencies.

The share ratio of the facility cost between the public and the private is assumed to be proposed by tender proposal by the private sector or by the negotiation process with the private sector. If the tender procedure is applied, the share ration would differ among the tender proposals of the consortia of the private sector.

The following figure shows the relationship between the allowable share ratio and the equity IRRs (on the VND basis) of particular share ratio by application of three different loans.

(i) Tranche 1: JICA PSIF Loan: Loan Period 20 years, Grace Period 5 years
Interest rate 3.0%/year + Currency, Depreciation Rate of 5.0% per year

(ii) Tranche 2: Domestic Bank Loan (Base Case): Loan Period 15 years, Grace Period 5 years
Interest rate15%/year

(iii) Tranche 3: JICA PSIF Bank Loan: Loan Period 15 years, Grace Period 5 years
Interest rate 12%/year

If the expected investment return level (Equity IRR on the VND basis) is assumed at 20.0% level, the private sector may shoulder 40% of the equipment investment portion by applying the Tranche 1, whereas, only 7% if financed only by the Tranche 2 (the domestic bank loan) as indicated in the Base Case and 14% if the private sector chose the financing of the Tranche 3 (JICA PSIF Bank Loan) only.

Table 7.6 Breakdown of Base Construction Cost between the Public and the Private
(Base Case with base cost excluding inflation and contingencies)

Construction	B VND			
item	Public	Private	Public	Private
A. Construction Cost	5,647	1,219		
I. Underground Shopping Mall (USM)	**5,647**	**1,219**		
(1) Construction Cost	**5,647**	**1,219**		
1) Ben Thanh Central Station Area	**2,989**	**764**		
i) Civil Structures (Public)	1,897	0	100%	0%
ii) Architecture (Public/Private)	0	682	0%	100%
iii) Facility (Public/Private)	1,092	82	93%	7%
2) Le Loi Street Area	**2,658**	**455**	0%	100%
i) Civil Structures (Public)	1,934	0	100%	0%
ii) Architecture (Public/Private)	0	401		
iii) Facility (Public/Private)	724	54	93%	7%
(2) Price Escalation				
(3) Physical Contingency				

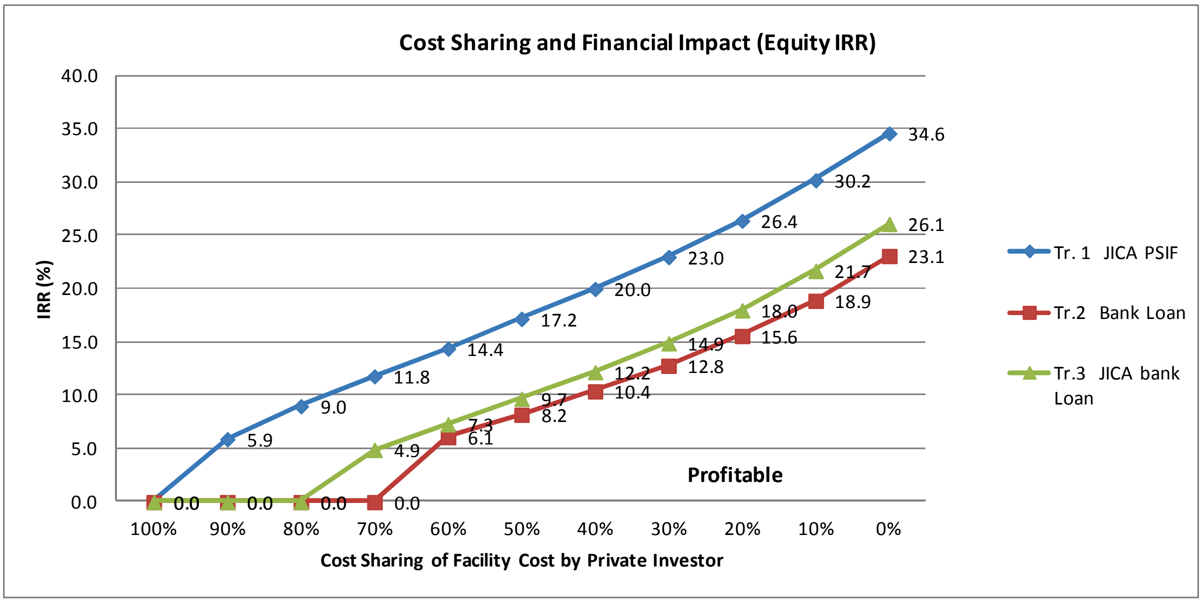


Figure 7.4 Analysis of Profitability based on Cost Sharing

(6) Risk Sensitivity Analysis

Sensitivity analysis of major project risks is conducted. The following risks are analyzed:

① Increase of Construction Cost

② Increase of Master Lease Fee to be paid to either MAUR or Project Owner

③ Decrease of Occupancy Rate of Tenants

④ Decrease of Tenant Rent

Based on the Base Case, profitability of the project is analyzed with change of equity IRR on the VND basis by varying the degree of above mentioned project risks. Change of 30% would bring down the equity IRR form the 20% level to13% to 15% level for the risks of construction cost increase , of decrease of the tenant occupancy and of the decrease of the tenant rent. On the other hand, increase of master lease fee would have larger impact to the profitability than the risks of construction cost increase and tenant occupancy decrease.

Table7.7 Sensitivity Analysis of Major Project Risks

Risk	Base Case		Risk Sensitivity		
1. Construction Cost Increase	0%		+10%	+20%	+30%
	Equity IRR	20.2	18.1%	16.5%	15.0%
2. Increase of Master Lease Fee	10 US$/m2		20US$/m2	30US$/m2	40US$/m2
	Equity IRR	20.2%	16.5%	12.9%	9.0%
3. Decrease of Tenant Occupancy	95%		90%	80%	70%
	Equity IRR	20.2%	18.7%	15.9%	13.0%
4. Decrease of Tenant Rent	70 US$/m2		65 US$/m2	60 US$/m2	55 US$/m2
	Equity IRR	20.2%	18.5%	16.9%	15.3%

7.2.2 Financial Analysis of Public Sector Portion

(1) Value for Money Analysis of Public Sector

Investment by the public sector of 14.3 Trillion VND (public sector administration cost, design and planning cost, construction cost of the structure, shared portion of the facility cost) is analyzed by calculating the amount of revenue generated to the public sector from the project.

As shown in the Figure7.5, nominal value of the investment is 14.3 Trillion VND and the net revenue from the project (total of VAT, corporate income tax and master lease fee paid by SPC (considered as actual profit sharing between the public and the private) deducting payment for maintenance fee paid by the public sector to SPC for the maintenance of the public space such as the passageway and the plaza for the period of 37 years) is calculated as 4.9 Trillion VND, which is about one fourth of the total investment.

On the other hand, the Net Present Value of the public investment based on the above mentioned net revenue at the discount rate of 12% is calculated as Minus 6.0 Trillion VND.

The total project cost including both the public and the private would be 16.8 Trillion VND (807 Million USD). Of which 15% (about 2.5 Trillion VND) would be the private sector investment. In view of the PPP effect for the public sector side, this saving of 2.5 Trillion VND of the public investment together with the above mentioned revenue generation by the project to the public sector side are the financial benefit of implementing this PPP project.

Analysis of economic benefit of the project including the benefit of land price increase is explained in detail in the following section of this report.

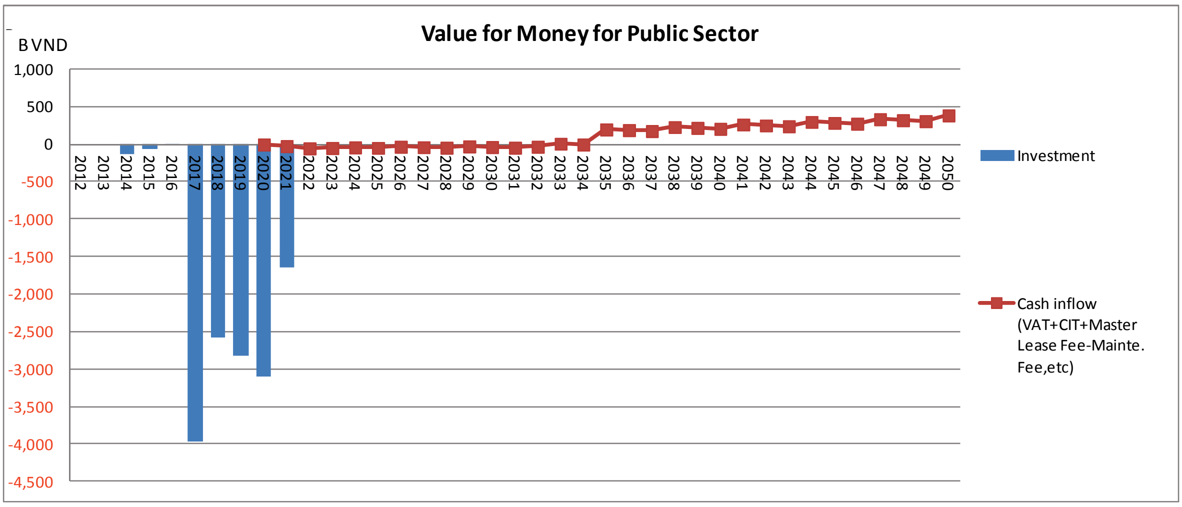


Figure 7.5 Value for Money Analysis of Public Sector Portion

(2) Analysis of Repayment Feasibility of ODA Loan

In the same manner mentioned above, feasibility of repayment of the ODA loan is analyzed by calculating how much of the ODA loan could be recovered by the net revenue of the public sector (the calculation is based on VND currency without considering the depreciation of currencies).

As shown in the Figure7.6, in the beginning years the net revenue is negative, but form the years of 2035 when the special treatment of corporate tax for the SPC expires, the net revenue would increase, as a result, the total net revenue could cover about 20% of the total repayment of the ODA loan.

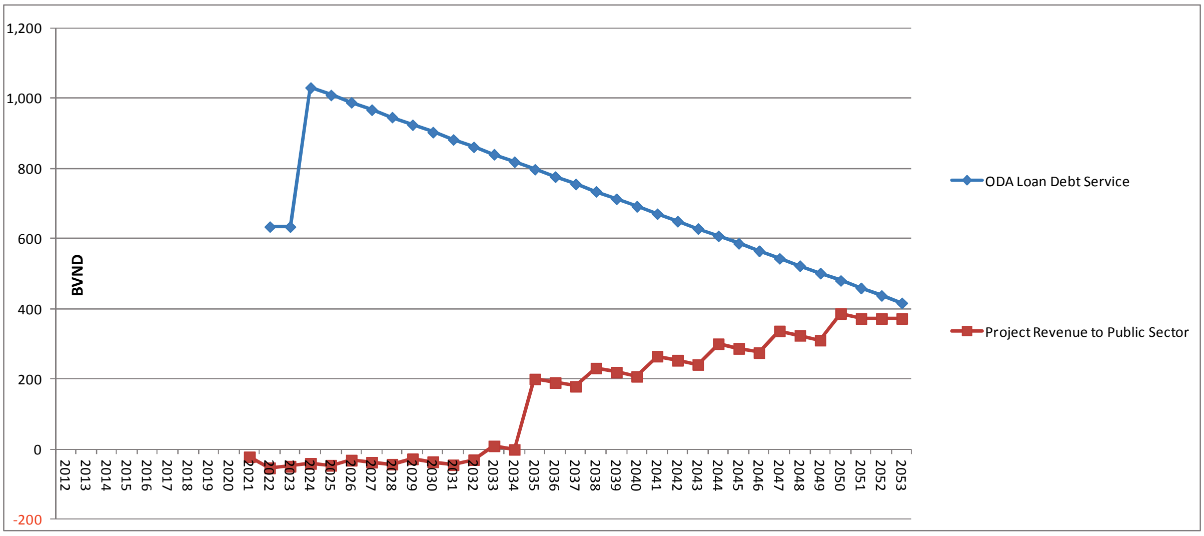


Figure7.6 Repayment Feasibility of ODA Loan

7.2.3 Economic Analysis of the Project

As an economic analysis of the project, based on the proposed plan and the results of study thus far, we will measure the social benefits of underground mall development and calculate the project's economic internal rate of return (EIRR).

Here, our economic analysis consists of estimates prepared using the "Proposed Cost Benefit Analysis Manual for Urban Renewal Projects (2007 revised edition) with Editorial Supervision by the Urban Development and Improvement Division, City and Regional Development Bureau and the Urban Building Division, Housing Bureau, Ministry of Land, Infrastructure, Transport and Tourism" (referred to below as the "Socioeconomic Benefit Estimation Manual"), with consideration for the characteristics of this project (having both a public service portion and a commercial for-profit portion).

