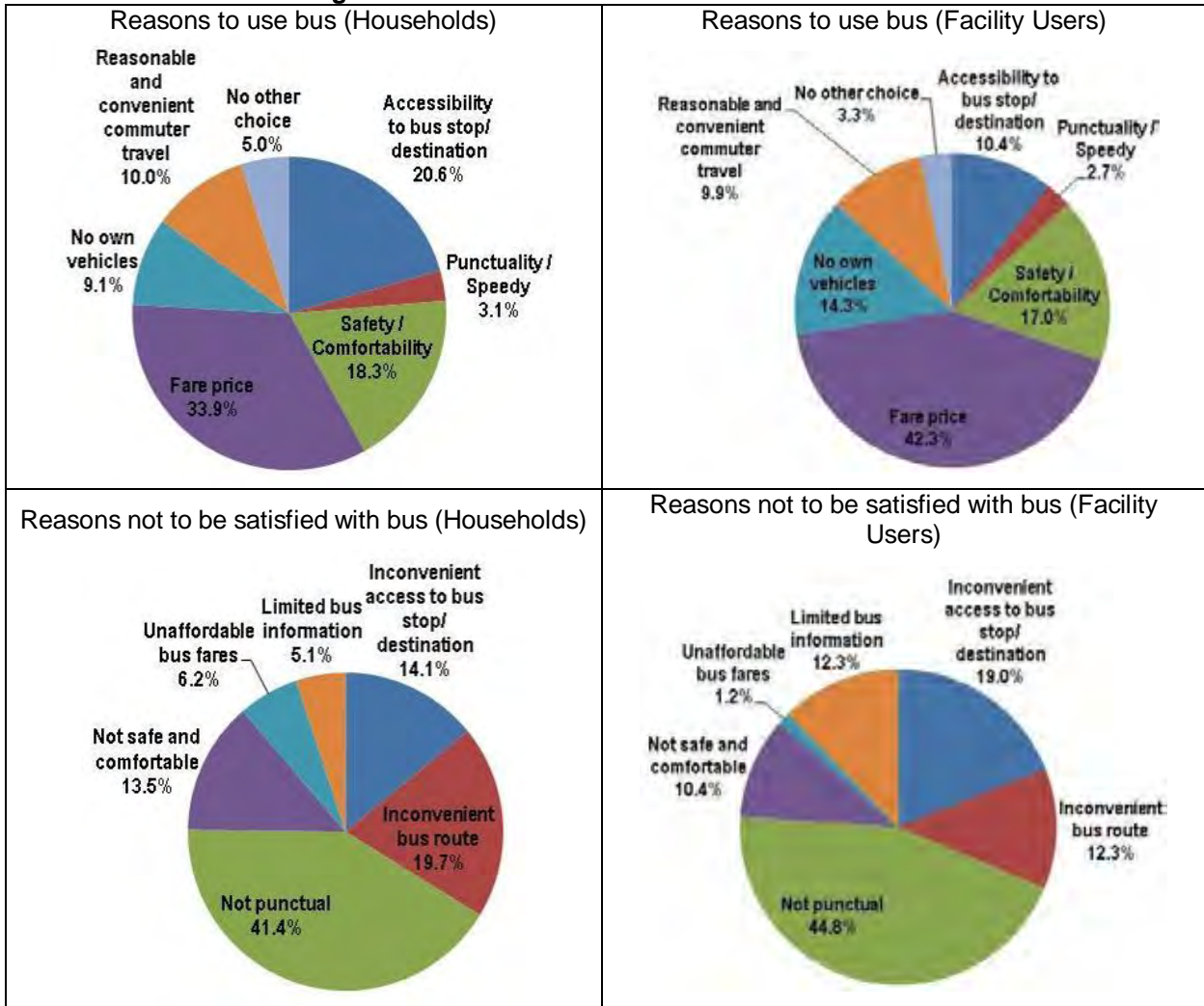


Figure 3.2.5 Assessment of Bus Condition



Source: Household Interview Survey and Facility User Interview Survey, 2009, JICA Project Team

3.3 Prospects for UMRT

3.3.1 Publicity and Future Perception on UMRT

318 About one-third of households around the UMRT station areas are aware of the UMRT projects of Hanoi City, but more than two-thirds of them are unsure of the location of stations near to their homes (see Table 3.3.1).

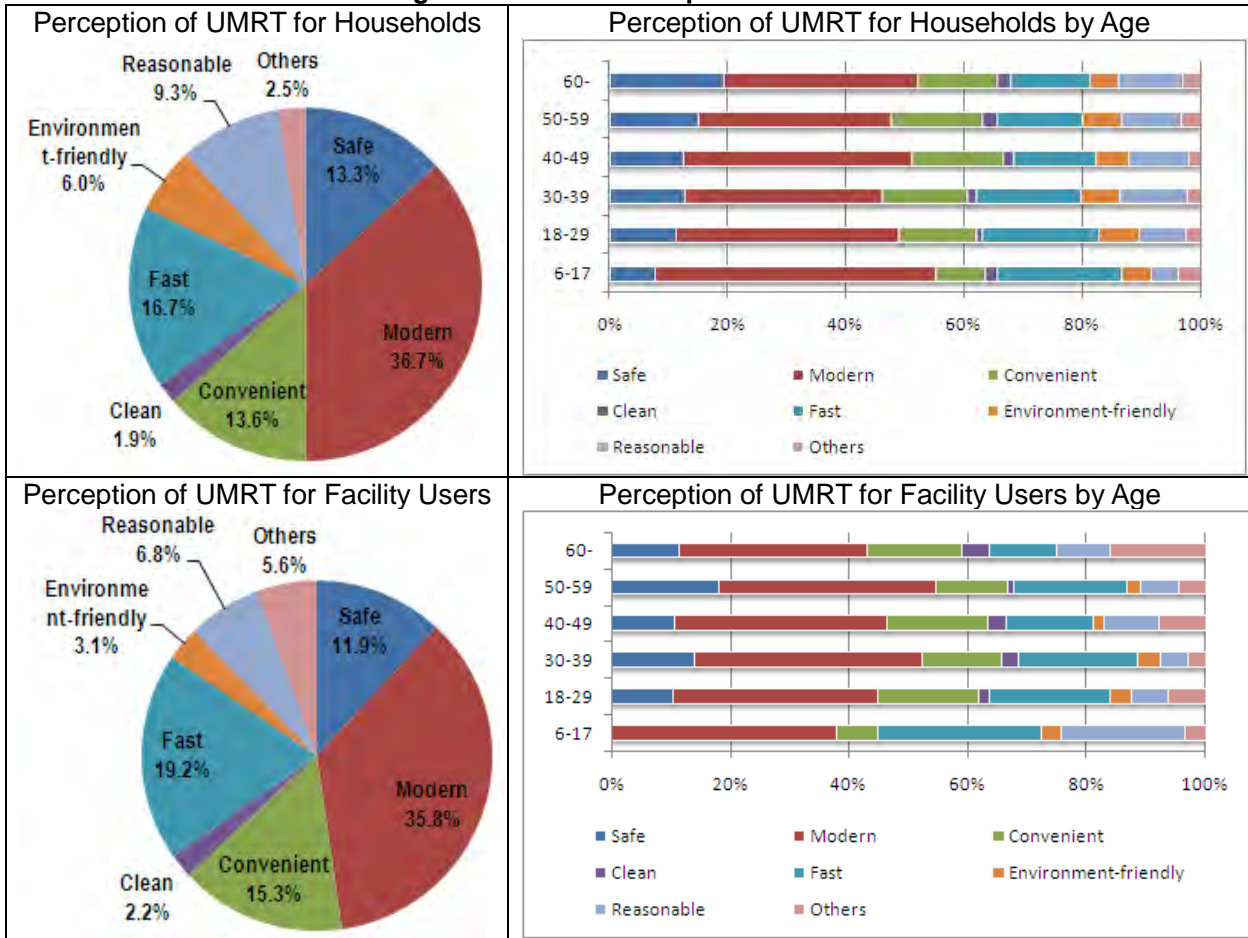
319 The most popular features associated with UMRT are: “modern”, then “fast”, “convenient” and “safe” (see Figure 3.3.1).

Table 3.3.1 Awareness of UMRT Project and Station Locations

| | | Know UMRT project | | How to Know | | | Know station location near to home | | |
|-------|----------------|-------------------|------|-------------|--------------|--------|------------------------------------|----------|------|
| | | Yes | No | Mass Media | Acquaintance | Others | Yes | Not Sure | No |
| Line1 | Households | 36.3 | 63.7 | 69.1 | 23.4 | 7.4 | 21.3 | 38.2 | 40.5 |
| | Facility Users | 35.1 | 64.9 | 76.5 | 17.0 | 6.5 | 29.2 | 29.2 | 41.5 |
| Line2 | Households | 41.5 | 58.5 | 67.9 | 25.1 | 7.0 | 39.2 | 41.7 | 19.1 |
| | Facility Users | 33.6 | 66.4 | 79.9 | 14.4 | 5.7 | 19.9 | 42.6 | 37.5 |

Source: Household Interview Survey and Facility User Interview Survey, 2009, JICA Project Team

Figure 3.3.1 Perception of UMRT



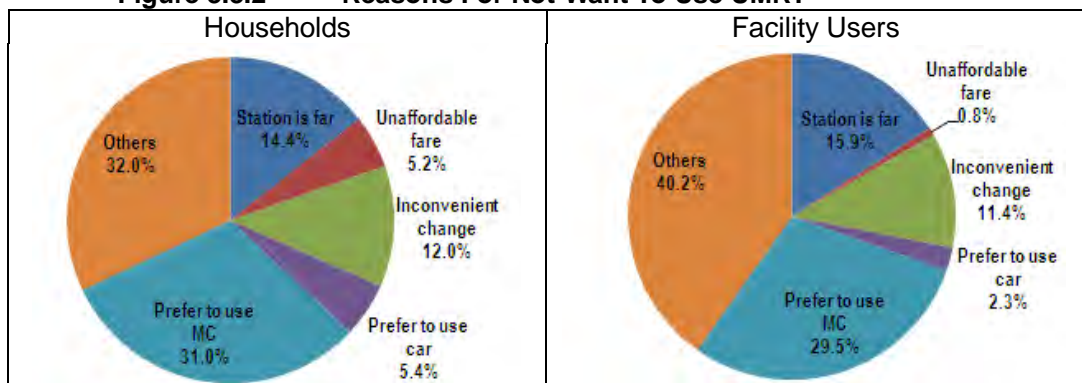
Source: Household Interview Survey and Facility User Interview Survey, 2009, JICA Project Team

3.3.2 To use or not to use UMRT

320 More than 90% of interviews answered that they wanted to use UMRT in the future (see Figure 3.3.2). A few of them said they won't use UMRT, since more than one-third still prefer to trust their motorbikes. Inconvenience of transfers as well as distance to stations, are cited as major disincentives to use UMRT.

321 It needs to be considered and well planned how to transfer motorbike users to public transport users, in addition to develop convenient transfer condition including UMRT, bus and other modes.

Figure 3.3.2 Reasons For Not-Want To Use UMRT



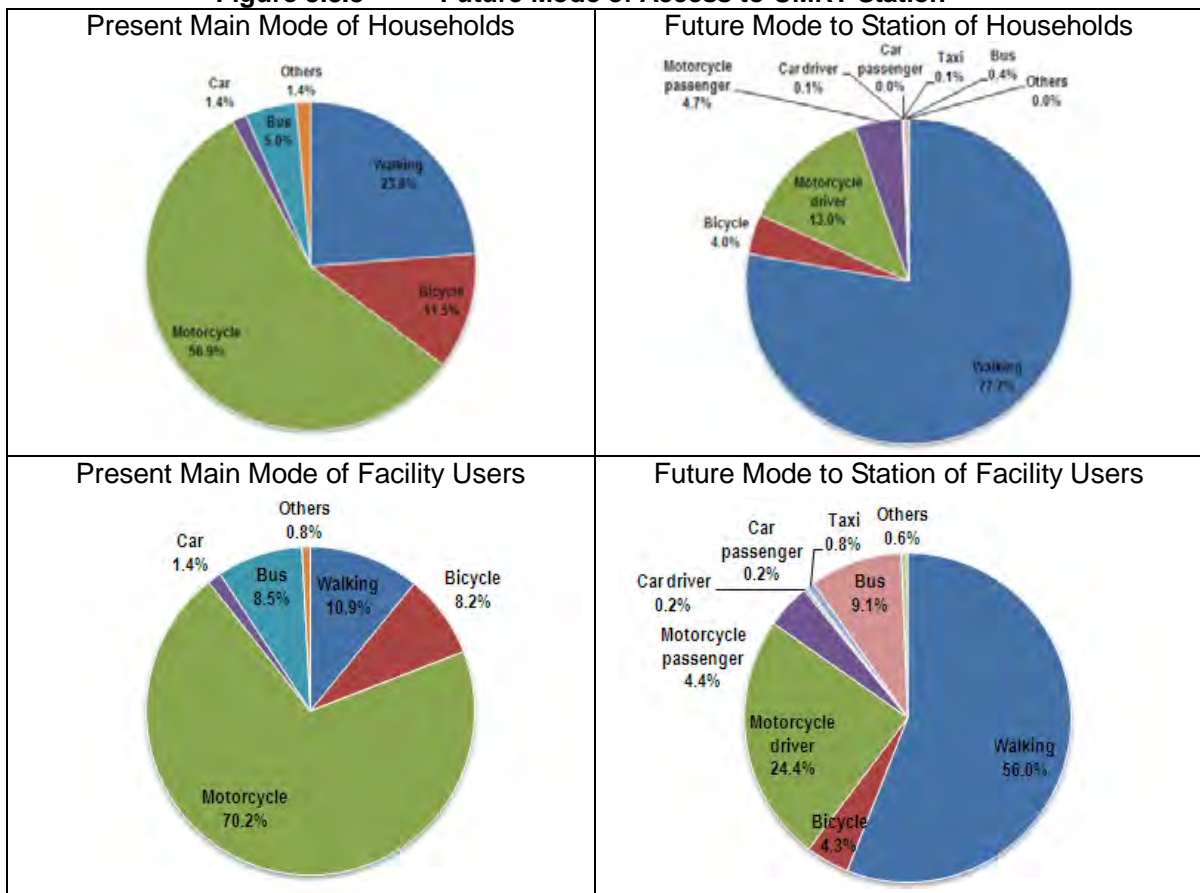
Source: Household Interview Survey and Facility User Interview Survey, 2009, JICA Project Team

3.3.3 Future mode of access to UMRT station

322 It is obvious that about 80% of households who live around UMRT station areas want to walk to UMRT station in the future (see Figure 3.3.3). The farthest walking distance is about 1km. Though more than half of facility users around UMRT station areas prefer to walk to station from home, about one-third want to use motorbikes, and 10% want to use buses.

323 For residents near the proposed stations, it is vital to improve the walking environment. But to expand the influence zones of the station, it would be necessary to improve the roads and public transport services.

Figure 3.3.3 Future Mode of Access to UMRT Station



Source: Household Interview Survey and Facility User Interview Survey, 2009, JICA Project Team

3.3.4 Future Purpose to use UMRT

a) Households

324 Most popular destination station is Hoan Kiem Lake of Line 2, where Ngoc Son Temple is located in south east of the Ancient Quarter. Hanoi and Gia Lam Stations are also popular, which are urban facilities are clustered. Residents around and inside of the Ancient Quarter prefer to use Hang Dau or Phung Hung Station, rather than Nam Cau Long Bien Station. At present, citizens know that location of Nam Cau Long Bien will be near to Long Bien Bridge and Market where are very crowded, the image of this station is not good for citizens.

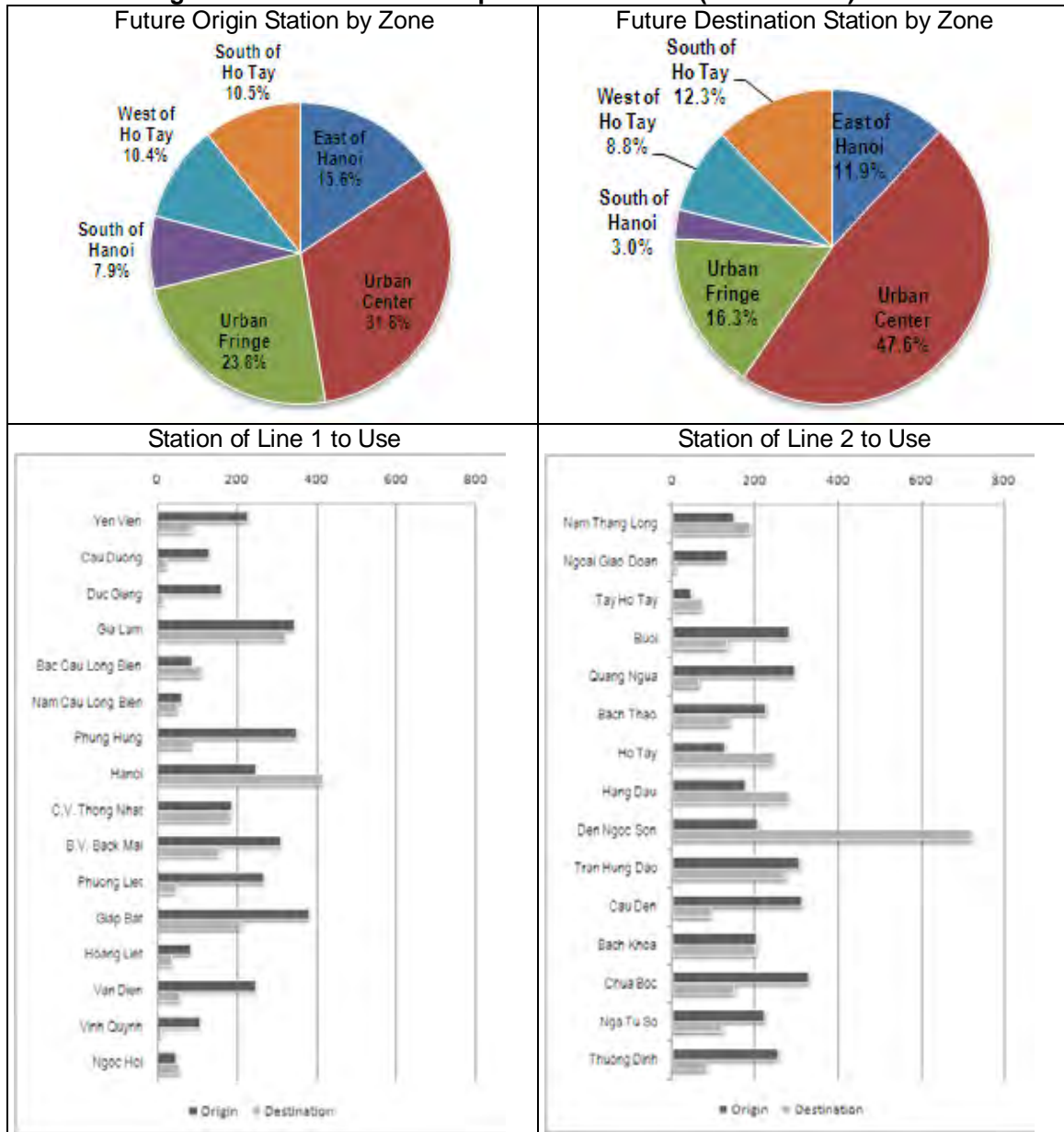
325 Purposes to use UMRT are various, and nearly half of interviewees could not select only one purpose. Since more than 90% of interviewees answered that they wanted

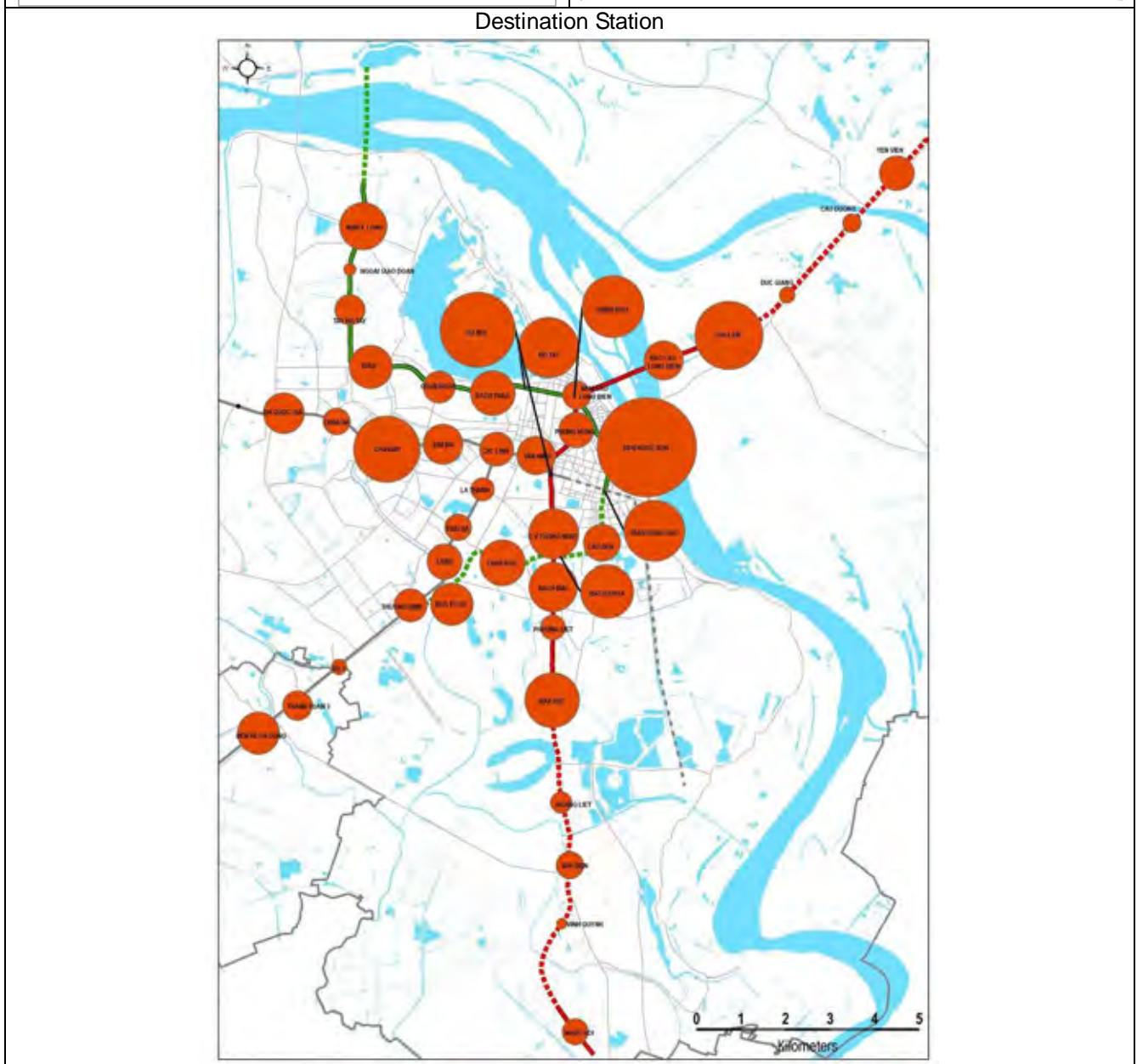
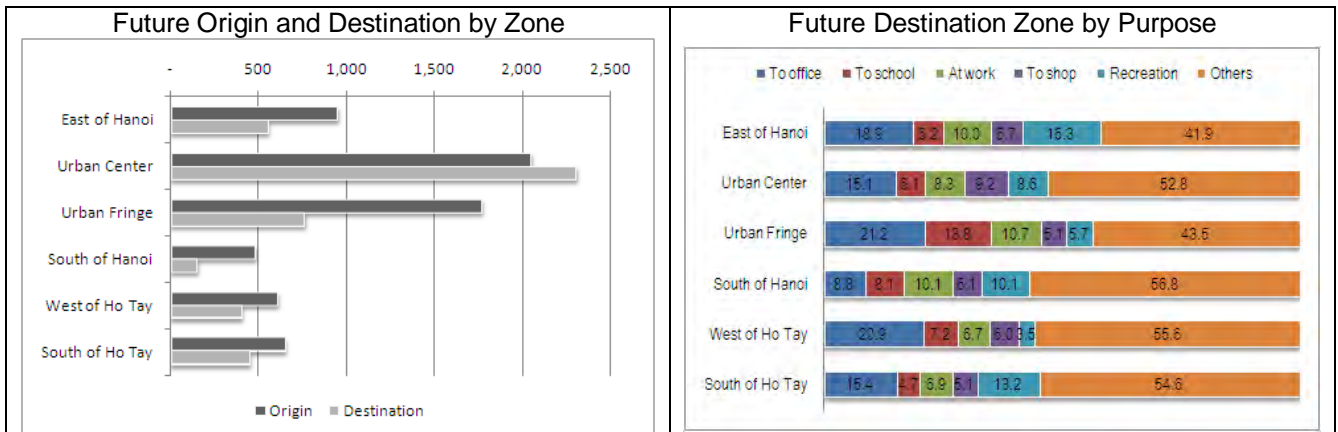
to use UMRT in future, it seems that citizens are interested in riding UMRT for any purposes. Especially for residents in East of Hanoi and South of Hanoi where are not convenient to go to Urban Center, recreation purposes to go to Urban Center are dominant.

b) Facility Users

326 For facility users which locate around UMRT station areas, Giap Bat is a popular station to go. It is considered that Giap Bat has an image of convenient transport node thanks to Giap Bat Bus Terminal, and people can use both UMRT and bus to go around Hanoi City as well as rural areas. Main purpose to use UMRT is mainly to go to work, especially in South of Hanoi. To commute to schools is also dominant in Urban Fringe where many universities are located.

