

4.2 Social and Economic Framework

4.2.1 Economic Framework

(1) GDP

1) GDP in 2020

The late 90's saw Vietnamese economy proceeding to a high growth on track, with the Foreign Direct Investment (FDI) playing an important role as catalyst. In the near future, the key element to the economic growth of Vietnam shall be FDI; therefore, the active promotion of FDI will be required. The major investors to Vietnam, on the other hand, have been France, the USA and those of Asian countries, which have been facing economic difficulties in recent years. To estimate the economic growth, the JICA Study Team came up with the following scenarios.

The most optimistic scenario is as follows:

- The financial crisis covering the neighboring countries will end within a few years owing to international cooperation and the adoption of appropriate policies by each Government, thereafter the Asian dynamism resurfaces.
- The growth of Vietnamese economy in the year 2000 will slightly fall short of its target or maintain its current situation. From the year 2000 onwards the Vietnamese economy will recover and move to a higher growth track with the expanding inflow of FDI.
- Regarding FDI, the major sector will be manufacturing. The investment for service sector will increase.
- The economic growth will cause the economic structure change to an industry-oriented one. Share of the first sector to the Gross Domestic Product (GDP), therefore, shall decline rapidly and the secondary sector shall be the prime engine for economy. With the expansion of the secondary sector, the income level will be go up and, in the long run, the purchasing power generated by the rising income will provoke the tertiary sector to grow.

The most pessimistic scenario, on the other hand, is as follows:

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- Recovery of the Asian economies is delayed until the year 2005 unavoidably caused by the rather long aftereffects of the financial crisis.
- The low inflow of FDI will slow down the growth of Vietnamese economy.
- Effects of recession will remain till the year 2005 at the least, thereafter, signs of recovery will show gradually.
- The Vietnamese economy will return to its growing track at the year 2010.

There is a third scenario, that is, the intermediate growth scenario. The difference among the scenarios is to consider the period of economic or financial crisis and that of aftereffects. In other words, when the Vietnamese economy will return to the high growth pass is the important question. In the optimistic case, it is expected at the year 2000, and the pessimistic at the year 2010. The third one, therefore, presumes it to be year 2005. The JICA Study Team projected the GDP in each case. The results of the estimate are summarized in the Table 4.2.1.

Table 4.2.1 GDP Estimation

	1997	2000	2005	2010	2015	2020
GDP(c.'97) Bill. VND	295,700	372,492	573,125	902,235	1,453,059	2,340,166
		362,240	520,043	764,114	1,175,683	1,893,450
		352,179	471,295	661,015	971,248	1,564,204
Per-capita GDP ('000 VND)	3,854.8	4,623.8	6,576.3	9,667.1	14,667.4	22,512.4
		4,496.5	5,967.2	8,187.2	11,875.6	18,215.0
		4,371.6	5,407.8	7,082.6	9,810.6	15,047.7
G.R. GDP	8.8%	8.0%	9.0%	9.5%	10.0%	10.0%
		7.0%	7.5%	8.0%	9.0%	10.0%
		6.0%	6.0%	7.0%	8.0%	10.0%
Population	76,710	80,560	87,150	93,330	99,000	103,950

Source: JICA Study Team

Note: Per-capita GDP is indicated as constant price in 1997. The nominal per-capita GDP shall be around two times as that of constant price. The population (unit: thousand) is adopted at the case of medium.

The scale of GDP will be 5-8 times in 2020 to compare with that in 1997. The JICA Study Team, hereafter, uses the medium case as GDP.

2) Per-capita GDP

The per-capita GDP in 2020 will be five times as that in 1997. However, it will still be a very low level as indicated by the US Dollar. Assuming the exchange rate to be fixed at the middle of 1998 at US\$ 1.00 VND 13,900, the per-capita GDP in 2020 will be US\$ 1,310. In the long run, however, the value of constant price would diminish since the

basket for the price determination will change. The nominal indicator of per-capita GDP is estimated at US\$ 2,580 in 2010. In general, the inflation rate will be higher in the case of high growth than that of low growth, therefore, the nominal per-capita GDP in case of the higher growth might be some US\$ 4,500.

3) Economic Structure

Although the primary sector marks a moderate growth, the share to the GDP gradually decreases during the projection period and reaches 16.5 % in 2010 and 11 % in 2020 (See Table 4.2.2). The secondary sector, on the other hand, grows at some 10 % and above, and the share to the GDP gains 40 % in 2010 and 43.5 % in 2020. Regarding the tertiary sector, during the early projection period, the growth rate is slightly moderate and thereafter it shows a pronounced increase and the share to the GDP is 43.5 % in 2010 and 45.5 % in 2020. In 2020 it achieve the industrialized society. The first sector, especially the agriculture falls from the leading sector but remains as the important sector.

Table 4.2.2 Economic Structure

		1997	2000	2005	2010	2020
Primary	Amount (bil. VND)	76,028	86,938	104,009	126,079	208,280
	Share (%)	25.7	24.0	20.0	16.5	11.0
	Growth (%)	-	4.6	3.7	3.9	5.1
Secondary	Amount (bil. VND)	93,849	123,162	195,016	305,646	823,655
	Share (%)	31.7	34.0	37.5	40.0	43.5
	Growth (%)	-	9.5	9.6	9.4	10.4
Tertiary	Amount (bil. VND)	125,819	152,141	221,018	332,390	861,524
	Share (%)	42.6	42.0	42.5	43.5	45.5
	Growth (%)	-	6.5	7.8	8.5	10.0

Source: JICA Study Team

Note: Growth indicates the annual average growth rate.

(2) Economic Structure in Red River Delta Region and HMA

1) Red River Delta Region

Since the regional data in time series is limited, the JICA Study Team, using the sectoral output as proxy variables for Gross regional Domestic Product (GRDP) component, estimated the GRDP and economic structure in Red River Delta (RRD). In case of the national economy, the Study Team estimated the GDP through the scenario at first and the calculated GDP as benchmark was distributed to the economic sectors. The economic structure was estimated at first and then the GRDP was calculated. In the calculation, the provincial share of each proxy variable, such as the provincial agricultural out put to those

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of first sector, provincial manufacture output to second and retail sales to the tertiary, to the whole country, was calculated. The share to the nation is assumed to be stable. The GDP component of whole country was distributed by the structure. Therefore, the expected GRDP in each group of provinces is slightly moderate or their regional structure is rather stable. The GRDP and economic structure in RRD Region are summarized in the Table 4.2.3.

Table 4.2.3 GRDP and Economic Structure in RR Delta Region

	2000	2005	2010	2020
GRDP (billion VND)	65,724	94,170	138,018	339,929
Primary (billion VND)	17,006	20,384	24,733	40,837
Secondary (billion VND)	21,973	34,858	54,685	147,287
Tertiary (billion VND)	26,745	38,928	58,600	151,804
Primary (%)	25.9	21.6	17.9	12.0
Secondary (%)	33.4	37.0	39.6	43.3
Tertiary (%)	40.7	41.3	42.5	44.7
GRDP Growth Rate (%)	6.9	7.5	7.9	9.4
Per-capita GRDP (1,000 VND)	4,679	6,198	8,482	18,756

Source: JICA Study Team

Note: Since the available data in the RRD is limited, the coverage area of RRD in the population estimation is different from that in GRDP estimation. In this section, the area of RRD consists of the following provinces: Hanoi, Hai Phong, Ha Tay, Hung Yen, Hai Duong, Thai Binh, Ha Nam, Nam Dinh, and Ninh Binh. The growth rate indicated in year 2000 is the annual average from 1997-2000. The population allocation used in the calculation of per-capita GRDP was that of current population structure.

2) Hanoi Metropolitan Area (HMA)

Although HMA covers 7,800 km², the urban area is the focal point. In the HMA M/P, the projected economic activities are rather weak, except for Hanoi City, as indicated by its economic structure. The estimation of the economic structure in HMA aims to contribute to set the economic framework in the Corridor21 Development. Since published economic data on the urban area is unavailable, the JICA Study Team considered using Hanoi data to proxy variables anew. The expected Hanoi GRDP will be similar to that of the HMA. Bases of the hypothesis are as follows:

- The objectives of HMA-M/P are directed towards the distribution of the expected population to Hanoi.
- The estimated Hanoi GRDP, excluding those generated by the projects in HMA-M/P, will be considered as the results of the economic activities generated by the above expected population.

Since the above hypothesis ignores the ripple effect from the development of the projects in HMA-M/P, the following GRDP might be considered as understated. The GRDP and per-capita GRDP in HMA are presented in the Table 4.2.4.

Table 4.2.4 Economic Structure in HMA

	2005	2010	2020
GRDP (billion VND)	38,211	57,629	151,654
Primary (billion VND)	1,188	1,982	531
Secondary (billion VND)	15,338	25,933	69,230
Tertiary (billion VND)	21,685	29,714	81,893
Primary (%)	3.11	3.44	0.35
Secondary (%)	40.14	45.00	45.65
Tertiary (%)	56.75	51.56	54.00
G.R. GRDP	8.0	8.6	10.2
Per-capita GRDP (1,000 VND)	15,855	16,367	32,042

Source: JICA Study Team estimates based on the modification of the M/P for Hanoi capital up to 2020 by HN-PC and MOC.

(3) Economic Framework in the Corridor 21 Development

Based on the economic structure and per-capita GRDP in HMA-M/P, the economic framework in the Corridor 21 Development is drawn up assuming the following scenario:

- The prime engine of the Corridor 21 Development at its early stage shall be the R&D and education institutes, high-tech industries and its supporting industries, construction, and related services. The share of secondary sector, therefore, is rather high.
- The primary sector occupies a certain position until mid-term, thereafter, the share to the GRDP falls sharply.
- The tertiary sector will be the followers except for the R&D institutes and software industry. The share to the GRDP, therefore, is rather low.
- The economic structure in 2020 shall be much sophisticated and the productivity in each sector shall be highest in the country.