The approach to this analysis is shown in the Figure7.7 and Figure7.8 below.

Note: No manuals exist for direct cost-benefit analysis concerning underground mall development. Therefore, we are using the manual for urban development projects which we have determined to be similar in nature to this project.

●Public nature of Use in Underground Space

Promotion of Formulation of Master Plan of public use in underground (1989, Ministry of Construction, Japan) , extracts

・Purpose: Smoothing of road traffic and Securing of functional urban activity
・Target: Central Business District or Large-scale Urban Renewal district in the City of 300,000 people or more
・These districts are located as much as possible as underground use district and underground traffic network district.

●Subsidies for Development Underground Space

No interest financing (Passageway and Plaza of USM, Underground Car Park)
Low interest rate financing (Store of USM, Underground Car Park)

●Necessity of Economic analysis

All public projects, included project with private potion, are obligated to execute Economic analysis.
We use the concept of Urban Renewal Projects, because there is not directly analysis method for Underground Space Development Projects.

The Benefit of Project Implementation is evaluated by theoretical rise in land prices around Project area.

✓Using "Cost Benefit Analysis Manual for Urban Renewal Projects" issued by Ministry of Land, Infrastructure, Transport and Tourism, Japan.

Figure 7.7 Approach to economic analysis for the present project

Benefit = Theoretical Rise in Land Price

=＜ Land Price (After opening of USM) - Land Price (Before)＞×Area

Relation between Theoretical Land Price and Level of Accessibility and Amenity

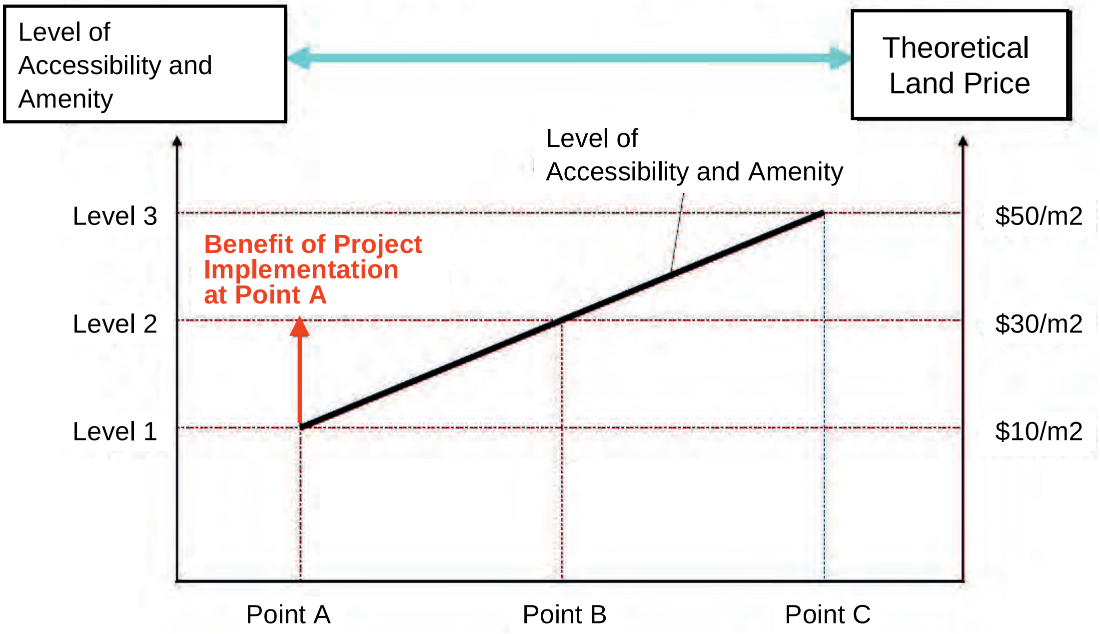


Figure 7.8 Graph of theoretical land price benefit in urban renewal projects

1) Estimation of social benefits in underground mall development

(1) Determination of scope subject to analysis

Estimation of the theoretical land price benefit based on the hedonic approach in the Socioeconomic Benefit Estimation Manual is performed within the scope where the effects of the project are expected to extend (impact scope). In this study, the impact scope is taken as approximately 500 meters from the outer perimeter of the underground mall plan site.

(2) Approach to land price function

The primary purpose of the land price function is to determine the enhancement of land before and after the project, and this process involves the derivation of a land price estimation formula.

To prepare the hedonic function, it is established from the explanation variable in part (4) below with consideration for the area's characteristics and the project's purpose, etc.; data is collected for each point; and the function with the highest statistical accuracy based on regression analysis is set as the land price function.

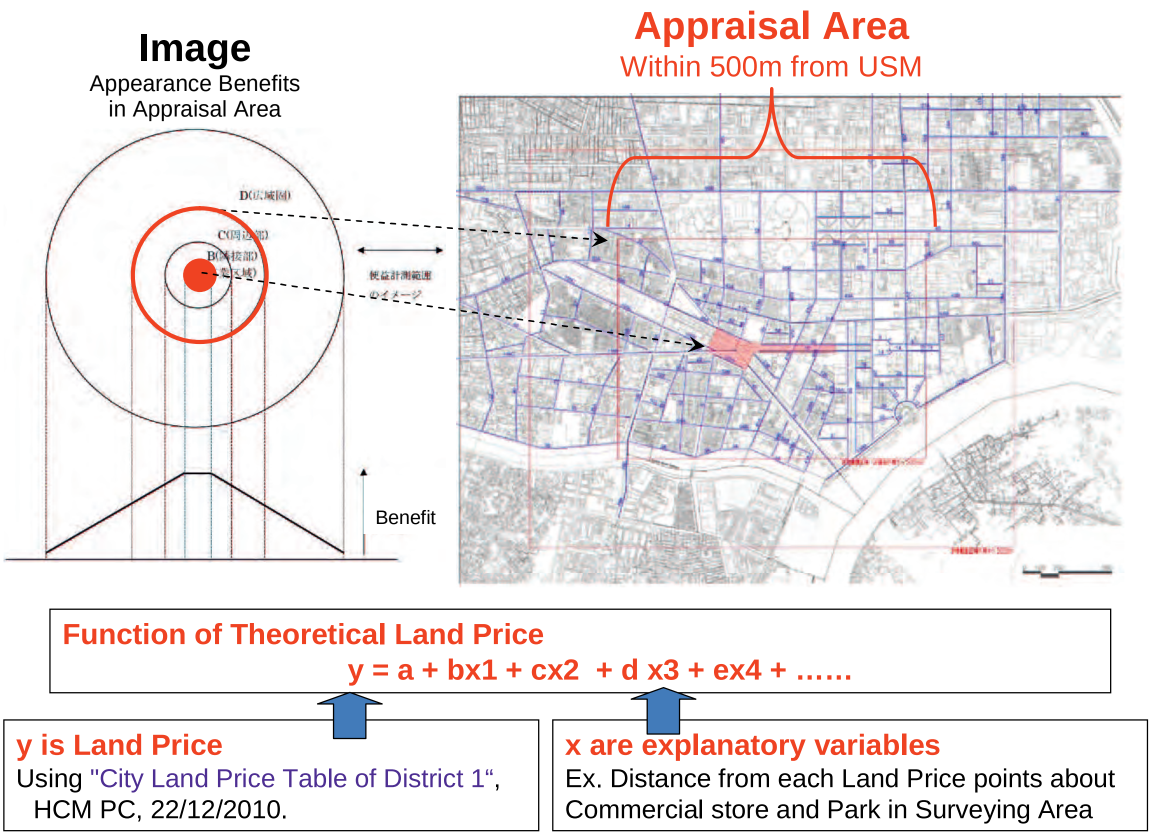


Figure 7.9 Scope subject to benefit estimation in the present project

(3) Determining the data extraction sample

The midway points in the values of land facing streets within the scope indicated in part (1) above are adopted as the land price sample points. Data on accessibility from each sample point (large scale commercial facilities and open spaces) is based on the large-scale commercial facilities and open spaces identified previously in section 2.2 (Current State of the Area) and located within 500 meters of each point.

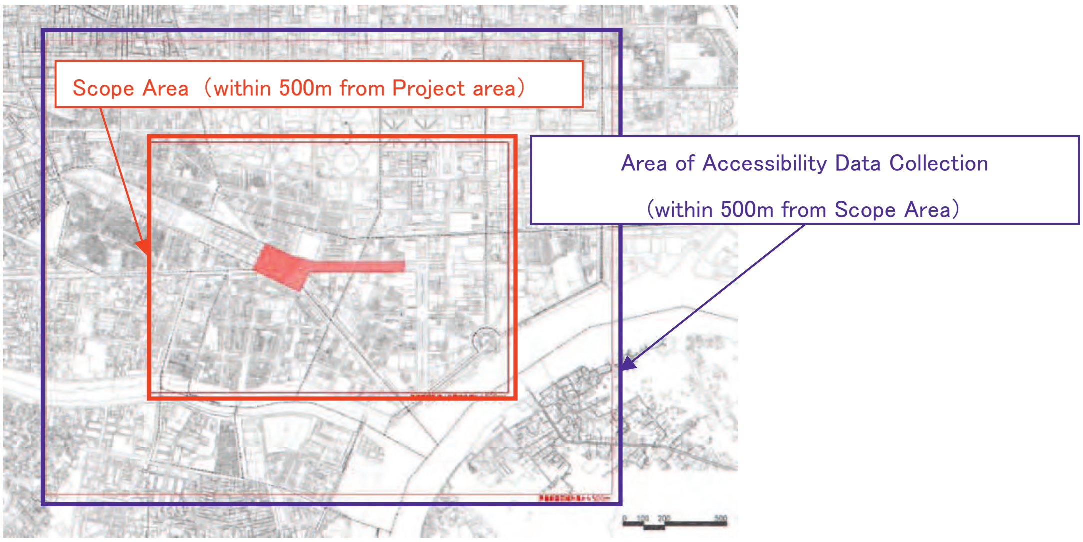
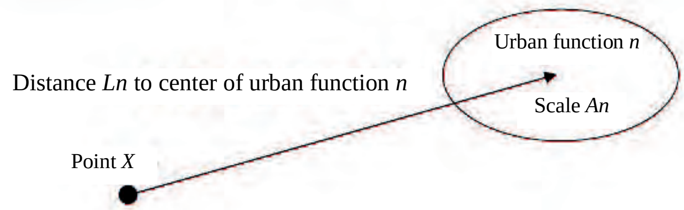


Figure 7.10 Scope of accessibility data collection

Reference: Approach to accessibility data

Accessibility data is a concept expressing the convenience of a location (for convenient shopping and so on). Convenience is expressed according to the scale of urban functions and proximity to urban functions.

Approach to accessibility data



Accessibility to urban function n at point X =
Scale An of urban function n / Distance $Ln^{1.2}$ to urban function n

$$X_{ACCm} = \sum_{n} A_{nm} / L_{nm}^{1.2}$$

X_{ACCm}:	Accessibility for purpose m at point X
n:	Facility number
m:	Purpose
A_{nm}:	Scale of facility number n of purpose number m
L_{nm}:	Distance from point X to facility of facility number n of purpose number m

Note: As stated in part (5) below, with respect to proximity to urban functions for accessibility calculations in this investigation, we will study cases where consideration is given to access by motorcycle, in addition to cases where only access by walking is taken into consideration. When access by motorcycle is considered, proximity to urban functions (L_{nm}) is expressed by time conversion. (We have assumed a 92% share for bicycles and motorcycles, with a speed of 80 m/min in the case of walking and a speed of 313 m/min in the case of motorcycles (based on the average motor vehicle travel speed of 18.8 km/h within the wards of Tokyo).)

(4) Data collection and compilation

The data of the purpose variables and explanation variables collected and compiled for each sample point cover the items indicated in the Table 7.8, with reference to the Socioeconomic Benefit Estimation Manual.