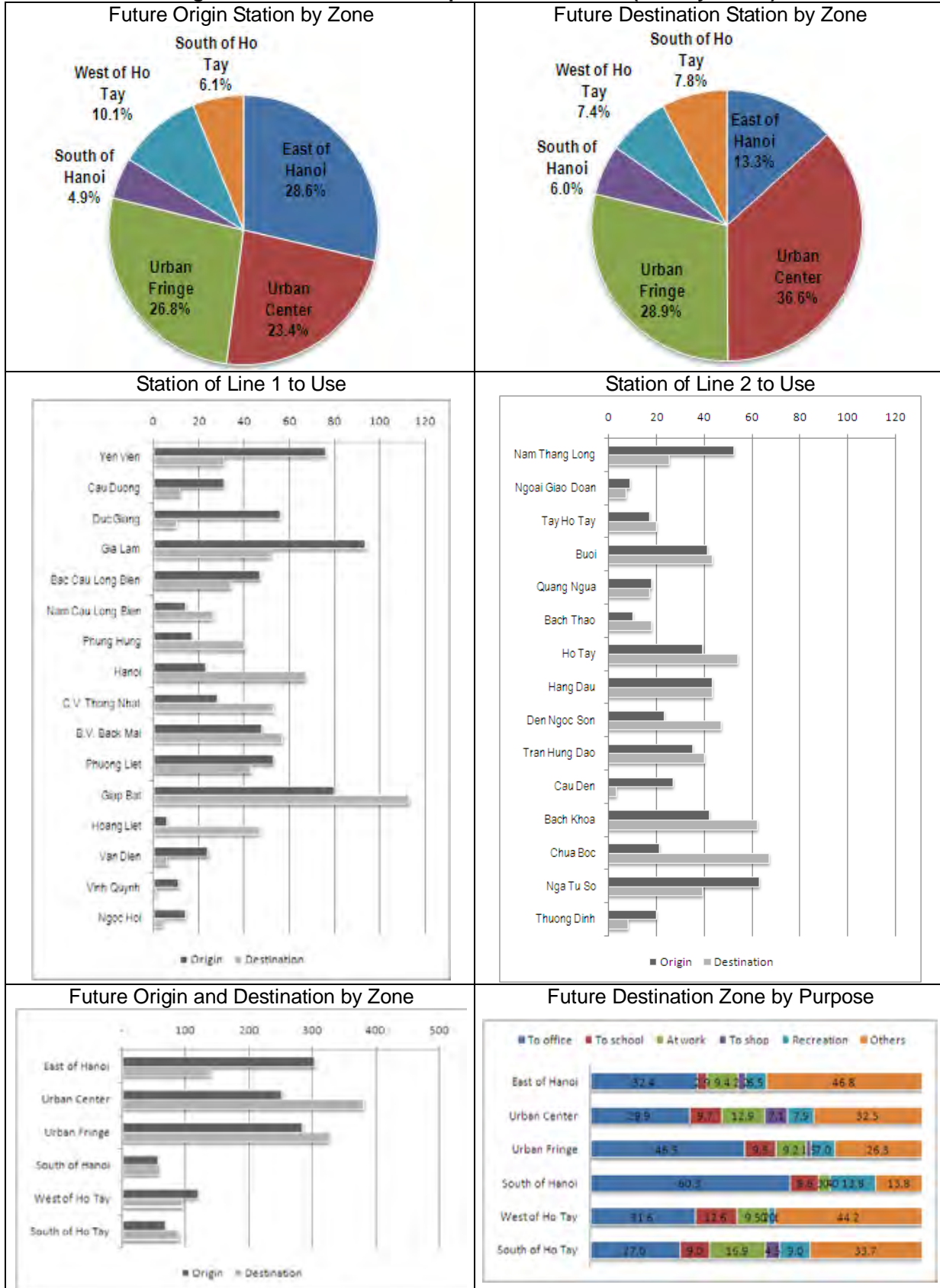
Figure 3.3.4 Future Purpose to use UMRT (Households)





Source: Household Interview Survey and Facility User Interview Survey, 2009, JICA Project Team

Figure 3.3.5 Future Purpose to use UMRT (Facility Users)



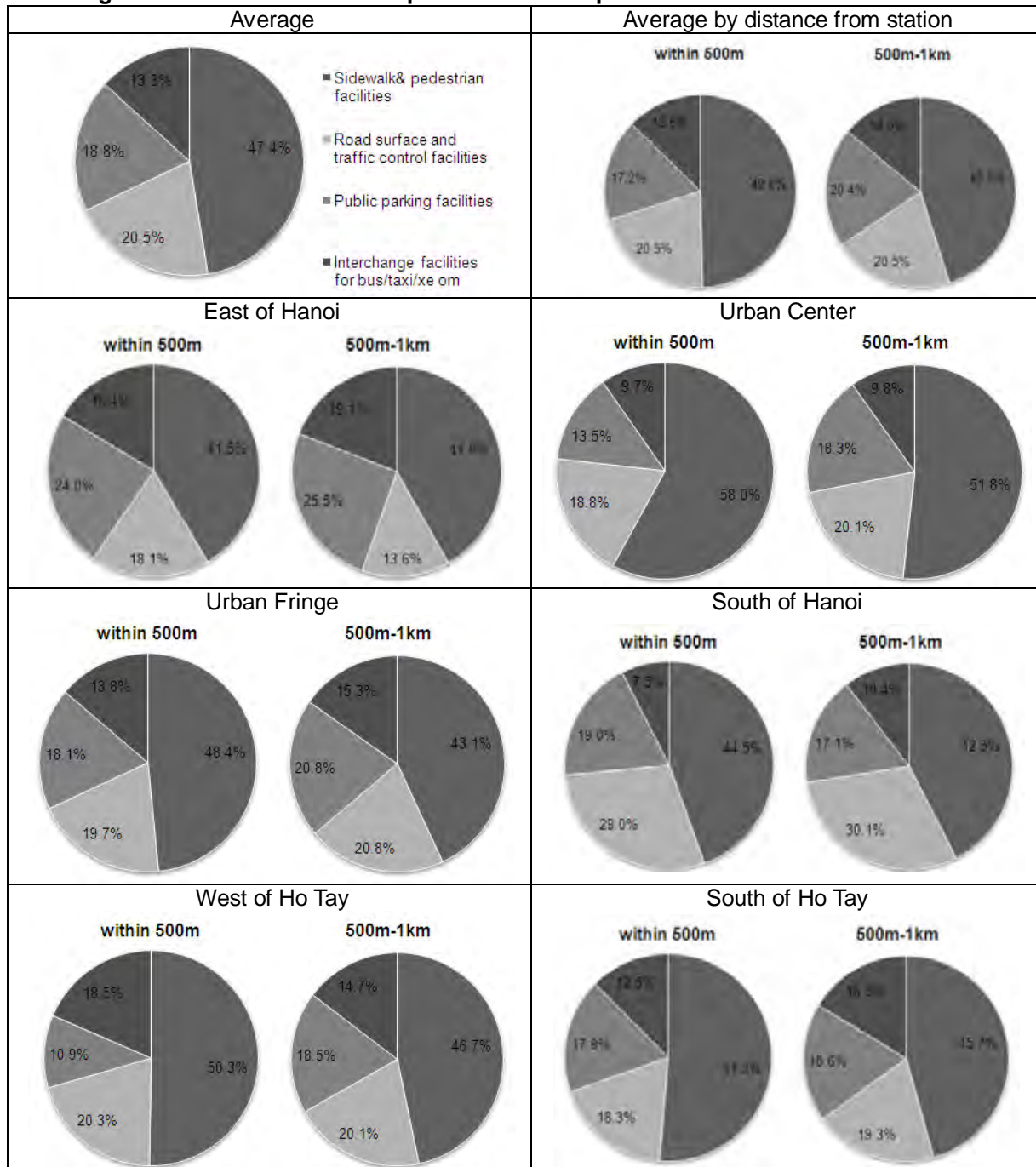
Source: Household Interview Survey and Facility User Interview Survey, 2009, JICA Project Team

3.3.5 Desired improvements around UMRT station

327 In general, the most desirable improvement around UMRT station is on sidewalk and pedestrian facilities. This is not surprising, since nearly 80% of households near to station want to walk to the station.

328 In the case of East of Hanoi, improvement in the interchange facilities with other modes is more important since station users would come from neighboring areas. In the case of South of Hanoi, road network development in conjunction with UMRT station development takes priority since the current road network is still undeveloped.

Figure 3.3.6 Future Transport Condition Improvement around UMRT Station



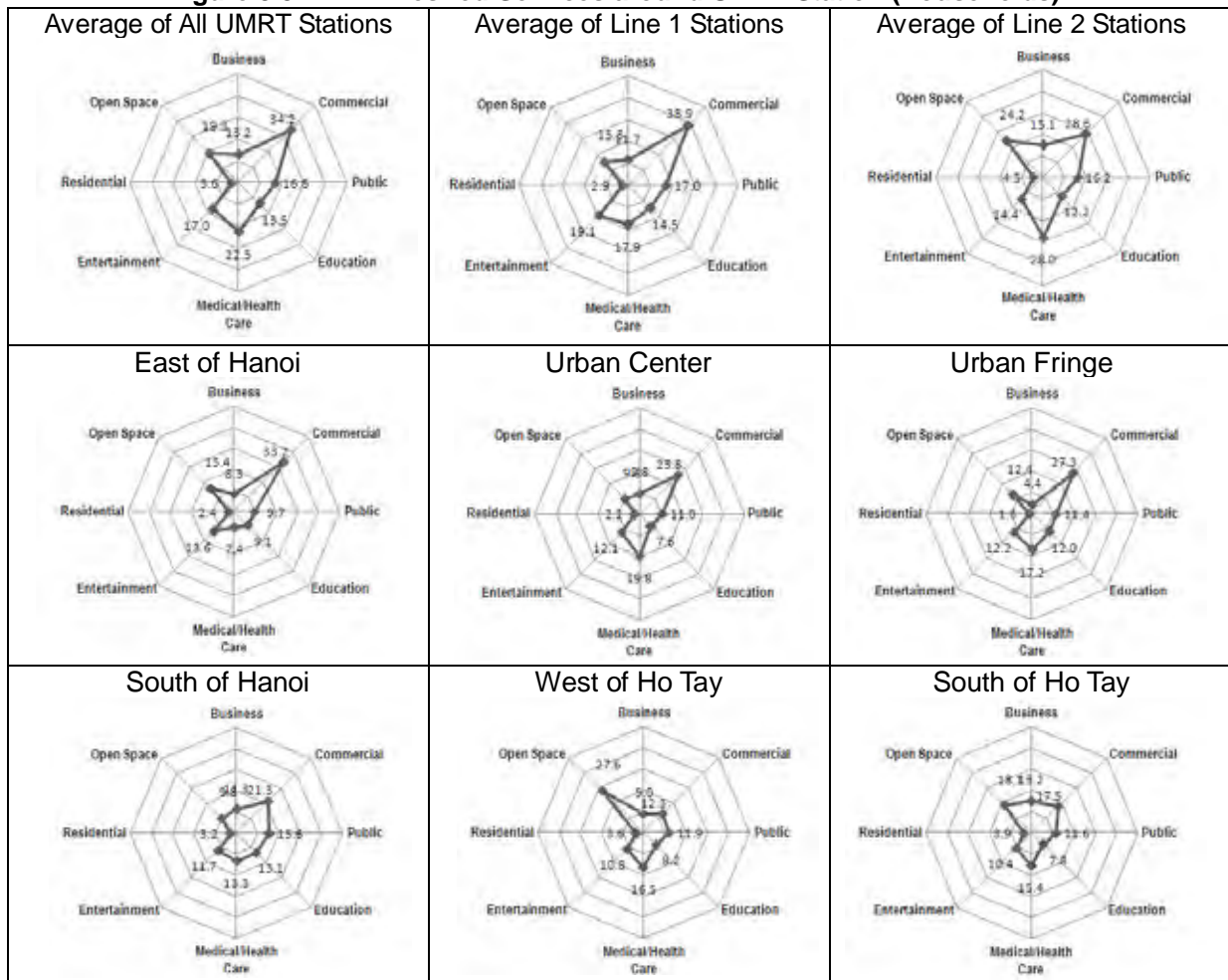
Source: Household Interview Survey and Facility User Interview Survey, 2009, JICA Project Team

3.3.6 Desired services around UMRT station

a) Households

329 Across all areas, households who live near stations expect to have commercial services to be available. Medical services also came up to those in the Urban Center and Urban Fringe. At present, hospitals and clinics are located in the city center. Because of their crowded and poor conditions, citizens would expect something better from new medical facilities that could be developed near the stations. Open space is more desired in West and South of Ho Tay. In general, new residential facilities (such as apartments) are not in their top list.

Figure 3.3.7 Desired Services around UMRT Station (Households)

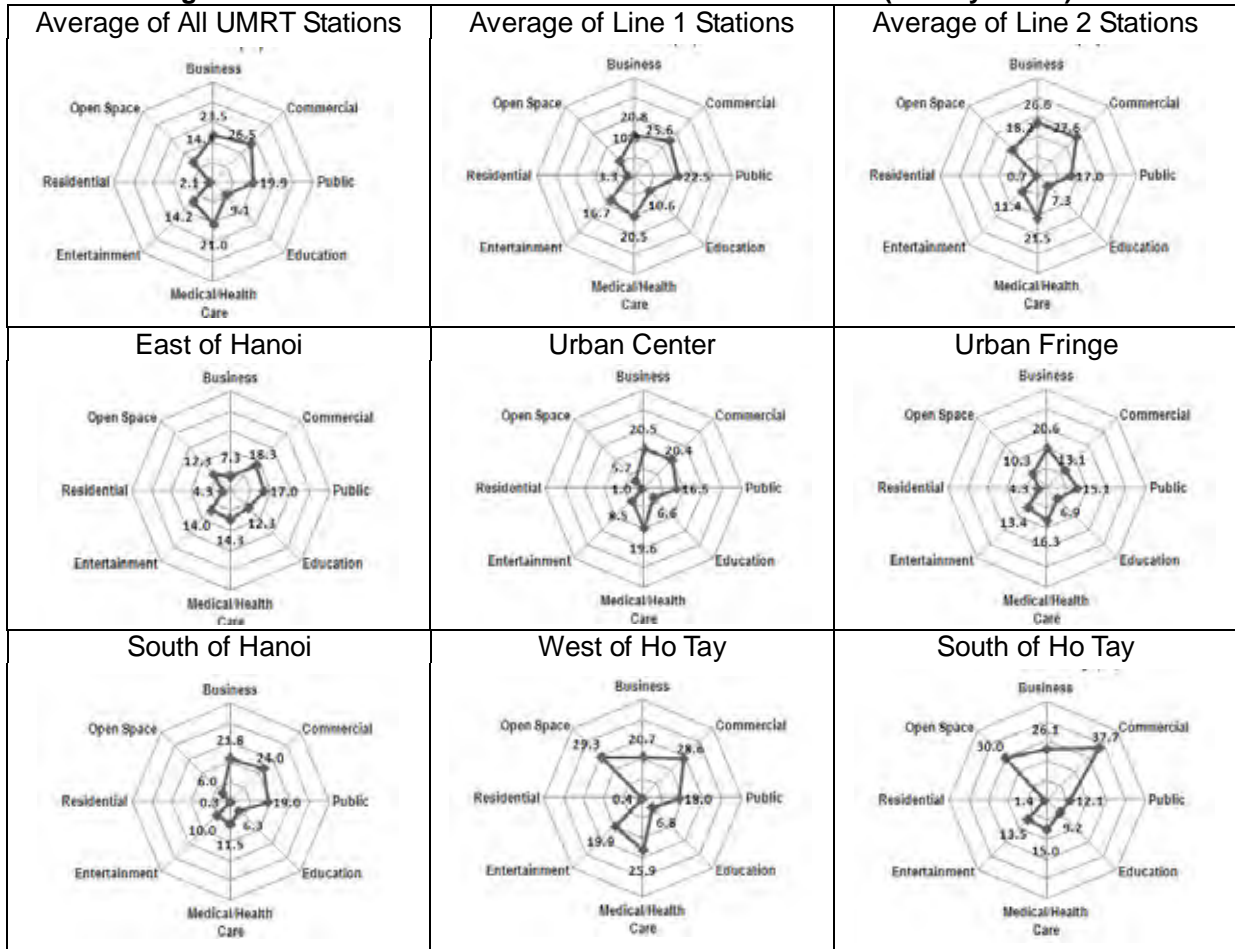


Source: Household Interview Survey and Facility User Interview Survey, 2009, JICA Project Team

b) Facility Users

330 For facility users who will commute to UMRT station area regularly, they would expect to find commercial and public services. It is therefore advisable to provide these services also so that visitors and commuters can avoid multiple journeys. Medical service in Urban Center and Urban Fringe and open space needs in West and South of Ho Tay, also ranked high in their wish list.

Figure 3.3.8 Desired Services around UMRT Station (Facility Users)



Source: Household Interview Survey and Facility User Interview Survey, 2009, JICA Project Team

3.3.7 Key Observations

331 **Present Issues of Transport Condition:** In terms of transport environment at present, most of people use motorbikes rather than buses. Many are concerned about air pollution and traffic congestion. In addition, people who live east of Hanoi (Long Bien and Gia Lam Districts) have fewer opportunities to go to urban center because of long distance and traffic congestion across Chuong Duong Bridge.

332 **Willingness to Use UMRT:** More than 90% of interviewees expect to use UMRT in the future. They perceived UMRT as modern, convenient and safe. Current motorbike users would prefer to walk to the stations.

333 **Attracting commuters to UMRT:** The main reason for avoiding UMRT is the attachment to motorbikes in providing direct access from home to destination in relation to the inconvenience of transferring other modes. Improved walkways and convenient transfer facilities would tend to overcome the negative factors.

334 **Unique attraction of Ancient Quarter:** UMRT stations in urban center, especially Hoan Kiem Lake Station, could become more popular as a destination in their own right. At present, many non-residents go there as the historical CBD and employment. Without as yet an operating UMRT, the public expectation is that it would be different from current situation at Nam Cau Long Bien Station - where traffic congestion and messy situation occur due to the nearby market and road intersections.

335 **Stations as a local CBD:** Other popular stations such as Hanoi, Gia Lam, Giap Bat appear to have the potentials to pull more users as a regional center of urban services and transportation hub to other areas. Many users from surrounding areas of Hanoi and neighboring provinces will go to these stations, if and when more varied commercial services get provided. Thus, these stations could grow beyond their simple transportation hub functions and into full-pledged commercial and business centers of suburban areas.

336 **Harmonization with local character:** While new urban services are expected and desired at UMRT stations, there is also a preference for non-disruption of present land uses. For example, many hospitals and universities are clustered around Bach Mai station; hence, walkways and parking improvements are expected to enhance these activities. In the case of stations near West Lake, open space is desirable. Stations (such as Hoan Kiem Lake and C.V. Thong Nhat) near popular parks have to be designed to suit recreational activities.

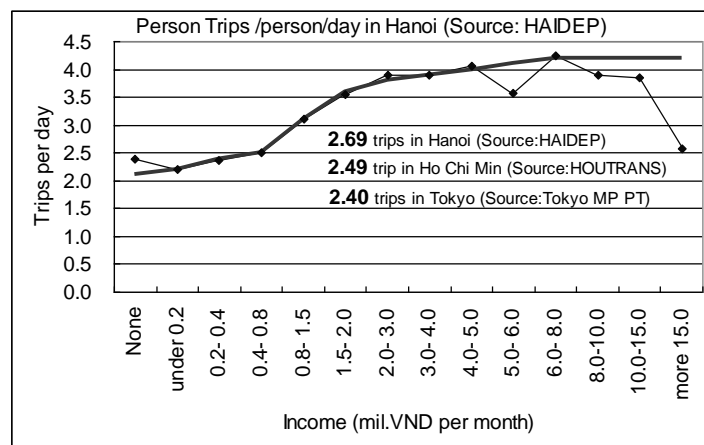
3.4 Development Scale of Station Areas

3.3.1 Demand Estimation at UMRT Stations

337 The key consideration in the design of the station is the passenger traffic, or the number of users expected to use the station. At the very least, it dictates what the size of the station should be. A basic station would suffice where the volume of boarding and alighting passengers is low. When the volume is large, a multi-function station becomes necessary. It is therefore important to estimate the number of passengers that is expected to board and alight at every station. There are various techniques for estimation. They take into account mode-choice behavior, size of population, the origin and destination patterns, transport alternatives, and the like.

338 A starting point of any estimation is to characterize the trip-making behavior based on actual surveys. The latest available, and most authoritative, HIS survey was carried out by HAIDEP study in 2005. It found out that about 7 million person trips were being made by 3 million persons. The calculated trip rate was 2.62 trips per person per day for urban areas, and 1.61 for suburban areas, excluding walking. This varied with income and is higher than many other cities, as shown on Figure 3.4.1.

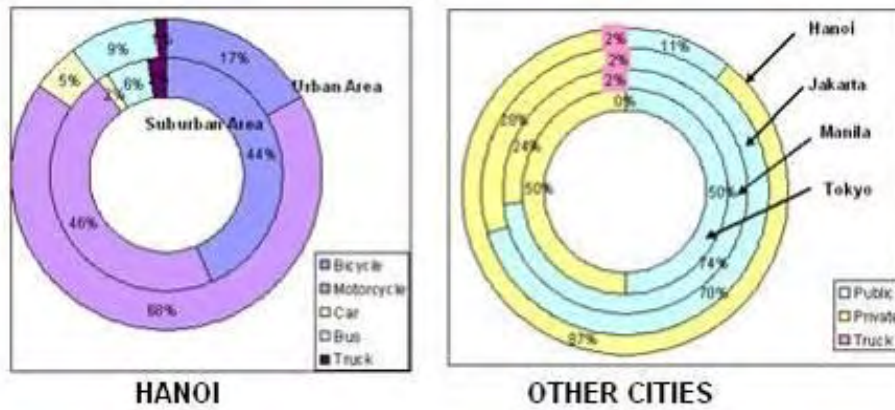
Figure 3.4.1 Trip Rates by Income



Source: Person Trips by HIS of HAIDEP

339 Understandably, motorcycles carried two-thirds of daily trips. Share of public transport was small – about 11% - in comparison with other developing country cities (see Figure 3.4.2). The hope is that this would increase when UMRT is built in Hanoi.