Under the above scenario and the working population estimated in the previous section, the JICA Study Team worked out the economic framework in the Corridor 21 Development. In the early stage, the low-productivity sector, such as the existing agricultural sector, remains, with its portion, relatively large. Therefore, the per-capita GRDP is slightly lower than that of Hanoi. Next period is positioned as that of expansion, with both secondary and tertiary sectors having a 10 % share and an increasing growth rate, and the

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industry-driven GRDP is more than double. The per-capita GRDP exceeds that of Hanoi at least in the year 2020. The target economic framework in the Corridor 21 Development is summarized in the Table 4.2.5.

Table 4.2.5 Economic Framework in the Corridor 21 Development

	2005	2010	2020
GRDP (billion VND)	2,608	5,185	26,949
Primary (billion VND)	287	461	135
Secondary (billion VND)	1,134	2,309	13,340
Tertiary (billion VND)	1,187	2,415	13,474
Primary (%)	11.0	8.90	0.50
Secondary (%)	43.5	44.53	49.50
Tertiary (%)	45.5	46.57	50.00
Per-capita GRDP (1,000 VND)	9,513	13,094	33,644

Source: JICA Study Team

4.2.2 Population

(1) Whole Country

Vietnam had a population of around 76 million in 1997. The rate of population growth in the early 90's was over 2 %, however the rate has been gradually decreasing from 1992 after reaching a peak of 2.4 %. The targeted growth rate in 1997 of 1.8 was achieved after adoption of "one or two family planning programs". Population distribution in Vietnam is characterized by large populations in the rural areas, which has a stable 80 % share to the total. However, in the process of modernization and industrialization, the population distribution shall change from rural to urban. There are at least three reasons to accelerate the migration from rural to urban,

- Capacity of maintenance of increasing population will be difficult to expand in the rural,
- Income difference between urban and rural is increasing, and
- Target industrial and service sectors growth shall require much labor force.

The basic scenario of the population projection is as follows:

- The whole population will gradually increase, but the growth rate will decline, and
- The urban population will increase dramatically and the urban population ratio will reach the same level with other ASEAN countries.

From a review of existing studies, the population projection is summarized as presented in the Table 4.2.6.

Table 4.2.6 Population Projection

Unit: 1,000 persons

	1995	1996	2000	2005	2010	2015	2020
Case-1	73,962	75,355	80,863	87,781	94,669	101,485	108,189
High Growth	2.0 %	1.9 %	1.80 %	1.66 %	1.52 %	1.40 %	1.29 %
Case-2			80,560	87,151	93,326	99,000	103,951
Mid. Growth			1.72 %	1.59 %	1.38 %	1.19 %	0.98 %
Case-3			79,678	84,784	89,109	93,654	98,432
Low Growth			1.50 %	1.25 %	1.00 %	1.00 %	1.00 %

Source: Case-1 is calculated based on the GSO projection to be adjusted by the recent year. Case-2 is the projection by GSO. While Case-3 is IHTP projection by JICA.

Note: The lower rows of each case indicate the average annual growth rate. In the recent Ha Tay Development Plans, the population of the whole country is assumed at around 95 million in 2010, which is similar to Case 1.

Based on the total population and urban population projection by the National Institute for Urban and Rural Planning (NIURP) under MOC, the urban population is projected. The NIURP projection was conducted in 1992 and excluded the social inflow and outflow. In this projection, in order to include migration, the difference between the estimate in 1995 and real population in 1995 is assumed as the net migration. Under this assumption, the estimates of younger generation are possibly over-shoot since the migrant structure is presumed to be the same as that of previous period. The urban population in 2020 is projected as some 32 million or 30% of the total. The result is summarized in the Table 4.2.7.

Table 4.2.7 Urban Population of Vietnam

Unit: 1,000 persons

	1995	2000	2005	2010	2015	2020
Total	14,575	17,388	20,438	23,867	27,704	31,979
Male	7,068	8,492	10,039	11,775	13,719	15,891
Female	7,507	8,895	10,400	12,092	13,985	16,088
Urban population-ratio (%)	19.7	21.6	23.5	25.6	28.0	30.1

Source: Worked out by the JICA Study Team based on NIURP projection.

Note: U-ratio is an abbreviation of urban population rate and calculated to Case-2.

(2) Red River Delta Region

Population, especially urban population in RRD Region is one of the bases for the project's justification. To estimate the RRD population, the JICA Study Team began a review of the RRD-M/P submitted in 1995. The population of RRD in 1993 was estimated at

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around 17 million, or 24 % of the whole country. The urban population rate was 16.7 %, which was slightly less than the national average of 19.2 %. The urban population rate in each province varied widely. The rates recorded by Hanoi of 51 %, Quang Ninh of 48 %, and Hai Phong of 34 % were higher. In the remaining provinces, the rate was below 10 % except for Ha Nam and Vinh Phu (both provinces garnered only 11.6 % and 11.4 % respectively), and that of Ha Tay was only 6.3 % in 1993. The estimated population is summarized as shown in the Table 4.2.8.

Table 4.2.8 Population of RRD in 1993

	Population (Thousand)	Urban (Thousand)	Rural (Thousand)	Urban Rate (%)	Population Density (persons/km ²)	Area (km ²)
Hanoi	2,155	1,106	1,049	51.32	2,341	921
Hai Phong	1,584	532	1,052	33.59	1,053	1,504
Hai Hung	2,658	137	2,521	5.15	1,042	2,551
Ha Tay	2,218	140	2,078	6.31	1,033	2,147
Nam Ha	2,586	299	2,287	11.56	1,038	2,492
Ninh Binh	840	70	770	8.33	605	1,388
Thai Binh	1,768	102	1,666	5.77	1,172	1,509
Ha Back	1,620	103	1,517	6.36	1,000	1,620
Quang Ninh	480	232	248	48.33	444	1,080
Vinh Phuc	1,141	130	1,011	11.39	796	1,433
Total	17,050	2,851	14,199	16.72	1,024	16,645

Source: RRD-M/P, MOSTE, 1995

Note: RRD in this table includes three provinces such as Ha Back, Quang Ninh, and Vinh Phu, which are categorized as North East Region in the Statistical Year Book by the GSO. Hai Hung, Nam Ha, and Ha Back were divided into two provinces respectively in recent years.

In order to estimate the population of RRD, the JICA Study Team presumed that the population share of RRD to the whole country would be same during the projection period. This assumption is rather strict, and the result might be underestimation. There are some estimates related to the RRD population, migrants, and urban population in RRD-M/P. However, the JICA Study Team had different views on such estimates since both total population and natural population growth rates were rather big. The natural population growth rate, which is defined as the annual growth rate of total population minus net migration, was estimated as 3.9 % in 1993-2000, 1.9 % in 2001-2010, and 1.65 % in 2011-2020. Regarding urban population, the rate of urban population to the total is also quite high. In the RRDM/P, the urban population rate was estimated as 47.9 % in 2020. In case of Hanoi, the population was estimated around 7.2 million. It is quite difficult to consider that the average land per-capita is only 128 m². In this case, the dividend is the whole territory of Hanoi including the water surface, mountain, public use and so on.

Regarding urban population, the JICA Study Team estimates it to be similar to that of neighboring countries at 35 %. Based on the above assumptions, the RRD population in 2020 will be around 24-26 million, and the urban population around 8-9 million. The projection of the RRD total and urban population is summarized as shown in the Table 4.2.9.

Table 4.2.9 Estimated Population of RRD

Unit: Thousand persons						
	1993	2000	2005	2010	2015	2020
Total Population						
High Case		19,407	21,067	22,721	24,356	25,965
Middle Case	17,050	19,334	20,916	22,398	23,760	24,948
Low Case		19,123	20,348	21,386	22,477	23,624
Urban Population						
Urban Ratio (%)	16%	23%	26%	29%	32%	35%
High Case		4,464	5,477	6,589	7,794	9,088
Middle Case	2,851	4,447	5,438	6,495	7,603	8,732
Low Case		4,398	5,290	6,202	7,193	8,268

Source: JICA Study Team

Note: Each of the cases corresponds to the projection of whole country. The urbanization is assumed to grow in a linear form.

(3) Urban Population in MHA

Since the Corridor 21 Development is the one component of the Hanoi Metropolitan Area Master Plan (MHA-M/P) up to 2020, the urban population of HMA estimated in HMA-M/P as 4.5 to 5 million should be assessed. Based on the estimate of the RRD urban population, the possibility of such urban population will be confirmed. The HMA consists of Hanoi and the surrounding four provinces of Ha Tay, Ving Phuc, Bac Ninh, and Hung Yen. The last two provinces are newly established. The urban population of the HMA in 1993 was around 1.6 million or less. The urban population share of the HMA to the RRD, therefore, was around 56 %. When this share of 56% is maintained during the period, the urban population of HMA in 2020 is calculated at 4.6-5.1 million. The target urban population of HMA-M/P is confirmed by the results.

Table 4.2.10 Estimated Urban Population in HMA

	1993	2000	2005	2010	2015	2020
High Case		2,500	3,067	3,690	4,365	5,089
Middle Case	1,604	2,490	3,045	3,637	4,258	4,890
Low Case		2,463	2,962	3,473	4,028	4,630

Source: JICA Study Team

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(4) Population Framework

In the MOC Plan, the Corridor 21 is allocated a population of one million, which is the same as the H/MAM/P. The schedule of the increment of population in the MOC Plan is summarized in the Table 4.2.11.

Table 4.2.11 Population Framework by MOC

Name of District	1996	2005	2010	2020
1. Son Tay	40,000	60,000	80,000	100,000
2. Hoa Lac	44,000	150,000	420,000	670,000
3. Xuan Mai	35,000	60,000	90,000	170,000
4. Mieu Mon	1,000	5,000	10,000	30,000
5. Reservation		10,000	20,000	30,000
Total Population	120,000	285,000	620,000	1,000,000

Source: NIURP/MOC

Note: The army force is excluded.