Table 7.8 List of purpose variable and explanation variable data

Category	Item		Calculation method
Purpose variable	Land price		Based on the ward urban land price table (HMC PC, 12/22/2010)
Explanation variable	Candidate variables expressing location characteristics	[1] Land use zone	1 for land zoned "commercial and business" (other than the following), 0 for land zoned "park," "administrative," or "culture."
		[2] Actual floor area ratio	Based on floor area ratio.
		[3] Width (m) of frontal road	
		[4] Distance (m) to the central point of the CBD	Taken as front of the tax center of the central business district (CBD)
	Candidate variables expressing convenience (accessibility)	[5] Convenience of large-scale commercial facilities	Calculated from the total floor area and distance from each point for large-scale commercial facilities* within the scope of data collection
		[6] Convenience of open spaces	Calculated from the site area and distance from each point for open spaces† within the scope of data collection

* The subject facilities are as follows: Nguyen Trai Street, Don Khoi Street, Saigon Center, Tax Center, Diamond Plaza, Ben Thanh Market, Vincom Center, and Parkson.
"Nguyen Trai Street"、"Don Khoi Street"、"Saigon Center"、"Tax Center"、"DiamondPlaza"、"Ben Thanh Market"、"Vincom Center"、"Parksonｍ"

† The subject facilities are as follows: September 23 Park, Tao Dan Park, and April 30 Park.
"September23 Park"、"Tao Dan Park"、"April 30 Park"

(5) Preparation of land price function

As stated previously in section 2.2 (Current State of the Area), Ho Chi Minh City is characterized by a high proportion of motorcycle and bicycle use. According to the Socioeconomic Benefit Estimation Manual, walking is the basis for the strict land price function of the 500 meter subject area. However, considering the situation of Ho Chi Minh City, we have based our analysis on a 92% share for motorcycles and bicycles, as shown in the chart below.

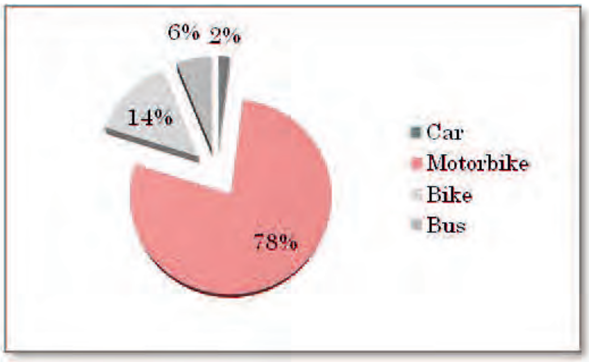


Figure 7.11 Use of means of transportation
(reposted from section 2.2 (Current State of the Area))

We estimated the land price function by performing multiple regression analysis based on the above database.

The function was taken as a linear function, and we established a total of seven cases for accessibility data, including the case of walking only as well as cases based on the share of motorcycle and bicycle transport. Based on statistical validation, the variables ultimately used in the land price function were frontal road width, distance to the central point of the CBD, convenience (accessibility) of commercial facilities (walking only), and park convenience (accessibility) (walking only).

As a result, based on the reproducibility of the model (models with a negative accessibility coefficient are inappropriate) and statistical accuracy of the model overall (multiple correlation coefficient R), we decided to use the model having the most accurate reproducibility and giving consideration to the 92% share of motorcycle and bicycle transport (for distances over 500 meters).

We have incorporated a variable that is not statistically significant (judged to have 95% significance at a level of at least 1.96 based on t-values) as a policy variable for the purpose of measuring the effects of the project

Table 7.9 List of land value function estimation results

Variable etc.	100% walking for entire area	92% share of motorcycle and bicycle transport (100% walking outside the area considered)					
		Considering entire area	Considering 100m and up	Considering 200m and up	Considering 300m and up	Considering 400m and up	Considering 500m and up
Section (t value)	43271.4 (7.50)	43271.4 (7.50)	44247.3 (5.56)	64187.5 (6.01)	67596.5 (7.11)	37748.0 (4.46)	32669.0 (3.56)
Width (m) of frontal road (t value)	436.2 (4.58)	436.2 (4.58)	441.8 (4.62)	439.3 (4.65)	506.8 (5.45)	440.1 (4.65)	466.7 (4.93)
Distance (m) to central point of CBD (t value)	-23.05 -(3.84)	-23.05 -(3.84)	-23.41 -(3.12)	-34.98 -(4.52)	-39.17 -(6.34)	-22.85 -(4.21)	-19.22 -(3.68)
Accessibility (commercial facilities) (t value)	28.10 (0.93)	0.037 (0.93)	0.031 (0.52)	-0.171 -(1.58)	-0.310 -(2.44)	-.134 (0.96)	0.283 (1.51)
Accessibility (open spaces) (t value)	20.25 (0.92)	0.026 (0.92)	0.023 (0.73)	0.023 (0.54)	0.096 (1.94)	0.074 (1.11)	0.021 (0.26)
Multiple correlation coefficient R	0.722	0.722	0.717	0.724	0.750	0.725	0.728

Land price function model used

Land price (Unit: 1,000 dong/m^2) = 32669.0
+ 466.7 x Width (m) of frontal road
- 19.22 x Distance (m) to central point of CBD
+ 0.283 x Convenience (accessibility) of commercial facilities
+ 0.021 x Convenience (accessibility) of open spaces

Note: Shaded portions indicate data items that will change before and after project development.

(6) Calculation of social benefit (theoretical land price change) due to project implementation

The social benefit (theoretical land price change) in the case of project implementation will be calculated in accordance with the land price function calculated in section (5). Implementation of the present project will create new commercial facility space of 20,000 m^2 and open space of 20,000 m^2. This change will improve accessibility to facilities from each of the sample points. Therefore, the social benefit (theoretical land price change) is estimated by applying this amount of change to the land price function.

The results of such calculations are as follows. The total social benefit (theoretical land price change) to the surrounding area based on implementation of the project is estimated at approximately two trillion dong (approximately 7.2 billion yen at the exchange rate of 1,000 dong = 3.7 yen).

Table 7.10 Results of estimation of social benefit (theoretical land price change)

Street number	Site area at the same land value (m^2)	Estimated theoretical unit increase in land value (1,000 dong/m^2)	Theoretical land price increase (1,000 dong)
3A	21,905	2,045	44,785,376
6	38,239	343	13,097,194
8	17,029	1,550	26,391,385
14	12,988	1,757	22,822,548
15	9,345	1,447	13,519,908
16	15,300	1,473	22,537,591
22	5,981	485	2,898,250
23	6,154	2,398	14,755,120
25B	13,362	1,661	22,190,726
26	54,552	2,059	112,304,174
28	18,404	1,558	28,672,870
29A	60,569	1,403	84,965,474
33A	12,035	215	2,584,249
33B	12,303	312	3,834,530
35	30,128	229	6,903,359
36B	15,768	1,701	26,817,697
37	10,681	1,960	20,934,839
39	6,798	1,617	10,994,756
41B	19,347	2,567	49,657,979
42	33,973	2,443	82,994,737
43A	104,066	318	33,124,956
46	5,365	734	3,938,400
47	7,303	305	2,228,550
49A	31,459	590	18,555,292
49B	28,090	1,375	38,635,964
50	37,756	252	9,532,615
51A	69,110	325	22,466,942
52	15,801	495	7,825,583
52B	13,039	380	4,958,763
53	27,304	1,330	36,306,631
54	6,796	328	2,228,414
58	14,441	1,772	25,594,474
61A	21,554	250	5,388,689
61B	26,984	282	7,621,362
61C	44,798	2,096	93,900,216
62	7,150	495	3,541,715
64A	28,870	2,078	60,003,429
64B	32,082	2,672	85,737,677
66A	85,361	501	42,735,675
66B	36,827	1,783	65,645,129
68	51,310	2,380	122,098,256
69	10,750	1,272	13,679,179
75	3,720	1,313	4,885,018
76	3,837	2,230	8,558,413
77	34,990	338	11,829,332
78A	6,868	2,242	15,394,736
78B	35,722	1,374	49,066,361
80	11,712	2,271	26,603,950
82A	4,110	301	1,236,845
82B	20,154	329	6,638,972
88	10,584	1,558	16,486,661
93	19,190	1,825	35,027,545
94A	71,381	2,663	190,067,332
94B	14,963	2,600	38,908,416
95	7,026	362	2,544,983
96	7,037	434	3,054,982
101	8,366	1,824	15,260,993
102	5,495	1,562	8,585,469
103	12,174	822	10,003,890
105A	4,687	406	1,901,148
105B	22,266	641	14,263,004
107	31,487	300	9,458,997
110	17,260	1,308	22,580,416
113A	10,321	408	4,214,136
113B	4,817	403	1,939,077
116	18,108	542	9,822,188
123	6,806	2,182	14,854,435
126	13,372	225	3,007,146
128A	15,482	216	3,338,705
128B	8,049	2,181	17,552,380
129B	5,895	1,498	8,829,645
131	33,973	2,370	80,503,047

Total theoretical land price increase	1,955,828,892	(1,000 dong)
	7,236,567	(1,000 yen)
Annual benefit	176,024,600	(1,000 dong/year)
	651,291	(1,000 yen/year)

(7) Conversion to annual benefit based on social benefit (theoretical land price change)

The social benefit (theoretical land price change) obtained in section (6) can be used to calculate the annual benefit corresponding to annual land rent by the following formula.

Annual benefit (theoretical land price change corresponding to land rent) =

Social benefit (theoretical land price change) x Interest rate*

* The interest rate used in this calculation was 9%, the base rate of the State Bank of Vietnam (according to June 2011 CBRE).

The annual benefit of this project, calculated as shown above, is 176 billion dong/year (651 million yen/year at the exchange rate of 1,000 dong = 3.7 yen).

2) Calculation of the project's economic internal rate of return (EIRR)

We have calculated EIRR on the basis of the above annual benefit of the project.

In the Socioeconomic Benefit Estimation Manual, the scope of benefit measurement is defined as follows.

Within the project area: The increase in profits of for-profit business (rental business) is taken as the benefit. Around the project area: Because it is impossible to determine the increase in profits, the theoretical land price change is taken as the benefit.

Based on the above approach, the benefit within the project area corresponds to the profits of private business from section 7.2.1 (Financial Analysis of Private Sector Portion). Meanwhile, the benefit around the project area corresponds to the annual benefit as estimated above.

The project's economic internal rate of return (EIRR) was calculated on the basis of the above. The results are shown in the figure below.

We have estimated that EIRR is improved by a scope of 7.2% (minimum) to 8.5% (maximum) compared to Project IRR for the present project; and as a result, EIRR is estimated as ranging from a minimum of 12.2% to a maximum of 28.3%.

This is higher in the majority of cases than the rate of 12% set for the discount rate, indicating that the project has an adequate level of social value.

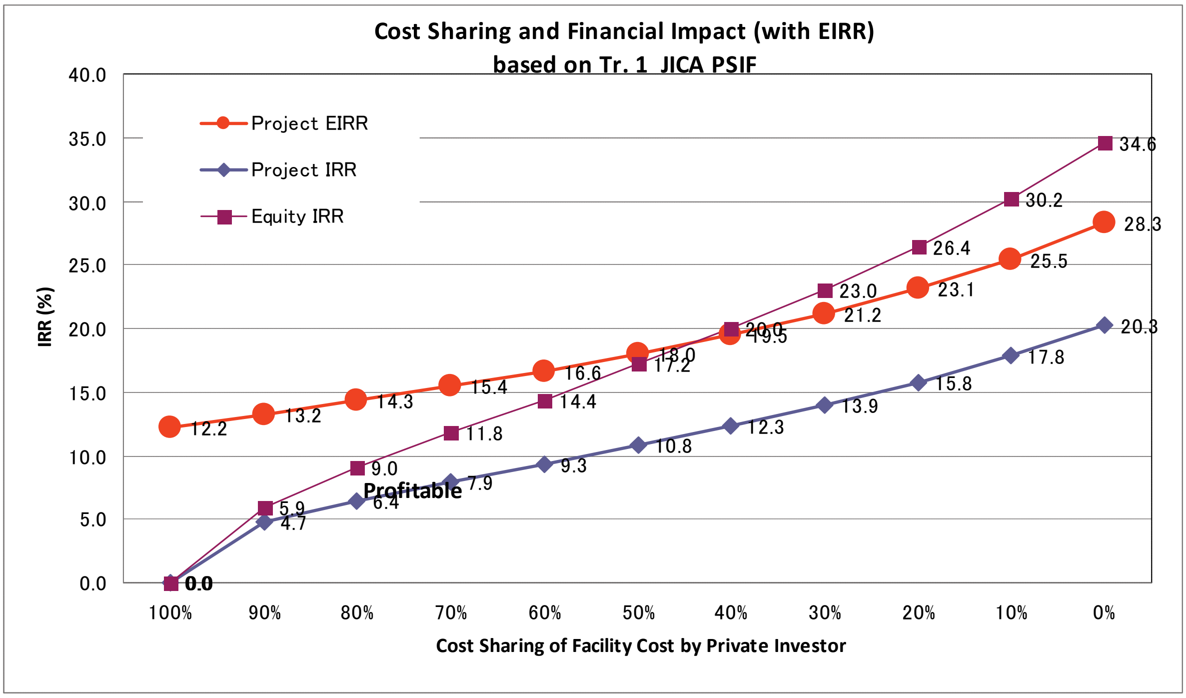


Figure 7.12 Calculation of this project's economic internal rate of return (EIRR)

7.3 SURVEY OF DEVELOPER INTEREST

We surveyed developers concerning their interest with regard to investing in this PPP infrastructure development project by interviews, etc. In particular, we investigated interest and potential, etc., for a PPP project with respect to business operators who are considering development in nearby areas.