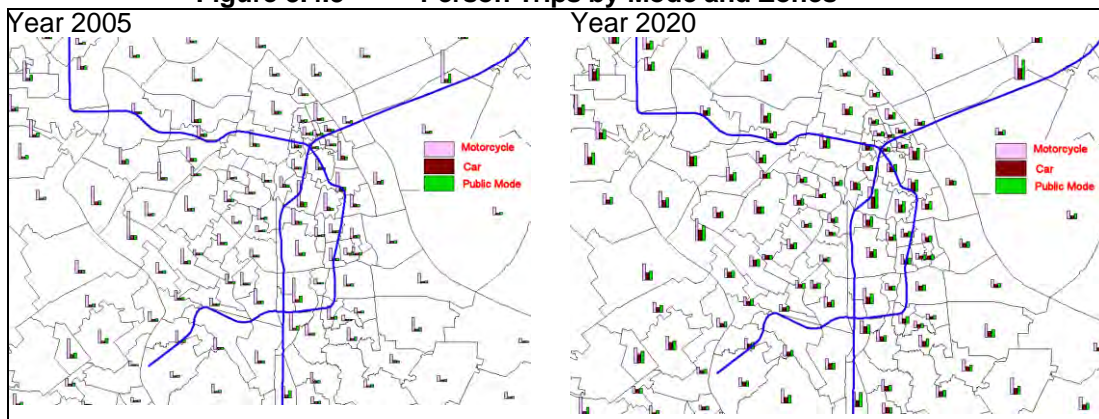
Figure 3.4.2 Comparative Modal Splits



Source: HAIDEP

340 HAIDEP was also able to determine the trip generations and attractions by zones, as shown on Figure 3.3.3. This suggested the desired alignments of urban rail lines.

Figure 3.4.3 Person Trips by Mode and Zones



Source: HAIDEP

3.3.2 Year 2020 Forecasts of Passenger Traffic

341 Based on Table 3.4.1, the demand forecast points to Gia Lam as having the highest traffic, followed by North Long Bien, on Line 1. On the other hand, for Line 2, the stations with the highest traffic are: Nam Thang Long and Long Bien.

Table 3.4.1 Forecast Number of Boarding/Alighting Passengers – Line 1 (2020)

| Station | Southbound | | | Northbound | | |
|----------------------|------------|-----------|----------|------------|-----------|----------|
| | Boarding | Alighting | On-Board | Boarding | Alighting | On-Board |
| V1 Yen Vien | | | | | | |
| V2 Cau Duong | | | | | | |
| V3 Duc Giang | | | | | | |
| V4 Gia Lam | 67,976 | 0 | 67,976 | 0 | 67,895 | 0 |
| V5 Bac Cau Long Bien | 11,044 | 327 | 78,693 | 326 | 11,045 | 67,895 |
| V6 Nam Cau Long Bien | 7,483 | 14,951 | 71,225 | 14,949 | 7,504 | 78,614 |
| V7 Phung Hung | 1,641 | 11,618 | 61,248 | 11,596 | 1,651 | 71,169 |
| V8 Hanoi | 3,771 | 22,204 | 42,815 | 22,171 | 3,756 | 61,224 |
| V9 C.V. Thong Nhat | 2,359 | 11,223 | 33,951 | 11,411 | 2,362 | 42,809 |
| V10 B.V. Bach Mai | 6,553 | 15,273 | 25,231 | 15,141 | 6,539 | 33,760 |
| V11 Phung Liet | 2,945 | 13,118 | 15,058 | 13,097 | 2,901 | 25,158 |
| V12 Giap Bat | 0 | 15,058 | 0 | 14,962 | 0 | 14,962 |
| V13 Hoang Liet | | | | | | |
| V14 Van Dien | | | | | | |
| V15 Vinh Quynh | | | | | | |
| V16 Ngoc Hoi | | | | | | |

Source: Feasibility Study on Hanoi Elevated Railway by JETRO 2006

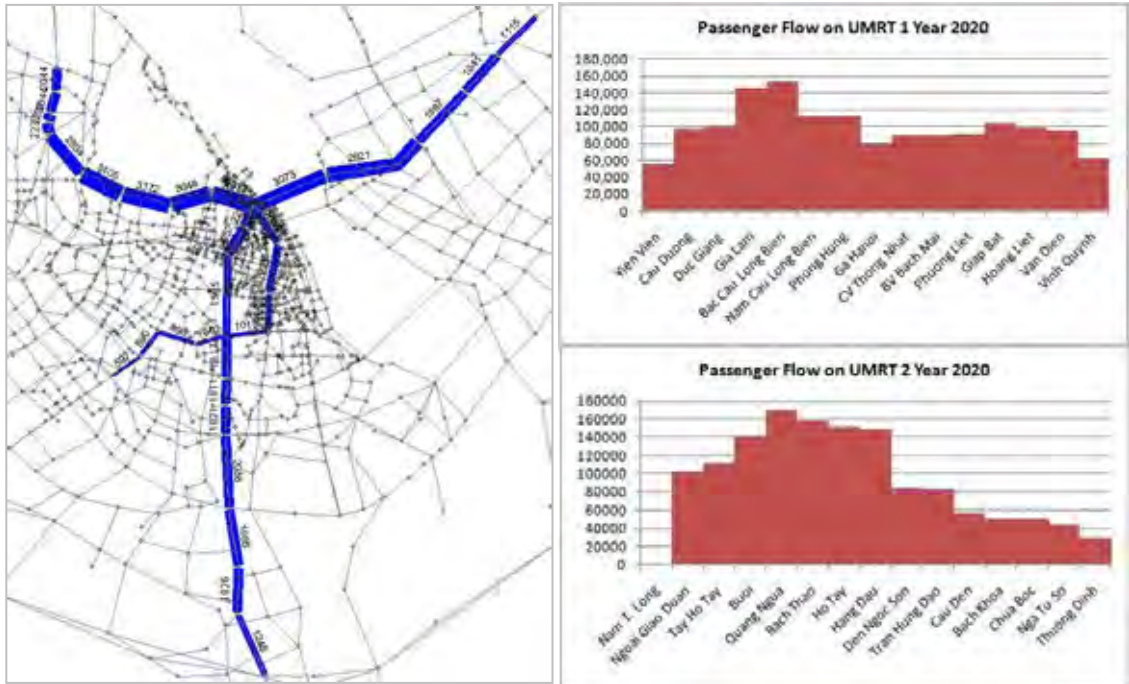
Table 3.4.2 Forecast Number of Boarding/Alighting Passengers – Line 2 (2020)

| Station | HAIDEP | | | | TEDI | | | |
|--------------------|------------|-----------|------------|------------|------------|-----------|------------|-----------|
| | Southbound | | Northbound | | Southbound | | Northbound | |
| | Boarding | Alighting | Boarding | Alighting. | Boarding | Alighting | Boarding | Alighting |
| C1 Nam Thang Long | | | | | 110,078 | 0 | 0 | 110,738 |
| C2 Ngoai Giao Doan | | | | | 10,205 | 651 | 654 | 10,215 |
| C3 Tay Ho Tay | | | | | 54,937 | 1,507 | 2,104 | 54,844 |
| C4 Bui | | | | | 40,600 | 24,390 | 23,430 | 40,576 |
| C5 Quan Ngua | | | | | 16,200 | 27,484 | 27,685 | 16,252 |
| C6 Bach Thao | | | | | 5,532 | 13,246 | 13,222 | 5,535 |
| C7 Ho Tay | | | | | 7,018 | 14,398 | 14,446 | 7,012 |
| C8 Hang Dau | | | | | 20,792 | 101,465 | 101,270 | 20,769 |
| Bo Ho | | | | | | | | |
| C9 Hoan Kiem Lake | | | | | 2,023 | 4,683 | 4,697 | 2,032 |
| C10 Tran Hung Dao | | | | | 0 | 79,551 | 80,465 | 0 |
| C11 Cau Den | | | | | | | | |
| C12 Bach Khoa | | | | | | | | |
| C13 Chua Boc | | | | | | | | |
| C14 Nga Tu So | | | | | | | | |
| C15 THuong Dinh | | | | | | | | |

Source: JICA Study Team

342 Since HAIDEP, there has been some changes as to station locations and numbers, as well as alignments and the addition of the BRT routes and 2 other rail lines. UMRT Line1 is now Yen Vien - Ngoc Hoi, and UMRT Line2 is Nam Thang Long - Thuong Dinh. Accordingly, the previous demand forecasts had to be re-assessed and updated in so far as the volumes at stations are concerned. The Study Team did not consider changing the forecasted passenger flows (see Figure 3.4.4) on UMRT or the vehicular traffic on the road network (shown on Figure 3.4.5), but instead focused into refinement of station traffic forecasts.

Figure 3.4.4 Demand Forecast on UMRT Line 1 and Line 2



Source: HAIDEP

343 30% share of public transport by 2020 is retained as a target – notwithstanding the current low level. With appropriate policies and station integration, a larger share for urban rail transit can be achieved in the future. It may not necessarily be in year 2020. This approach ensures that stations would not end up as undersized.

344 The Project Team took into consideration some limitations in modeling. Firstly, the passengers in the inbound and outbound directions were not the same because the OD tables by mode as used in the original forecasts were non-symmetric. Generally, future OD tables should be symmetric because people do not relocate their domiciles every day. On an annual average daily basis, the inbound passengers must be the same as the outbound passengers in all stations. Secondly, the traffic assignment follows a generalized cost model which tends to over-estimate trip attractions at short sections; whereas the reality is that passengers with longer trip distance are unlikely to transfer to UMRT when the connecting trip is very short.

345 Therefore, the forecasted transfer passengers at station might be lower than the model results. Thirdly, a detailed opinion survey is necessary to determine more accurately how commuters would react when connectivity with feeder transport modes is involved.

Table 3.4.3 Revised Demand Forecast/Day for Line 1, One-Way, Year 2020

| UMRT Line1 Station | | Southbound | | | Northbound | | |
|--------------------|-------------------|------------|-----------|--------------|------------|-----------|--------------|
| | | Boarding | Alighting | Transferring | Boarding | Alighting | Transferring |
| V1 | Yen Vien | 11,639 | 0 | 26,576 | 0 | 34,282 | 0 |
| V2 | Cau Duong | 9,234 | 805 | 27,750 | 497 | 34,309 | 196 |
| V3 | Duc Giang | 7,195 | 3,811 | 67 | 3,600 | 7,601 | 0 |
| V4 | Gia Lam | 8,991 | 5,060 | 37,703 | 1,182 | 38,028 | 3,365 |
| V5 | Bac Cau Long Bien | 0 | 176 | 5,561 | 0 | 5,901 | 157 |
| V6 | Nam Cau Long Bien | 1,587 | 52,909 | 27,886 | 1,283 | 19,956 | 42,482 |
| V7 | Phung Hung | 1,424 | 5,913 | 1,963 | 3,138 | 6,228 | 2,091 |
| V8 | Hanoi | 1,870 | 36,553 | 7,017 | 5,531 | 8,312 | 29,985 |
| V9 | C.V. Thong Nhat | 1,851 | 19,071 | 30,009 | 1,921 | 36,855 | 12,655 |
| V10 | B.V. Bach Mai | 1,189 | 7,360 | 4,818 | 4,463 | 10,857 | 1,450 |
| V11 | Phung Liet | 0 | 8 | 89 | 0 | 141 | 4 |
| V12 | Giap Bat | 14,115 | 9,858 | 10,186 | 6,615 | 26,276 | 3,351 |
| V13 | Hoang Liet | 394 | 15,737 | 213 | 12,172 | 998 | 2,844 |
| V14 | Van Dien | 0 | 2,366 | 0 | 0 | 0 | 2,351 |
| V15 | Vinh Quynh | 0 | 30,182 | 61 | 0 | 23 | 34,855 |
| V16 | Ngoc Hoi | 0 | 49,579 | 0 | 0 | 0 | 53,579 |

Source: JICA Project Team

Table 3.4.4 Revised Demand Forecast/Day for Line 2, One-Way, Year 2020

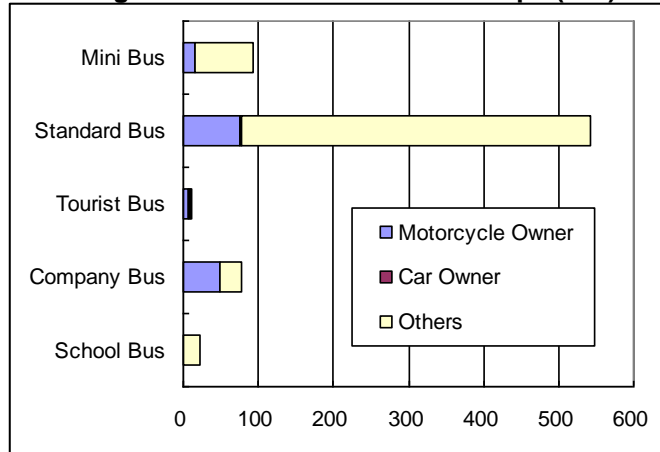
| UMRT Line2 Station | | Southbound | | | Northbound | | |
|--------------------|-----------------|------------|-----------|--------------|------------|-----------|--------------|
| | | Boarding | Alighting | Transferring | Boarding | Alighting | Transferring |
| C1 | Nam Thang Long | 10,599 | 0 | 88,729 | 0 | 75,159 | 0 |
| C2 | Ngoai Giao Doan | 9,527 | 584 | 50 | 427 | 12,569 | 0 |
| C3 | Tay Ho Tay | 4,807 | 4,607 | 21,141 | 1,092 | 26,305 | 3,445 |
| C4 | Buoi | 5,403 | 7,537 | 15,090 | 2,996 | 20,097 | 2,187 |
| C5 | Quang Ngua | 4,226 | 18,162 | 2,968 | 3,480 | 9,112 | 9,232 |
| C6 | Bach Thao | 6,086 | 8,210 | 90 | 2,970 | 3,860 | 4,699 |
| C7 | Ho Tay | 2,776 | 8,728 | 2,005 | 2,929 | 5,546 | 4,882 |
| C8 | Hang Dau | 1,064 | 70,346 | 16,985 | 3,873 | 12,464 | 63,106 |
| C9 | Hoan Kiem Lake | 2,699 | 4,556 | 0 | 4,615 | 2,358 | 0 |
| C10 | Tran Hung Dao | 1,612 | 22,996 | 1,666 | 3,389 | 3,459 | 16,355 |
| C11 | Cau Den | 1,616 | 12,712 | 2,480 | 1,959 | 4,437 | 7,501 |
| C12 | Bach Khoa | 2,195 | 18,160 | 9,744 | 3,237 | 14,560 | 13,629 |
| C13 | Chua Boc | 1,954 | 8,873 | 197 | 6,718 | 3,567 | 927 |
| C14 | Kim Lien | 2,392 | 7,979 | 37 | 5,928 | 3,421 | 480 |
| C15 | Nga Tu So | 473 | 10,012 | 166 | 2,764 | 907 | 4,164 |
| C16 | Thuong Dinh | 0 | 15,315 | 0 | 2,336 | 0 | 18,501 |

Source: JICA Project Team

3.3.3 Transfers To/From Stations

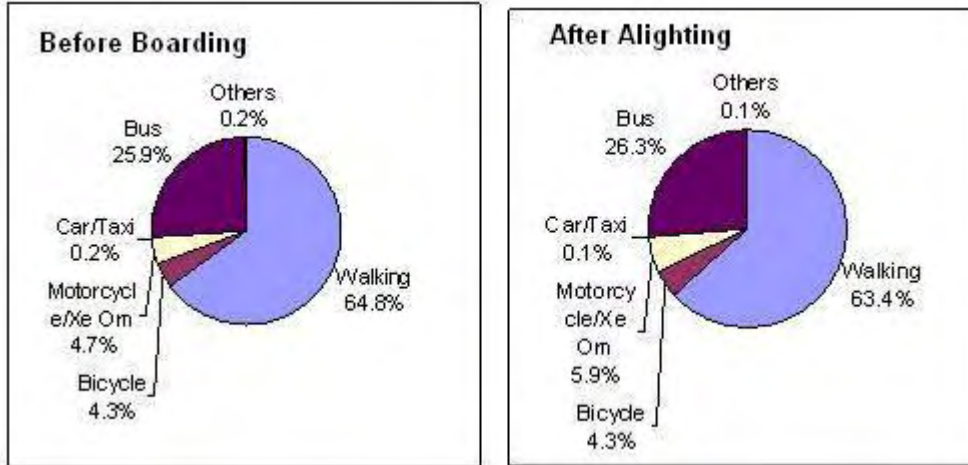
346 Another important factor in the design of the UMRT stations is the mode of transfers – for those boarding and alighting from the UMRT. HAIDEP survey results provide insights. While there were no UMRT then, the transfers to/from bus mode is similar, because most passengers on UMRT have been or are bus riders. Very little from car users are expected to shift to UMRT. It can be concluded from Figure 3.4.5 that passenger transfers will mostly come from walking, buses and other public transport mode, a few from motorcycles, and very little from cars.

Figure 3.4.5 Bus Transfer Trips (000)



Source: HAIDEP

Figure 3.4.6 Transfers at Bus Stations

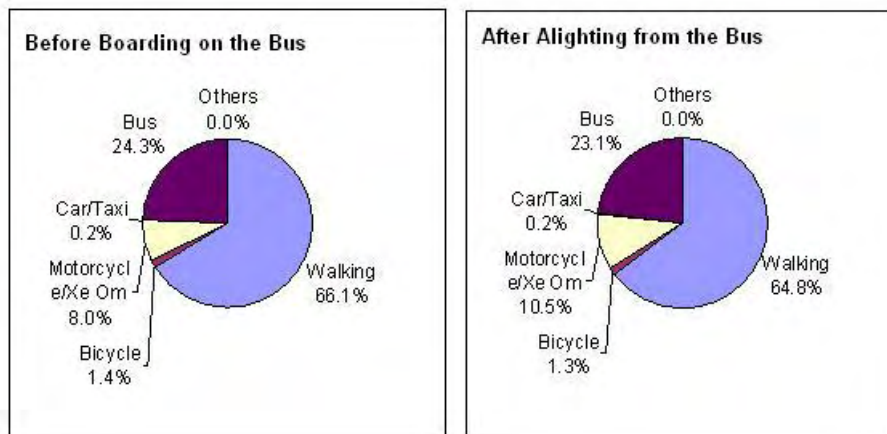


Source: HAIDEP

347 In Figure 3.4.6, the transport mode used - before getting on and after getting off the bus - is shown. The real ratio of walking is under-estimated – because people usually do not answer the walking transfer trips after alighting. Walking could easily be 3 times the survey results. Next to walking, the transfer is to/from bus. The ratio of the commuter who come to/leave bus stop by motorcycle or bicycle is only 10%. Very few people transfer by car or taxi. Extrapolating this result to UMRT, it can be surmised that car parks are not necessary at UMRT stations; only parking lots for motorcycle/bicycle would be needed. This study, however, cannot ignore the possibility that in some stations, car parking spaces would still be required.

348 Because of the dominance of motorcycles in Hanoi, the transfer behavior of motorcycle users/owners needs to be evaluated. As shown on Figure 3.5.7, they are not too different from bus-only passengers in terms of walking. However, they show greater preference – by 2 or more – for motorcycles/Xe Om at the stations for their connecting journeys. The data suggests that “kiss-and-ride”, as well as “park-and-ride”, options for motorcycles would be important design considerations at UMRT stations. In contrast to cities of industrialized countries, these transfer schemes apply to car-owners.

Figure 3.4.7 Transfers of Motorcycle Owners at Bus Stations



Source: HAIDEP

3.3.4 Total Ridership without/ with Integrated Urban Development and Modal Share

349 Impacts of UMRT and integrated development are categorized from viewpoints of (i) transport improvement, (ii) socio-economic improvement and (iii) living condition and urban amenity improvement.

350 Direct impact of UMRT development is to increase ridership of UMRT lines. UMRT will diversify transport mode for citizens toward public transport oriented mode (see Figure 2.1). It is estimated app.12% of citizens (app. 1.2mil trips) will use UMRT as a main transport mode.

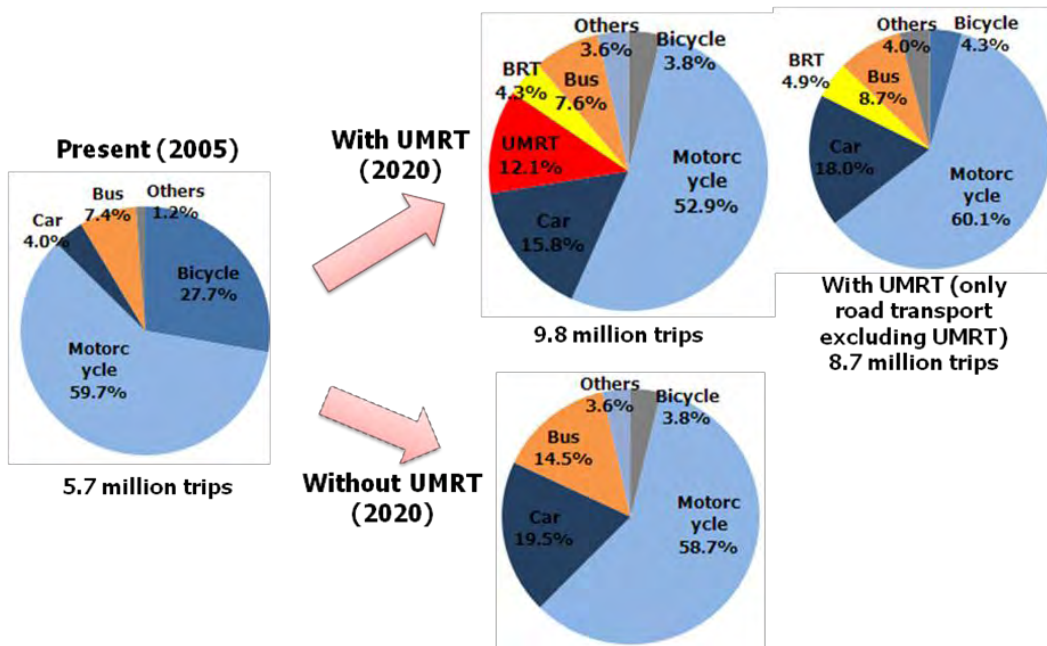
351 Taking into account the results of traffic demand analysis as well as of proposed concept plans of UMRT and integrated urban development, the JICA Project Team re-adjusted and estimated the future ridership of (a) base case which is estimated based on HAIDEP (without integrated urban development), and (b) with integrated urban development of station area (see Table 3.4.5).

352 The total ridership with integrated urban development was estimated in consideration of new road network development, landuse around the station area which are proposed in the concept plans. According to the result of the interview survey, most station users of station area within 500m prefer to walk, and users out of walking distance will use bus as a feeder service if the walking and bus condition will be improved. So modal share will be converted from motorbike-oriented at present into walking and public transport-oriented in future.

353 As for modal share to access to station, walking and bus are more than 30% for each in UMRT Line1. Accessibility on foot and convenience of bus and other UMRT transfer are prioritized than development of parking spaces, especially in CBD. In case of

UMRT Line2, since most of stations will be located under trunk roads, interchange with buses and other UMRT lines are priority issues.