As for the population framework by the MOC, there are several questions that need to be answered and issues to be addressed:

- Is it possible to commence the development of four areas in parallel?
- At a time when the population pressure from Hanoi is still small at the initial stage, the attractiveness of the new town for potential migrants must be prepared and must be such that it would gain for them a much better life than in Hanoi.
- Is it possible to provide a lot of job opportunities at the first stage, this being one of the attractions to the new town?
- Can the Project remain unaffected when the economic crisis in neighbouring countries causes Vietnam's economy to slow down?

After careful assessment of the above, the JICA Study Team worked out the population framework as follows:

- Commuters to Hanoi shall be minimal in the initial stage.
- Migration to the Corridor 21 Development shall be insignificant without the job opportunities.
- Recession shall influence the Development causing delay of job creation and financial difficulty.
- Population framework shall be reconstructed based on the review of existing plans composing the Development.

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The target population of one million by MOC should be realized, however the target year to reach the planned population should be postponed.

One of the objectives of the Development in the Corridor 21 Development is to establish a place that can absorb partly the expanding Hanoi population. Since the mass-transportation system between Hanoi and the Corridor 21 Development is still a long way in the future (at least after 2010), the commuting between them is quite few. This indicates that in the Corridor 21 Development, a 'people-follow-job' situation shall be required. In this context, to set the population framework equals to consider job creation.

Based on the review of the existing plans, the job creation in each component is shown in the Table 4.2.12.

Table 4.2.12 Working Population

	Phase-1A	Phase-1B	Phase-2
VNU	7,100	9,900	14,700
HHTP	9,000	15,000	25,000
Manufacture	12,000	24,000	60,000
Construction	12,000	19,400	32,900
Services	10,000	18,000	45,000
Existing	31,600	31,600	31,600
Commuting to Hanoi	-	-	22,000
TOTAL	81,700	117,900	231,200

Source: JICA Study Team estimates based on the review of existing plans.

Note: Commuters to Hanoi will reside subject to the development of mass transportation.

Based on the working population, the total population of the Corridor 21 Development was calculated, with an assumption made on the average number of a family. The result is summarized as shown in the Table 4.2.13.

Table 4.2.13 Population in Corridor 21

	Short-Term	Mid-term	Long Term
Total Population	231,500	322,000	594,000
Son Tay	50,000	60,000	90,000
Hoa Lac	135,000	205,000	400,000
Xuan Mai	45,000	55,000	100,000
Mieu Mon	1,500	2,000	4,000

Source: JICA Study Team

CHAPTER 5

SPATIAL DEVELOPMENT PLAN



CHAPTER 5 Spatial Development Plan

5.1 Basic Concept

5.1.1 Characteristics of the Corridor 21 Development

The Study Area will also remain unchanged from the plan by MOC, including the areas of Son Tay, Hoa Lac, Xuan Mai, and Mieu Mon, together with Dong Mo Resort Area. However, as explained heretofore, the M/P will only cover the Hoa Lac and Xuan Mai Urban Area as the M/P Area due to its relative importance and significance for priority implementation.

The four urban areas which constitutes the Corridor 21 Development are located along NR21A in the form of mutually independent but chained “clusters”. Therefore, the Corridor 21 Development should take the advantages of their locational and characteristic features as mentioned below:

- (a) Harmony with the natural environment,
- (b) Rationale of adopting the phased development,
- (c) Development of the four urban areas by differentiating their distinctive clusters,
and
- (d) Flexibility of each cluster to ensure the long-term development.

Whilst, the cluster development has some subjects to be solved, such as how to efficiently integrate the clusters involved, how to individualize the clusters, and how to develop an attractive C-21 urban center that can cover the whole clusters. In this context, the four urban areas are suitable for the cluster development because of their locational and characteristic features, having the C-21 urban center in the Hoa Lac Urban Area where the prime functions such as VNU and HHTP are introduced as a core of the whole clusters. Hoa Lac can meet the requirements for the development of the large-scale urban center due to its central location of the Corridor 21 Development with the Lang-Hoa Lac Highway directly linked to the central Hanoi area.

Also, the planned four functions in the Hoa Lac Urban Area will remain unchanged such as VNU, HHTP, Phu Cat Industrial Zone, and Dong Xuan Residential District. However, the JICA Study Team is of the opinion that the part of the Phu Cat Area near the proposed Center

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Area should be used for catering amenities for the people residing in Hoa Lac such as sports and recreation, amusement parks, events plaza, and so on.

As for the four functions in the Hoa Lac Urban Area, which are divided into four areas divided by NR21A and the Lang-Hoa Lac Highway, the JICA Study Team will basically keep the MOC plan as the VNU in the northwest; HHTP in the northeast; Residential Area in the southwest; and Industrial Zone in the southeast. However, it is quite debatable from the urban planning aspect that the four functional areas will have their own land use “genuinely and exclusively” using the land of more than 1,000 hectares over the future. According to the on-going plans of VNU and HHTP, they have their own residential areas and service centers within their areas, but from the urban planning aspect, it is highly desirable that each area will have close functional linkages apart from their own specific ones, and they should be integrated as a “united town” rather than separated functional areas.

5.1.2 The Process of the Development Plan

To create a large-scale town like the Corridor 21 Development requires massive investments and various policy options for the implementation such as relocation of universities, development of a high-tech park, provision of community services such as schools and hospitals, establishment of an attractive urban center, creation of various types of jobs, construction of massive infrastructure including off-site and on-site transportation, and preservation of the natural environment. Particularly, development of a mass railway transit (MRT) system linking the central Hanoi and the Corridor 21 Development is important if the Corridor 21 Development attracts more people and companies to come in, but its implementation involves a considerable time and cost, and hence, it would be a long-term subject.

Inevitably, the Corridor 21 Development will be a time-consuming project which requires formulation of consensus among the parties concerned, allocation of budget and arranging project financing, involving the private sector by sharing responsibilities, coping with continual changing circumstances, and so on.

Also, from the urban planning aspect, there is a potential danger if the Corridor 21 Development is developed in a short time, due to probable creation of a homogeneous social structure in terms of generation, job, income level, and so on. Therefore, it is important to develop the Corridor 21 Development over the considerable time period so that it can absorb more diverse categories of people, thus making itself more balanced, diverse, and vivacious.

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It is envisaged that the economic and social environment of Vietnam could change faster than expected in the future, and hence, development plan needs to be flexible to ensure proper response to the changing situations, thus necessitating the process planning approach based on a behavioral theory.

Also, to make the plan more economically viable, minimizing the infrastructure cost by means of pursuing a “compact development” is important, whilst maximizing the development effects. Therefore, it is necessary for the four areas in Hoa Lac to inter-link each other so that they should really function as one integrated and compact area. In this context, the Project should be developed in a well coordinated and orchestrated manner under the strong initiative of the Central Government.

5.1.3 Arterial Road Network

The existing NR21A, a backbone of the Corridor 21 Development, and the highway between Hanoi and Mt. Ba Vi should remain as is planned. In addition to these two arterial roads, a NR21 Bypass should be constructed to link the four urban areas. This NR21 Bypass could be used as part of the future outer ring road in the HMA. When the Lang-Hoa Lac Highway be extended to Mt. Ba Vi, the proposed route is to run the NR21 Bypass towards the north, and then across the NR21A in the north of Hoa Lac to run towards Mt. Ba Vi. This is to avoid the adverse environmental effects onto the C-21 Urban Center. Figure 5.5.1 shows the alternative schemes of the NR21 Bypass.

The NR21 Bypass avoids heavy traffic going into the Center Area, and enables the existing NR21A to use a community boulevard providing a cheerful, attractive, main street of the Corridor 21 Development. The Lang-Hoa Lac Highway will have a full-scale interchange with the NR21 Bypass, instead of the existing NR21A, so that negative environmental effects should not be created in the Center Area in Hoa Lac.

This NR21 Bypass concept is a common environmental policy adopted in many cities in the world. By providing the interchange at the intersection with the NR21 Bypass, it makes possible to save the precious land around the Center Area otherwise used for the interchange. Thus, the saved space can be used for more value-added purposes in the Center Area. The Center Area should be best accessible from adjacent areas, and the C-21 Urban Center is ideal location in this context. The proposed MRT system needs to have its central station in the proximity of the Center Area although it comes in the distant future.

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The east-west arterial road network planned by the on-going VNU and HHTP plans are not linked each other except for those running the south of VNU/HHTP and the north perimeters. This concept stems from the original MOC plan where VNU and HHTP will be completely separated with the high-standard highway (upgraded NR21A) together with wide (about 250 meters in width) green belts on both sides of the highway.

Whereas, according to the proposed concept, such high-standard highway will be provided as NR21 Bypass, and the existing NR21A will be utilized as a symbolic major urban artery such as a community boulevard, and as such, both sides of the NR21A need to be utilized as precious urban spaces. Under the proposed concept, VNU and HHTP need to be linked each other with appropriate east-west major arterial roads, which is quite essential to ensure the functional linkage between VNU and HHTP in the fields of Human Resource Development (HRD) and Research & Development (R&D) operations.

Also, ingress and egress to HHTP is planned mainly to and from NR 21 Bypass, which is deemed reasonable as far as physical distribution is concerned but inconvenient for the intra-area traffic running the east-west or north-south directions. Appropriate east-west arterial roads as well as north-south arterial roads need to be provided to facilitate the traffic flows between VNU and HHTP as well as between VNU, Dong Xuan and Center Area, and between HHTP, Phu Cat Area and Center Area.