Table 7.11 to Table 7.17 show the results of our survey of developer interest based on the proposed plan as of the present time.

○ Commercial developers:	Company A, Company B, and Company C
○ General contractor:	Company D
○ Trading company:	Company E
○ Overseas enterprise support organization	Company F

The main comments obtained on the above basis are summarized below.

Table 7.11 Summary of main comments in survey of developer interest (Japanese business operators)

Item	Content
Overall impression	• The location is outstanding. • Ownership rights and land usage fees are important. The bottom line will depend on land usage fees. At 10 billion for 20,000 m^2, the balance of investment is not bad. • The timing is not bad, since the project is scheduled to open in 2017 or later, and income and purchasing power should be higher by then. • It is a serious hurdle that it needs for 10 years from now until the time of USM opening.
Anticipated floor area unit price and customer unit price	• The floor area unit price is about US$100/$m^2$ on average for the ground floor. For basement space, it is thought to be about US$80/$m^2$. • Considering the flow of people from the subway station, the floor area unit price is thought to be about the same as above-ground levels, about US$100/$m^2$. • The customer unit price varies greatly depending on the type of store, but at local prices, it is thought to be about 500–600 yen/person for accessories, and about 1,000–2,000 yen/person for luxury brand items.
Potential for participation, conditions, etc.	• The underground floor area usage fee is zero for the underground parking garage at Le Van Tam Park. If the underground floor area usage fee would also be zero in this project, participation would definitely be a possibility. • It would be difficult to attract investment. The types of involvement that investors would want to commission are project management and leasing. It would be possible if the customer unit price was on the level of a department store. • It is normally considered excellent if the initial investment can be recouped in seven years.
Important points	• For a good quality underground mall, it is necessary to ensure an effective ceiling height of at least 3 meters in public passageways. Similarly, depth is also important. • In spaces such as the plaza, the ceiling height should be at least 4 meters for sales promotion activities (showing cars, selling moon cakes, etc.) • It is absolutely necessary to install air conditioning.

Table 7.12 Survey of developer interest (1 of 6)

Interviewee	Company A
Overall impression	• The location is outstanding. • Based on this information, we will consider it internally.
Anticipated floor area unit price and customer unit price	• In this area, the floor area unit price is about US$100/$m^2$ on average for the ground floor. Underground, it would be about US$80/$m^2$. However, this could be higher or lower depending on the level of the tenants.
Potential for participation, conditions, etc.	• The underground floor area usage fee is zero for the underground parking garage at Le Van Tam Park. If the underground floor area usage fee would also be zero in this project, participation would definitely be a possibility. • There is potential if will not open until 2017 at the earliest, since income and purchasing power should be higher by then.
Important points	• For a good quality underground mall, it is necessary to ensure an effective ceiling height of at least 3 meters in public passageways. Similarly, depth is also important. • It is absolutely necessary to install air conditioning.
Other	• At present, we are pursuing business operations related to commercial consulting. It is currently in the license application process.

Table 7.13 Survey of developer interest (2 of 6)

Interviewee	Company B
Overall impression	• We are not sure whether this is possible for a Japanese syndicate. • Ownership rights and land usage fees are important. The bottom line will depend on land usage fees. At 10 billion for 20,000 m^2, the balance of investment is not bad. • Our style is basically to operate a single building as a department store. In the case of this sight, a partial lease would also be considered. • At present, the GDP of Ho Chi Minh City has only just reached US$3,000/person/year. It will take more time to reach the level of purchasing power desired by the Group, so the timing is not bad since the project is scheduled to open in 2017 or later.
Anticipated floor area unit price and customer unit price	—
Potential for participation, conditions, etc.	• When expanding overseas, our Group normally starts by redecorating an existing building. In this project as well, we would probably begin participating at the interior decoration phase. • The basic approach is rent/lease. • Our unit size for starting a store is generally 30,000 m^2, but we may consider taking a flexible approach in the case of Ho Chi Minh City. Because this would be underground, it would not be a department store format.
Important points	• Based on future trends in development and store openings in the surrounding area, if there is competition, we may consider whether we should open some kind of store there.
Other	• Our current task is research to decide whether we should open a store (whether we should do business here).

Table 7.14 Survey of developer interest (3 of 6)

Interviewee	Company C
Overall impression	• The image of the area around Ben Thanh Station consists of relatively large-scale luxury tenants and apparel stores. The space under Le Loi Street will have a depth of only 7 or 8 meters for stores that are currently being planned, so it will be suitable for selling miscellaneous goods such as accessories, shoes, and bags. • When restaurants are added, customers ordinarily stay around for longer, and the customers tend to be middle-income or less, reducing the grade. Therefore, there should be mainly apparel stores here rather than restaurants. • In a commercial facility, the space is arranged differently depending on the purchasing levels and business categories of tenants, so it is important to confirm the wishes of business operators starting at the design stage. Factors such as passageway width, ceiling height, and studio space as a highlight are closely related to business categories and content.
Anticipated floor area unit price and customer unit price	• The customer unit price varies greatly depending on the type of store, but at local prices, it is thought to be about 500–600 yen/person for accessories, and about 1,000–2,000 yen/person for luxury brand items. • Considering the flow of people from the subway station, the floor area unit price is thought to be about the same as above-ground levels, about US$100/$m^2$.
Potential for participation, conditions, etc.	• Investment by our Group is unlikely. The types of involvement that investors would want to commission are project management and leasing. • Considering the products handled by our Group and the low customer unit price for tenants, investment at 10 billion for 20,000 m^2 is out of the question. It would be possible if the customer unit price was on the level of a department store. • Our Group normally considers it to be excellent if the initial investment can be recouped in seven years.
Important points	• Ceiling height is important. It should be 3 meters for stores and passageways. • In Aeon malls, special events and advertising campaigns are held frequently, and this creates an environment that encourages shopping. Therefore, in spaces such as the plaza, the ceiling height should be at least 4 meters for sales promotion activities (showing cars, selling moon cakes, etc.)
Other	• There are many underground malls in Singapore, and successful cases could provide a useful reference. One could learn from the concepts and unit prices of those malls. (We will introduce companies that deal with such malls at a later)

Table 7.15 Survey of developer interest (4 of 6)

Interviewee	Company D
Overall impression	• We have less experience in overseas real estate developments. • We can not show a clear policy on the participation decision about this project at this time. • We will continue to consider about possibility of participation of this project.
Anticipated floor area unit price and customer unit price	—
Potential for participation, conditions, etc.	—
Important points	—
Other	• Precondition for studying participation of this project, we first want to assess the tender of UMRT Line1.

Table 7.16 Survey of developer interest (5 of 6)

Interviewee	Company E
Overall impression	• This plan is interesting. However, it is a serious hurdle that it needs for 10 years from now until the time of USM opening. • Usually, our study subjects are the opening time from now within about 3 to 5 years. • We can not show a clear policy on the participation decision about this project at this time.
Anticipated floor area unit price and customer unit price	—
Potential for participation, conditions, etc.	• If we participate in this project, we will be minor equity. • For this project, opening of large scale tenants are very important.
Important points	—
Other	• We have skills about foreign exchange risks.

Table 7.17 Survey of developer interest (6 of 6)

Interviewee	Company F
Overall impression	• We cannot give the names of specific companies, but there are many inquiries from Japanese companies about real estate investment. • For this project, there could be a positive reaction from large real estate companies, railroads (two companies: a company related to the Tokyo Metro Subway and XX Electric Railway), trading firms, or store developers. We recommend contacting them.
Anticipated floor area unit price and customer unit price	—
Potential for participation, conditions, etc.	—
Important points	• It is probably about 15 or 20 years behind Bangkok. The future is not certain, but it is important to get involved now.
Other	• At present, we are independently investigating flows of people in Ho Chi Minh City (nighttime population changes, transportation volumes, etc.) and changes in urban development. • Japanese companies in the service industry (logistics, retail, restaurants, etc.) are interested in establishing a presence, so we plan to hold study tours, seminars, and exchange meetings, etc. in the near future concerning Bangkok and Ho Chi Minh City.

7.4 GENERAL ASSESSMENT

The purpose of this project is to build an underground mall by establishing an underground plaza and underground pedestrian passageway with consideration for commercial premises, one story underground within the premises of a transfer station with access to Metro Lines 1, 2, 3a, and 4, creating a comfortable underground urban space in central Ho Chi Minh City, 500 meters from the opera house.

The plan has been categorized into [1] a portion to be implemented in the UMRT Line 1 Ben Thanh Station Plan, [2] the portion of this project to be implemented with public investment, and [3] the portion of this project to be implemented with private investment. Item [1] is not included in this chapter. We have conducted financial analysis for the public side with respect to item [2], and financial analysis for the private side with respect to item [3].

Concerning financial analysis for the private side with respect to item [3], based on the cost and area calculations of Chapter 4, we have prepared some estimates after establishing the public-private division of roles. Based on the determination that further study is needed concerning the detailed division of roles for the furnishing of the underground space (private portion: underground mall; public portion: underground plaza and underground pedestrian passageway), we have handled the furnishing aspects of the underground space in terms of sensitivity analysis (subject to public-private cost sharing) in performing the financial analyses. In addition to the above division of roles, we determined that in a case where the private sector bears about 30% of the initial furnishing cost, equity IRR would be higher than 20%.

Taking this as the basic case, we performed sensitivity analysis on the three major risks: the risk of construction cost increases, the risk of increases in the master lease fee paid by the SPC to the project owner, and the risk of declines in the tenant occupancy rate. Changes of about 30% in construction cost and the tenant occupancy rate would reduce IRR by 6% to 8%. Increases in the master lease fee would also have a significant impact on profitability, and it will be necessary to study ways to reduce these risks when working out the details of the business scheme and contract conditions in the future.

Based on the results of the above estimations, there is a high potential that this project could succeed as a PPP project if the basic conditions set in financial calculations are met and if the public side provides appropriate support.

With regard to EIRR, since no methodology directly exists for evaluation of the social benefits of underground malls, we have prepared estimates using the "Proposed Cost Benefit Analysis Manual for Urban Renewal Projects (2007 revised edition)." By applying the estimated benefits to the basic case for the above financial analysis, we obtained the following estimate for EIRR: From private responsibility (100%): 11.1% to private responsibility (0%): 26.6%. This is higher in the majority of cases (other than 100%) than the rate of 12% set for the discount rate, indicating that the project has an adequate level of social value.

Based on the above study findings, although this constitutes quantitative assessment from a certain perspective, we have determined that from the standpoints of both financial analysis and economic analysis, this project has appropriateness for implementation.

Several matters still remain for study with respect to business development in this project. The following are the matters which can be determined as of the present time. In addition, in our judgment, it is necessary to establish early phase policies for the following important matters through continued study, and it will also be necessary to establish suitable early phase policies for other matters than the following as soon as they can be confirmed.

- Identifying the project's business scheme and public sector project owner
- Identifying potential domestic and foreign private investors for this project and obtaining commitments
- Realization of ODA financing for the portion of this project to be implemented with public investment
- Specifying the public-private allocation for furnishing of the underground space
- Realization of a master lease agreement from the public sector to the private sector for the underground space overall
- Realization of a long-term consignment agreement from the public sector to the private sector for the underground space
- Determination of the approach to risk allocation between the public sector and the private sector
- Determination of the private business operator's business format and method of participation (such as bidding)

CHAPTER 8 PROJECT EFFECTS

The following is a proposed framework for continuous evaluation of the project effects for the part of this project for which the use of Japanese ODA funds is being considered.

8.1 OUTLINE OF PROJECT EVALUATION BY JICA

8.1.1 Outline of evaluation at each stage

The framework for project evaluation (project level) for yen loans is described in "New JICA Project Evaluation Guidelines 1st Edition (August 2010)" (hereafter referred to as the "Guidelines"). The following is a summary of the evaluation of yen loan projects from the Guidelines for ¥200 million and higher.