Figure 3.4.8 Change in Transport Mode Composition



Source: JICA Project Team

**Table 3.4.5 Estimated Total Ridership and Modal Share of UMRT Line1 in 2020
(without Phung Hung Station, V7)**

| UMRT Line1 Station | | (a) Base Case | (b) With Integrated Urban Development | | | | | | | |
|--------------------|-------------------|---------------|---------------------------------------|---------|---------|-----------|--------|---------|-------|--------|
| | | | Total | by Mode | | | | | | |
| | | | | Walking | Bicycle | Motorbike | Car | Bus | VNR | UMRT |
| V1 | Yen Vien | 32,500 | 37,000 | 16,800 | 400 | 4,500 | 2,400 | 12,800 | 100 | 0 |
| V2 | Cau Duong | 32,900 | 37,400 | 14,300 | 400 | 8,300 | 4,700 | 9,800 | 0 | 0 |
| V3 | Duc Giang | 7,500 | 10,900 | 4,600 | 200 | 2,800 | 1,100 | 2,200 | 0 | 0 |
| V4 | Gia Lam | 42,000 | 50,900 | 24,000 | 400 | 2,400 | 3,600 | 20,300 | 100 | 0 |
| V5 | Bac Cau Long Bien | 3,900 | 4,600 | 2,100 | 200 | 400 | 200 | 1,800 | 0 | 0 |
| V6 | Nam Cau Long Bien | 48,200 | 53,300 | 7,900 | 200 | 9,300 | 5,200 | 23,800 | 0 | 7,000 |
| V7 | Phung Hung | 7,800 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| V8 | Hanoi | 44,100 | 57,100 | 24,100 | 100 | 7,700 | 3,200 | 10,400 | 1,700 | 9,800 |
| V9 | C.V. Thong Nhat | 30,700 | 32,800 | 6,200 | 400 | 4,400 | 2,500 | 5,000 | 0 | 14,200 |
| V10 | B.V. Bach Mai | 12,800 | 7,500 | 3,300 | 100 | 1,500 | 600 | 2,000 | 0 | 0 |
| V11 | Phuong Liet | 100 | 4,200 | 1,100 | 100 | 1,000 | 300 | 1,800 | 0 | 0 |
| V12 | Giap Bat | 18,100 | 20,400 | 9,000 | 300 | 1,500 | 600 | 9,000 | 0 | 0 |
| V13 | Hoang Liet | 7,800 | 12,800 | 6,100 | 100 | 2,300 | 1,000 | 3,200 | 0 | 0 |
| V14 | Van Dien | 600 | 11,300 | 3,300 | 200 | 2,500 | 1,100 | 4,200 | 0 | 0 |
| V15 | Vinh Quynh | 18,600 | 15,900 | 3,700 | 400 | 2,200 | 1,700 | 7,800 | 0 | 0 |
| V16 | Ngoc Hoi | 29,600 | 34,200 | 7,300 | 600 | 8,700 | 4,900 | 12,700 | 0 | 0 |
| Total | (number) | 337,200 | 390,200 | 134,600 | 3,900 | 59,900 | 33,000 | 126,200 | 2,000 | 30,500 |
| | (%) | - | 100.0 | 34.5 | 1.0 | 15.4 | 8.5 | 32.3 | 0.5 | 7.8 |

Note: Phung Hung Station (V7) was removed based on conclusion by HPC and MOT on 17th November 2010.
Source: JICA Project Team

Table 3.4.6 Estimated Total Ridership and Modal Share of UMRT Line2 in 2020

| UMRT Line2 Station | | (a) Base Case | (b) With Integrated Urban Development | | | | | | |
|--------------------|-----------------|---------------|---------------------------------------|---------|---------|-----------|--------|---------|--------|
| | | | Total | by Mode | | | | | |
| | | | | Walking | Bicycle | Motorbike | Car | Bus | UMRT |
| C1 | Nam Thang Long | 39,480 | 83,790 | 4,090 | 320 | 2,600 | 1,930 | 74,840 | 0 |
| C2 | Ngoai Giao Doan | 3,890 | 8,440 | 5,310 | 470 | 1,680 | 940 | 40 | 0 |
| C3 | Tay Ho Tay | 13,930 | 25,710 | 3,110 | 190 | 920 | 770 | 0 | 20,740 |
| C4 | Buoi | 11,890 | 21,660 | 3,200 | 180 | 2,530 | 1,170 | 14,570 | 0 |
| C5 | Quan Ngua | 10,470 | 16,790 | 2,360 | 350 | 2,260 | 1,530 | 3,700 | 6,590 |
| C6 | Bach Thao | 5,970 | 11,680 | 3,450 | 380 | 2,500 | 1,310 | 4,040 | 0 |
| C7 | Ho Tay | 6,130 | 10,620 | 1,670 | 460 | 1,850 | 820 | 5,810 | 0 |
| C8 | Hang Dau | 36,100 | 71,720 | 2,140 | 270 | 1,160 | 590 | 32,010 | 35,550 |
| C9 | Hoan Kiem Lake | 3,310 | 6,170 | 3,180 | 1,110 | 1,470 | 410 | 0 | 0 |
| C10 | Tran Hung Dao | 11,310 | 19,420 | 2,220 | 670 | 970 | 360 | 11,410 | 3,790 |
| C11 | Cau Den | 7,020 | 11,430 | 1,020 | 310 | 1,190 | 490 | 8,420 | 0 |
| C12 | Bach Khoa | 13,170 | 24,300 | 1,840 | 360 | 1,620 | 770 | 2,770 | 16,950 |
| C13 | Kim Lien | 4,600 | 8,260 | 3,660 | 730 | 2,190 | 730 | 950 | 0 |
| C14 | Chua Boc | 4,610 | 7,450 | 2,720 | 470 | 2,290 | 1,540 | 440 | 0 |
| C15 | Nga Tu So | 4,030 | 6,380 | 1,430 | 160 | 710 | 430 | 3,650 | 0 |
| C16 | Thuong Dinh | 8,010 | 17,580 | 520 | 120 | 790 | 540 | 870 | 14,740 |
| Total | (number) | 317,800 | 351,410 | 41,910 | 6,550 | 26,740 | 14,340 | 163,520 | 98,350 |
| | (%) | - | 100.0 | 11.9 | 1.9 | 7.6 | 4.1 | 46.5 | 28.0 |

Source: JICA Project Team

4 PLANNING CONDITIONS FOR INTEGRATED UMRT AND URBAN DEVELOPMENT IN HANOI

4.1 Station Location and Railway Alignment

4.1.1 Reviews of Station Location and Alignment of the Line1 Feasibility Study

1) Summary Issues for UMRT Line1 Stations

401 Although development plans for station areas would be formulated by planned or fixed location and alignment for the 16 stations (Phase1 and Phase2) of UMRT Line1 in the feasibility study¹ as premises of planning conditions, all locations of the stations and some alignments were reviewed by several criteria in terms of appropriate formulation of station area development shown in below. Table 4.1.1 shows critical development issues of 16 stations of UMRT Line1 according to three criteria for appropriate formulation of station areas.

- (i) Effective transferability to promote ridership by smooth and convenient connection between Line1 station and other UMRT Lines and stations
- (ii) Promotion of effective station area development to contribute to “Transit Oriented Development” maximizing opportunities for urban service development in the station area
- (iii) Mitigation of negative development impacts by station location

Table 4.1.1 Issues on Planned Location and Alignment of 16 Stations of UMRT Line1

| UMRT L1 Station | Phase | Interval (km) | Station Development Issues of Planned Location and Alignment | | |
|-----------------------|-------|---------------|--|---|---|
| | | | Effective Transferability | Promotion of Station Area Urban Development | Mitigation of Negative Development Impact |
| V1. Yen Vien | II | 0.0 | -- | • Promotion of north side agriculture land utilization | • Necessary village improvement in front of the station |
| V2. Cau Duong | II | 1.7 | -- | -- | -- |
| V3. Duc Giang | II | 2.0 | -- | -- | -- |
| V4. Gia Lam | I | 1.7 | -- | -- | -- |
| V5. Bac Cau Long Bien | I | 1.4 | • Planned road accessibility | • Coordination with Ngoc Thuy New Town development | • Conservation of Ancient Quarter and Long Bien Bridge |
| V6. Nam Cau Long Bien | I | 2.0 | • Connection with C8 (Hang Dau) Line2 Station | • Promotion of attractiveness of Ancient Quarter and Long Bien Bridge environment | |
| V7. Phung Hung | I | 1.1 | -- | -- | -- |
| V8. Hanoi | I | 1.2 | • Connection with Line3 Station | • New Urban Core as one of Hanoi gateways | • Appropriate conservation of present Hanoi Station |
| V9. C.V.Thong Nhat | I | 1.6 | • Connection with C12 (Bach Khoa) Line2 Station | • Attractive open space as one of important intersections | -- |
| V10. B.V.Back Mai | I | 0.9 | -- | -- | -- |
| V11. Phuong Liet | I | 0.9 | -- | -- | -- |
| V12. Giap Bat | I | 1.5 | • Connection with Phia Nam Bus Terminal | • Harmonizing proposed new urban development (Doi Dam) | -- |
| V13. Hoang Liet | II | 2.5 | -- | • Harmonizing proposed new urban development | • Keeping settlements in front of planned station at a distance |
| V14. Van Dien | II | 1.4 | -- | -- | -- |
| V15. Vinh Quynh | II | 1.4 | -- | • Harmonizing proposed new urban development (Doi Dam) | • Keeping villages in front of planned station at a distance |
| V16. Ngoc Hoi | I | 2.8 | • Connection with High Speed Railway Station | • (Harmonizing proposed new urban development) | -- |

Source: JICA Project Team

1 The Hanoi Construction Project of Elevated Railway (Ngoc Hoi – Yen Vien) 2007 approved by the Prime Minister of the Vietnam Government

2) Yen Vien Station (V1: Phase2)

402 The area where Yen Vien Station is located is expected to play an important role in future urban development of Hanoi for various purposes including logistics center, new housing areas, transportation and logistic node in combination with planned Ring Rail and planned major road with National Highway No.1. In view of above based on the location of the Feasibility Study, two locations between the Feasibility Study and proposed location were compared and evaluated as follows shown in Figure 4.1.1

Figure 4.1.1 Two Options and Concluded Location for Yen Vien Station (V1)



Source: JICA Project Team

403 Although it was concluded by the JICA project team and recommended that location of the station was proposed to shift south-westward in order to formulate appropriate station development, technical conditions was changed by current engineering study by the Detailed Design Team (JKT Consortium for UMRT Line1) based on new height formation of the planned railway. It is concluded that Yen Vien Station is necessary to shift to further north-eastward location (see Figure 4.1.1) rather than locations of the proposed station and the Feasibility Study due to engineering aspect (slope condition, operation, necessary redundancy distance from curving section, etc)

3) Gia Lam Station (V4: Phase1)

404 Gia Lam Station is planned in the feasibility study to set in just next to the large factory yard of the railway, while two planned transfer facilities sites in the west and east of the station are pinched by local villages and the factories. Although there is the Gia Lam Inter-city Bus Terminal in the station area, this Feasibility Study has not considered its connectivity from the UMRT station by retaining the location (360 m from the UMRT station) of the existing bus terminal

405 Gia Lam station is important from two aspects. (i) It will function as a gateway to Hanoi for interprovincial passenger train, and (ii) it will be a centre of fast growing Long Bien urban areas. This implies that the station will be heavily used by intercity and urban travel passengers and urban development potentials at and around the station will significantly increase. In order to play a role of a city centre, the station and its surrounding areas need to be planned from more comprehensive viewpoint from which

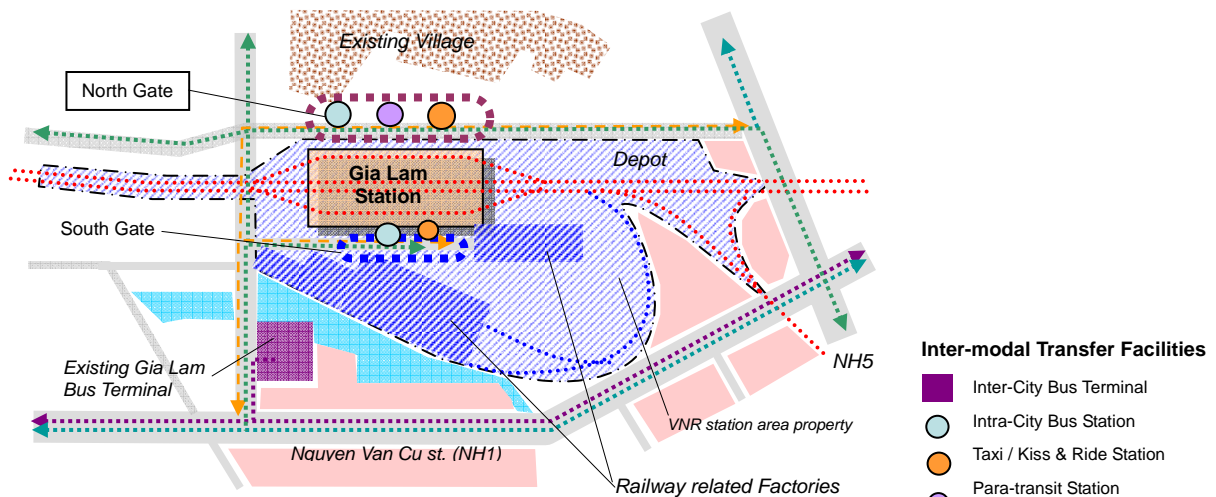
another alternative development are proposed as follows based on the evaluation criteria shown in below.

- (i) Efficient Inter-modal transfer facilities including Gia Lam Inter-city Bus Terminal accessibility.
- (ii) Effective road and transport network at the station area to connect with major roads (National Highway No.1 and No.5).
- (iii) Effective urban land use and services at the station area to encourage in facilitating convenience commercial and business development
- (vi) Mitigation of negative impact on existing settlement by station and related facilities construction.

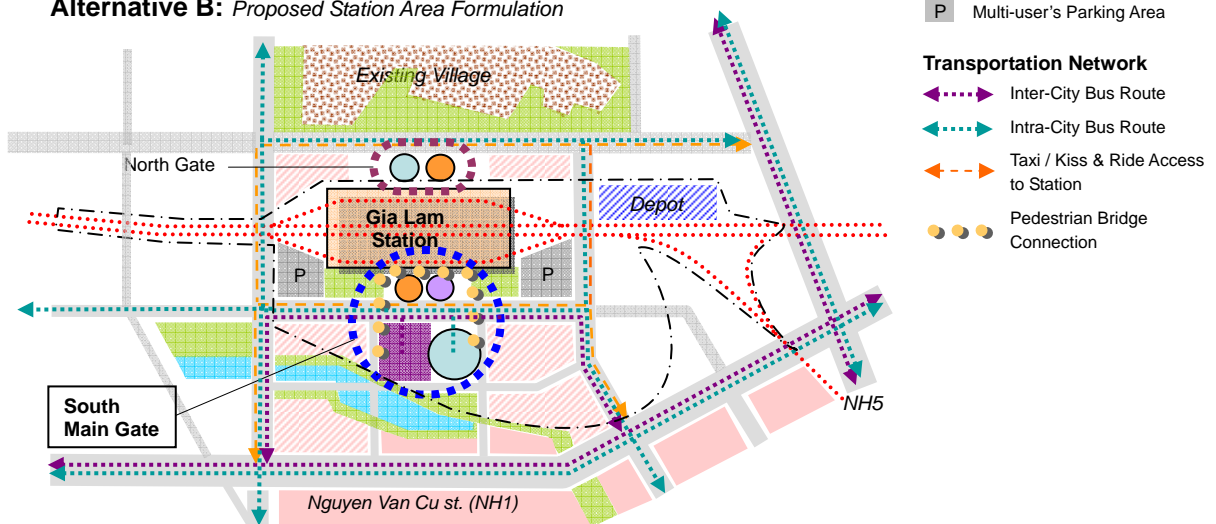
Desirable townscape form for the gateways of Long Bien urban center area

Figure 4.1.2 Alternatives for Gia Lam Station (V4) Area Development

Alternative A: UMRT Line1 of Planned Station by the Feasibility Study



Alternative B: Proposed Station Area Formulation



Source: JICA Project Team

406 Although the location of Gia Lam station of the Feasibility Study is not necessary to be changed, it is recommended that Alternative B is desirable for formulation of station area development from long-term view in integrated manner. Therefore its development

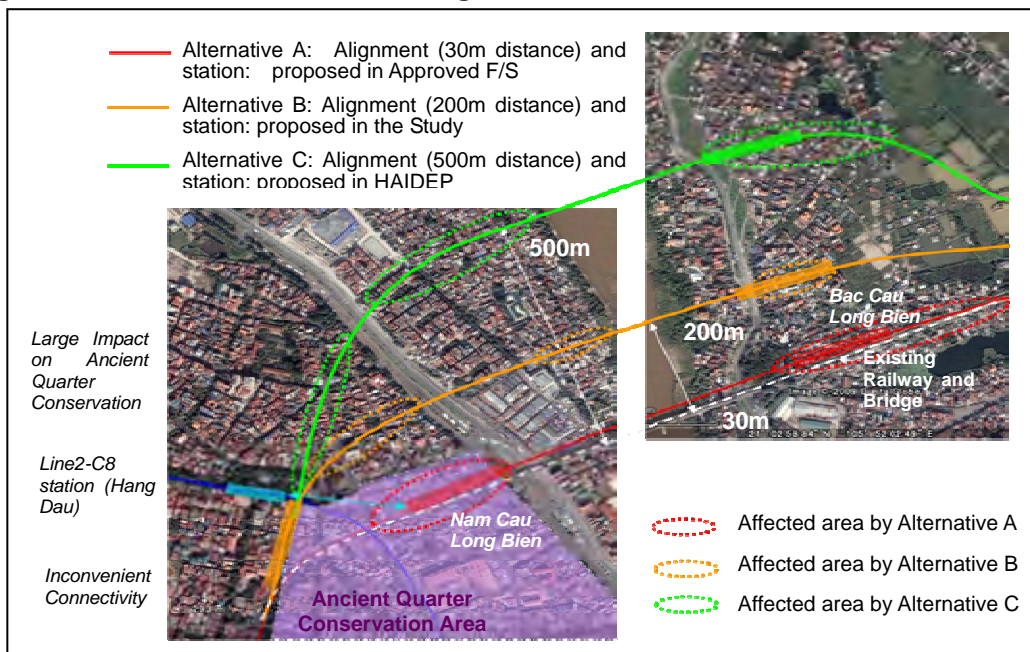
needs careful measures by phased development, taking account of time frame for relocation of the large factory site. There will be a possible program for relocation of the railway factory yard, while initial transfer facilities in the north of the station (opposite site of the factory) will play a key role in serving users during relocation program as follows.

- (i) Development of access road and feeder bus service (Short-term) at available and appropriate space.
- (ii) Relocation of factories in medium-term
- (iii) Development of new intermodal facilities including inter-city bus terminal, commercial/business development using relocate factory land (Medium- to long-term)

4) Red River Crossing Alignment and Station Locations (V5/V6, Phase1)

407 The study has been made on alternative locations of new UMRT Line1 Bridge with regard to transportation convenience (connecting with UMRT Line2-C8 station), historical landscape of Long Bien Bridge and Ancient Quarter, river engineering and resettlement aspects. Based on comprehensive assessment of the alternatives, the JICA Project Team proposed a new alignment which is about 200 meter from the existing Long Bien Bridge.

Figure 4.1.3 Location of Alternative Alignments for UMRT Line1 across the Red River



Source: JICA Project Team

408 After the project team recommended in the Steering Committee that Alternative B was superior to Alternative A and C due to the following reasons (also refer to Table 4.1.3), the Government has agreed the new UMRT railway bridge can be set at 200 m northwards from existing Long Bien Bridge (Alternative B), although it has been required to study continuously locations of V5 (Bac Cau Long Bien) and V6 (Nam Cau Long Bien) stations with necessary coordination among relevant stakeholders (VNR, HRB and related agencies).

- (i) New UMRT Line1 Bridge under Alternative B can ensure good landscape of the

red river and will not affect view of Long Bien Bridge negatively.

- (ii) In Alternative B, integration and connectivity of Line1 and Line2 stations will be ensured which facilitate smooth transfer urban passengers between the two lines enhanced urban development at and around the stations.
- (iii) In Alternative B, there will be no houses to be resettled within the Ancient Quarter Conservation Area which can protect heritage value of Ancient Quarter. On the other hand Alternative A affects the northern part of Ancient Quarter significantly.
- (iv) There will be no negative impact on river flow and environment in Alternative B, while Alternative A may cause problems.
- (v) The station of C8 of Line2 is difficult to shift and make it closer toward V6 station due to technical difficulties (curve section and descending section to avoid negative impact on Ancient Quarter by railway structure and expected vibration.
- (vi) Increase in construction cost is minimal (only 2 %) composed to Alternative A, while benefits of Alternative A is expected to be much larger.

Table 4.1.2 Assessment of Alternatives of New UMRT Line 1 Bridge and Related Stations

| Evaluation Criteria | | Alternative A (Approved F/S) | Alternative B (Proposed) | Alternative C (HAIDEP) |
|--|---|---------------------------------|-----------------------------|---------------------------|
| Distance from Existing Long Bien Bridge | | 30 m | 200m | 500m |
| Visual Impact on Existing Long Bien Bridge | | Negative | Positive | Positive |
| Transport | Integration of Line1 & Line2 Stations | Separated (370 m*) | Fully Integrated | Fully Integrated |
| | Access to/from Long Bien Bus Interchange to Station | 180 m | 370 m | 370 m |
| Social/Cultural | Resettlement (number of houses) | Ancient Quarter | about 80 | none |
| | | North Long Bien | about 60 | about 110 |
| | | South Long Bien | about 10 | about 30 |
| | Total | about 150 | about 140 | about 500 |
| Impact on Ancient Quarter | | Negative | none | none |
| Impact on River Flow and Environment | | Negative | none | none |
| Impact on UMRT Project | Length of Main Bridge (excluding approach bridges) | Approx. 1,335 m | Approx.1,375 m | Approx.1,395 m |
| | Length of Route (including all bridge sections) | Approx. 3,300 m | Approx.3,400 m | Approx.3,850 m |
| | Approx. Construction Cost (Index) INDEX | 100.0 | 102.1 | 107.9 |

Source: JICA Project Team

409 As a result, the Government made a final decision in the Notice (No.200/TB-VPCP, 15th July 2010) that the Government agreed with position alternative of the railway bridge over Red River far 186m-north from Long Bien Bridge.

4) Nam Cau Long Bien Station (V6, Phase1)

410 In parallel with discussion of railway alignment of Red River, the station location alternatives of Nam Cau Long Bien (V6 of Line1) had been discussed. There are three alternatives which are proposed by HAIMUD Project Team, VNR (based on Detailed Design of UMRT Line1) and Feasibility Study.

Figure 4.1.4 Alternatives of location of Nam Cau Long Bien Station (V8)



Source: JICA Project Team based on drawing of JKT

- (i) Alternative A, proposed by HAIMUD is to locate Nam Cau Long Bien Station near Hang Dau Station (C8 of Line2) to prioritize convenience of transfer between two UMRT lines.
- (ii) Alternative B, proposed by VNR-RPMU is to locate Nam Cau Long Bien Station over Long Bien Bus Terminal along Yen Phu Street (Dyke Road of Red River) to prioritize convenience of transfer between UMRT Line1 and bus users of Long Bien Bus Terminal, which is located along Yen Phu Street.
- (iii) Alternative C is the approved F/S location, which didn't carefully considered convenience of transfer to other transport nodes.

411 As for impacts on landscape, there are many opinions from various stakeholders.

- (i) Since the station of Alternative A will be located at northwestward of the Ancient Quarter, there are no direct impacts on landscape of Long Bien Bridge. There are two different types of impacts to the Ancient Quarter: (a) the new elevated station will create a new image of the Ancient Quarter (positive impact), and (b) the large structure may negatively damage traditional image of the Ancient Quarter (negative impact).
- (iv) In case of the station of Alternative B located near to Long Bien Bridge, there are also two different considerations: (a) station users will be able to enjoy scenery of Long Bien Bridge (positive impact), (b) the elevated station will obstruct distant view of Long Bien Bridge (negative impact).

412 In terms of land acquisition, resettlement will be easier in case of Alternative B, since there is only Long Bien Market around the planned location. In case of Alternative A, resettlement is necessary including some army-related facilities and private owners.