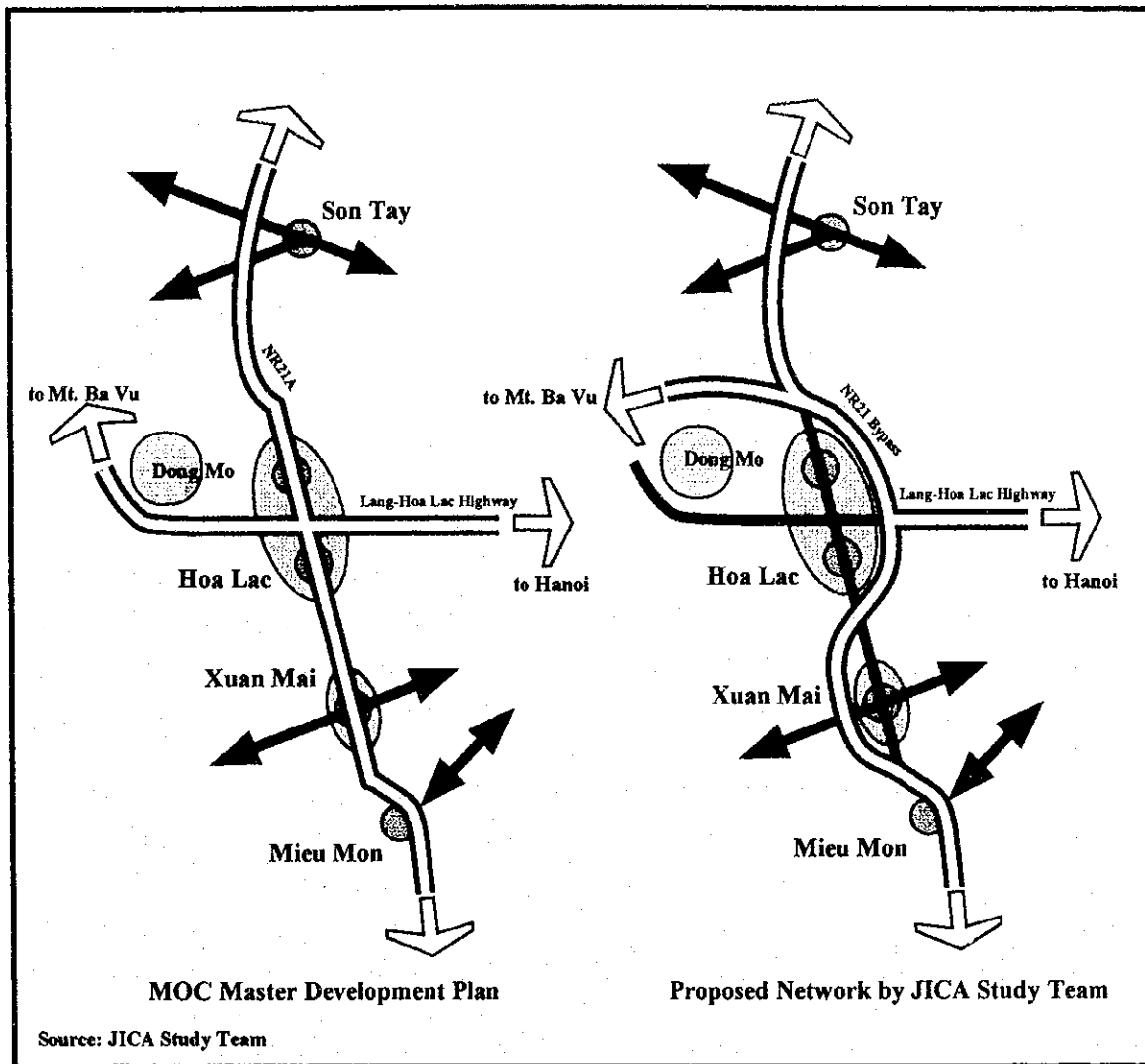


Figure 5.1.1 Alternatives of National Road 21 Bypass

5.1.4 Establishment of the C-21 Urban Center

An urban center represents the attractiveness of a town. According to the surveys conducted in Japan, majority of people appreciated most the attractiveness of an urban center amongst other attractive functions of cities. An urban center is a place where business, public administration, culture, information, hotels, and transportation are concentrated, and where people gather. Those activities are the very reasons for the existence of a city.

Locational conditions of an urban center should be easily accessible from various places. The center of Hoa Lac where the intersection of the existing NR21A and the Lang-Hoa Lac highway is located, satisfies this condition. In addition, this urban center is located just adjacent to the four functional areas such as VNU, HHTP, industrial park in Phu Cat, and residential area of Dong Xuan. Figure 5.1.2 shows the concept on the location of the Center Area in Hoa Lac.

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This locational condition unique to Hoa Lac enables to create a unique urban center. Usually, an urban center primarily has the functions of commerce and business, nodal point of transports, various administrative services, recreation and amenities, hotels and restaurants, culture and information, and so on. But the urban center of Hoa Lac will have not only those common functions, but also involve the functions of education, science and research, and as such, may include libraries, art and historical museums, convention hall, science & technology (S&T) and industrial museum, and so on. Linking to the developments in Son Tay, Dong Mo and Mt. Ba Vi tourism including international events and conventions, the C-21 Urban Center Area can collect international visitors, coupled with the functions as the HRD and R&D centers.

It is particularly important for the four areas to coordinate to create a “compact” urban center at the first phase of the development. Creating a compact urban center brings about an attractive urban space that will help achieve the target population. For the connection between the urban center and the four areas, a “bicycle road” for exclusive use of bicycles will be provided apart from ordinary road systems, as a model of an “Eco-City” in the 21st century.

According to the Japanese experience, the urban center of the Senri New Town was designed to have 30 ha with the target population of 150,000 which results in 2 m² per person. The Center Area is still functional even after the population increased to 300,000 due to accumulation of the commerce and business area. Similarly, the urban center of the Tama New Town was designed to have 60 ha with the target population of 300,000 resulting in 2 m² per person.

When the Corridor 21 Development absorb one million population in the long future, the C-21 Urban Center in Hoa Lac should provide various urban services to the people living in a wider area, which probably implies that the Center Area should have a larger area as experienced in Japan. Therefore, the C-21 Urban Center Area is designed to have 3 m² per person, which eventually requires 300 ha when one million target population be realized. The wider Center Area having sufficient space would be justified if diverse cultural and information functions can be induced taking full advantage of the existence of VNU and HHTP.

5.1.5 Flexibility of the Urban Development and Establishment of a Garden City

In order for the development plan to flexibly response to changes in the future, a belt-shaped zone along the existing NR21A should be designated as an urban development area, and any development activities outside the area should be strictly prohibited or regulated. The Corridor 21 Development should be implemented on a step-by-step basis within the designated area towards the north-south axis along the NR21A. Even when the development tends to ripple

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over the planned area, it should still be implemented within the designated belt zone. This kind of urban structure can be called a ladder structure along the existing NR21A.

As the Corridor 21 Development is an environmental friendly model town of the 21st century, the existing plan should carefully preserve the natural environment within the development area so that it may be called as a “Garden City” or “Eco-city”. At the end of the 19th century, Dr. Howard, prominent British Town Planner, advocated the concept of a “garden city”. According to his concept, an ideal town is the town where convenient urban life and natural environment coexist. A garden city can be created if the natural environment outside a town is strictly preserved over the future. To apply the concept, it is necessary to preserve the natural environment or agricultural areas around the Corridor 21 Development as they are at present.

In addition, networking the designated natural environment within the Corridor 21 Development and outside green areas is preferred to create a “green network” for the Corridor 21 Development.