Table 8.1 Outline of evaluation of yen loan projects

Stage	Type	Timing	Outline of evaluation	Main focus of evaluation
Prior stage	Prior evaluation	Before implementation	Comprehensive judgment on the appropriateness of implementation, after checking the priority and necessity of implementation, and clarifying the contents and predicted effects. The evaluation indicators established at the prior evaluation stage are used as criteria for measuring the degree of progress of the cooperation and the effect.	In particular the project <u>necessity, relevance, objectives, content, effect (usefulness), external factors and risks</u>, etc., are analyzed using five DAC evaluation items, and the overall suitability of the project plan is examined.
Project implementation stage	Interim review	5th year after the loan contract	Re-examines the relevance, as well as analyzes the prospects for achievement of the targets, the factors promoting and the factors hindering the project, and trends, etc. The evaluation results are used to review the plan and improve the operational system.	<u>Examines relevance, effectiveness (is the initially anticipated project effect occurring?), efficiency</u>, together with the contributing and hindering factors affecting the project, based on the current situation and achievements.
Subsequent stage (after completion)	Evaluation after completion	Up to the 3rd year after completion	Evaluation is carried out using the five DAC evaluation items (relevance, effectiveness, efficiency, impact, sustainability) with the objective of comprehensive evaluation after project completion.	A comprehensive judgment is carried out focusing on whether the initially envisaged effect has been achieved for <u>all five evaluation items</u>.
	Monitoring after completion	7th year after completion	Of the five DAC evaluation items, re-examination is carried out for effectiveness, impact, and sustainability. In addition, the status of response to any lessons or advice arising from the evaluation after completion is checked, and any final advice or lessons are derived and used to improve the project.	Examined for <u>effectiveness, impact, sustainability</u>.

* DAC: Development Co-operation Directorate

Table 8.2 Focus of the evaluation using the five DAC items

Relevance	Degree of consistency of development assistance with the target group, recipient country, donor priorities, and government policies.
Effectiveness	Yardstick to measure the degree of achievement of the target of the development assistance.
Efficiency	Measurement of output (qualitative as well as quantitative) for the given input. This is an economic term that indicates that the resources with the least cost have been used to achieve the effect anticipated by the development assistance. In order to confirm that the most efficient approach has been adopted, normally it is necessary to carry out comparison with other approaches.
Impact	Changes brought about by the development assistance, whether direct or indirect, intentional or unintentional, and positive or negative. Development assistance includes the major influences and effects on the local society, economy, environment, and other development indicators.
Sustainability	Measurement of whether the benefit of the development assistance continues even though the support from the donor has been finished. Development assistance must be sustainable from both the environmental and financial points of view.

Based on the above, the timing and content of the evaluations are reproduced in Table 8.3.

Table 8.3 Summary of evaluation timing and content of implementation

Stage	Type	Timing	Necessity	Objectives	Content	External factors	Risks	Five DAC items				
								Relevance	Effectiveness	Efficiency	Impact	Sustainability
Prior stage	Prior evaluation	Before implementation	○	○	○	○	○	○	○			
Project implementation stage	Interim review	5th year after loan contract						○	○	○		
Subsequent stage (after completion)	Evaluation after completion	Up to the 3rd year after completion						○	○	○	○	○
	Monitoring after completion	7th year after completion							○		○	○

8.1.2 Setting indicators for continuous evaluation

On the other hand, JICA uses performance indicators for consistent project evaluation from before to after, as a continuous evaluation initiative.

For yen loan projects, operational and effectiveness indicators for the main sectors have been introduced since the year 2000 as performance indicators. Operational and effectiveness indicators are defined as follows, and both operational and effectiveness indicators correspond to outcome indicators in the types of performance indicators defined by the World Bank. In yen loan projects, operational and effectiveness indicators are considered to be outcome level indicators as a rule.

- Operational indicator: An indicator that quantitatively measures the operational status of a project
- Effectiveness indicator: An indicator that quantitatively measures the effect producing status of a project

The "project objectives" of a yen loan project are frequently stated relating to two stages. In other words, they indicate the effect of the project of developing the equipment or facility (output).

(1) The output is being appropriately operated and used

(2) These are producing effects in the area of the beneficiary

Operational indicators measure (1), and effectiveness indicators measure (2).

For all yen loan projects that have been examined since 2001, a prior evaluation has been carried out and published. The prior project evaluation table produced during this evaluation contains the actual values (baseline) existing at the time of examination of the operational and effectiveness indicators, the target values, and the time for their achievement, and JICA and the implementing organization agree on setting these indicators at the time of examination.
After commencement of the project, the implementing organization measures and records the operational and effectiveness indicators as part of the interim review, the post project evaluation, and post project monitoring. It is required that the indicators be measured continuously for seven years after completion of the project, and the effectiveness of each stage is evaluated using the measured results.

8.2 SETTING A FRAMEWORK FOR EVALUATION OF THE PROJECT EFFECT

Based on the fundamental thinking of the Guidelines as described above, the following framework is proposed for continuously evaluating the effect of the project.
Also, the operational indicators and the effectiveness indicators are set taking into consideration the criteria given in the Guidelines provided for reference when setting indicators.

Table 8.4 Criteria for reference when setting indicators

・**Validity**

Whether setting indicators can measure real results of the project.

・**Reliability**

Whether setting indicators can measure the same results that anyone measures several times.

・**Accessibility**

Whether setting indicators are possible to access data easily.

8.2.1 Setting evaluation indicators for the effect of this project

It is considered that the indicators set by Kawasaki Azalea for the relevant bureau (Commercial and Tourism Section, Economic and Labor Bureau, Kawasaki City) in a similar project in the past were effective, so the framework for setting the operational and effectiveness indicators for this project will be proposed with reference to this example.

First, Table 8.5 summarizes the concepts regarding the significance of the project required from the operator. It is considered that by sharing these concepts with the operator, the public benefit can be ensured.

Table 8.5 Concepts of significance required from operator

<table>
<tr><td>Role required from operator</td><td colspan="2">It is expected that the convenience of the area around the station will be improved by functioning as a commercial facility that will be the core for raising the image and improving the attractions and amenities of the area around Ben Thanh Station, and in addition by providing a safe and comfortable public underground walkway for users such as the city residents, etc.</td></tr>
<tr><td>Main work of the operator</td><td colspan="2">Management of the rental or operation of the shops within the underground shopping mall</td></tr>
<tr><td rowspan="2">Public benefits of the operator</td><td>Public benefit</td><td>Ensuring a safe and comfortable walking space for pedestrians around the Ben Thanh Station area and contributing to the improvement in convenience.</td></tr>
<tr><td>Contribution</td><td>The underground shopping mall is indispensable for the convenience and safety of the city residents and for the commercial vitality of the area around Ben Thanh Station.</td></tr>
<tr><td rowspan="2">Necessity of use of private sector</td><td>High specialism</td><td>The work requires a high degree of specialism, such as maintenance of a large-scale facility and management of the rental of the shops, etc., so safe, lively, and effective operation is required from the private operator.</td></tr>
<tr><td>Independence</td><td>It is necessary that independent initiatives be undertaken to create a secure, safe, and comfortable environment for the users of the underground shopping mall, and to improve the attractiveness to customers.</td></tr>
</table>

Next, the proposal for setting the operational indicators and effectiveness indicators for continuously evaluating the project effect, taking into consideration the possibility of obtaining data, etc., are shown in Figure 8.1.

In addition, the reasons for selection of these indicators and examples of setting target values, etc., are shown in Table 8.6.

The proposal for setting the indicators is draft at the present stage, and it will be necessary to change it at the time of seeking the operator, taking into consideration the progress in the content of the project and trends in the area around Ben Thanh Station, etc. Also, it will be necessary to set the target values in Table 8.6 at the time of seeking the operator.

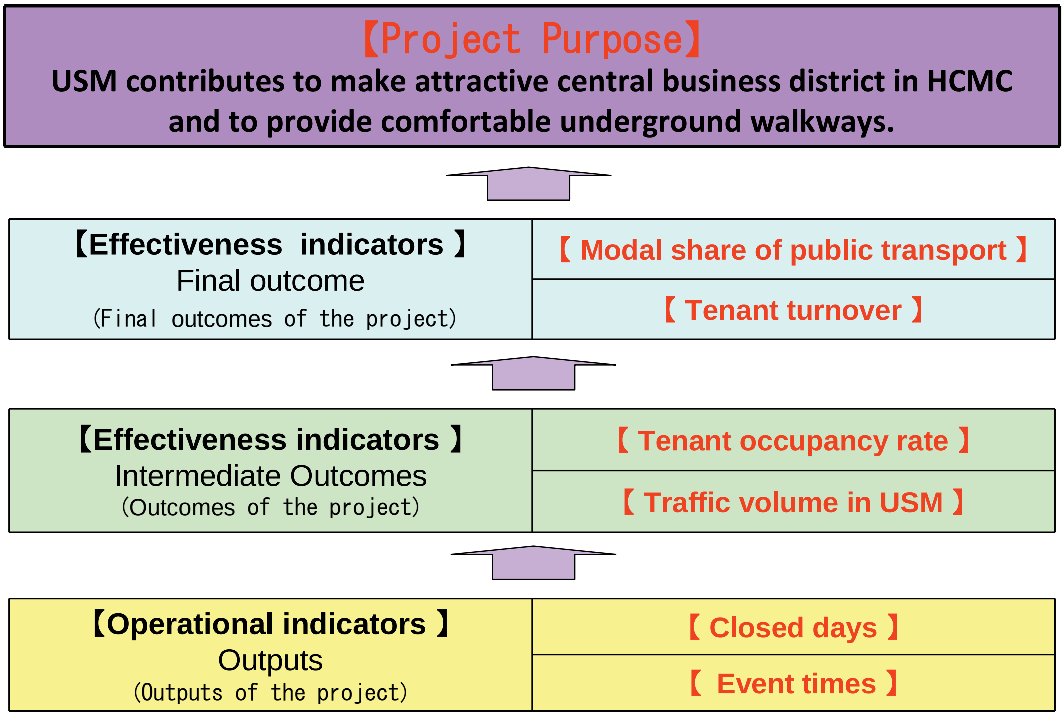


Figure 8.1 Concept of continuous evaluation of the project effect

Table 8.6 Reasons for selection of indicators and example of setting of target values

Kind of Indicators	Indicators (per year) (per day)	Reasons for selecting indicators	Target Value <Reference> Kawasaki Azalea USM
【Effectiveness indicators】 Final outcome	Modal share of public transport	The higher modal share of public transport contributes to good urban transportation environment	—
	Tenant turnover	The higher sales attract people to Commercial area in USM	About 157 billion JPY
【Effectiveness indicators】 Intermediate outcomes	Traffic volume in USM	Traffic volume is related to safety and comfort of pedestrian network and Tenant turnover	401,290 (persons／day)
	Tenant occupancy rate	Tenant occupancy rate is related to Tenant turnover	100(%)
【Operational indicators】 Outputs	Closed days	Increase working days is related to performance	0(days)
	Event times	Event times is related to performance	180(times)

In addition, besides the operational indicators and the effectiveness indicators, it is considered useful to check the financial condition of the operator, as this is a project that uses ODA funds. Also, as a qualitative evaluation of the effect of the operation of the underground mall itself, it is considered beneficial to periodically (about once per year) carry out a survey of the satisfaction of the visitors and the tenants, and to publish the results and the policy for response to the results. It will be necessary to re-examine the necessity of these measures at the time of seeking the operator.

Table 8.7 Financial condition and qualitative evaluation of operator

Operator's financial condition	Changes in Income Changes in Payment Changes in Benefit
Customer’s satisfaction	Survey to visitors Survey to tenant owners （Once a year, By Questionnaire）

8.2.2 Proposal for setting target values for this project

The following is the proposal for setting the target values at the present time, based on the results of studies to date, etc., in connection with Table 8.6 above.

The conditions for the calculation are shown below. [Modal share of public transport] , [Tenant turnover] and [Traffic volume in USM] have been set using the results of studies to date, but for the other indicators, the required items can be obtained when seeking the operator, so the set values of Kawasaki Azalea USM have been used.

It will be necessary to update these set values at the time of seeking the operator in accordance with the progress of the content of the project.

〈Modal Share of Public Transport〉

・Use the estimated number from Chapter 4.1.2(2020,2050).