Table 4.1.3 Assessment of Alternatives of New UMRT Line 1 Bridge and Related Stations

| Evaluation Criteria | | Alternative A (HAIMUD Proposed) | Alternative B (VNR-RPMU Proposed) | Alternative C (Approved F/S) |
|---|-----------------------------------|---|--|---------------------------------------|
| Distance from Existing Long Bien Bridge | | app.200 m | 186m | 30m |
| Distance from Phung Hung Station (V7) | | app. 500m | app. 1000m | app. 1,000m |
| Convenience of transfer (distance from other nodes) | to Hang Dau station of Line2 (C8) | Directly connected by underground path (app. 100m) | Connected by pedestrian deck under viaduct (app. 300m) | Not enough considered (app. 200m) |
| | to Long Bien Bus Terminal | Connected by pedestrian deck under viaduct (app. 300m) | Directly connected | Walk along Yen Phu Street (app. 150m) |
| Landscape | Impact on Long Bien Bridge | Not affect | Affect | Negative |
| | Impact on Ancient Quarter | Affect | Not affect | Not affect |
| Land acquisition and resettlement | | about 30 including army-owned facilities and private owners | Only a part of Long Bien Market | about 50 |

Source: JICA Project Team

413 At the Steering Committee of Draft Final Report which was held on 22nd September 2010, the Chairman of the Steering Committee instructed that convenience of transfer for users should be prioritized for station location planning. In this sense, the Steering Committee supported Alternative A. But this issue will be further discussed among relevant agencies, and final decision will be made at the meeting between HPC and MOT.

414 On 17th November 2010, the meeting between HPC and MOT was held to discuss alignment and station location of UMRT Line1 of Phase1. In conclusion, the Alternative A of the location of Nam Cau Long Bien Station was selected, which HAIMUD proposed. Since the station location of Phung Hung Station (V7) is too near to Nam Cau Long Bien Station (V6), it was decided that Phung Hung Station (V7) would be removed.

5) Hanoi Station (V8: Phase1)

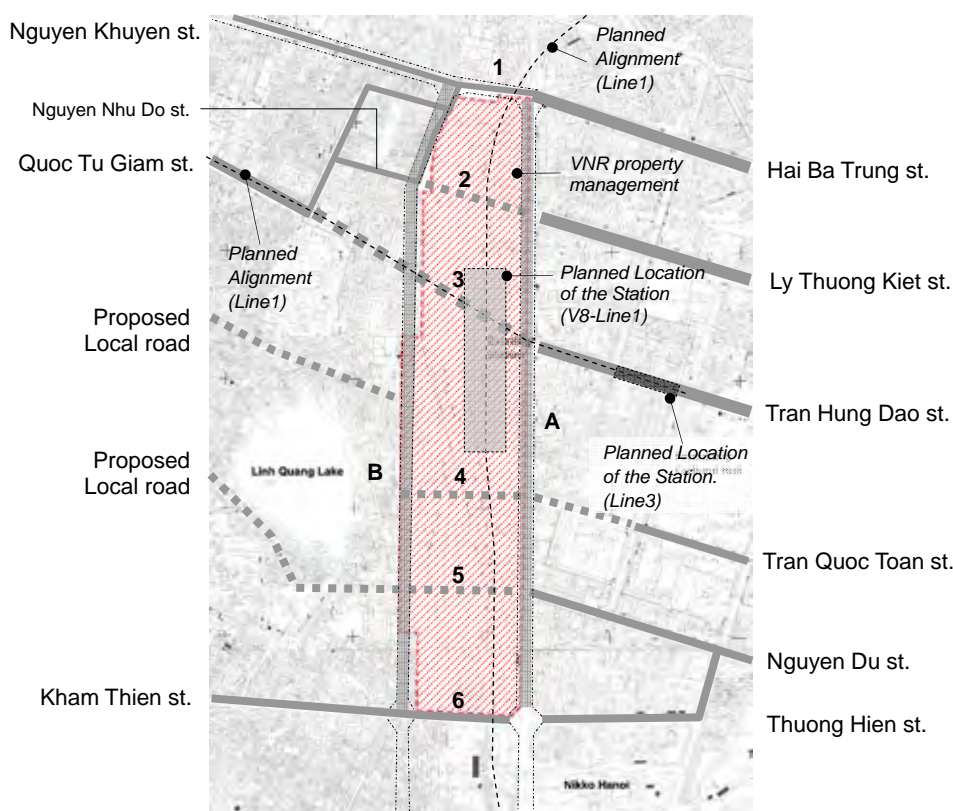
415 Hanoi station area has a great opportunity to formulate redevelopment of the station area as one of the urban centers in Hanoi after reformulation of present railway system with urban use conversion from the large railway yard. When the railway yard is planned for a new urban area, key issues are to connect with missing links (see Figure 4.1.4) as a part of whole road network of Hanoi, and to secure transferability with the station of UMRT Line3, taking account of attractive and appropriate urban design as one of the most important gateways to Hanoi by railway.

Table 4.1.4 Missing Links Desirable to Secured by the Station Area Development

| East – West Road Link | | | | | |
|-------------------------|-------|--|--------|----------------------|-------|
| West-side Urban Road | | Missing Link | | East-side Urban Road | |
| Street Name | Width | Obstacle | Length | Street Name | Width |
| Nguyen Khuyen | 12 m | 1. No (connected) | 0 m | Hai Ba Trung | 24 m |
| Nguyen Nhu Do | 8 m | 2. Building / VNR-Yard | 100 m | Ly Thuong Kiet | 22 m |
| Quoc Tu Giam | 16 m | 3. Building / VNR-Yard | 360 m | Tran Hung Dao | 22 m |
| no arterial road | -- | 4. Building / VNR-Yard | 360 m | Tran Quoc Toan | 12 m |
| no arterial road | -- | 5. Building / VNR-Yard | 150 m | Nguyen Du | 16 m |
| Kham Thien | 16 m | 6. No (connected) | 0 m | Thuong Hien | 16 m |
| North – South Road Link | | | | | |
| A. Le Duan (NH1) | 16m | Expansion of width to 30 m (Line1 Feasibility Study) | | | |
| B. New Street | -- | Planned width (30 m) | | | |

Source: JICA Project Team

Figure 4.1.5 Current Road and Planned UMRT Stations and Alignment for the Hanoi Station Area Development



Source: JICA Project Team

416 To take into consideration connectivity and integration for urban development of station area to maximize accessibility and convenience for users, station location should be carefully planned with aspects of: (i) connectivity between Line1 and Line3 stations, (ii) improvement of missing link of road network (especially west-east), (iii) location of inter-modal facilities, (iv) appropriate townscape of the station and its surroundings, (v) designation of urban development project areas and (vi) technical consideration for over bridge structure crossing roads. Two alternatives for the station location is set and evaluated as following Table 4.1.5 and Figure 4.1.6.

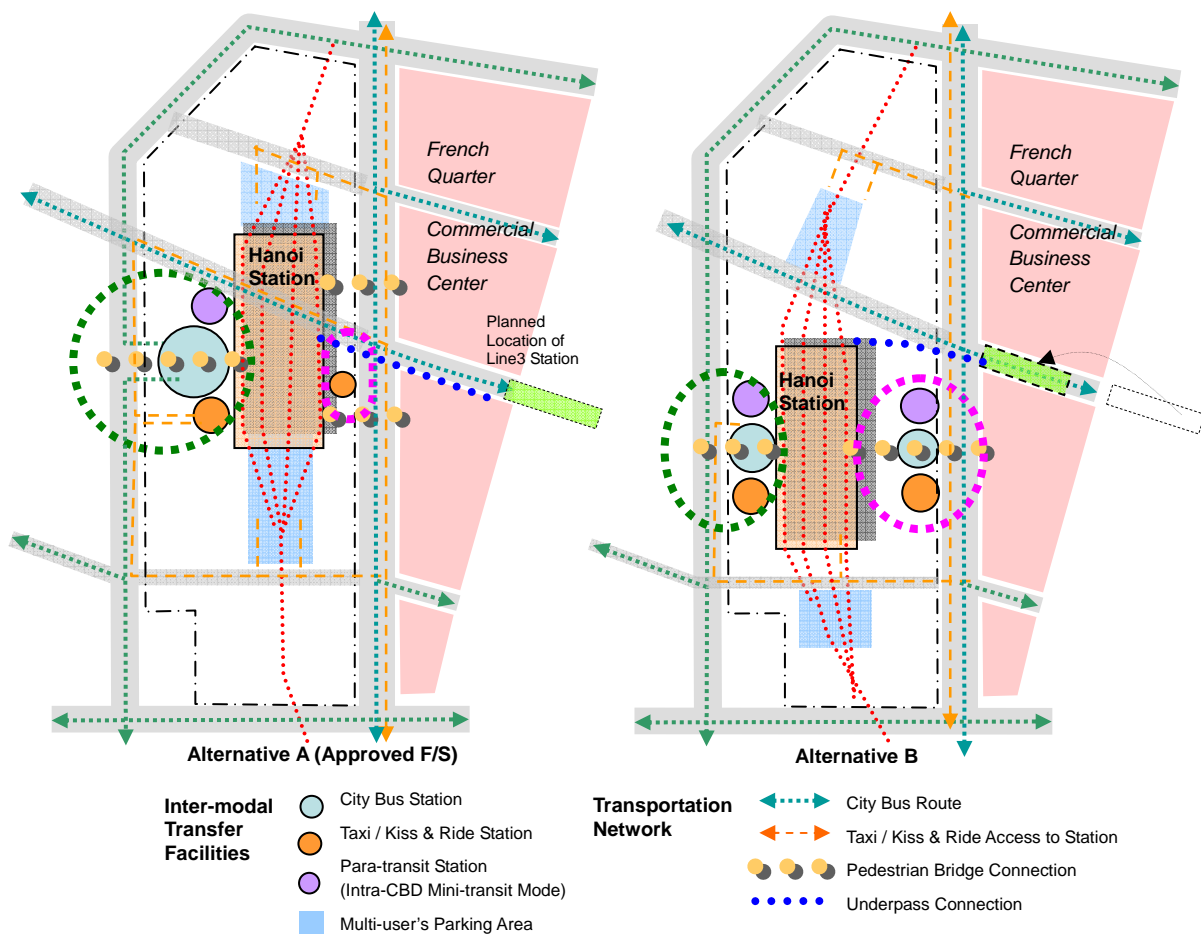
Table 4.1.5 Assessment of Alternatives of Hanoi Station

| Development Criteria for Main Gate Development | | Alternative A | Alternative B |
|--|---|---------------|---------------|
| Integration of Line1 and Line3 | | ○ | ● |
| Appropriate Road & Transport Network | From / to existing NH1 (Le Duang) road | ○ | ● |
| | From / to major roads in CBD (FQ, etc) | ○ | ● |
| | From / to existing walkway network | ○ | ● |
| Efficient Inter-modal Transfer Facilities | Suitable formulation by available land area | ● | ● |
| | Smooth formulation of feeder bus network | ○ | ● |
| | Traffic load distribution on NH1 | ● | ○ |
| Development Impact | Opportunity to improve living environment | ● | ○ |
| | Opportunity to redevelop business area | ● | ● |
| Impact on Townscape | Station façade suitability on City Urban Axis | ○ | ● |
| | Opportunity to have several visual axis | ○ | ● |
| Overall Evaluation | | ○ | ● |

Source JICA project team,

Note: ● = Most suitable or highest potential, ○ = medium value, - = low value or potential

Figure 4.1.6 Two Alternatives for Hanoi Station Location and its Alignment



Source JICA project team,

417 It is evaluated by this comparison that Alternative B was superior to Alternative A to the following reasons (also refer to Table 4.1.5). It has been requested by the Steering Committee to adjust locations of both stations (V9 and Line3 station) with necessary coordination among relevant stakeholders (VNR, HRB and related agencies).

- (i) Alternative B will ensure flexible and equitable access for feeder services from

both sides of western and eastern side of the station.

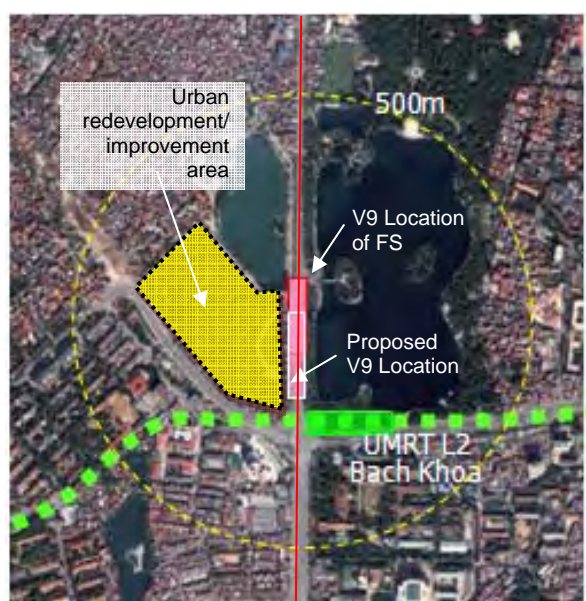
- (ii) Land form in case of Alternative B could give appropriate opportunities for private sector investment having the advantage of major roads accessibilities including Le Duan street.
- (iii) Proposed location of the station of Line3 to be shifted to the station of Line1 would secure convenient transfer between two stations.
- (iv) In case of Alternative B, areas for the station front could formulate appropriate townscape as the gateway of Hanoi together with consolidation of Le Duan streetscape as one of considerable axes of Hanoi.
- (v) The Hanoi station could avoid their long-span structure in order to cross proposed road (especially Tran Hung Dao expansion), which affect difficult technical solution and cost increase.

6) C.V. Thong Nhat Station (V9: Phase1)

418 C.V. Thong Nhat station has set in farther north to Bach Khoa station in the Feasibility Study. Key development issues are 1) to secure connectivity between two stations to shift the V9 station in the proximity to the C12 station, and 2) to formulate attractive urban node with convenient walkway and open space, taking account of discreet urban design as one of the most important urban node with famous urban park and Bach Khoa University.

419 It is recommended that the location of V9 station will be moved toward around 100m-south from the location of FS, which is near to C6 station and the intersection of Dai Co Viet Street. In addition, it is also recommended to redevelop an urban block nearby the station in order to create a good image and landscape of C.V. Thong Nhat Station in harmony Thong Nhat Park, where residential areas as one of the most densely populated in Hanoi, and their living conditions are poor due to lack of road network, deteriorated buildings and urban utilities, etc..

Figure 4.1.7 Proposed Adjustment of Location for C.V. Thong Nhat Station (V9)



Source JICA project team,

7) Giap Bat Station (V12: Phase1)

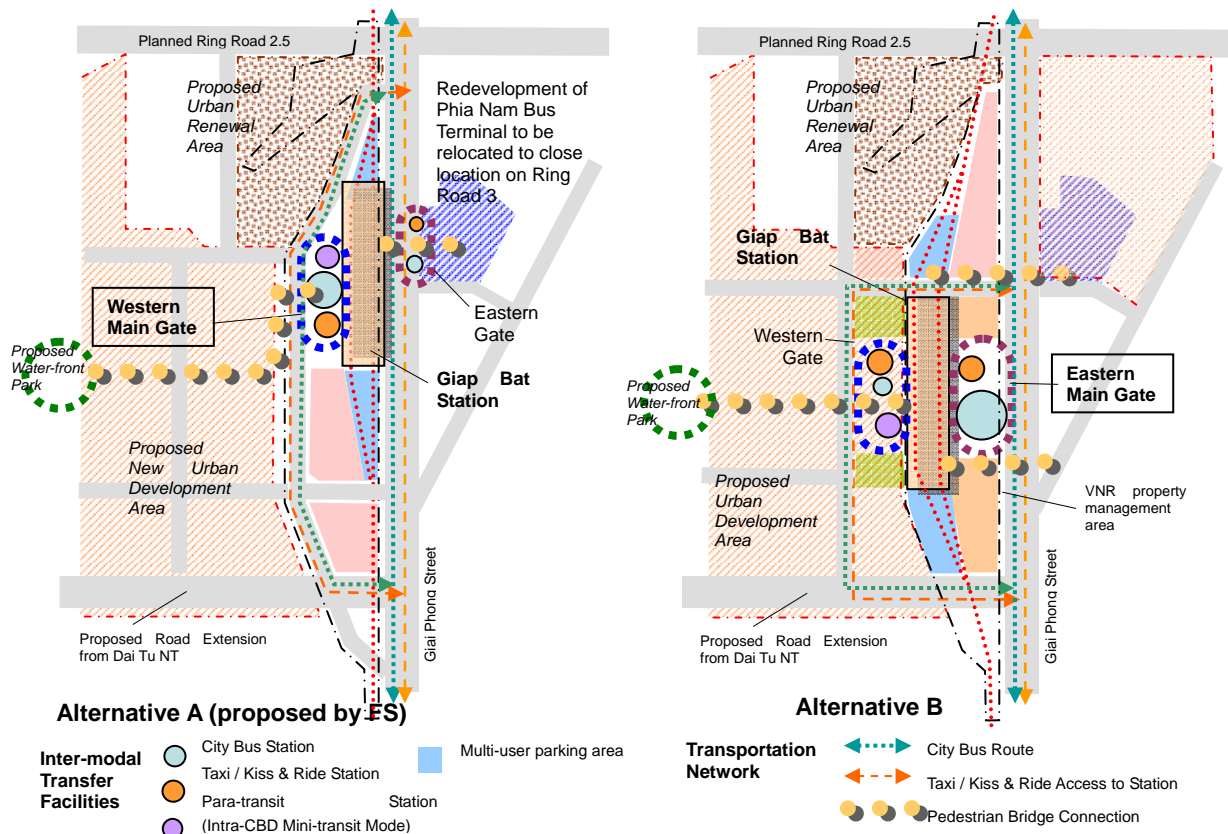
420 Giap Bat Station is planned in the feasibility study to set in just next to the Giai Phong Street (NH1) at northern part of the railway yard close to existing Phia Nam Inter-city Bus Terminal of which future relocation of the Bus Terminal to the traffic node between NH1 and Ring Road 03. The function of existing railway yard (marshaling yard, depot) will be relocated to Ngoc Hoi station area.

421 Giap Bat station and its station area is expected to play an important role in formulating one of Urban Centers in the southern part of Hanoi utilizing the railway yard and other potential vacant land and lakes in adjacent area of the station.

422 Two alternatives for the station area development are set by Alternative A (the Feasibility Study) and Alternative B (proposed location by the JICA project team) shown in Figure 4.1.7 to be assessed by criteria shown in below.

- (i) Effective road and transport network provision at the station area to connect with the major road (Giai Phong Street / NH1).
- (ii) Efficient urban land use and services at the station area to fit with expected function of Southern Urban Center of Hanoi
- (iii) Sufficient space for eastern and western gates of the station
- (iii) Desirable townscape form for the gateways of Southern Urban Center of Hanoi

Figure 4.1.7 Two Alternatives for Giap Bat Station Area Development



Source JICA project team,

423 Alternative B for the station area development is suitable and desirable for future urban formulation in consistence with technical solution for railway design by Detailed Design Team (JKT Consortium).

8) Other Stations of Line1 with Some Adjustment of Location

424 There are several other stations of Line1 necessary to adjust or modify slightly their locations. Key reasons for adjusting their planned locations are to fit suitable locations for 1) mitigation of negative impact on existing settlement, 2) maximization of station area development potential as transportation node, 3) integration of station area development by efficient road and transportation service and attractive urban services to promote ridership of UMRT. By minor shifts in the location of other stations, Cau Duong (V2), Phung Hung (V7), Hoang Liet (V13) , Vinh Quynh (V15) are proposed to be sifted. Table 4.1.6 and Figure 4.1.9 illustrates necessary adjustment of location and alignment.

Table 4.1.6 Stations to Adjust Locations for Effective and Attractive Urban Development

| UMRT Line1 Stations | Dev Phase | Location Adjustment Length (m) and Direction | Rationale of Modification of Planned Station | | | Remarks |
|---------------------|-----------|---|--|--|--|---|
| | | | Effective Transferability | Promotion of Station Area Urban Development | Mitigation of Negative Development Impact | |
| V2. Cau Duong | II | 260 (sw) | -- | Coordination with access to Planned New Town Developments (Thuong Thanh NT and Viet Hung NT) | Keeping the station away from large intersection for planned new road and bridge | New Planned Road and Bridge crossing UMRT |
| V7. Phung Hung | I | 40 (s) | -- | Redevelopment of northern side gateway on Ly Nam De road as IT commercial street | Conservation of Ancient Quarter and Phung Hung street | Keeping adequate station interval |
| V13. Hoang Liet | II | 170 (n) | Proposed Inter-city Bus Terminal | Harmonizing proposed redevelopment (east) and planned new urban development (west) | Minimizing resettlements in front of station construction utilizing vacant land | -- |
| V15. Vinh Quynh | II | 60 (s) | Formulate appropriate transfer facilities area | Harmonizing proposed new urban development | Keeping existing settlements away from the station at a distance | -- |

Source JICA project team

Figure 4.1.10 Other Stations to be Adjusted for Effective Station Area Development (1)



V2 Cau Duong Station (Phase2)



V7 Phung Hung Station (Phase1)

Source JICA project team,

Figure 4.1.11 Other Stations to be Adjusted for Effective Station Area Development (2)



V13 Hoang Liet Station (Phase2)

V15 Vinh Quynh Station (Phase2)

Source JICA project team,

9) Considerations for Ngoc Hoi Station (V16: Phase1) Area Development

425 The planned Ngoc Hoi station (V16) as terminal station of UMRT in the southern part of Hanoi has been set in the large planned railway yard. Existing land use of surroundings of the planned railway yard is industry area (eastern side) and agricultural land (western side), where future land use of the General Plan of HAIDEP is expected to formulate industrial zone including logistic function having the advantage of planned junction area of trunk transportation network with Ring Road No.4 and Ring railway.

426 On the other hand, there is another transportation plan as an option to set the terminal station of High Speed Railway (HSR). Coping with these planning conditions with uncertain factors, key issues are identified by 1) to secure future possibility of transfer station function (HSR, Long Distance, UMRT) in case of HSR stopping Ngoc Hoi, 2) to formulate effective inter-modal facilities, and 3) to formulate attractive station area urban development suitable for Terminal Station.

427 Taking account of the planned railway yard and future land use as industry and logistic and possible HSR station, the planned station may have the disadvantage of unsuitable urban environment for an attractive terminal station. Therefore, conversion from existing land use of industrial areas beside the planned station to business-commercial and residential use is proposed unless the location of UMRT and other stations including HSR station could shift to more suitable area outside of the large planned railway yard.

428 It is also recommended that the railway yard for UMRT and Long-distance railway could expand the property in order to accommodate its future expansion including HSR marshalling yard having the advantage of concentration of function for railway maintenance and services.

10) Summary of Station Location and Alignment for UMRT Line1

429 Table 4.1.7 summarizes proposed station location in association with alignment adjustment for further selected detailed planning studies and for the railway design (schematic design and detail design) by the Consulting Team2 for Line1 railway construction.

Table 4.1.7 Summary of Proposed Station Location and Alignment Adjustment of UMRT Line1

| Code & Name of UMRT L01 Station | Interval (km) | | Dev Phase | Station Location Adjustment of Feasibility Study | | |
|---------------------------------|---------------|----------|-----------|--|---|--|
| | Original | Proposal | | Length (m) and Direction | Alignment Modification | Reference |
| V1. Yen Vien | 0.0 | -0.1 | II | 135 (e) / 5 (n) | In association with station shift | JKT proposal* |
| V2. Cau Duong | 1.7 | 2.1 | II | 260 (s) | -- | -- |
| V3. Duc Giang | 2.0 | 1.5 | II | -- | -- | -- |
| V4. Gia Lam | 1.7 | 1.7 | I | 45 (e) | -- | JKT proposal* including widening platforms |
| V5. Bac Cau Long Bien | 1.4 | 1.6 | I | 175 (n) / 140 (w) | In association with Planned UMRT Bridge Shift | JKT proposal* |
| V6. Nam Cau Long Bien | 2.0 | 2.5 | I | 90 (s) / 350 (w) | | -- |
| V7. Phung Hung | 1.1 | 0.6 | I | 40 (s) | -- | -- |
| V8. Hanoi | 1.2 | 1.4 | I | 205 (s) / 30 (w) | In association with station shift | JKT proposal* |
| V9. C.V.Thong Nhat | 1.6 | 1.5 | I | 60 (s) | -- | -- |
| V10. B.V.Back Mai | 0.9 | 0.9 | I | -- | -- | -- |
| V11. Phuong Liet | 0.9 | 0.9 | I | -- | -- | -- |
| V12. Giap Bat | 1.5 | 1.6 | I | 135 (s) / 65 (w) | In association with station shift | JKT proposal* |
| V13. Hoang Liet | 2.5 | 2.2 | II | 170 (n) | -- | -- |
| V14. Van Dien | 1.4 | 1.1 | II | -- | -- | -- |
| V15. Vinh Quynh | 1.4 | 1.4 | II | 60 (s) | -- | -- |
| V16. Ngoc Hoi | 2.8 | 2.8 | I | -- | -- | -- |

Note: shifting direction following basic alignment toward (n): north, (s): south, (e): east, (w): west, JKT: Association of JKT for Engineering Consulting Services for Hanoi Urban Railway Construction Project (Line 1), Phase1
Source JICA project team

4.1.2 Reviews of Station Location and Alignment of the Line2 Feasibility Studies

1) Summary Issues for Stations of UMRT Line2

430 In case of UMRT Line2, where underground section in planned alignment including Phase1 and Phase2 has a 85% share of total length (16.8 km), some locations out of 15 station's locations (Phase1 and Phase2) would be necessary to be adjusted after reviews of the Feasibility Studies.