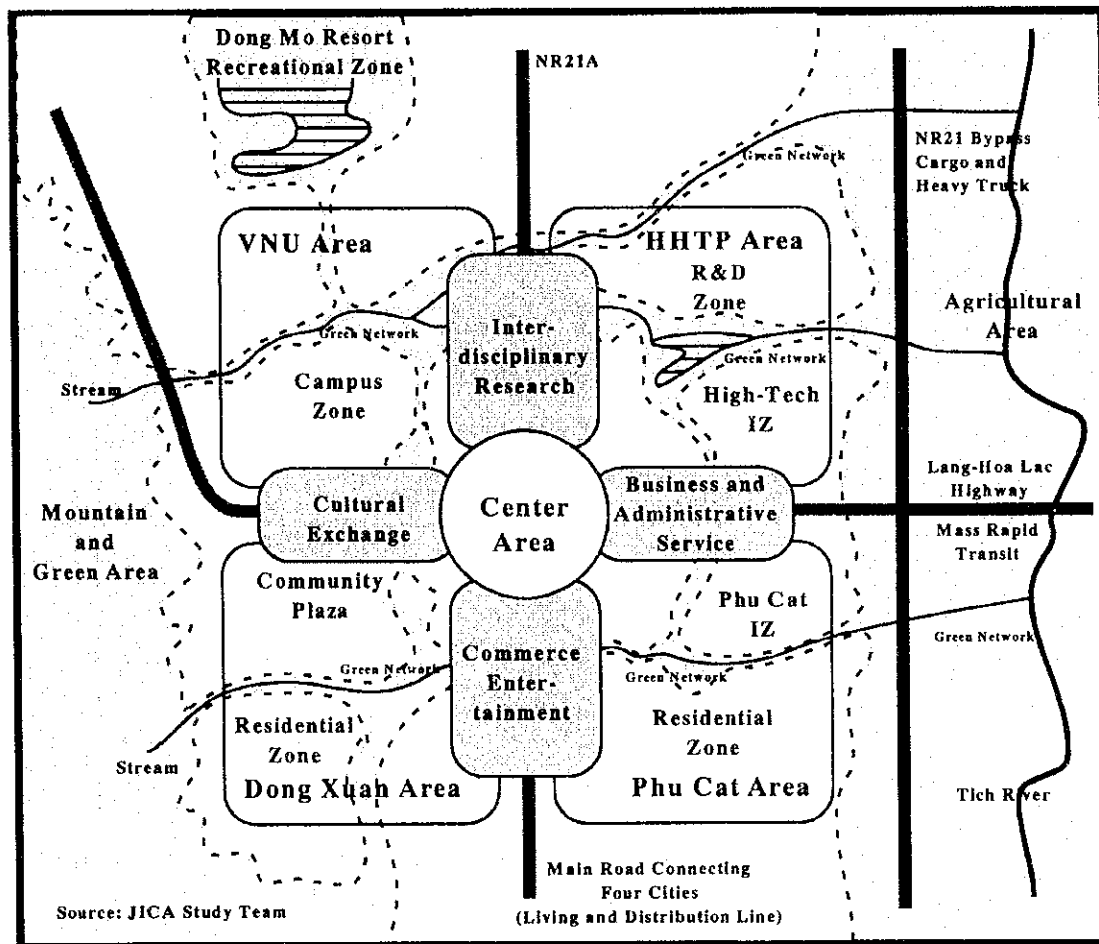


Figure 5.1.2 Concept of Center Area Development in Hoa Lac

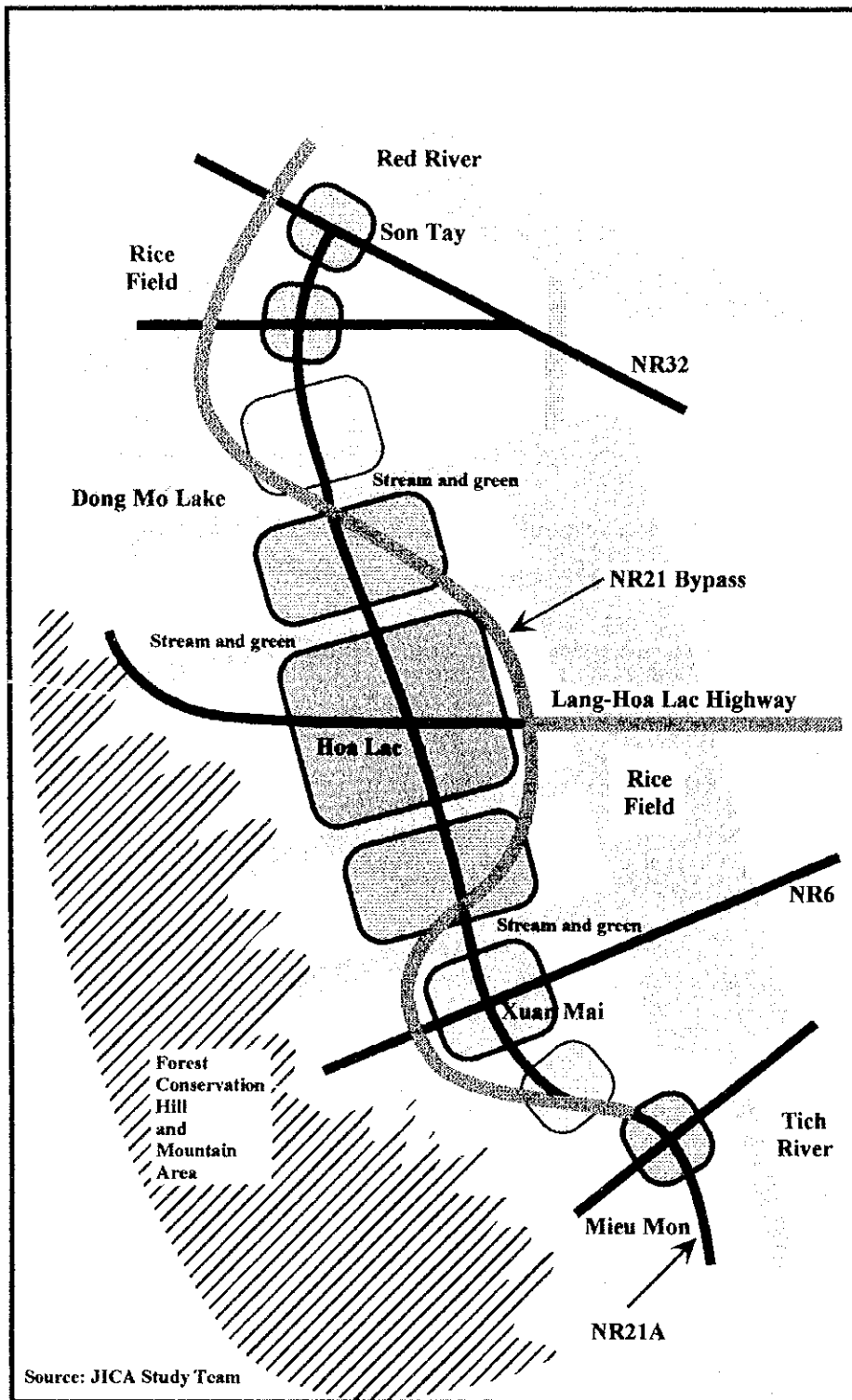


Figure 5.1.3 Balancing of Corridor Development and Conservation of Surrounding Environment

5.2 Planning Framework

This section discusses the establishment of the spatial development framework of the Corridor 21 Development. The target year of the C-21 Development is 2020. The population targeted by the M/P prepared by MOC is one million. In consideration of the M/P prepared by MOC and reality of this target population, the one million population should be treated as a long-term target. In this section, the development framework of the C-21 Development is determined by each phase: 2005, 2010, 2020 and long-term.

5.2.1 Population and Housing Supply Framework

(1) Population

Based on the social and economic framework determined previously, population of Son Tay, Hoa Lac, Xuan Mai, and Mieu Mon is decided as follows. According to the MOC M/P, the population of 2020 is; 100,000 in Son Tay, 670,000 in Hoa Lac; 170,000 in Xuan Mai; and 30,000 in Mieu Mon (See Table 5.2.1). However, according to the study done by the JICA Study Team, it is impossible to allocate 670,000 people in Hoa Lac Urban Area in terms of appropriate development land allocation, so that the JICA Study Team proposes the following population framework.

Table 5.2.1 Population Framework

Unit: persons

Name of Urban Area	Present (1996)	Destination According to Planning Stages			
		Phase-1A (2005)	Phase-1B (2006-2010)	Phase-2 (2011-2020)	Long-Term (2020)
Son Tay Urban Area	40,000	50,000	60,000	90,000	150,000
Hoa Lac Urban Area	44,000	135,000 (32,000)	205,000 (43,000)	400,000 (65,000)	570,000 (110,000)
Dong Mo Area	0	10,000	20,000	30,000	30,000
Xuan Mai Urban Area	35,000	45,000	55,000	100,000	200,000
Mieu Mon Urban Area	1,000	1,500	2,000	4,000	50,000
Total	120,000	241,500 (32,000)	342,000 (43,000)	624,000 (65,000)	1,000,000 (110,000)

Source: JICA Study Team

Note: A parenthesis shows the number of students and their family members.

(2) The Number of Households

In accordance with the population of each area, excluding the number of students, the Table 5.2.2 shows the number of households when the average number of persons per household is four.

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Table 5.2.2 The Number of Households

Unit: households

Name of Urban Area	Present (1996)	Destination According to Planning Stages			
		Phase-1A	Phase-1B	Phase-2	Long-Term
Son Tay Urban Area	10,000	12,500	15,000	22,500	37,500
Hoa Lac Urban Area	11,000	25,750	40,500	83,750	115,000
Dong Mo Area	0	2,500	5,000	7,500	7,500
Xuan Mai Urban Area	8,750	11,250	13,750	25,000	50,000
Mieu Mon Urban Area	250	400	500	1,000	12,500
Total	30,000	52,400	74,750	139,750	222,500

Source: JICA Study Team

(3) Framework of Housing Supply

Approximately 30 % of the incremental population in the Corridor 21 Development Area are estimated to be allocated in existing villages and their expansion areas. Table 5.2.3 shows the number of housing units necessary to be supplied in the newly developed area to absorb the rest of the incremental population.

Table 5.2.3 The Number of Housing Units Necessary to be Supplied in the Corridor 21 Development Area

Unit: housing

Name of Urban Area	Distribution According to Planning Stages				Total
	Phase-1 (1996 - 2005)	Phase-1B (2005 - 2010)	Phase-2 (2011 - 2020)	Long-Term (2020)	
Son Tay Urban Area	1,750	1,750	5,250	10,500	19,250
Hoa Lac Urban Area	10,300	10,300	30,300	21,900	72,800
Dong Mo Area	1,750	1,750	1,750	0	5,250
Xuan Mai Urban Area	1,750	1,750	7,900	17,500	28,900
Mieu Mon Urban Area	100	100	350	8,050	8,600
Total	15,650	15,650	45,550	57,950	134,800

Source: JICA Study Team

(4) Framework of Employed Residents

When the rate of working population is 50 %, the number of employed residents is calculated in the Table 5.2.4.

Table 5.2.4 The Number of Employed Residents

Unit: persons

Name of Urban Area	Present (1996)	Destination According to Planning Stages			
		Phase-1A	Phase-1B	Phase-2	Long-Term
Son Tay Urban Area	16,000	25,000	30,000	45,000	75,000
Hoa Lac Urban Area	17,600	51,500	81,000	167,500	230,000
Dong Mo Area	0	5,000	10,000	15,000	15,000
Xuan Mai Urban Area	14,000	22,500	27,500	50,000	100,000
Mieu Mon Urban Area	400	800	1,000	2,000	25,000
Total	48,000	104,800	149,500	279,500	445,000

Source: JICA Study Team

Employed population by industry is calculated in the Table 5.2.5.