〈Tenant turnover〉

・Use the estimated number of users per day of USM(2025,2050).
・Set that the holidays are 105 days and the weekday are 260 days.
・Set that 50% of users buy something.
・Set that average sale per customer is 250,000VND/person because range is 100,000- 500,000VND/person from the survey of developer’s investment intent.

〈Traffic volume in USM〉

・Use the estimated number of users per day of Underground Facilities(2025,2050).
・Set that the holidays are 105 days and the weekday are 260 days.

〈 Tenant occupancy rate 〉〈 Closed days 〉〈 Event times 〉

・Use the Target values of Kawasaki Azalea USM.

Table 8.8 Draft setting of target indicators in this project

Kind of Indicators	Indicators (per year) (per day)	Target value (tentative)
【Effectiveness indicators 】 Final outcome	Modal Share of Public Transport	<2020> 16 (%) <2050> 30 (%)
	Tenant turnover	<2025> 1.1trillion VND／year (4.3billion ／year) <2050> 1.9trillion VND／year (7.1billion/year)
【Effectiveness indicators 】 Intermediate outcomes	Traffic volume in USM	<2025> 71,000(persons／day) <2050> 108,000(persons／day)
	Tenant occupancy rate	100(%)
【Operational indicators 】 Outputs	Closed days	0 (days)
	Event times	180 (times)

*1VND=0.0037JPY

Reference Information (From the Vietnam Economic Newspaper, Fri 22/04/2011) http://vnbusiness.vn/articles/ch%C3%A2n-dung-ng%C6%B0%E1%BB%9Di-ti%C3%AAu-d%C3%B9ng-vi%E1%BB%87t
Among those living in Ho Chi Minh City in the age range 20 to 45 with a stable source of income, the average consumption per month on clothes and fashion-related items is 18%. In this age range, 60% of the consumers spend 150,000 to 500,000 dong every month on clothing. In this age range, 70% of the consumers buy fashion-related items on average once in 2-3 months. The trend is that consumers younger than 25 years old go shopping once per month, and consumers 25 years and older go shopping once every 2-3 months.

CHAPTER 9 SUMMARY

9.1 SUMMARY OF PREPARATORY SURVEY

This report is the final report of the preparatory survey on Ben Thanh Central Station Project. Since this survey has deep relationship with UMRT Line 1 planning which is currently in process by an ODA loan from Japan, the study in this report is arranged with the planning of Line 1 project. In addition, the overall planning of this project is performed in consideration with the planning of the other UMRT Lines 2, 3a, and 4 which arrive at Ben Thanh Central Station.

As for the planning policy and/or the contents of the study, this survey is advanced through the technical and business meetings with Management Authority for Urban Railways (MAUR) and the Task Team for Ben Thanh Central Station Project which is organized in HCMC PC for the evaluation of this survey. Especially, the following principles for the project planning has been determined in consultation with HCMC PC.

- Implementation of the integrated design in Ben Thanh Central Station area
- Construction method for the UMRT Line 1 tunnel and the area of the underground development in the Le Loi Street area

In this survey, the construction sequence among 4 UMRT Lines and underground shopping mall has large influence to the study. Since HCMC strongly requests to start the Line 1 commercial operation as early as possible, the phased construction, where the Line 1 station is constructed in the 1st phase, is adopted as basic policy. This policy is not officially determined by HCMC, however this is based on the consultation with MAUR.

According to these planning policies, the schematic facility planning and design have been performed, and the schematic design drawings are created. In addition, based on these drawings the construction planning has been studied, and the construction cost is estimated. Through this planning, the project implementation scheme has been studied and proposed, and the assessment of the project feasibility is performed.

On the other hand, the environmental and social impacts have been examined as IEE level. As for the examination of the environmental and social impacts, Advisory Committee for Environmental and Social Considerations was held and the study has been reviewed based on the consultation and the comments of this committee.

As the summary of this survey, regarding the Ben Thanh Central Station Project the efficiency of this project has been confirmed from both the viewpoints of the financial analysis and the economic analysis. However, in the next stage, the countermeasure for various risks included in this project shall be studied, and the implementation project scheme shall be fixed through the consultation with the relative parties of both Japan and Vietnam.

Table 9.1 Summary of Preparatory Survey – 1/2

	Item		Outline	Progress of Vietnamese Side	Issue	Action Plan
1	Planning Condition	Urban Planning of HCMC	This survey follows urban planning of HCMC under approval process for both the underground plan and ground level plan	All Documents have been submitted for the approval by HCM PC.	Review and update by HCM PC	Approx. 2 months for the approval
		Demand Forecast on Underground Facilities	Demand forecast on underground facilities is performed under the condition that all 6 UMRT Lines and the private development in surrounding area are completed.	Outline of the demand forecast was reported to MAUR & Task Team.	—	—
		UMRT Line 2 & Line4	All studies for the station facility plan, the construction planning, and so on are performed considering the planning of UMRT Line 2 and 4 which are planned to arrive at BTCS.	Line 2 project without Ben Thanh Station proceeds by German support. The source of fund for Line 4 has not been decided.	The source of fund for Ben Thanh Station of Line 2 and 4 has not yet been decided.	HCMC (MAUR) shall clarify the policy for the source of fund.
		PPP Related Laws & Regulations	Considering current Vietnamese laws and regulations for BOT and PPP, the implementing procedure for this urban development Project is proposed.	Outline of the proposed procedure was reported to MAUR & Task Team.	Study and consultation with relative parties like DPI and etc. is necessary.	Additional study is performed for project implementation
		Technical Standards	It is recommended that UMRT Line 1 technical standards should be adopted for BTCS, and the disaster prevention standards for USM based on Vietnamese standard supplemented by Japanese standards is proposed.	Outline of the proposed technical standards was reported to MAUR & Task Team.	Study and consultation with relative parties like DFP and etc. are necessary.	Detail study is performed in Integrated Design of BTCS.
		Existing Bus Terminal	According to the documents from DOT, the existing bus terminal located in the south side of Ben Thanh Market will be relocated to the west end of September 23rd Park. Some bus stops for several routes are remained.	HCMC decided the relocation of the bus terminal, however the relocation has not yet executed.	Confirmation of bus terminal relocation.	Some bus stops for several routes are remained at the same location.
		Existing Underground Utilities	Existing underground utilities (water pipes, sewage lines, telephone cables, electrical cables, and etc.) shall be basically moved to the area out of the project site in advance.	MAUR is under study. There are some utilities like electrical main cables which have already decided to be moved.	The utilities like sewage lines are difficult to be moved and the counter measure is needed.	Relocation of utilities shall be confirmed during Integrated Design of BTCS.
2	Planning Policy	Underground Development in Ben Thanh Station Area	Regarding the planning policy of BTCS, Integrated Design is recommended. In this design USM and stations of UMRT Line 1, 2, and 4 are unified and designed comprehensively.	As the result of discussion with HCM PC, the implementation of Integrated Design was determined.	The design change is necessary in UMRT Line 1 project.	The design change is decided to be executed in Integrated Design of Line 1 project.
		Underground Development in Le Loi Street Area	As for the underground planning policy beneath Le Loi Street, it is recommended that shield tunnels of Line 1 are changed to C&C tunnel in 1st phase construction and the area of USM in 2nd phase becomes larger.	As the result of discussion with Task Team, the recommendation for the change to C&C tunnel was approved.	The design change is necessary in UMRT Line 1 project.	The design change is decided to be executed in Integrated Design of Line 1 project.
		Construction Sequence	With regard to the construction sequence, for the early commencement of Line 1 operation the phased construction with first priority for Line 1 is recommended.	As the result of discussion with MAUR, the recommendation for the phased construction was approved.	The coordination with Line 1 project is necessary.	Detail study is performed in Integrated Design of BTCS.
		Construction of Line 2 in 1st Phase	In case of the phased construction of BTCS it is recommended that the whole Line 2 station structure shall be constructed in 1st phase together with Line 1 station considering the impact on the Line 1 structure.	As the result of discussion with MAUR, the recommendation for whole Line 2 structure construction was approved.	The source of fund for Line 2 station structure has not yet been decided.	Further coordination between JICA and MAUR is necessary.
3	Planning & Design	Planning of Ben Thanh Central Station	The facility planning and design of BTCS project by Integrated Design including USM and all stations of UMRT Line 1, 2, and 4 is recommended for the convenient and reasonable BTCS.	As the result of discussion with MAUR and Task Team, the recommendation for facility design was basically approved.	The detail facility design is necessary in next stage.	Detail study is performed in Integrated Design of BTCS.
		Planning of Underground Shopping Mall	The planning and the design of USM is recommended corresponding to project needs such as the construction of overall underground terminal, the creation of the attractive underground space, and the formation of the underground pedestrian network.	As the result of discussion with MAUR and Task Team, the recommendation for facility design was basically approved.	The detail facility design is necessary in next stage.	The detail facility design is executed in the next stage for the project implementation.

Table 9.1 Summary of Preparatory Survey – 2/2

	Item		Outline	Progress of Vietnamese Side	Issue	Action Plan
3	Planning & Design	Ground Level Plan	Since the urban planning of HCMC is not yet approved, the ground level plan under current traffic arrangement is recommended as a basic plan. In addition the plan based on the urban planning is also proposed.	As the result of discussion with MAUR and Task Team, the proposed ground level plan was basically approved.	The detail study for the impact on the scenery by the structures above grade is necessary.	The detail design is executed in the next stage for the project implementation.
4	Construction Planning	Construction Planning	Based on the planning policy the phased construction planning with first priority for Line 1 is recommended. The proposal divides the area between Ben Thanh station and Le Loi Street areas and includes traffic diversion.	As the result of discussion with MAUR and Task Team, the recommendation for construction planning was approved.	The more detail study for the construction planning is necessary in the next stage.	The detail study is executed in the next stage for the project implementation.
5	Cost Estimate	Cost Estimate of Underground Shopping Mall	The cost for the USM is estimated considering Oct 2011 as a base year & month referring the construction cost of Line 1. The cost allocation between public and private is decided by the results of financial analysis.	The cost was reported to MAUR & Task Team. As the result of Pre-F/S it was approved.	The more detail study for the cost estimate is necessary in the next stage.	The detail study is executed in the next stage for the project implementation.
		Cost Estimate of Ben Thanh Central Station	The cost for the BTCS is estimated considering Oct 2011 as a base year & month referring the construction cost of Line 1. This cost has no relation with the cost estimate of Line 1 because the scope is different.	The cost was reported to MAUR & Task Team. As the result of Pre-F/S it was approved.	The cost shall be reviewed in Line 1 project together with the design change.	The cost estimate shall be executed in Integrated Design of Line 1 project.
6	environmental & social consideration	Environmental & social consideration	The investigation of IEE level is performed reviewing and updating by the comments of the advisory committee. The environmental scoping is performed, and the draft of TOR for EIA is recommended.	Outline of the environmental investigation was reported to MAUR & Task Team.	EIA shall be executed in early timing for the project implementation.	MAUR shall conduct EIA in early timing for the project implementation.
7	Project Implementation Scheme	Public - Private Division of Roles	Regarding USM the public and private role division is recommended in order to reduce the public fund as the infrastructure project and to create the attractive and effective underground development by private sector.	Outline of the public and private role division was reported and confirmed by MAUR & Task Team.	Further study and consultation with relative parties like DPI and etc. are necessary.	Further study for project implementation scheme is conducted mainly by the potential concessionaire.
		Project Implementation Scheme	To implement the USM project in coordination with the UMRT construction project, regarding the implementation program, MAUR owner route and the public company owner route are recommended.	Outline of the project implementation scheme was reported and confirmed by MAUR & Task Team.	Further study and consultation with relative parties like DPI and etc. are necessary.	Further study for project implementation scheme is conducted mainly by the potential concessionaire.
		Project Schedule	The project schedule for USM is proposed in case the public portion is expected as the ODA project for the public fund.	Outline of the project schedule was reported and confirmed by MAUR & Task Team.	Further study and consultation with relative parties like DPI and etc. are necessary.	Further study for project implementation scheme is conducted mainly by the potential concessionaire.
8	Project Evaluation	Financial Analysis	Considering the following 3 cases of the loan, 1)JICA PSIF, 2)Local Bank, and 3)JICA Bank Loan, the financial analysis is performed. The equity IRR which indicates the profitability of the private sector investment is calculated on the VND basis as approx. 20 %.	Outline of the financial analysis was reported and confirmed by MAUR & Task Team.	Further study and consultation with relative parties like DPI and etc. are necessary.	Further study for project implementation scheme is conducted mainly by the potential concessionaire.
		Economic Analysis	The social benefit of underground mall development is evaluated by the theoretical rise in land price around project area. Calculating the project's economic internal rate of return (EIRR), the project has an adequate level of social value because EIRR is approx. 20%.	Outline of the economic analysis was reported and confirmed by MAUR & Task Team.	Further study and consultation with relative parties like DPI and etc. are necessary.	Further study for project implementation scheme is conducted mainly by the potential concessionaire.
9	Project Effects	Project Evaluation	The indicators for the project evaluation are studied and proposed. The target value of these indicators is also recommended.	Outline of the project evaluation was reported and confirmed by MAUR.	Further study and consultation with relative parties like DPI and etc. are necessary.	Further study for project implementation scheme is conducted mainly by the potential concessionaire.