431 On the other hand, the section of Phase2 alignment from Tran Hung Dao station to Thuong Dinh station has been reviewed currently by HRB with several options which has been not finalized yet. In addition, Kim Lien station is newly proposed to add between Bach Khoa station and Chua Boc station. So there are 16 stations of which 9 stations of Phase1 and 7 stations of Phase2 of UMRT Line2.

432 Table 4.1.9 shows critical development issues of 16 stations of UMRT Line2 according to three criteria for appropriate formulation of station areas.

Table 4.1.9 Issues on Planned Location and Alignment of 16 Stations of UMRT Line2

| UMRT Line2 Station | Phase | Interval (km) | Station Development Issues of Planned Location and Alignment | | | Remarks |
|---------------------|-------|---------------|--|---|--|--|
| | | | Effective Transferability | Promotion of Station Area Urban Development | Mitigation of Negative Development Impact | |
| C1. Nam Thang Long | 1 | 0.0 | • Connection with proposed parking area | -- | -- | -- |
| C2. Ngoai Giao Doan | 1 | 1.0 | -- | • Harmonizing planned new urban development | • Minimize changes of planned urban area utilizing planned park and green area | Coordination with urban development project (under construction) |
| C3. Tay Ho Tay | 1 | 0.9 | • Connection with Line4 (BRT) station and proposed CAT | • Harmonizing planned new urban development | • Minimize changes of planned urban area utilizing planned park and green area | Coordination with urban development project |
| C4. Buoï | 1 | 1.6 | • Connection with planned road intersection | -- | -- | -- |
| C5. Quang Ngua | 1 | 1.7 | • Connection with Line5 terminal station | -- | -- | Coordination with planned major road (Hoang Hoa Tham-Thuy Khe) |
| C6. Bach Thao | 1 | 1.3 | -- | -- | -- | |
| C7. Ho Tay | 1 | 0.7 | -- | • Issue of Central Political Facilities (presidential house) development plan | -- | |
| C8. Hang Dau | 1 | 1.1 | • Connection with V6 (Nam Cau Long Bien) | • Harmonizing Hang Dau Park development | -- | -- |
| C9. Hoan Kiem Lake | 1 | 1.5 | • Connection with Bo Ho bus interchange | • Harmonizing planned redevelopment in the Electricity Company | • Minimize negative impacts on Ngoc Son Temple, Hoan Kiem Lake | -- |
| C10. Tran Hung Dao | 1 | 1.0 | • Connection with Line3 station | -- | -- | Feasibility Study of Phase2 has been implemented by HRB and TEDI-South. Kim Lien station is newly added. |
| C11. Cau Den | 2 | 1.0 | -- | -- | -- | |
| C12. Bach Khoa | 2 | 1.2 | • Connection with Line1 V9 (C.V.Thong Nhat) | -- | -- | |
| C13. Kim Lien | 2 | | -- | • Integration with urban redevelopment of Kim Lien KTT | -- | |
| C13. Chua Boc | 2 | 1.4 | -- | -- | -- | |
| C14. Nga Tu So | 2 | 1.5 | -- | • Harmonizing Market redevelopment project | -- | |
| C15. Thuong Dinh | 2 | 0.9 | • Connection with Line 2A station | -- | -- | |

Source: JICA Project Team

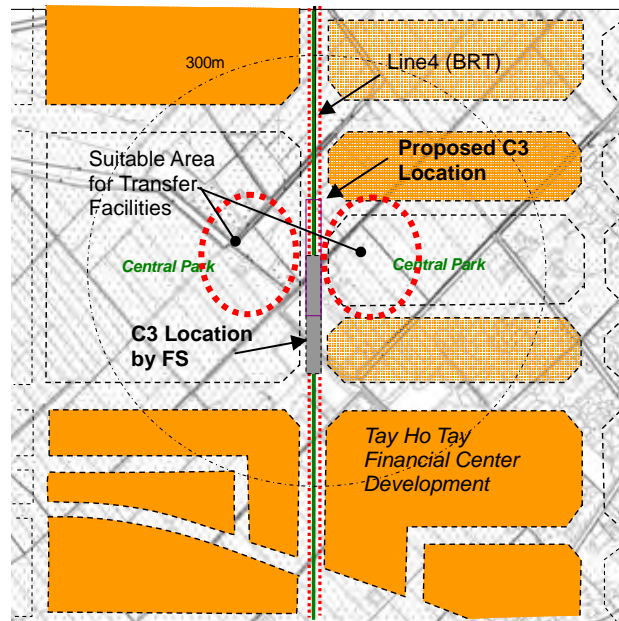
2) Tay Ho Tay Station (C3: Phase1)

433 Tay Ho Tay station (C3) in the Feasibility Study has set on the planned urban arterial road in the middle of the New Town Development Area (Korean Consortium) as one of Main Urban Center of Hanoi beside the West Lake in Tu Liem District, where the Line4 has also been planned on the same route of Line2.

434 Key development issues are 1) to formulate northern gateway transportation hub accommodating public transportation network from the northern part of Hanoi, 2) to secure connectivity between two stations of UMRT Line2 and Line4 by setting properly in close location each other, and 2) to formulate airline checking station (City Air Terminal), taking account of the northern gateway of Hanoi.

435 The station of Line4-BRT is proposed to set under the C3 station of which location is also proposed by minor modification to shift to farther north (100 m). Link between two stations can be provided by steps and elevator directly. Transfer facilities for feeder bus and others are proposed to set in the planned open space or park beside the C3 station.

Figure 4.1.12 Proposed Location for Tay Ho Tay Station (C3)



Source: JICA Project Team

3) Potential Locations (Line2 station) for City Air Terminal Development

436 City air terminal (CAT) concept provides high-quality and reliable airport passenger services by UMRT Line2 with air travelers in Hanoi city center in comparison with road access to the airport in association with mitigation of environmental pollution by vehicle travels to the airport.

437 CAT facilities include airline's check-in facilities with security check, baggage handling facilities, inter-modal transfer facilities and related commercial service facilities. CAT requires good accessibility together with inter-modal facilities, where adequate land use by business and commercial area generates enough demand of users for CAT without road access congestion.

438 Potential stations of UMRT Line2 in future after completion of entire line

construction to Noi Bai International Airport are evaluated by certain criteria shown in Table below and Tay Ho Tay station (C3) could be one of the most favorable stations for CAT service Quan Ngua station (C5) would be the second option where Line5 would connect with covering large western urban development of Hanoi (e.g. Lang Hoa Lac New Town, industry and other new town development along Lang Hoa Lac road / Line5).

Table 4.1.10 Assessment for Candidate Stations (Line2) for City Air Terminal Development

| Development Criteria for City Air Terminal (CAT) | | Potential Station for CAT | | | | |
|--|---|---------------------------|----|----|----|-----|
| | | C1 | C3 | C5 | C8 | C10 |
| | | EL | EL | UG | UG | UG |
| Road & Transport Accessibility | From / to major trunk urban roads | ● | ● | ● | ○ | ● |
| | Adequate access point avoiding traffic congestion | ● | ● | ● | ○ | ○ |
| | Other transportation mode connectivity | -- | ● | ● | ● | ● |
| Physical Conditions of Location | Land availability for adding CAT on the station | -- | ● | ○ | ○ | ○ |
| | Ground land availability for baggage handling service | -- | ● | ○ | -- | -- |
| | Adjustability of CAT facilities to Line2 Station | -- | ● | ● | -- | -- |
| Development Opportunity | Optimum location and range to pick users up | ● | ● | ● | ○ | ○ |
| | Land use by commercial and business facilities | -- | ● | ○ | ● | ● |
| | Station area status targeting foreign business users | ○ | ● | ○ | ● | ● |
| Future Train Operation | Flexibility to operate one-stop airport link train | ○ | ○ | ○ | -- | -- |
| | Proximity to depot for Line2 | ● | ● | -- | -- | -- |
| Overall Evaluation | | ○ | ● | ○ | -- | ○ |

Note: ● = Most suitable or highest potential, ○ = medium value, -- = low value or potential, EL = Elevated station, UG = Underground station, C1 = Nam Thang Long, C3 = Tay Ho Tay, C5 = Quan Ngua, C8 = Hang Dau, C10 = Tran Hung Dao

439 After submission of HAIMUD Draft Final Report, HAUPA proposed another alternative: (a) which will be located outside and in the south of the urban axis zone to secure the vista from the new cultural center to the West Lake, and (b) which Nam Thang Long Station (C1) and Ngoai Giao Doan Station (C2) will be developed underground.

440 On the contrary, HRB, the railway developer of UMRT Line2 supports the location where HAIMUD proposes. JICA Project Team submitted the technical note (see Box 4.1.1) to HRB and HAUPA on 12th November 2010. The station location has not been finalized yet as of December 2010, so it is strongly proposed that HPC will make a conclusion as soon as possible.

Box 4.1.1 Technical Note on Comparison of Alternative Location of Tay Ho Tay Station (C3)

Technical Note on Comparison of Alternative Locations of Tay Ho Tay station (C3)

12 November, 2010

1. Background

1.1 In the HAIMUD Study, locations of Tay Ho Tay Station (C3) of the Line2 have been discussed from the following viewpoints.

- (i) **Engineering and technical aspect:** Whether or not the location of the station will not cause engineering and technical difficulties in construction of the Line2 which may result in increase in construction cost and decrease in operational efficiency.
- (ii) **Integrated urban development:** Whether or not effective integration with land-use and potential urban development at and around the station can be ensured.
- (iii) **Transportation connectivity:** Whether or not the station can be accessed conveniently by feeder transportation services.
- (iv) **Landscape and aesthetic aspect:** Whether or not the C3 station will not spoil or contribute to enhancement of desired landscape and image of the area.

1.2 In this process, discussions were held in the study team, and related organizations were consulted through Steering Committee and separate meetings.

2. Summary of Comparative Assessment

1) Alternatives

2.1 While a number of alternatives were formulated and discussed, they are basically grouped into the following two;

A: Alternatives located in the urban axis of the Tay Ho Tay New Urban Development Zone including Huu Nghi Park, Cultural Center, and Central Park. (see Figure 2.1)

B: Alternatives located outside and in the south of the urban axis zone

2.2 The two alternatives were objectively assessed among the experts in consultation with related organizations as well as based on the study on the experiences of other developed cities. The results of the comparative assessment are as follows;

(a) Assessment from engineering and technical aspect: Alternative A is superior to Alternative B. Alternative A can maintain a smooth alignment for the section between C3 and C4. On the other hand, Alternative B may cause difficulties in the following points;

- (i) At the location where the shield enters the underground section, the curvature radius may reduce from 350 m to 200 m which may increase construction difficulties and operational performance of the train.
- (ii) As the elaborated structure becomes the underground structure in the section between C3 and C4 stations, it may become a constraint to maintain sufficient clearance at intersecting points with at-grade roads.
- (iii) The above disadvantages of Alternative B may result in higher construction cost and longer construction period.

(b) Assessment on transportation network connectivity: Hanoi intends to promote public transportation based compact city to reduce excessive use of private cars and motorcycles, environmental pollution and accidents by expanding high-quality public transportation services. C3 station is expected to play an important role as a transportation hub or gateway to connect

western and northern parts of Hanoi. In order to ensure effective connectivity between UMRT and feeder transportation services, the C3 station must be provided with a good set of intermodal facilities and located at convenient locations in trunk road network. In this regard, the Alternative A is ideally located. Moreover, when adequate large-scale underground parking space is provided in the park area in direct integration with C3 station, it will provide much convenience for and benefit UMRT users as well as urban activities of the new urban area.

(c) Assessment from integrated urban development: Unless public transportation system is closely integrated with urban development, people still use private transportation and UMRT ridership will not be encouraged. Accessibility also affect value of urban development as congestions on roads may farther increase in the future. Good access ensures higher value of properties and benefit everybody. For this in many cities, UMRT stations become a center of commercial, business and even social and cultural activities, especially for the people who use public transportation. It is the view of the study team that C3 station can demonstrate a superb model of integrated development not only in Hanoi but also in the world.

(d) Assessment from landscape view point: In the world, there are many cases that transportation terminals and stations represent symbolic space and identical landscape of cities as can be widely seen for airports, railway stations and even ports, because they attract a lot of people including visitors. While it is important that UMRT stations, especially those such as C3 must be designed in well-coordinated design principle of the surrounding areas, it is highly possible that C3 station can add landscape value in the area by introducing adequate architectural design.

3. Conclusion and Recommendations

3.1 On the basis of the above comprehensive assessment, it is concluded that Alternative A is superior to Alternative B. (see Table 3.1)

Table 3.1 Summary of the Assessment

| Aspect | Alternative A | Alternative B |
|----------------------------------|---------------------|---------------|
| (a) Engineering/ Technical | ☑ | △ |
| (b) Transportation Connectivity | ☑ | △ |
| (c) Integrated Urban Development | ☑ | △ |
| (d) Landscape/ Aesthetic | ☑ - △ ¹⁾ | ☑ - △ |
| Overall | ☑ | △ |

¹⁾ depending on architectural design

3.2 In the next step, it is recommended to formulate detailed plans for the station and adjoining areas including land-use, structural and architectural plans from comprehensive aspects including;

- (i) Engineering/ technical aspects
- (ii) Urban transportation network connectivity and feeder transportation services
- (iii) Integrated urban development at the station and in adjoining areas as well as overall development of new urban area development
- (iv) Landscape and urban design aspects

4) Consideration of Connectivity between Quan Ngua Station (C5) and Line5 Terminal Station

441 Quan Ngua station (Line2-C5) in the Feasibility Study has set in the intersection between Van Cao Street and Hoang Hoa Tham Street, although the station of as a terminus of Line5 has not yet been studied yet in detail.

442 Key development issues are 1) to secure connectivity between two stations by setting properly the terminal station in the proximity to the C5 station, and 2) to formulate attractive transportation node with convenient walkway and open space, taking account of the gateway of the West Lake area as one of the tourism and recreational destinations of Hanoi.

443 Quan Ngua station (Line2-C5) together with the terminal station of Line5 could formulate an attractive place as one of the important urban nodes facing Ho Tay tourism and recreation waterfront area. Although there is no certain information of design of Line5 and the terminal station whether it would be underground or elevated or where it would be located, It can be proposed that underground station and its location in terms of integrated development of two stations through an examination of two cases of station location as following Figure 4.1.13.

444 As shown in Table 4.1.9, Southern terminal station of Line5 in case of Alternative 2 (southern and underground) is the most suitable location for effective and appropriate connectivity with Quan Ngua station (Line2-C5), taking account of not only effective transferability for two stations but also appropriate urban design (landscape, node formulation, etc).

Figure 4.1.13 Alternatives of Station Location and Type of Line5 for Integration of Two Station (C5 / Line5 Station)

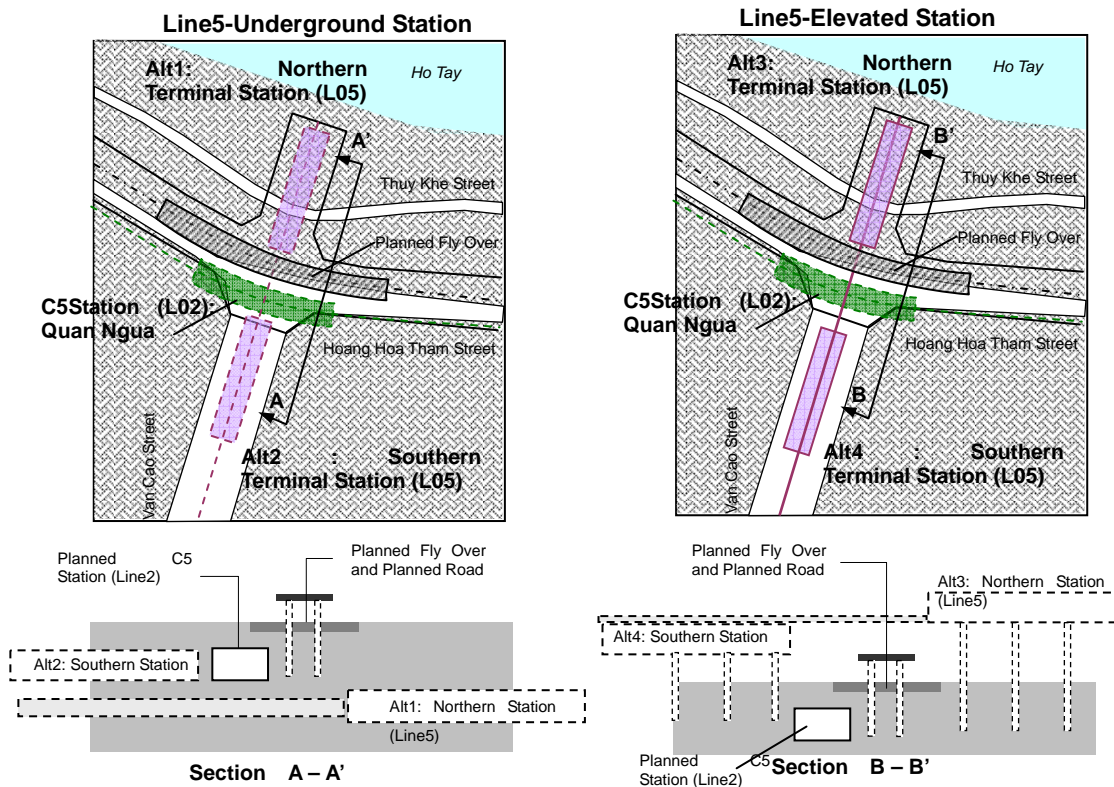


Table 4.1.11 Alternatives for Line5 Station in conjunction with Line2-C5 Integration

| Development Criteria for UMRT 05 Terminal Station Location | | Location of Line5 Station | | | |
|--|--|---------------------------|---------------|---------------|---------------|
| | | Northern | | Southern | |
| | | Alt-1 (EL) | Alt-2 (UG) | Alt-3 (EL) | Alt-4 (UG) |
| Road & Transport Accessibility | From / to major trunk urban roads | ● | ● | ● | ● |
| | Engineering constraints by the planned road Fly Over | -- | ○ | ○ | ● |
| | Other mode connectivity (efficient vehicle circulation) | ○ | ○ | ● | ● |
| Station Transferability | Horizontal distance between two stations | -- | -- | ● | ● |
| | Vertical distance between two stations | -- | -- | ○ | ● |
| | Adequate gate formulation for both stations | -- | ○ | ● | ● |
| Development Opportunity and Advantage | Proximity to expected Ho Tay waterfront development | ● | ● | ○ | ○ |
| | Proximity to Quan Ngua Stadium | ○ | ○ | ● | ● |
| | Combination with expected redevelopment area by new | ● | ● | ○ | ○ |
| Adequate Urban Design | Consistency with HPC policy for underground after Ring 2 | -- | ● | -- | ● |
| | Mitigation of landscape impact on Ho Tay visual axis | -- | ● | -- | ● |
| Overall Evaluation | | -- | ○ | -- | ● |

Note: ● = Most suitable or highest potential, ○ = possible but constraints, -- = difficult, EL = Elevated station, UG = Underground station

5) Alignment at Two Stations (Bach Thao-C6 and Ho Tay-C7) along West Lake

445 Bach Thao (C6) and Ho Tay Station (C7) are planned in underground close to existing road (C6 under Thuy Khue Street, C7 under Hoang Hoa Tham Street), where the Presidential House and residences of higher government officials are located along coastal areas of West Lake. On the other hand, a new arterial road is also being planned along West Lake taking different alignment with Line2, especially at stations.

446 Rather than a separate alignment for the road and the UMRT, it might be more economical and flexible free from existing settlement to merge their alignments closer. These will also avoid the risk arising from an underground line passing underneath these buildings. And entrance from ground utilizing road property will be also critical issues whether there is a new road or not above station. A possible adjustment as a subject to a final determination of conformity with minimum railway curvature and the road alignment will set final locations of two stations.

447 Station areas development for these two stations (C6, C7) including entrance gates and transfer facilities are based on locations and alignment of the Feasibility Study presuming a new road development fitting with the Line2 alignment as premise.

Figure 4.1.14 Necessary Alignment Conformity with UMRT Line2 and New Road Scheme along West Lake to fix locations of Bach Khoa Station (C6) and Ho Tay Station (C7)



Source: JICA Project Team

6) Hoan Kiem Lake Station (C9: Phase1)

448 Hoan Kiem Lake station (C9) in the Feasibility Study has been set just beside of the Ngoc Son temple (national heritage) along Hoan Kiem Lake as one of the best known destinations in Vietnam, and near the head quarter of Hanoi People's Committee (HPC).

449 Key development issues are 1) to minimize negative impacts on historical and natural heritages (Ngoc Son Temple, Den Ba Kieu, Hoan Kiem Lake) by setting appropriate position of the station, 2) to formulate attractive gateway area with convenient walkway and open space as one of the most important destination for Hanoi citizen, and 3) to consider connectivity with Bo Ho bus interchange. In consideration with issues of sensitive environment on the planned station, two options shown in below by shifting location of the station can be added on the planned station.

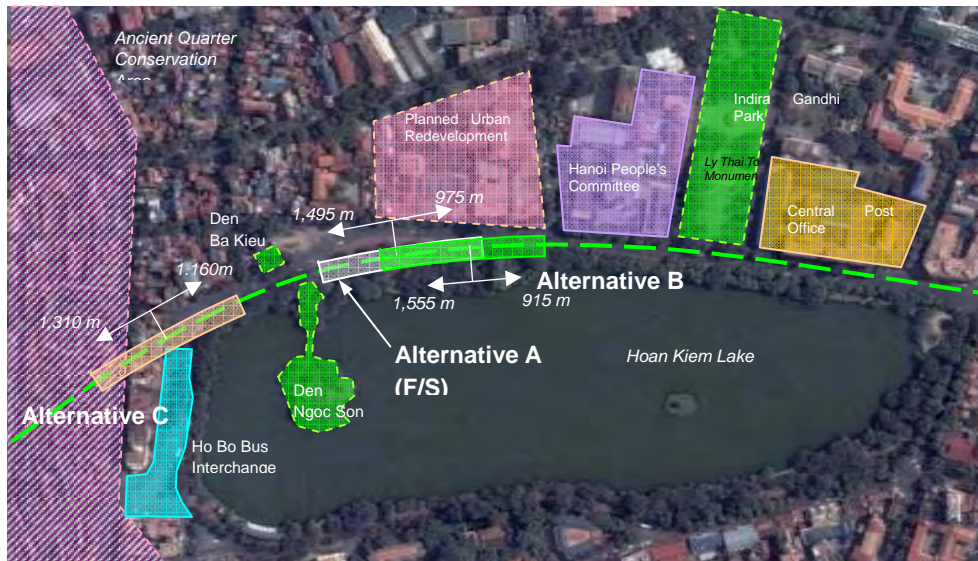
- (i) Alternative A (Feasibility Study): Planned UMRT C9 station in the green park area facing Ngoc Son Temple in Hoan Kiem Lake by the feasibility study
- (ii) Alternative B: Station location to be shifted toward southern side apart from Ngoc Son Temple where there is a plan for redevelopment of the property of Electricity Company
- (iii) Alternative C: Station location to be shifted toward north apart from Ngoc Son Temple and into Ancient Quarter area where Bo Ho bus interchange is located at the southern edge of Ancient Quarter

450 After the project team laid the comparison of alternatives in the Steering Committee that every alternative having advantages and disadvantages is necessary to have a policy decision by the Government, the Government has concluded that Alternative B is agreeable as the station to be studied further for detailed design together with necessary coordination among relevant stakeholders.