Table 5.2.5 Employed Population by Industry

Unit: persons

Industry	Distribution According to Planning Stages							
	Phase-1A		Phase-1B		Phase-2		Long-Term	
	(persons)	(%)	(persons)	(%)	(persons)	(%)	(persons)	(%)
Existing Industry	48,000	42.7	48,000	30.2	48,000	17.7	48,000	10.8
University	7,100	6.3	9,900	6.2	14,700	5.4	25,000	5.6
R&D Business	2,700	2.4	5,300	3.3	9,600	3.5	18,000	4.0
Manufacturing	24,000	21.3	43,500	27.4	96,100	35.4	185,000	41.6
Construction	15,000	13.3	23,000	14.5	30,300	11.2	49,000	11.0
Service Sector	15,700	14.0	29,200	18.4	72,500	26.7	120,000	27.0
Total	112,500	100.0	158,900	100.0	271,200	100.0	445,000	100.0
Commuter from Hanoi	7,700		9,400		13,700		20,000	
Commuter to Hanoi	0		0		22,000		50,000	
Employed Residents	104,800		149,500		279,500		445,000	

Source: JICA Study Team

Note: Service sector includes Dong Mo Cultural Village

5.2.2 Urban Development Framework

- On the base of the population and employment frameworks, the necessary development area of each area is calculated under the following conditions:
- The residential development area (The number of housing units necessary to be supplied x 300 m²/unit (75 m²/person))
- The industrial development area (The number of labors involved in manufacturing x 100 m²/person (100 persons/ha))
- The university development area (The number of students x 110 m²/person (90 persons/ha) + the extra area for additional facilities)

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- The R&D development area (The number of labors involved in R&D x 330 m²/person (30 persons/ha))
- The business and commercial development area (The Urban Center Area)
- The recreation development area (Dong Mo Cultural Village follows the MOC master plan)
- Other (Including the area for Olympic Game Complex (Phu Cat Area), Golf Course (HHTP Area) and so on)

The development area by land use of the Corridor 21 Development Area and the necessary development area by phase are mentioned in the Table 5.2.6 and Table 5.2.7.

Table 5.2.6 Development Framework of Corridor 21 Development

Land Use	Phase-1A		Phase-1B		Phase-2		Long-Term	
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)
Urban Center	50	2.9	120	3.7	210	3.0	300	2.9
University	490	28.8	590	18.4	820	11.9	1,240	12.0
R&D Business	90	5.3	150	4.7	270	3.9	500	4.8
Industry	230	13.5	420	13.1	940	13.6	1,850	17.9
Culture and Tourism	350	20.6	850	26.5	2,090	30.2	2,090	20.3
Residential	430	25.3	860	26.8	2,300	33.3	4,050	39.3
Others	60	3.5	220	6.9	280	4.1	280	2.7
Total	1,700	100.0	3,210	100.0	6,910	100.0	10,310	100.0

Source: JICA Study Team

Table 5.2.7 Development Framework of Each Area

Area	Unit: ha			
	Phase-1A (ha)	Phase-1B (ha)	Phase-2 (ha)	Long-Term (ha)
Son Tay Urban Area	110	200	460	980
Hoa Lac Urban Area	1,080	1,870	3,570	5,050
Dong Mo Area	400	950	2,250	2,250
Xuan Mai Urban Area	110	190	610	1,570
Mieu Mon Urban Area	0	0	20	460
Total	1,700	3,210	6,910	10,310

Source: JICA Study Team

5.3 Land Use Plan for the Year 2020 and the One Million Town

5.3.1 Corridor 21 Urban Center Area

Before discussing the urban center of the Corridor 21 Development Area, this section starts with the case of Japanese new town planning, the Senri New Town and Tama New Town, for reference. The total area of the Senri New Town is 26 ha, and the target population is 150,000.

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Thus, the area per person is 1.7 m²/person. The total area of the Tama New Town is 60 ha, and the target population is 300,000, which implies that the area per person is 2 m²/person.

The Senri New Town has good extensive road services. The urban center is located where people have easy access from surrounding areas. Therefore, the range using the urban center includes the surrounding areas of the New Town. In addition, there are not many green and open spaces within the New Town. On the other hand, the surrounding areas of the Tama New Town are green spaces and not urbanized. The majority of people using the urban center are residents of the Tama New Town. There is a nine-hectare park in the urban center, and the area per person of the urban center excluding green spaces becomes 1.7 m²/persons.

According to the MOC master plan, the civic area (626 ha) is about 18 % of the residential area (3,480 ha). The civic area includes all facility development area. If half of the civic area is the urban center area, about 9 % of the residential zone, which is 313 ha, is the urban center area. The target population of the Corridor 21 Development is one million. Thus, the area per person becomes 3 m²/person. In the case that the population of Hoa Lac is 670,000, the area per person becomes 5 m²/person.

It is obvious that the urban center of the Corridor 21 Development becomes the urban center of not only the Corridor 21 Development but also its surrounding areas, because currently, there is no urbanized area in the surrounding areas of the Corridor 21 Development, except Son Tay. Therefore, at least, the target population of the urban center, including Hoa Lac, can be one million. The urban center is located in the intersection between Lang-Hoa Lac Highway and NR21A. Its area becomes 300 ha and 3 m²/person.

The residential zone is concentrated along NR21A of Phu Cat Area and in Dong Xuan Area. It is estimated that 60,000 students live in VNU Area by 2020, and in the further future the number increases to 100,000. Important urban facilities such as commercial facilities and terminals of buses and trains are located near the intersection between Lang-Hoa Lac Highway and NR 21A of Dong Xuan Area because the rest of the residential zone is allocated in northern part of VNU and HHTP Areas. Half of the Center Area, 150 ha, is allocated in Dong Xuan Area, and each 50 ha is allocated in VNU, HHTP, and Phu Cat Areas.

There exist independent mountains whose height is around 100 meters in the Dong Xuan and VNU Areas. These mountains are used as green spaces of the sub-urban center and an observatory. This green space exceeds 30 ha, and extensive urban roads, Lang-Hoa Lac Highway and NR21A, occupy about 40 ha. Besides, a large park and green belts are expected to be located. The total facility development area becomes fewer than 200 ha. Therefore, as

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for the target population of one million people, the area per person becomes 2 m²/person and 3.5 m²/person for 570,000 people in Hoa Lac.

5.3.2 Land Use Plan for the Year 2020

As the urban development framework discussed as mentioned above, the target population and newly developed area of the Corridor 21 Development by Phase-2 are: 90,000 people and 460 ha in Son Tay, 400,000 people and 3,570 ha in Hoa Lac, 100,000 people and 610 ha in Xuan Mai, and 4,000 people and 20 ha in Mieu Mon. If existing villages and their future development area are added, the total target area of the Corridor 21 Development becomes: 860 ha in Son Tay, 5,070 ha in Hoa Lac, 1,000 ha in Xuan Mai, and 20 ha in Mieu Mon. These areas become larger if reserved rivers, lakes, mountains, and low lands are included. As a result of accurate investigation on the area of Hoa Lac and Xuan Mai, the area of Hoa Lac is about 6,000 ha, which is 18 % more than the above number, and the area of Xuan Mai is 1,380 ha, which is 38 % more. Therefore, if 20 % is taken as the middle number between 18 % and 26 %, the area of Son Tay becomes approximately 1,030 ha.

(1) Son Tay Area

It is expected that the present population of Son Tay, which is 50,000, almost double to 90,000. Of 90,000, about 30 % are allocated in existing villages and towns, and the rest are allocated in the newly developed residential zone.

Existing villages have their core in an old town including the ruins of a castle in Son Tay. Son Tay town is located where NR21A diverges to the Mt. Ba Vi. NR21 Bypass is along the Tich River in Hoa Lac, which is the east border of the development area. In northern Hoa Lac, NR21 Bypass intersects with NR21A, changes the direction to northwest in order to connect the Dong Mo Lake and Mt. Ba Vi directions, passes west of Son Tay, and finally crosses the Red River.

The industrial zone is established along NR21 Bypass. The development area is about 1,000 ha.

(2) Hoa Lac Area

NR21 Bypass avoids passing through existing villages and is located in the much more west than the MOC master plan. In Dong Xuan Area, the development of the west side of the big mountain is avoided. The east foot of the mountain is the target development area

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by Phase-2. Thus, the development area spreads over from north to south. The south of the airport in VNU Area is also the target development area.

(3) Xuan Mai Area

The Corridor 21 Development proposes to exclude the east of NR21A from the development area because the area is low land. As a result, the development area becomes half of the MOC master plan. NR21 Bypass passes along the east of the Hoa Lac Urban Area until the southeast tip, changes its direction to west, goes south along the west side of Mieu Mon Urban, crosses NR6, changes its direction to southeast, and eventually merges with NR21A.

(4) Mieu Mon Area

There are small limestone mountains in Mieu Mon and currently 400 people living in a plain of the MOC master plan area. The population by Phase-2 is estimated to be 2,000. The full-scale development of this area would start after Phase-2, or in other words, after the second international airport next to Hanoi is decided to be constructed in Mieu Mon. Until the time of the full-scale development comes, the development of Xuan Mai affects the population of Mieu Mon to slightly increase.

5.3.3 Land Use Plan for the One Million Town

It is not clear what processes the Corridor 21 Development goes through to reach the long-term target population of one million. It depends on the development of Vietnam as a whole and even more directly HMA as well as the secondary and tertiary industries in Hoa Lac and Xuan Mai. In addition, the construction of a railway as a substitute of a bus system and the increase in use of recreational sources such as Lake Dong Mo and Mt. Ba Vi are important elements influencing the Corridor 21 Development to be a one-million populated town (See Figure 5.3.1).

This section discusses how the framework established is allocated in each land use. The population distribution is assumed to be 100 m²/person, including the IZ. Depending on the green space, this number can be more than 100 m²/person. The basic development policy is to encourage the flexible urban development along NR21A and its NR21 Bypass running from north to south as a development axis and to control the urban sprawl development toward east and west directions.

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(1) Son Tay Area

It is estimated that the incremental population of Son Tay Urban Area after Phase-2 is 60,000, and that the total population is 150,000. Son Tay is expected to be an old historic town by reserving the historic environment and developing traditional crafts original in Son Tay.

In order to keep the quality of urban space, 40,000 people out of the incremental population are allocated in the residential zone where an existing village, located 5 km west of the junction of NR21A going to the Mt. Ba Vi, is the core. The rest live in Son Tay and two other towns and villages south of Son Tay. The industrial zone develops along NR21 Bypass, in accordance with the same policy as the one applied until Phase-2. The total development area is 1,700 ha. Of the total area, 700 ha is the residential zone, which includes existing villages.