9.2 ACTION PLAN FOR PROJECT IMPLEMENTATION

Based on the Study results, the recommendation for the issues and the action plans of the project implementation are summarized as follows.

9.2.1 Ben Thanh Central Station Project

1) Implementation of Integrated Design

(a) Issues

Ben Thanh Central Station receives 4 UMRT Lines which are Line 1, 2, 3a, and 4. However the procedure of each project is much different. UMRT Line 1 is on the tendering stage for the design and the construction. For the UMRT Line 2, the feasibility study has been just finished. UMRT Line 4 is on the stage that the initial feasibility study has been reported. And the feasibility study for the underground shopping mall is now performing in this survey. In those planning there is some uncertain elements. These UMRT projects are proceeded individually, and in case of this separate design for all projects Ben Thanh Central Station, it will become inconvenient and unreasonable for the smooth transfer and high accessibility to each platform. Therefore in this survey through the comparative study, Integrated Design is recommended in order to make Ben Thanh Central Station comfortable and attractive. In Integrated Design the overall design through the rearrangement and the adjustment of each project planning is performed.

Regarding this recommendation, as a result of consultation with the people's committee of Ho Chi Minh City, the implementation of Integrated Design for Ben Thanh Central Station has been officially determined. According to this decision through the consultations between MAUR and JICA, the construction package 1 of UMRT Line 1 project (CP-1) for the construction of underground section is divided to two packages. One is CP-1a that is the section between Ben Thanh Station and Opera House Station excluding Opera House Station. The other is CP-1b that is the section between Opera House and Ba Son Station. Integrated Design for Ben Thanh Central Station will be performed for CP-1a.

On the other hand, Ho Chi Minh City intends to operate UMRT Line 1 as early as possible. For this purpose Integrated Design for Ben Thanh Central Station shall be commenced promptly.

(b) Action Plan

The implementation of Integrated Design for Ben Thanh Central Station has been already decided through the consultation with the people's committee of Ho Chi Minh City. The budget for the design was already agreed to be procured from the ODA budget of Line 1 Project for CP-1a. Therefore it is assumed that MAUR is currently preparing the order of Integrated Design. This procedure shall be confirmed to MAUR and MAUR is requested to implement Integrated Design promptly.

2) Technical Standards for Underground Central Station

(a) Issues

The implementation of Integrated Design for Ben Thanh Central Station has been already determined. Furthermore in this design the common & integrated technical standard for the construction of underground central station shall be applied for whole area of the Ben Thanh Central Station. Ben Thanh Central Station receives 4 UMRT Lines which are Line 1, 2, 3a, and 4. On the other hand, the technical standard of each project may be different. However as Ben Thanh Central Station is one station which consists of three platforms of four lines, Ben Thanh Central Station shall be planned and designed based on the common and integrated technical standard.

In the UMRT Line 1 project, the STandard urban RAilway SYstem for Asia (STRASYA) urban railway system prepared in 2007 by the Japanese Ministry of Land, Infrastructure, Transport and Tourism based on Japanese technical standards relating to urban railways is being used. Based on STRAYA, the Japanese standards for the design and the construction of the civil structures for the railway are adopted as the structural technical standards of the underground structures. In addition, with regard to disaster prevention planning for underground stations, there are no disaster prevention standards in Vietnam. For this reason, following approval by the Ho Chi Minh City Department of Fire Fighting & Prevention based on Article 29 in the Ministerial Ordinance for Establishing Technical Standards Relating to Railways" established by Japan's Ministry of Land, Infrastructure, Transport and Tourism (MLITT Ministerial Ordinance No. 151, December 2001), this plan has been used for the design of the UMRT Line 1 underground station. On the other hand UMRT Line 2 project proceeds by the official development assistance from Germany, however the technical standard of Line 2 Ben Thanh station is not clarified because Line 2 Ben Thanh station is not included in their scope. As for the UMRT Line 4 project the investment ODA is under preparation, so the technical standard is not determined.

Considering above mentioned situation, as the recommendation of this survey it is most suitable that the technical standards of UMRT Line 1 is adopted. This recommendation has not yet been approved, therefore the technical standards for the design and the construction of Ben Thanh Central Station shall be officially clarified before Integrated Design is commenced.

(b) Action Plan

Based on the recommendation in this survey, the technical standards for the design and the construction of Ben Thanh Central Station shall be determined through the consultation with the relative parties of Ho Chi Minh City and the Government of Vietnam. The relative parties of Ho Chi Minh City are MAUR, DOC, DOT, and Department of Fire Fighting & Prevention. The ones of the Government of Vietnam are MOT, MOC, and Bureau of Fire Fighting & Prevention. It is the best way that MAUR gets the approval for the technical standards through the discussion with relative parties before the commencement of Integrated Design. In case this procedure is impossible, in the beginning of the implementation of Integrated Design as the confirmation of the technical standards, MAUR and the design consultants of Integrated Design cooperate and obtain the approval for the technical standards, if necessary through the consultation with relative parties.

In addition, as for the planning of Ben Thanh stations of UMRT Line 2, 3a, and 4, the technical standards of Ben Thanh Central Station are the conditions of the design and the construction because these lines are constructed after the Line 1 project is completed. Therefore MAUR shall provide the technical standards of Ben Thanh Central Station to the design consultants of UMRT Line 2, 3a, and 4.

3) Phased Construction of Ben Thanh Central Station

(a) Issues

Integrated Design for Ben Thanh Central Station will be implemented as the central station which receives 4 UMRT Lines of Line 1, 2, 3a, and 4. However the procedure of each project is much different. Therefore it is unnecessary that all station facilities shall be constructed simultaneously. Because the Line 1 project is already proceeded by Japanese ODA and Ho Chi Minh City intends to operate Line 1 as early as possible, the construction of Line 1 has the first priority. For this purpose, in this survey the phased construction of Ben Thanh Central Station is recommended with the first priority of the Line 1 construction. Adopting the phased construction method, it is expected that the Line 1 operation become earlier than the unified construction. In this case the station structures beneath the Line 1 station shall be constructed simultaneously even if those structures are not for Line 1 station facilities.

This recommendation of the phased construction is discussed and agreed with MAUR, however it is confirmed as the official decision of Ho Chi Minh City. In case of the phased construction, Integrated Design shall be performed in consideration with this condition, therefore, the adoption of the phased construction is determined before the implementation of Integrated Design.

(b) Action Plan

Based on the result of this survey, MAUR shall obtain the approval for the phased construction of Ben Thanh Central Station from the people’s committee of Ho Chi Minh City. In this manner the phased construction is officially determined. The detail planning of the phased construction will be studied and determined during the implementation of Integrated Design of Ben Thanh Central Station.

4) Source of Fund for Construction of Ben Thanh Line 2 Station

(a) Issues

Integrated Design for Ben Thanh Central Station will be implemented as the central station which receives 4 UMRT Lines of Line 1, 2, 3a, and 4. On the other hand as for the construction, because the Line 1 project already proceeds by Japanese ODA and Ho Chi Minh City intends to operate Line 1 as early as possible, the phased construction with the first priority of the Line 1 construction is recommended in this survey and the other lines are assumed to be constructed in the later stage. In this manner Line 2 station will be constructed basically in the later stage. However, because it locates beneath the platform of Line 1 Ben

Thanh station, the structure of Line 2 Ben Thanh station shall be constructed together with Line 1 Station. The UMRT Line 2 project is supported by German and ADB fund and has been under progress, but its scope does not include Ben Thanh Line 2 Station. Therefore the source of fund for its construction has not been decided. For the construction of Line 1 Ben Thanh station, the source of fund for the construction of Line 2 station structures shall be determined promptly.

In addition, as for the construction part of Line 2 station structure, in this survey the construction of the whole Line 2 station structure at the same timing as Line 1 is recommended in consideration with the impact on the Line 1 station structure during the construction period of Line 2 station structure. This recommendation has not yet been approved. Because the construction cost of Ben Thanh Central Station in the first phase of the phased construction depends on the construction part of the Line 2 station structure, this Line 2 construction part in the first phase shall be determined in the decision of the source of fund.

In this case only the construction of Line 2 station structure is needed. Because the interior works and the facility works such as electrical system and air conditioning system can be performed in the later stage of the construction of the Line 2 project, the source of fund for these works has not yet clarified. Only the source of fund for the construction cost of Line 2 station structure shall be determined.

(b) Action Plan

Based on the result of this survey, MAUR decides the policy for the source of fund for Ben Thanh Central Station, and this policy shall be determined through the consultation with the relative parties of Ho Chi Minh City and the Government of Vietnam. The relative parties of Ho Chi Minh City are HCM PC, and DPI, and etc. The ones of the Government of Vietnam are MPI MOF, and etc. Ho Chi Minh City would like to request the Japanese funds for the construction of Ben Thanh Line 2 station. On the other hand Line 2 project is proceeded by the official development assistance from Germany (KfW, ADB, EIB). Considering the current source of funds for UMRT Line 2, co-finance by JICA and ADB will be an alternative, and other alternatives will be also available. The Integrated Design for Ben Thanh Central Station is expected to be commenced promptly, MAUR and JICA shall discuss this issue in the early timing, and the source of fund shall be determined promptly, if necessary through the consultation with relative parties mentioned above.

9.2.2 Underground Shopping Mall Project

With regard to the underground shopping mall as PPP Project in Ben Thanh Central Station Project, based on the Study results, the recommendation for the issues and the action plans for the project implementation are summarized as follows.

1) Project Implementation Scheme

As the main items for the project implementation scheme, the recommendation for the issues and the action plans for the relations to laws and regulations, the rights and obligations, and the Project schedule are summarized as follows.

(1) Project Scheme for Relations to Vietnamese Laws and Regulations

(a) Issues

With regard to the underground shopping mall as PPP Project in Ben Thanh Central Station Project, the project implementation scheme is proposed and its effectiveness is introduced in this survey. However the proposed project implementation scheme has not been officially confirmed. In case of this project such as the underground development beneath the public street is implemented as the urban development project with PPP style, the project is likely to be treated as a special urban development project based on the current Vietnamese laws and regulations. Therefore the project implementation should supposedly proceed upon the basis of mutual consensus and agreement of both Vietnamese Government and Ho Chi Minh City.

In addition, for the project implementation the next step would be that the potential concessionaire summarizes the contents of the Pre FS and submits it to the above mentioned Governments as their proposal for obtaining a consent for implementing a F/S of the project (In-principle Approval/Acceptance of GOV/PC for the investors to make F/S).

The Pre FS has been already performed through this survey. However the proposed project implementation scheme has not been officially confirmed. Therefore this proposed project implementation scheme shall be clarified through the consultation with the relative parties.

(b) Action Plan

In order to clarify the policy of the project implementation scheme, based on the proposed project implementation scheme, mainly the potential concessionaire will study furthermore and discuss with the relative parties of both Vietnamese Government and Ho Chi Minh City. The relative parties of Vietnamese Government are MPI, MOF, and etc. and the ones of Ho Chi Minh City are MAUR, DPI, DOC, DOT, and etc. For one more year the policy of the project implementation scheme will be clarified through the mutual consensus and agreement of relative parties.

Based on this policy, the potential concessionaire summarizes the contents of the Pre FS and submits it to the above mentioned Governments as their proposal for obtaining a consent for implementing a F/S of the project. Then the F/S is performed by the developers. In this study the detail of the project implementation scheme is also discussed with relative parties of both Vietnamese Government and Ho Chi Minh City, and determined with the mutual consensus and agreement of relative parties. This procedure is expected to need another one more year. After submitting the results of F/S, the developer obtains an investment certificate.

On the other hand the source of fund for the public is expected to be Japanese ODA. In accordance with above mentioned procedure of the private sector, it is necessary for the procedure of the decision of the investment project by Vietnamese Government and the loan agreement between Japanese and Vietnamese Governments.