451 Furthermore, HRB consulted with Ministry of Culture, Sports and Tourism (MOCST) regarding the alignment and location of Hoan Kiem Lake station in terms of cultural and environmental impacts in March 2010. MOCST basically agreed with Alternative B, and requested not to develop station and related facilities inside the area

within 100m range from Ngoc Son Temple. In addition, MOCST proposed to develop the station entrances near the Hanoi Power Company. HRB will take into consideration and decide detailed location during Detailed Design Phase.

Figure 4.1.15 Alternatives for Location of Hoan Kiem Lake Station (C9)



Source: JICA Project Team

Table 4.1.12 Assessment of Alternatives for Location of Hoan Kiem Lake Station (C9)

| Evaluation Criteria for Location Options for Hoan Kiem Lake Station | | Alternative A | Alternative B | Alternative C |
|---|---|---------------|---------------|---------------|
| Road & Transport Accessibility | Proximity to Bo Ho bus interchange | ○ | ○ | ● |
| | Access road availability | ● | ● | ● |
| | Access to walkway network (Hoan Kiem walkway) | ● | ● | ● |
| Environment Sensitivity | Ngoc Son Temple and its surrounding conservation | -- | ○ | ○ |
| | Ancient Quarter conservation | ● | ● | -- |
| | Security of Hanoi Central Administrative Offices | ○ | -- | ● |
| Adequate Urban Form | Minimization of negative impact on the lake environment | ○ | ○ | ● |
| | Attractive urban node development for Historical Center | ○ | ● | ● |
| | Convenient location as the gateway of Historical Center | ○ | ○ | ● |
| Engineering Conditions | Harmonized development with redevelopment area | ● | ● | -- |
| | Sufficient space for open-cut construction | ○ | ○ | -- |
| | Minimization of necessary resettlement | ● | ● | -- |
| | Appropriate intervals between stations | ○ | ○ | ● |
| | Adequate alignment in the station area (little curve) | ○ | ○ | ● |

Note: ● = Suitable or potential, ○ = medium value, - = low value or potential

Source: JICA project team

7) Stations between Cau Den (C11) and Thuong Dinh (C16) in Phase2 Section

452 After the feasibility study for Line2 of Phase2 section (C1: Nam Thang Long – C10: Tran Hung Dao), HRB has conducted recently additional feasibility study³ for Phase2 section. The draft Inception Report shows alternative alignments and locations of stations from technical points of view taking account of structural constraints and potential demand of passengers in densely habitat areas.

453 After alternative alignments and their stations in two sections (Kim Lien –Trung

³ The Feasibility Study (Inception Report) for UMRT Line2 Development: Tran Hung Dao – Thuong Dinh Section / TEDI South - Hanoi Construction Planning Institute 2009

Tu section and Chua Boc – Nga Tu So section) in the study were examined preliminarily, it has been evaluated and proposed by the consultant in the Inception Report that one station at Kim Lien needed to be added on the previous plan and new Nga Tu So station also was suitable to be located rather than previous location at Nga Tu So junction due to difficult technical condition such as constraints of usage of underground by deep bases or piles for large upper structures.

Figure 4.1.16 Alternatives for Alignment and Station Locations of Phase2 section in the Feasibility Study (TEDI South)



Source: JICA Project Team

454 The project team reviewed this study from integrated station area development point of views taking account of potential feeder linkage (bus and future road network), potential areas for urban redevelopment and appropriate interval among stations of Line2. The followings are key issues to be addressed in further examination by the Feasibility Study (TEDI South).

- (i) Appropriate Station Interval:
 - Average interval (Phase1 and Phase2): 1.2 km
 - Land use characteristic average: 1.3 km (suburban) 0.9 km (CBD)
 - C12 to C15 proposed stations by average: 0.9 km.
 - It is necessary for these two sections to consider with appropriate interval of stations taking account of balanced project investment and service standard in Phase2 section
- (ii) Important Transportation Nodes:
 - Taking account of current traffic flow including bus services and future road network in these sections of alignments, two junctions of Nga Tu So and a junction by Chua Boc –Ton That Tung could be important.
- (iii) Strategic urban renovation (redevelopment) utilizing UMRT opportunities
 - Location of UMRT station will give high opportunities for urban redevelopment and living environment improvement having the advantage of accessibilities and increase of land value.
 - Old housing areas (KTTs), large property of private companies in this area are considerable place to be located by stations of Line2 could be accelerated by Line2 development.

455 Addressing issues above mentioned, it is proposed that three stations in two alignment sections after Bach Khoa (C12) station could locate in strategic places at or close to road junctions. In case of three stations after Bach Khoa station, average interval is estimated as 1.2 km. Figure 4.1.17 shows alternative station locations based on proposed alignment by TEDI South proposed by the project team. It should be noted that Nga Tu So station is proposed to set in the site of Nga Tu So market by the project team, where redevelopment project for Nga Tu So market is under implementation.

Figure 4.1.17 Proposed Alternatives for Station Locations of Phase2 section



Source: JICA Project Team

456 HRB and the JICA project team discussed appropriate station number, location and alignment with inviting TDSI-South which implements the Feasibility Study of Phase 2 of UMRT Line 2 (Tran Hung Dao – Thuong Dinh). JICA Project Team agreed on these proposals in terms of integrated development, and proposed addition of Kim Lien station in the 4th Steering Committee.

457 In March 2010, HRB and TDSI-South submitted the draft Inception Report of F/S which proposes to add Kim Lien Station, adjust location of Chua Boc, Nga Tu So and Thuong Dinh stations (see Figure 4.1.16). HPC, HRB, HAUPA and HAPI discussed on the locations of Chua Boc, Nga Tu So and Thuong Dinh stations in May 2010, but not concluded and the Inception Report of F/S has not been approved yet.

Figure 4.1.18 Proposed Alignment and Station Location of Feasibility Study



Source: JICA Project Team based on information of Feasibility Study by TDSI-South

8) Summary of Station Location and Alignment for UMRT Line2

458 Table 4.1.13 summarizes proposed station location in association with alignment adjustment for further selected detailed planning studies and for the railway design (schematic design and detail design).

Table 4.1.13 Summary of Proposed Station Location and Alignment Adjustment of UMRT Line2

| UMRT Line2 Station | Interval (km) | | Development Phase | Station Location Adjustment of Feasibility Studies* | |
|-----------------------------|---------------|----------|-------------------|---|--|
| | Original | Proposal | | Length (m) and Direction | Reference |
| C1. Nam T. Long | 0.0 | 0.0 | I | -- | -- |
| C2. Ngoai Giao Doan | 1.0 | 0.9 | I | -- | -- |
| C3. Tay Ho Tay | 0.9 | 0.8 | I | 100 (n) | -- |
| C4. Bui | 1.6 | 1.7 | I | -- | -- |
| C5. Quang Ngua | 1.7 | 1.7 | I | -- | -- |
| C6. Bach Thao | 1.3 | 1.3 | I | -- | Coordination with new planned road along West Lake |
| C7. Ho Tay | 0.7 | 0.7 | I | -- | |
| C8. Hang Dau | 1.1 | 1.1 | I | -- | -- |
| C9. Hoan Kiem Lake | 1.5 | 1.5 | I | 60 (s) | -- |
| C10. Tran Hung Dao | 1.0 | 1.2 | I | -- | -- |
| C11. Cau Den | 1.0 | 1.0 | II | -- | -- |
| C12. Bach Khoa | 1.2 | 1.2 | II | -- | -- |
| C13. Kim Lien (newly added) | - | 0.7 | II | -- | Necessary further coordination and adjustment with HRB |
| C14. Chua Boc | 1.4 | 0.8 | II | 200 (w) | |
| C15. Nga Tu So | 1.5 | 1.3 | II | -- | |
| C16. Thuong Dinh | 0.9 | 0.9 | II | -- | |

Note: shifting direction following basic alignment toward (n): north, (s): south, (e): east, (w): west,
1) Ha Noi Urban Railway Construction Line 2: Nam Thang Long-Tran Hung Dao, 2) The Feasibility Study (Inception Report) for UMRT Line2 Development: Tran Hung Dao – Thuong Dinh Section / TEDI South - Hanoi Construction Planning Institute
Source JICA project team

4.2 Station Characters and Station Area Development Direction

4.2.1 UMRT Station as Transportation Node

1) Railway Services of Line1 and Line2 Stations

459 Although both UMRT lines of Line1 and Line2 play a similar role in serving passengers mainly as commuters in the Hanoi City, Line1 has been planned by multi-function of railway serving urban commuters and long-haul passengers of national railway. Some stations have railway transfer function within railway network including long-distance train, High-speed Rail (HSR) and UMRT lines where larger passenger's movement is expected to be generated.

460 On the other hand, every station is required by effective and efficient feeder services as a fundamental element of station, of which services are supported by other modes including walk, public transit such as other UMRT lines, bus, bus rapid transit (BRT) and semi public vehicle (taxi, bike-taxi=Xe-om) and private vehicles. 31 stations should be strengthened and encouraged by necessary transportation services with appropriate transfer facilities. Table 4.2.1 shows different function of railway system between Line1 and Line2.

Table 4.2.1 Railway Function of Line1 and Line2

| Railway Station Function by Type | | Transit Transfer | | | | | Feeder Service | | | Railway Operation Service | |
|----------------------------------|--------------------|------------------|-----|-----|-------|-----|----------------|----|---|---------------------------|----|
| | | Long-distance | | | | | PT | PC | W | OS | LG |
| | | UMRT | BRT | VNR | VNR-I | HSR | | | | | |
| Line1 | Transportation Hub | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | Transit Center | ● | ○ | ● | ○ | -- | ● | ● | ● | ○ | ○ |
| | Standard Station | ○ | ○ | ○ | -- | -- | ○ | ○ | ● | -- | -- |
| Line2 | Transit Center | ● | ● | ● | -- | -- | ● | ● | ● | -- | -- |
| | Standard Station | -- | -- | -- | -- | -- | ○ | ○ | ● | -- | -- |

Note: ● = major function, ○ = minor function or single function

VNR-I= International Train, BRT = Bus Rapid Transit, HSR = High-speed Rail, PT= Public Transit, PV= Private Vehicle, W = walk, OS = marshalling yard, workshop, depot, LG = cargo, logistic

Source: JICA project team

2) Urban Transportation Node Formulation

461 In order to maximize potential role of public transportation and its utilization in the metropolitan city of Hanoi, integrated transportation system should be formulated by making public transit pivot taking account of sufficient network and effective transportation node formulation. Transportation network density in combination with character of land use of Hanoi is also on of essential element where appropriate transportation node will support effective integration of urban transportation system with public transit.

462 Several type functions and facilities such as park and ride system (P&R), inter-bus terminal and city-air terminal (CAT) are desirable to be incorporated into UMRT station in appropriate location for effective urban transportation node formulation.

Table 4.2.2 Unban Transportation Node Formulation in conjunction with UMRT Station

| Node Development | | Transportation Facilities By Urban Function and Land Use Category | | |
|---------------------------------------|--------|--|--|--|
| | | Urban Center (CBD) | Urban Center Fringe | Suburban / Peri-urban |
| Transportation Policy in station area | | - Pedestrian friendly road network - Zone traffic control management | - Well-controlled traffic flows - Total traffic volume reduce - Airport service connection | - Convenient trunk public transportation - Distribution center for goods and passenger distribution into City |
| Transportation Facilities Provision | | - Bay facilities base for inter modal transfer (ITF/ feeder bus, taxi, para-transit, etc) - Well-prepared walk way by sidewalk, footbridge, underpass | - Station facilities–base inter modal transfer - Para-transit station - Well-prepared walk way | - Feeder and trunk public transportation terminal /station - Park & Ride station - Logistic / distribution centers |
| Line1 | Phase1 | Hanoi (V8) / Nam Cau Long Bien (v6) | Gia Lam (V4) / Giap Bat (V12) | Ngoc Hoi (V16) |
| | Phase2 | | | Yen Vien (v1) / Cau Duong (V2) / Hoang Liet (V13) / Van Dien (V14) / Vinh Quynh (V15) |
| Line2 | Phase1 | Quang Ngua (C5) / Hang Dau (C8) / Hoan Kiem Lake (C9) / Tran Hung Dau (C10) / Bach Khoa (C12) | Tay Ho Tay (C3) | |
| | Phase2 | | Nga Tu So (C15) / Thuong Dinh (C16) | |

Source: JICA project team

Figure 4.2.1 Concept for Urban Transportation Node Formulation in conjunction with UMRT Area Station Development

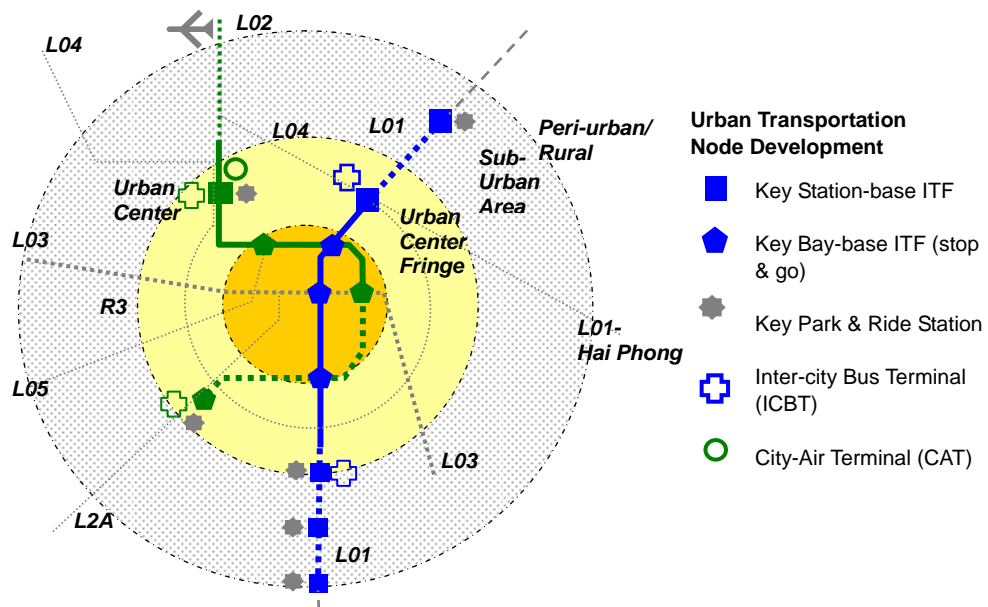


Table 4.2.3 Proposed Transportation Node Formulation of UMRT Stations

| Name of Station | | Transit Transfer to | | | | | Railway Facilities | | ITF | Urban Transportation Node | | |
|------------------|-----------------------|---------------------|-------|---------------------|-----------------|-----|--------------------|------------|-----|---------------------------|------------------------|-----|
| | | Long-distance train | UMRT | International train | High speed rail | BRT | Yard/depot | Cargo yard | | P&R | Intercity bus terminal | CAT |
| UMRT Line1 | V1. Yen Vien | ● | -- | ● | -- | -- | ● | ● | ● | ● | -- | -- |
| | V2. Cau Duong | -- | -- | -- | -- | -- | -- | -- | ○ | ● | -- | -- |
| | V3. Duc Giang | -- | -- | -- | -- | -- | -- | -- | ○ | ○ | -- | -- |
| | V4. Gia Lam | ● | L01-H | ● | -- | -- | -- | ○ | ● | -- | ● | -- |
| | V5. Bac Cau Long Bien | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | V6. Nam Cau Long Bien | -- | L02 | -- | -- | -- | -- | -- | ○ | -- | -- | -- |
| | V7. Phung Hung | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | V8. Hanoi | ● | L03 | ● | ○ | -- | -- | -- | ● | -- | -- | -- |
| | V9. C.V.Thong Nhat | -- | L02 | -- | -- | ● | -- | -- | -- | -- | -- | -- |
| | V10. B.V. Back Mai | -- | -- | -- | -- | ● | -- | -- | -- | -- | -- | -- |
| | V11. Phuong Liet | -- | -- | -- | -- | ● | -- | -- | -- | -- | -- | -- |
| | V12. Giap Bat | ● | -- | ● | -- | ● | -- | -- | ● | -- | -- | -- |
| | V13. Hoang Liet | -- | -- | -- | -- | -- | -- | -- | ○ | ● | ● | -- |
| | V14. Van Dien | -- | -- | -- | -- | -- | -- | -- | ○ | ○ | -- | -- |
| | V15. Vinh Quynh | -- | -- | -- | -- | -- | -- | -- | ● | ● | -- | -- |
| | V16. Ngoc Hoi | ● | -- | -- | ○ | -- | ● | ● | ● | ● | ● | -- |
| UMRT Line2 | C1. Nam T. Long | -- | -- | -- | -- | -- | -- | -- | -- | ● | -- | -- |
| | C2. Ngoai Giao Doan | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | C3. Tay Ho Tay | -- | L04 | -- | -- | -- | -- | -- | ● | ○ | ● | ● |
| | C4. Bui | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | C5. Quang Ngua | -- | L05 | -- | -- | -- | -- | -- | -- | -- | -- | ○ |
| | C6. Bach Thao | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | C7. Ho Tay | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | C8. Hang Dau | -- | L01 | -- | -- | -- | -- | -- | -- | -- | -- | ○ |
| | C9. Hoan Kiem Lake | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | C10. Tran Hung Dao | -- | L03 | -- | -- | ● | -- | -- | -- | -- | -- | -- |
| | C11. Cau Den | -- | -- | -- | -- | ● | -- | -- | -- | -- | -- | -- |
| | C12. Bach Khoa | -- | L01 | -- | -- | ● | -- | -- | -- | -- | -- | -- |
| | C13. Kim Lien | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | C13. Chua Boc | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | C14. Nga Tu So | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| C15. Thuong Dinh | -- | L2A/04 | -- | -- | ● | -- | -- | ○ | ● | -- | -- | |

Source: JICA Project Team

4.2.2 Station Area Character for Integrated Development

1) Concept for UMRT Transit Corridor Formulation and Integration

463 UMRT lines of Line1 and Line2 have been set in Hanoi City where both lines cover various urban land use from CBD to suburban and rural area. Different land use at station areas requires adequate development approach to fit to each socio-economic activities and people's mobility, while two lines are expected to encourage in formulating and managing "UMRT Transit Corridor" development in integrated manner.

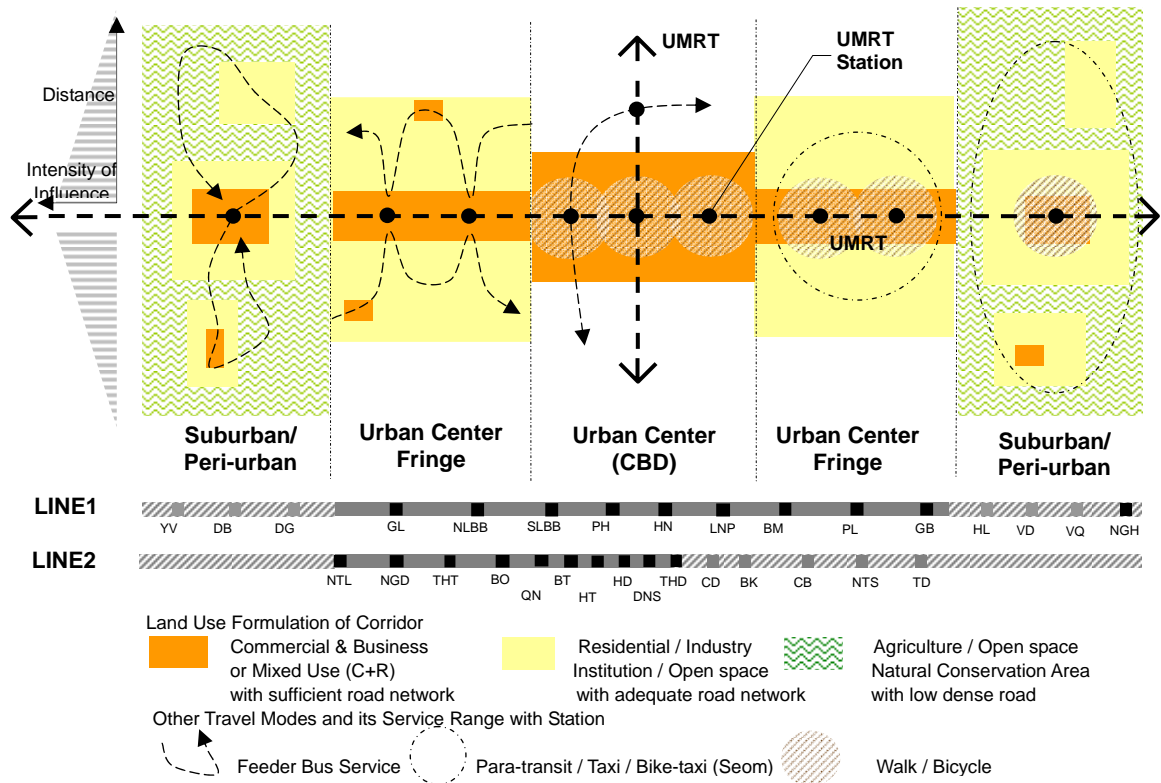
464 Table 4.2.4 illustrates desirable development of station area as common broad direction in order to achieve TOD concept for Line1 and Line2 development.

Table 4.2.4 Urban Development Formulation for UMRT Transit Corridor in Hanoi

| Item | Urban Center | Urban Center Fringe | Suburban / Peri-urban |
|---------------------|---|--|---|
| Development Concept | <ul style="list-style-type: none"> Attractive urban center environment by walk-friendly Capital and international commercial & business and tourism center with convenient facilitation | <ul style="list-style-type: none"> Modern urban core /node formulation by walk-friendly Competitive commercial & business urban cores with convenient facilitation | <ul style="list-style-type: none"> Attractive urban center environment by walk-friendly Competitive commercial & business center with convenient facilitation |
| Urban Form | Integrated urban district area development with transit stations | Conurbation of urban core/node development by transit | Single urban core development by transit station |
| Land Use & Density | Commercial & Business and mixed use with high-dense development | Higher-density development along transit by C+M and mixed use | C+M and mixed use by high-dense development at urban core with transit station |
| Road network | High-dense collector and distributor roads with pedestrian network | Medium-dense arterial, collector, distributor roads network | Limited-dense arterial, collector, distributor roads network |
| Feeder Services | Walkway network linking with stations in combination with para-transit | Link services by Intermodal Transfer Facilities (ITF) with other modes (bus, taxi, bike) | Feeder services by ITF and station-base bus services |

Source: JICA Project Team

Figure 4.2.2 UMRT Transit Corridor Development Formulation



Source: JICA Project Team

2) UMRT Line1 Transit Corridor Development

465 Station area development at five stations of Nam Cau Long Bien (V6), Phung Hung (V7), Hanoi (V8) and C.V. Thong Nhat (V9) locating in dense developed urban area as the Urban Center of Hanoi, are expected to encourage and promote revitalization of socio-economic activities in consideration with historical and traditional environment conservation under development control zone of Hanoi City.