(2) Hoa Lac Urban Area

The incremental population of Hoa Lac Urban Area after Phase-2 is estimated to be 170,000. Of the incremental population, 45,000 are students.

The new development area is the reserved area west of VNU Area and the north area adjacent to paddy fields along NR21A. Paddy fields are reserved as they are. The new development area in HHTP Area is the northern part along NR21A until the area adjacent to paddy fields. In Dong Xuan Area, there are plains between mountains. These plains can be newly developed after Phase-2.

The sum of the new development areas of the above four areas is 2,200 ha. The sum of the new development area and the area developed by Phase-2 becomes 8,200 ha.

(3) Xuan Mai Urban Area

The incremental population of Xuan Mai Urban Area after Phase-2 is 100,000. Most of them are allocated in the north of NR6 and the west of NR21 Bypass. The rest live in the area between NR21A and NR21 Bypass. In addition, the south of NR6 and the west of NR21 Bypass are developed as an industrial zone. The new development area is totally 1,500 ha. Thus, the total area including the area developed by Phase-2 is about 2,900 ha, which includes reserved mountains (160 ha).

(4) Mieu Mon Urban Area

The development of Mieu Mon Urban Area depends on the establishment of the second international airport in this area. In consideration of the wind direction of this area, a runway is located in the direction between north-north-west and south-south-west. That is, it is constructed east of NR21A. The area between the runway and NR21A is used as an industrial zone. The 50,000 populated town is established in the opposite side of the airport. The area developed as a town is 500 ha. In addition, an industrial zone and airport facility area are located in the opposite of the residential zone along NR21A. The runway should be 2 to 3 km away from the residential zone to avoid noise pollution from the airport.

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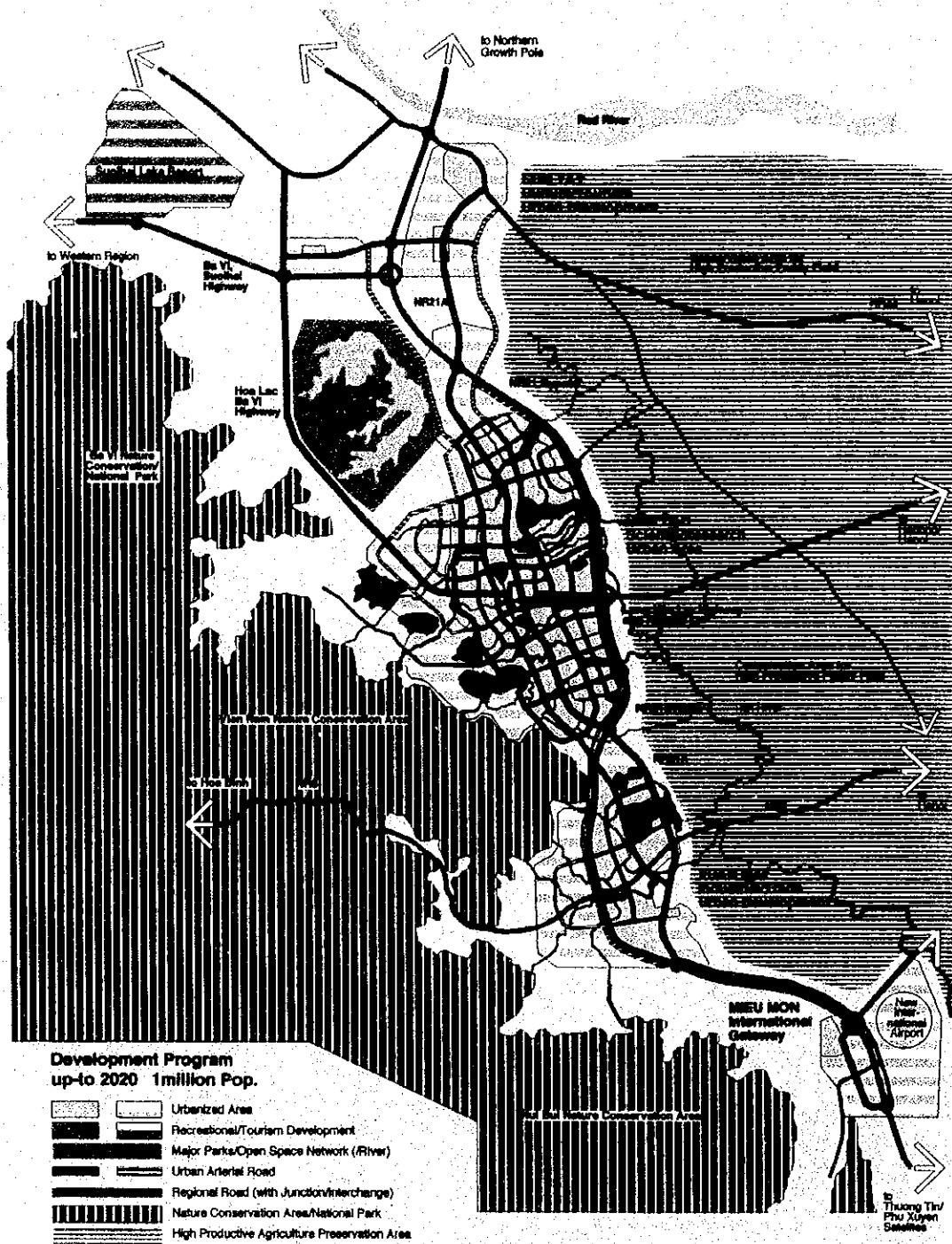


Figure 5.3.1 One Million Populated Town

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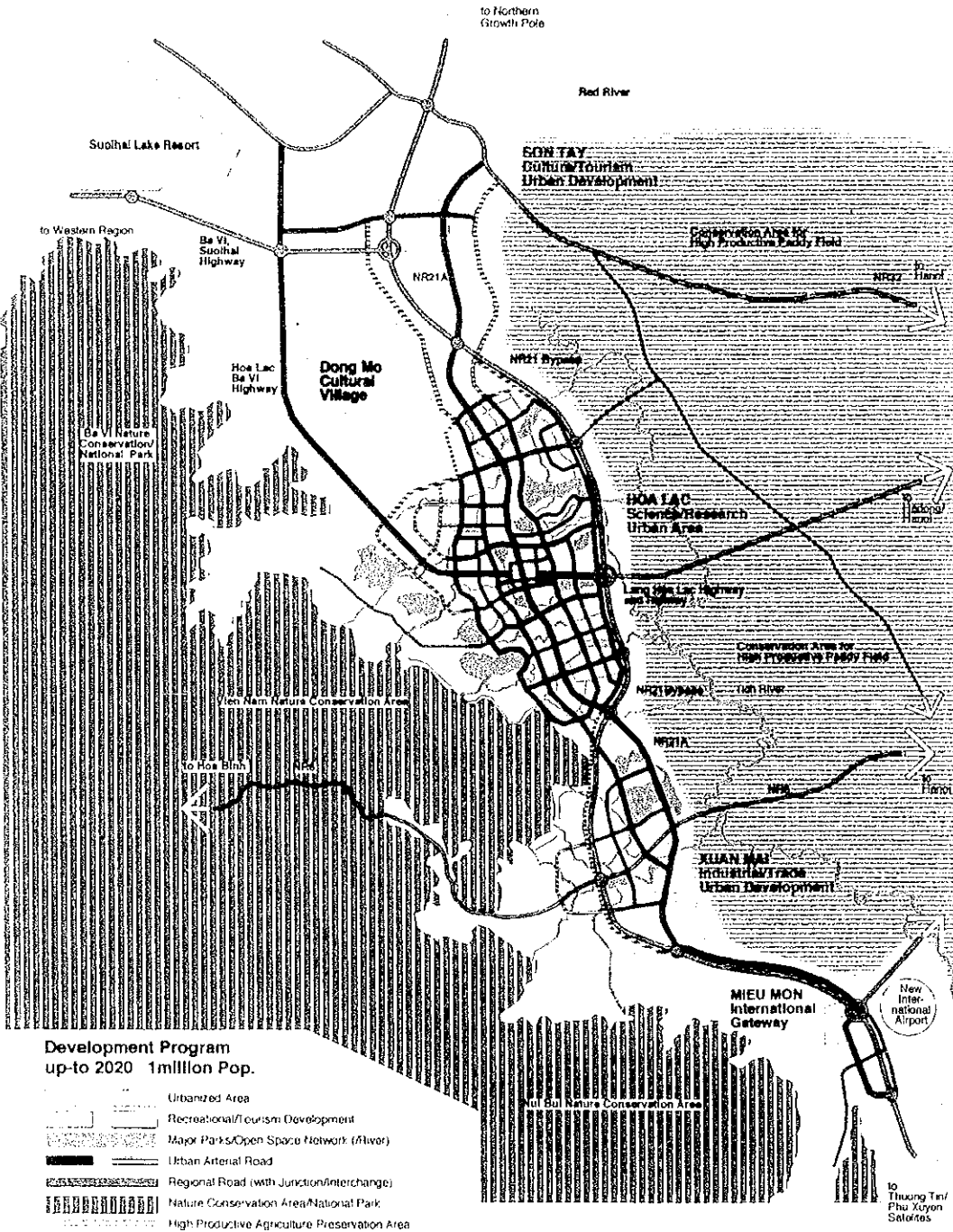


Figure 5.3.1 One Million Populated Town

CHAPTER 6

INFRASTRUCTURE DEVELOPMENT PLAN





Chapter 6 Infrastructure Development Plan

6.1 Overall View

The system and capacity for the first phase infrastructure development is importantly dominated by the definitive development concept and framework for the urban functions introduced in the first phase in the M/P Area. Therefore, detailed studies for the infrastructure development is basically carried out in the next M/P Study on the basis of the established concept and framework. However, in this Chapter attempts will be made on the initial conceptualization of the infrastructure development, particularly in the two major fields, which are the transport sector and the water supply sector.