Regarding the project implementation scheme for the underground development beneath the public street, neither the public side nor the private side have sufficient experiences thus far, therefore required procedures should be clarified in the investigation to be conducted from now on.

(2) Right and Obligations for Project Implementation

(a) Issues

With relation to the project implementation scheme, the right and the obligations of the developers for the project implementation are not clarified. The rights mean the investment certificate or the land use right and so on, and the obligations mean the lease fee, the responsibility of the project implementation, or the possibility of the project transfer and so on. The rights and the obligations for the project implementation are important factors as a basic condition for the judgment of the risks and the investment by the developers. Especially as this project develops the underground space beneath the public street, it has not yet been confirmed in this survey whether the rights such as the land use right in the public space can be obtained or not.

In addition, in this survey the developer is assumed to obtain the usage right of the underground space based on the master leasing contract, and this master lease fee gives the large influence to the profitability of the project. Therefore the policy for the rights and the obligations as the basic condition shall be confirmed for the judgment of the investment in the early timing. Besides, the responsibility of the project implementation and the possibility of the project transfer are also important factors.

As for the rights and the obligations of the project implementation, that policy shall be clarified through the consultation with the relative parties.

(b) Action Plan

In order to clarify the policy of the rights and the obligations for the project implementation, based on the results of this survey, mainly the potential concessionaire will study furthermore and discuss with the relative parties of both Vietnamese Government and Ho Chi Minh City. The relative parties of Vietnamese Government are MPI, MOF, and etc. and the ones of Ho Chi Minh City are MAUR, DPI, DOC, DOT, and etc. For one more year the policy of the rights and the obligations for the project implementation will be confirmed through the mutual consensus and agreement of relative parties. These rights and the obligations are the basic conditions for the proposal to above mentioned Governments submitted by the potential concessionaire summarizing the contents of the Pre FS. Based on this policy of the rights and the obligations, the consent for implementing the F/S of the project could be obtained.

The F/S is performed by the developers based on this policy of the rights and the obligations, and the developer obtains an investment certificate. After this step the developer obtains the certificate of the land use right, although it is special land use right for the use of the underground space. In this procedure, the detail of the rights and the obligations for the project implementation is also discussed with relative parties of both Vietnamese Government and Ho Chi Minh City if necessary, and determined with the mutual consensus and agreement of relative parties.

Regarding the rights and the obligations for the project implementation, neither the public side nor the private side have sufficient experiences thus far, therefore required procedures should be clarified in the investigation to be conducted from now on.

(3) Project Schedule

(a) Issues

There are many risks when it takes many years to commence the project operation from the decision of the investment for the developers because it is difficult to evaluate the future trend. In this survey the outline of the project schedule is introduced. According to this schedule it is estimated that the commencement of the project operation is nine years later from now because it takes approximately four years until the construction start and five years for the construction period. This period is too long for the private project implementation, and it is difficult to judge the investment. Therefore the study for the shortening of the project schedule is also necessary.

As this project schedule depends on the project scheme, the project schedule shall be studied at the same timing as the project scheme study. In this meaning it is important that the project scheme which makes the early commencement of the project operation is investigated considering the project schedule.

In addition, regarding the public project expected as Japanese ODA project, the period from the decision of the project until the construction start is estimated to become the critical pass for the project schedule. Therefore the study for the shortening of the schedule as an ODA project is also necessary.

(b) Action Plan

As for the project schedule, at the same timing as the investigation of the project scheme, mainly the potential concessionaire will study furthermore and discuss with the relative parties of both Vietnamese Government and Ho Chi Minh City. For one more year the policy of the project schedule will be confirmed through the mutual consensus and agreement of relative parties. In this procedure as for the public project expected as Japanese ODA project, the policy of the project schedule will be clarified through the consultation with Vietnamese Government, Ho Chi Minh City, and JICA.

After the consent for implementing the F/S of the project, the F/S is performed by the developers, and the developer obtains an investment certificate. According to these procedures the project schedule is determined.

2) Implementation of EIA

(a) Issues

As for the environmental and social consideration, in this survey the investigation of IEE level is performed. Reviewing and updating by the comments of the advisory committee the examination of environmental and social impacts (environmental scoping) are performed. The draft of TOR for the environmental and social consideration is recommended, and the outline of the environmental monitoring plan is introduced. The approval on the project by Vietnamese Government is necessary for the project implementation, and for this approval EIA shall be reported. Therefore EIA shall be implemented in the early stage for the project implementation.

With regard to Ben Thanh Station of the UMRT Line 1 project, EIA report has been already approved. In this project not only the Ben Thanh station but also the underground plaza and passageway are planned, so the area of the project becomes larger. From this viewpoint the EIA report for this project is necessary. In addition, based on the Environmental Guideline of JICA, the discussion with Stakeholders shall be also conducted in EIA.

(b) Action Plan

For the early commencement of the Project, EIA shall be conducted in 2012 by MAUR based on the TOR of EIA prepared in this Study. In this investigation the EIA report of UMRT Line 1 is reviewed, the field reconnaissance survey is carried out, and the assessment of environmental impacts is executed. In addition the discussion with Stakeholders shall be also conducted.

An Environmental Management Program shall be formulated in the stage of EIA study, as a part of the EIA Report to ensure the environmental commitments made at the EIA study are implemented in an efficient and effective manner. In addition, an Environmental Management Plan shall be formulated after the approval of the EIA Report.

3) Technical Standards for Underground Construction

(a) Issues

The main technical standards for the construction of the underground shopping mall are the structural standards and the disaster prevention standards. Because the structure of this underground shopping mall is unified with the UMRT Line 1 structure, it is most suitable that the structural standard of UMRT Line 1 is adopted for the overall structure of Ben Thanh Central Station Project including the underground shopping mall. As for the disaster prevention standards, no technical standards dealing specifically with disaster planning for underground shopping malls have been established in Vietnam though technical standards have been established for buildings. Therefore the technical standards for disaster prevention planning is based on the construction standards in Vietnam, with Japanese construction technology standards used as specialized technical standards for underground shopping malls to supplement items of insufficiency

As for the technical standards for the construction of the underground shopping mall, in this survey the above mentioned proposal is recommended and explained to MAUR. However this recommendation has not yet been approved. The technical standards are necessary for the detail design of Ben Thanh Central Station Project including the underground shopping mall, and it gives large influence to the construction cost because the specification of underground shopping mall depends on the technical standards. Therefore the technical standards for the construction of the underground shopping mall shall be officially determined before the commencement of its detail design.

In addition because the structure of this underground shopping mall is unified with the UMRT structures, the comprehensive technical standards, especially comprehensive disaster prevention standards, is needed to be arranged and confirmed before the commencement of the design of the each project.

(b) Action Plan

As for technical standards for the construction of the underground shopping mall, the potential concessionaire and the public sector cooperate and study furthermore and discuss with the relative parties of both Vietnamese Government and Ho Chi Minh City. The relative parties of the Government of Vietnam are MOT, MOC, and Bureau of Fire Fighting & Prevention. The ones of Ho Chi Minh City are MAUR, DOC, DOT, and Department of Fire Fighting & Prevention. For one more year the policy of the technical standards will be confirmed through the mutual consensus and agreement of relative parties.

In the next step based on this policy, the detail of the technical standards is expressed in writing and proposed for the approval by Vietnamese Government and Ho Chi Minh City.

The underground shopping mall and the underground station are needed to satisfy each technical standard basically though these structures are unified together. Furthermore in the common area between the underground shopping mall and the underground station the buffer zone is created in order to give no influence to each other. In this manner the overall facility keeps the safe comprehensively. Thus the concept for the comprehensive technical standards of the underground shopping mall and the underground station is arranged and clarified.

4) Coordination of Structures above Grade

(a) Issues

Same as metro projects, the surface structures like Cooling Towers etc. are necessary to be allocated on the ground level, and their location plan was prepared based on the official Master Plan of Ho Chi Minh City, in this Study.

Even with the above consideration, the coordination meeting with them for the surface structures shall be held in the early timing, because the competent departments of HPC are interested in the landscape issue.

In the underground development, same as metro projects, the structures such as staircases, atria, ventilation towers, and so on are necessary to be allocated on the ground level. In this survey their location plan is prepared. In addition considering the impact on the scenery of the ground level in the project site, the comparative study for the some design options of these structures above grade is performed in the next detail design stage. The design and shape of the structures above grade have to be determined through this comparative study and the consultation with relative parties of Ho Chi Minh City in the next detail design stage.

In this survey the ground level plan is studied and introduced under the current traffic arrangement since the urban planning of Ho Chi Minh City has not yet been approved. Besides, because this urban planning is expected to be approved within a few months, the ground level plan based on this urban planning is also investigated in this survey. In the urban planning the existing roundabout in front of Ben Thanh Market will change to be a new pedestrian plaza, and Le Loi Street will be a great pedestrian oriented transit mall. Therefore the urban planning will make the scenery of the ground level in the project site much different from current scenery.

Since the project site is the sensitive area in front of Ben Thanh Market located in the center of Mo Chi Minh City, the ground level plan of on-ground structures which have some influence to the scenery shall be studied and discussed with the relative parties of Ho Chi Minh City in early timing in whichever plans based on the current traffic arrangement and the urban planning. It is important that the scenery of the project site is studied in consideration with the latest situations due to new developments in the surrounding area. In case the ground level plan is not approved by the People's Committee of Ho Chi Minh City, there is a risk that the underground development can not be planned.

(b) Action Plan

As for the ground level plan, because the scenery of the project site is much different between the plans under current traffic arrangement and based on the urban planning, it is necessary to wait for the approval of the urban planning. After the approval, in accordance with the ground level plan based on the urban planning recommended in this survey, the consultation with the relative parties is conducted. Regarding the landscape design of the project site and the design of the on-ground structures, the potential concessionaire and the public sector cooperate and study furthermore. Through discussion with the relative parties like the architecture assessment committee, the mutual consensus and agreement of relative parties are obtained for the design policy of the ground level plan.

In the next detail design stage the structures above grade are designed based on this design policy

5) Source of Fund for Ben Thanh Line 4 Station for the construction of USM

(a) Issues

Because the platform of Line 4 Station was planned beneath USM, the structure of Ben Thanh Line 4 Station shall be construction together with USM. The source of fund for MRT Line 4 Project has not been decided, and the budgetary schedule for MRT Line 4 shall be considered referring to the schedule of USM Project.

In this survey not only Ben Thanh Central Station which receives 4 UMRT Lines of Line 1, 2, 3a, and 4 but also the underground development in the surrounding are of the central station are studied and planned as a unified structure. On the other hand as for the construction, because the Line 1 project already proceeds by Japanese ODA and Ho Chi Minh City intends to operate Line 1 as early as possible, the phased construction with the first priority of the Line 1 construction is recommended. The other facilities like UMRT Line 4 and the underground shopping mall is expected to be constructed in the later stage. In this case since the platform of the Line 4 station is planned beneath the underground shopping mall, the structure of Line 4 Ben Thanh station shall be construction together with the underground shopping mall. Therefore the source of fund for UMRT Line 4 station, which has not yet been decided, shall be clarified together with the underground shopping mall.

In addition, since the underground shopping mall is unified with only the station structure, the part of the UMRT Line 4 station without the shield tunnel section shall be constructed simultaneously. Furthermore only the structure of Line 4 station is needed to be constructed. Because the interior works and the facility works such as electrical system and air conditioning system can be performed in the later stage of the construction of the Line 4 project, the source of fund for these works has not yet clarified. Only the source of fund for the construction cost of Line 4 station structure shall be determined.

(b) Action Plan

Based on the result of this survey, MAUR decides the policy for the source of fund for Ben Thanh Central Station, and this policy shall be determined through the consultation with the relative parties of Ho Chi Minh City and the Government of Vietnam. The relative parties of Ho Chi Minh City are HCM PC, and DPI, and etc. The ones of the Government of Vietnam are MPI MOF, and etc. Ho Chi Minh City would like to request the Japanese funds for the construction of Ben Thanh Line 4 station. On the other hand MAUR has signed a Memorandum with Italian – Thai Development Public Cooperation (Thailand) regarding the investment cooperation. Considering the current source of funds for UMRT Line 4, the source of fund for Ben Thanh Central Station shall be clarified. Since the structure of the Line 4 station is constructed together with the underground shopping mall, the policy for the source of fund for Line 4 station shall be studied at the same timing as the investigation and the consultation of the project implementation scheme of the underground shopping mall.