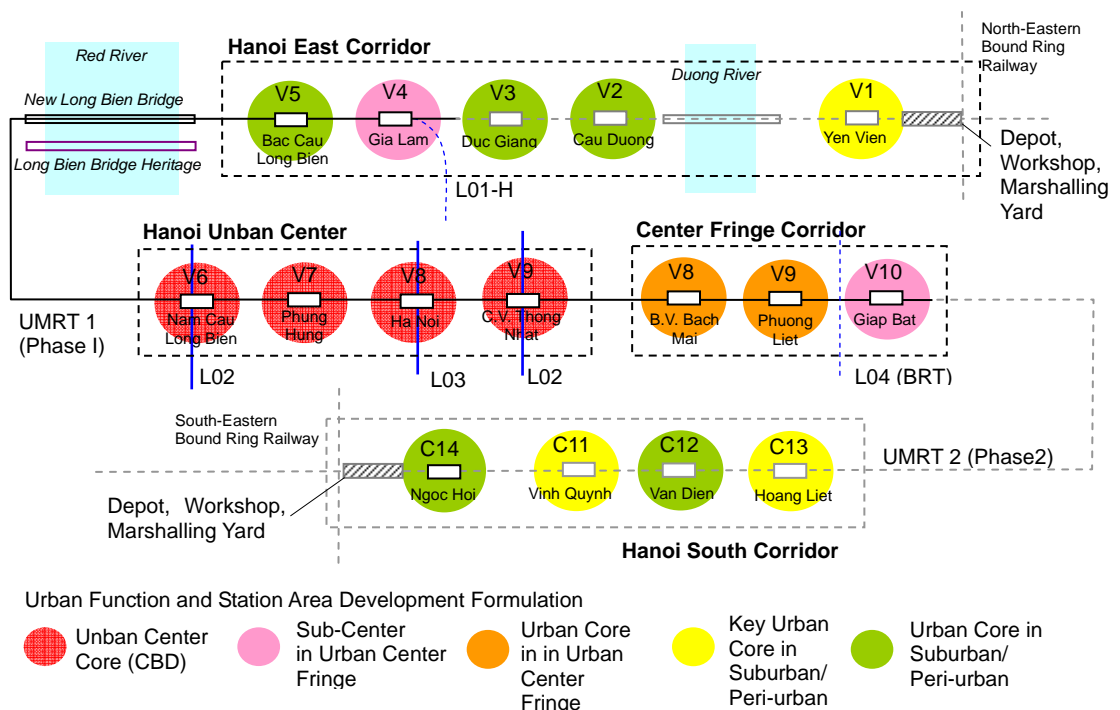
466 Gia Lam station (V4) is expected to play a key role in supporting Urban Sub-center formulation as the eastern gateway city of Hanoi on “Hanoi East Transit

Corridor”, where several new town developments before Duong River would require more convenient and attractive urban service in the corridor. Eastern side of Duong River close to Yen Vien town where agriculture fields are predominantly occupied, it is necessary to promote urban development for increasing ridership.

467 Giap Bat station as the southern gateway city of Hanoi is necessary to strengthen expected function and role utilizing opportunity of station area development including railway yard redevelopment and new town development in adjacent vacant area of the station. Other stations in the “Center Fringe Corridor” are expected to promote urban renovation in surroundings of stations for urban core formulation.

468 Hanoi South Corridor where agriculture fields are predominantly occupied except some industrial developments along National Highway No.1 with UMRT Line1, is expected to promote urbanization by well-organized urban development initiated by station area development as urban service cores for surrounding development.

Figure 4.2.3 Station Area Development of UMRT Line1 by Transit Corridors



Source: JICA project team

3) UMRT Line2 Transit Corridor Development

469 Station area development at six stations from Ho Tay (C7) to Bach Khoa (C12) in locating in dense Urban Center are of Hanoi City, are expected to encourage and promote revitalization of socio-economic activities in association with underground development (underpass, underground parking, underground commercial area), having the advantage of connectivity to underground station development of Line2 in this section.

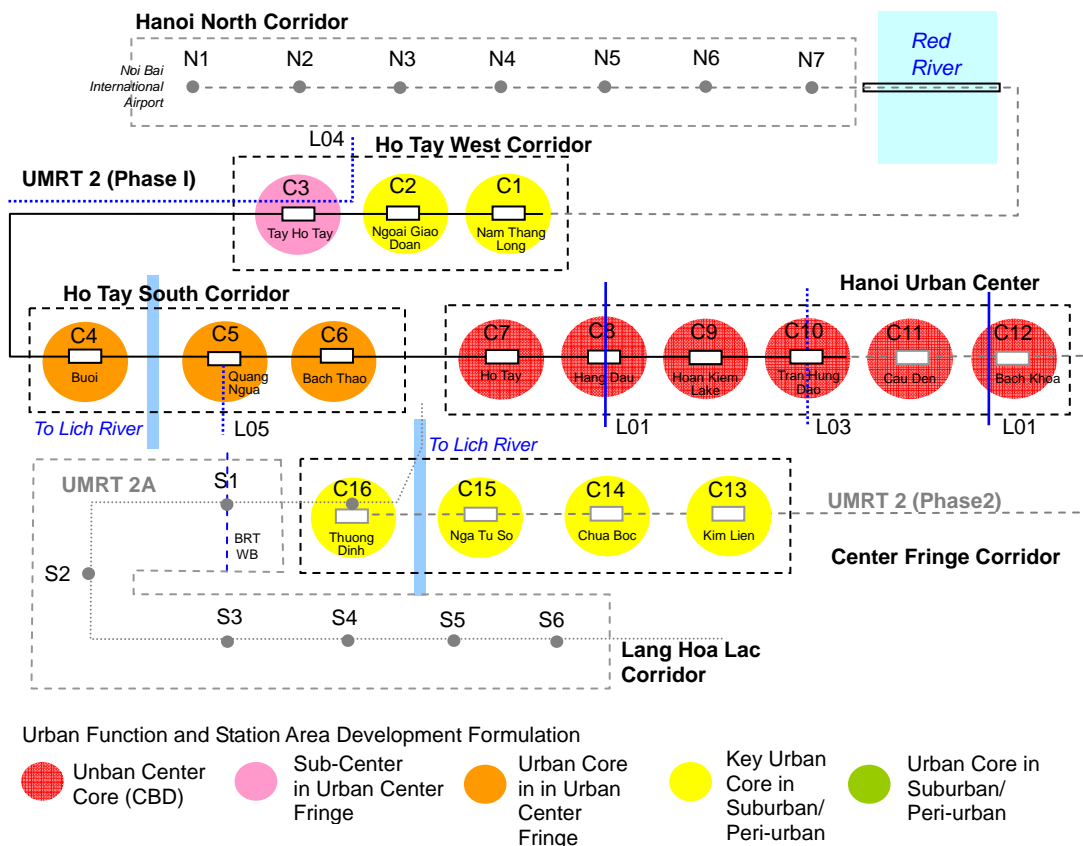
470 Tay Ho Tay station (C3) is expected to play a key role in supporting Urban Sub-center formulation as the Financial Center city of Hanoi on “Ho Tay West Transit Corridor”, where large new urban developments are implemented currently. All stations in this Corridor are full of promise by on-going urban development projects. Therefore formulation of attractive urban services at station areas requires well-coordinated

arrangement with each project implementation bodies.

471 Three stations of “Ho Tay South Transit Corridor” are expected to encourage and promote urban function and role of lakeside recreation and tourism destination of Hanoi utilizing opportunity of station area development. As a new road development has been planned along Line2 and the West Lake will affect also future station area development, harmonized development is required.

472 “Center Fringe Transit Corridor” where large and old high-dense housing areas (KTT) are predominantly occupied except SOE factories and universities, is expected to promote urban redevelopment by well-organized development management incorporated by station area development as urban service cores for surrounding development.

Figure 4.2.4 Station Area Development of UMRT Line2 by Transit Corridors



Source: JICA project team

4.2.2 Station Area Development Direction addressing Hanoi Urban Issues

1) Integration and Appropriate Development Component

473 It is necessary for station area development to guide and coordinate the separate and independent actions of various stakeholders. Integrated development for station area covering i) road and transport, ii) public amenities provision, iii) commercial and business encouragement, iv) housing and residential area provision, v) living condition improvement, and institutional arrangement such as land use control and urban design consideration will be essential requirement to achieve effective and efficient public transport-oriented development. Table 4.1.16 illustrates basic development component necessary to apply 32 stations of Line1 and Line2.

Table 4.2.5 Basic Development Component for UMRT Station Area

| Station Area Development Component | | | Development Body | | | Location | | | Development Type | | | |
|---|--|--|------------------|----|----|----------|----|----|------------------|----|---|---|
| | | | RC | PU | PR | A | B | C | M | S | I | F |
| UMRT Railway Development | Trackage (tunnel, viaduct) | | ● | -- | -- | ● | -- | -- | ● | ● | ● | ● |
| | Station Facilities with small convenient shops | | ● | -- | ○ | ● | -- | -- | ● | ● | ● | ● |
| | Station In-outlet walkway & gates, Ventilator Upcast | | ● | ○ | ○ | ● | ○ | -- | ● | ● | ● | ● |
| | Workshop, Marshalling Yard, Depot | | ● | -- | -- | ● | -- | -- | ● | ● | ● | ● |
| Station Area Development or Improvement | Road & Transport | Access road development and improvement | -- | ● | ○ | ● | ○ | ○ | ○ | ● | ● | ● |
| | | Intermodal Transfer Facilities | -- | ● | ○ | ● | ○ | -- | ○ | ○ | ● | ● |
| | | Bus, Para—transit, Taxi, service provision | -- | ● | ● | ● | ● | ● | ○ | ○ | ● | ● |
| | | Parking Space, Parking Building provision | -- | ● | ● | ○ | ● | -- | ○ | ○ | ● | ● |
| | | Walkway, Pedestrian, (sidewalk, footbridge, underpass) | -- | ● | ○ | ○ | ● | ● | ○ | ● | ● | ● |
| | | Traffic Control, TDM implementation | -- | ● | ○ | ● | ● | ● | ○ | ○ | ○ | ● |
| | Public Amenities | Open Space for resting, waiting | -- | ● | ○ | ● | -- | -- | -- | ○ | ● | ● |
| | | Toilet, Police Box, Information Booth | -- | ● | ○ | ● | -- | -- | -- | ○ | ● | ● |
| | | Town Symbol / Landmark Facilities | -- | ● | ○ | ● | -- | -- | -- | ○ | ● | ● |
| | Commercial and Business Encouragement | Retail shops, civic service business | -- | -- | ● | ○ | ● | -- | -- | -- | ○ | ● |
| | | Hotel and amusement facilities | -- | -- | ● | -- | ● | -- | -- | -- | ○ | ● |
| | | Office building including public administration services | -- | -- | ● | -- | ● | -- | -- | -- | ○ | ● |
| | Housing and Residential | High-rise housing / condominium | -- | -- | ● | -- | ● | -- | -- | -- | ○ | ● |
| | | Community facilities (clinic, nursery) | -- | ○ | ● | -- | ● | -- | -- | -- | ○ | ● |
| | Living Condition Improvement | Urban renewal | -- | ● | ○ | -- | ● | ● | ○ | ○ | ○ | ○ |
| Infrastructure and public service | | -- | ● | ○ | -- | ● | ● | ○ | ○ | ○ | ○ | |

Note:

Location: A = Station Facilities Area, B = Station Vicinity, C = Station Area, ,

Development Body: RC = Railway Company, PU = Public Sector, PR = Private Sector / ● = key responsibility, ○ = sharing responsibility or cooperation, -- = outside of responsibility Location,

Development Type: M = minimum development, S = standard, I = intermediate, F = full-scale / ● = compulsory, ○ = case by case or partially, -- = not applicable

Source: JICA project team

474 Among those components of the station area development, inter-modal transfer facilities (ITF) development as one of fundamental elements needs specific concerns to organize effective transfer from/to station to station area and its hinterland. And it is also desirable for its development to consider wider role and function such as amenity service, open space provision as gateway environment formulation, landscape etc.

Table 4.2.6 Inter-modal Transfer Facilities Development for UMRT Station Area

| Function | Type of Facilities | Facilities |
|---|-------------------------------|---|
| Transfer to | Public Transit | Other railway (long distance railway, UMRT, BRT, LRT, etc) |
| | | Route bus (bus berth, waiting, alighting, boarding areas, shelter, etc) |
| | | Para-transit (community bus, on-demand bus service, etc) |
| | | Inter-city Bus |
| | Semi-public transportation | Taxi, Xe-om, |
| | | Shuttle bus services for establishment (private, institutes, SOE, etc) |
| | Private | Ordinal car for kiss & ride (berth, waiting, alighting, boarding areas) |
| Motor-cycle, bicycle, Xe-lam (tricycle) | | |
| Connection by | Parking (long and short time) | Parking facilities for Park and Ride (long time parking) |
| | | Waiting parking for public transit (short time parking) |
| | | Short-time parking for private vehicles (short time parking) |
| | Walkway | Side-walk of road, pedestrian deck, underpass, |
| | | Elevator, escalator, moving walkway |
| Amenity and Service | Rest and wait | Shelter and bench in open space |
| | Urban public service | Toilet, police box, information guide and signage |
| | | Drinking facilities, emergency facilities, etc |
| | Daily convenience | Kiosk (fast food, book, lottery booth, etc) |
| | | Daily commercial and business service in public area |
| Urban Open Space | Event & exhibition | Multi-purpose stage and space for public event and performance |
| | Landscape | Town symbol, monument, statue |

Source: JICA project team

475 Taking account of physical constraints of each station spreading out various land use, its urbanization conditions, land availability and development opportunities of station area, development should be taken by appropriate scale and measures in terms of passenger volume, role and function of station area in consideration with current planned programs and projects. The followings are factors to be taken account of.

- i) Development needs by station area conditions and future roles
 - Intensity of ridership at station (high volume flow)
 - Degree of necessary promotion for increase ridership
 - Necessity of securing and consolidating intermodal transfer function
 - Necessity of urban core development (no competitive others, no urban facilities, expected hinterland development, etc)
 - Necessity of re-formation of access and traffic flow for urban block with station development
- ii) Development conditions of station area development
 - Land availability for acquisition
 - Potential existing land use for development
 - Large non built-up area (vacant, agricultural field, unprotected natural area such as pond, marsh, grass land)
 - Built-up area by large public-based property (SOE, government, VNR, etc)
 - Built-up area by necessary urban renewal area due to poor living conditions
 - Built-up area by potential redevelopment area by commercial and business having the advantage of land value
 - Potential area by on-going urban /infrastructure development project & plan

Table 4.2.7 Station Area Development Applicability by Conditions

| Station Area Development Type | Dev Conditions (land use & property) | | | | | Development Needs to be Prepared | | | |
|-------------------------------|--------------------------------------|-------------------------------|----|----|----|----------------------------------|-----|-----|----|
| | Non-built-up | Large Block in Built-up Areas | | | | Ridership (H) | ITF | UCD | TM |
| | | SOE | RW | RD | UD | | | | |
| 1. Minimum Development | ○ | -- | -- | -- | -- | -- | -- | -- | -- |
| 2. Standard | ○ | ○ | -- | -- | ○ | ○ | ○ | -- | ○ |
| 3. Intermediate | ○ | ○ | ○ | ○ | ○ | ○ | ● | ○ | ○ |
| 4. Full-scale | ● | ○ | ○ | ○ | ○ | ● | ● | ● | ● |

Note: SOE = large public based property, RW = necessary urban renewal, RD = potential urban redevelopment, UD = on-going urban /infrastructure development plan & project, ITF = intermodal transfer function, UCD = urban core development, TM = necessary reformation of traffic flow by area traffic management

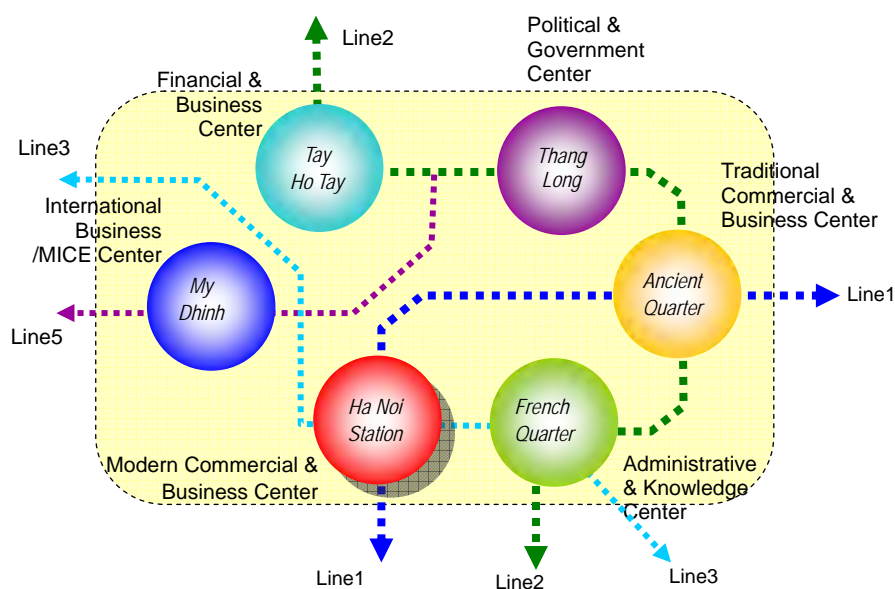
● = compulsory, ○ = case by case or partially, -- = not applicable

Source: JICA project team

2) Competitive Urban Revitalization through Station Area Redevelopment

476 Redevelopment at station area aims at formulating and creating attractive urban space for Hanoi citizens (e.g. open space, cultural and amenity facilities, modern commercial business place, etc), where a new urban lifestyle can emerge in the Hanoi urban core at station area. Having the advantages of proximity to UMRT, competitive urban service could be provided taking account of encouragement of urban character of Hanoi. Figure 4.2.5 shows example of competitive urban function of urban core at station areas in Hanoi CBD.

Figure 4.2.5 Formulation of Competitive Commercial Business Development through Station Area Redevelopment



Source: JICA project team

477 Some stations of UMRT lines would have great opportunities to revitalize station area where large properties by SOE or private sector locate in the vicinity of UMRT stations. Old collective housing estates, large factories and other large commercial and business properties could be candidates to be incorporated in to station area development. Especially present large railway yards locating in the city center of Hanoi such as Hanoi station area, Giap Bat station area are planned areas for urban

development by the feasibility study of Line1.

478 Redevelopment of the area will encourage new investments and transform a rail property into more valuable and profitable uses, aside from creating attractive urban space for Hanoi citizens (e.g. open space, cultural and leisure facilities, other urban public service facilities). A new urban lifestyle can emerge in the Hanoi urban core places by station area development.

479 From a public transport standpoint, this re-development will increase ridership on UMRT due to the introduction of high traffic attractions and generators. The development intensity should be set to medium-high density commensurate for commercial and business purposes.

3) New Urban Area Development at Station Area through Adequate Development Measures

480 Some stations of UMRT lines locate in agriculture field of rural area. These stations' surroundings require inevitably access development and urban development through effective development measures. It is necessary for new town development at station area to encourage and promote well-organized urban form taking account of high-density and mixed use development in the proximity to station.

4) Livable Living Environment through Station Area Improvement

481 Due to new UMRT development in existing urban area, planned stations sometimes locate in residential areas by poor living conditions. It is necessary for station area not only to maximize development opportunities for commercial and business, but also to encourage and promote improvement living conditions introducing possible mechanism such as cross-subsidy by development benefit sharing.

5) Underground Developments

482 Urban land in the city center of Hanoi is facing scarcity of supply against land demand by socio-economic activities expansion in association with its strict development control and public consensus. UMRT, especially Line2 as underground subway will give opportunities underground development in conjunction with its station development in order to maximize land utilization of underground area at station area, although the scale and opportunities for underground development will depend on the resolution of legal issues concerning property rights on underground spaces.

483 There are several type of underground facilities in conjunction with station development by i) access and transportation facilities (underpass, underground parking), ii) underground public open space (sunken plaza, etc) and iii) commercial and business facilities (underground shopping-mall, underground floor spaces under commercial business building). Although public underground facilities needs its space and property under public property such as road and park, more attractive underground space formulation requires integrated development with underground spaces of private sector..

6) Proposed Urban Revitalization by Station Area of Line1 and Line2

484 Table 4.2.8 summarizes proposed urban revitalization component at each station area of Line1 and Line2.

Table 4.2.8 Formulation of Station Area Development by Urban Revitalization Program

| Name of Station | | Urban Redevelopment | | | | Living Condition Improvement | | New Urban Area Development | | Underground Dev |
|-----------------|-----------------------|---------------------|------------|----|-----|------------------------------|-----|----------------------------|-----|-----------------|
| | | RY | Planned RD | LP | KTT | NW | INF | Planned NT | PNT | |
| UMRT Line1 | V1. Yen Vien | ● | -- | ● | -- | ● | -- | -- | ● | -- |
| | V2. Cau Duong | -- | -- | -- | -- | -- | ● | ● | -- | -- |
| | V3. Duc Giang | -- | -- | ○ | -- | -- | ● | ● | -- | -- |
| | V4. Gia Lam | ● | -- | ● | -- | -- | ● | ● | -- | ○ |
| | V5. Bac Cau Long Bien | -- | ○ | -- | -- | -- | ○ | ● | -- | -- |
| | V6. Nam Cau Long Bien | -- | -- | -- | -- | -- | ○ | -- | -- | ● |
| | V7. Phung Hung | -- | -- | -- | -- | -- | ○ | -- | -- | -- |
| | V8. Hanoi | ● | -- | ○ | ● | -- | ● | -- | -- | ● |
| | V9. C.V.Thong Nhat | -- | -- | -- | -- | -- | ● | -- | -- | ○ |
| | V10. B.V. Back Mai | -- | -- | -- | -- | -- | ○ | -- | -- | -- |
| | V11. Phuong Liet | -- | -- | -- | -- | -- | ○ | -- | -- | -- |
| | V12. Giap Bat | ● | -- | ○ | -- | ● | ● | -- | ● | -- |
| | V13. Hoang Liet | -- | -- | ● | -- | -- | ● | -- | ● | -- |
| | V14. Van Dien | -- | -- | -- | -- | -- | ● | -- | ● | -- |
| | V15. Vinh Quynh | -- | -- | -- | -- | -- | ● | -- | ● | -- |
| | V16. Ngoc Hoi | -- | -- | ○ | -- | -- | -- | -- | ● | -- |
| UMRT Line2 | C1. Nam T. Long | -- | -- | -- | -- | -- | -- | ● | -- | -- |
| | C2. Ngoai Giao Doan | -- | -- | -- | -- | -- | ○ | ● | -- | -- |
| | C3. Tay Ho Tay | -- | -- | -- | -- | -- | -- | ● | -- | -- |
| | C4. Bui | -- | -- | -- | -- | -- | ○ | -- | -- | -- |
| | C5. Quang Ngu | -- | -- | -- | -- | ● | -- | -- | -- | ○ |
| | C6. Bach Thao | -- | -- | -- | -- | -- | ○ | -- | -- | -- |
| | C7. Ho Tay | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| | C8. Hang Dau | -- | -- | -- | -- | -- | ○ | -- | -- | ● |
| | C9. Hoan Kiem Lake | -- | ● | -- | -- | -- | -- | -- | -- | ● |
| | C10. Tran Hung Dao | -- | -- | ○ | -- | -- | -- | -- | -- | ● |
| | C11. Cau Den | -- | -- | -- | ● | -- | ○ | -- | -- | ○ |
| | C12. Bach Khoa | -- | -- | -- | -- | -- | ○ | -- | -- | ○ |
| | C13. Kim Lien | -- | ● | -- | ● | -- | ○ | -- | -- | ○ |
| | C14. Chua Boc | -- | -- | ● | ● | -- | ○ | -- | -- | ○ |
| | C15. Nga Tu So | -- | ● | ● | -- | -- | -- | -- | -- | ● |
| | C16. Thuong Dinh | -- | ● | ● | ● | -- | -- | -- | -- | ○ |

Note: RY= existing Railway Yard (VNR), Planned RD= Redevelopment plan by public or private sector, LP= large property of factories or company, KTT= Old collective housing area, NW=Urban renewal, INF=infrastructure and utilities provision, Planned NT= New Town development plan by public or private sector, PNT= Proposed New Town development

● = compulsory, ○ = case by case or partially, -- = not applicable

Source: JICA project team referring to various planned projects