Beside the technical aspect, the JICA Study Team is of the opinion that the following points need to be considered in the next M/P Study, for the first phase implementation of the infrastructure and other public facilities as well.

- (a) Basic infrastructure such as roads, water supply, sewerage and sanitation, electricity, telecommunications, and so on, should be developed by the proposed Corridor 21 Authority under the Management Board for Urban Development. Relevant responsible line agencies (such as MOT, Electricity of Vietnam (EVN), etc.) should entrust the implementation to the Authority in order to ensure the effective and efficient coordination required for the implementation.
- (b) Similarly, various public and community facilities such as housing, schools, hospitals, and so on, should be initially implemented by the Authority but those facilities deemed possible for privatization should be transferred to the private sector as early as possible.
- (c) Careful studies need to be done as to how the development economy be maximized; in other words, to select the optimum option for the phased development as well as so-called “compact development”, taking into account their investment efficiency.
- (d) Strategic development should be considered to give a positive image of the Hoa Lac Urban Area so that potential investors should be attracted to come in. In this context, the first phase development should pursue the “compactness” by concentrating the functions introduced rather than dispersing them in the spatial

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context. The compact development will naturally result in the saving of construction cost.

- (e) Among the infrastructure development, those possibly compatible with the “private finance initiative” (PFI) should be carefully examined of their commercial viability.

6.2 Transportation

6.2.1 Concept for Transport Network System

Along with the urban development of Hoa Lac Urban Area, it is significant to provide the adequate transport infrastructure facilities for residents, commuters and visitors. This provision should be made mainly in consideration of the future populations, urban scale, facilities and functions based on the development framework of the Study Area.

The C-21 Urban Center area is possibly to be developed as a core of the New Town with academic, residential, industrial and cultural activities. In this regard, the provision of improved access road to the Study Area should be made to cope with their needs. The main purposes of trip for users are assumed as follows;

- Daily life trips of residents within the Hoa Lac Urban Area,
- Weekend trips of residents/students for Hanoi,
- Cargo traffic for distribution between Hoa Lac Urban Area and towns, airports and seaports,
- Commuter’s daily trips for academic or employment purpose, and
- Outside visitors for amusement trip (e.g.: Ba Vi national park and Dong Mo cultural village).

Along with the construction of the Lang-Hoa Lac Highway, the major urban access road NR6 and NR32 should be improved for the new town. In addition, the improvement of NR21A should be considered, which will serve as a major urban corridor in the Hoa Lac New Town. Moreover, provision of additional north-south road in parallel with the existing NR21A as a Bypass should be considered in order to separate daily life traffic for residents from for mainly cargo distribution and through traffic. This proposed NR21 Bypass is considered to serve as a partial section of future regional ring road route in Hanoi area in the long-term view.

6.2.2 Regional Access Road from the Study Area to Seaports and Airports

With the future urban development of Hoa Lac New Town, it is considered that the truck traffic volume will increase between HHTP, Phu Cat IZ and other areas, airport/seaport as a cargo distribution routes. The improvement of these routes is significant for the promotion of industrial activity of the new town. It is noted that the cargo distribution route for other cities and airport/seaport should be provided direct access to the destination without penetrating into the central town of Hanoi to relive urban traffic. Thus, the connection with ring road (RR) or bypass road network should be highly considered in Hanoi area to conduct efficient cargo traffic movement.

The regional access road routes for mainly cargo distribution service between Hoa Lac Urban Area and seaports and airports in the Hanoi region are considered as follows (see Figure 6.2.1). The high priority should be given for the development of these roads along with the Hoa Lac.

Hoa Lac Urban Area: Noi Bai International Airport Route

- Hoa Lac Area / Lang-Hoa Lac Highway / RR3 / Noi Bai International Airport
- Hoa Lac Area / NR21A / Son Tay / NR2 / Noi Bai International Airport

Hoa Lac Area: Hai Phong Seaport/Cai Lan Seaport Route

- Hoa Lac Area / Lang-Hoa Lac Highway / RR3/ NR5 / Hai Phong Seaport
- Hoa Lac Area / Lang-Hoa Lac Highway / RR3/ NR1 / NR18 / Cai Lan Seaport
- Hoa Lac Area / Lang-Hoa Lac Highway / RR3/ NR5 / NR183 / NR18 / Cai Lan Seaport
- Hoa Lac Area / NR21A / NR10 / Hai Phong Seaport
- Hoa Lac Area / NR21A / Son Tay / NR2 / Bac Ninh-NR18 / Cai Lan Seaport

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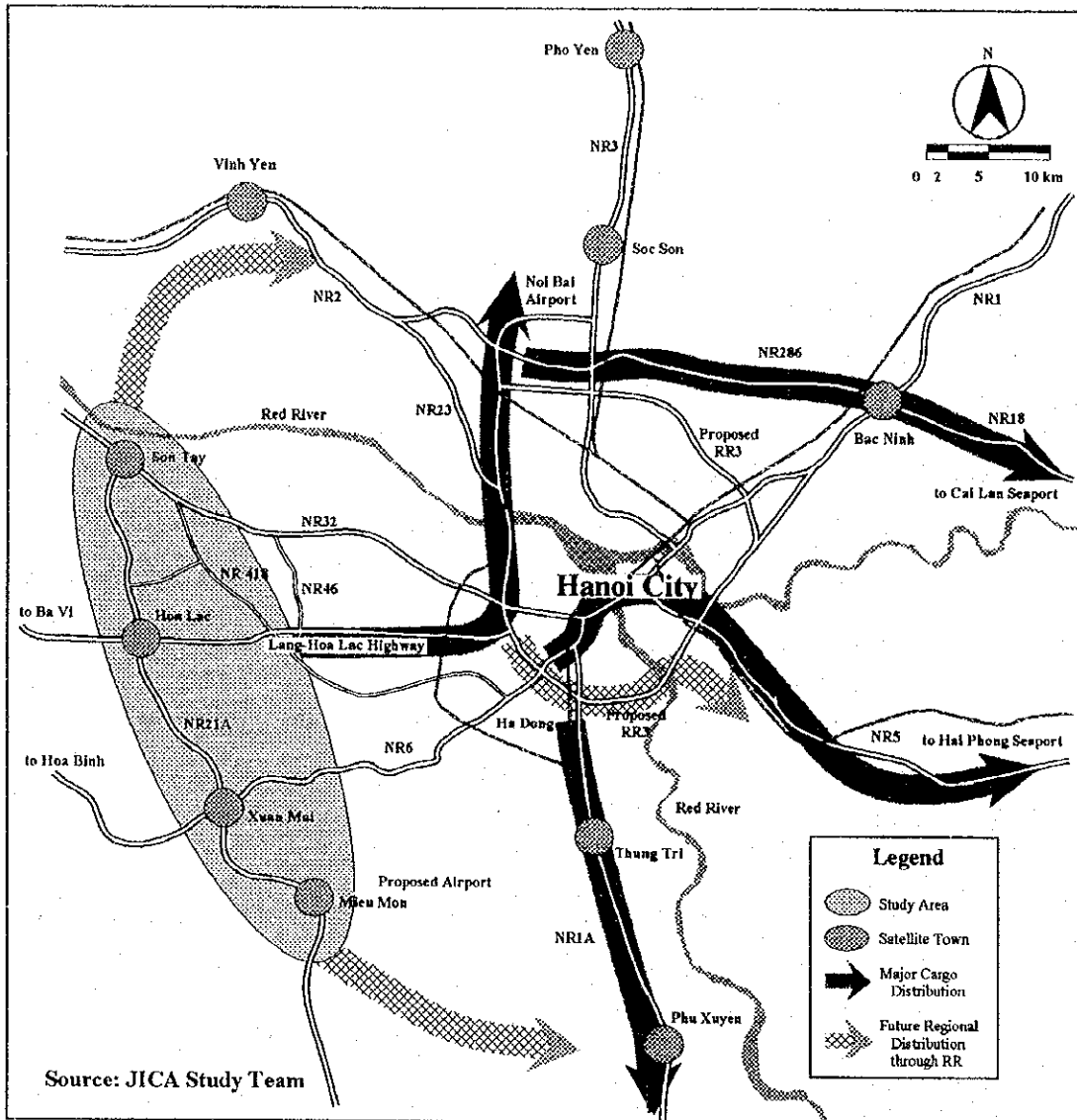


Figure 6.2.1 Regional Transport Network for Distribution

6.2.3 Traffic Demand Forecast

(1) Existing Traffic Volume

According to the traffic volume survey between 1992-1997 by Traffic Management Service in the Ha Tay Transport Authority, the existing traffic volume of the access roads of the Study Area is shown in Table 6.2.1. In addition, the surveying spots on NR6, NR21A, and NR32, are illustrated in Figure 6.2.2.

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In 1997, traffic volume on NR6 at Got Town, about 20 km west of Hanoi, is about 2,700 vehicles/day, counting only 4-wheel vehicles. When converted whole traffic vehicles including motorcycles and bicycles into Passenger Car Unit (PCU), the traffic on this road is about 6,380 PCU day. Of which, the shares of motorcycle and bicycle account for almost 53 %.

Also, the traffic volume on NR32 at Tram Troi, 16 km west of Hanoi, is about 3,500 vehicles/day, excluding 2-wheel vehicles. When converted all types of vehicle including motorcycles and bicycles into PCU, the traffic volume becomes about 10,200 PCU/day. Of which, the shares of motorcycle and bicycle account for almost 70 %.

Furthermore, the traffic volume on NR21A at Hoa Lac and near Xuan Mai Junction are observed as about 634 vehicles and 988 vehicles per day, respectively when counting only 4-wheel vehicles. When converted all types of vehicle into PCU, the traffic volume becomes 2,540 PCU/day and 3,050 PCU/day. Of which, the shares of motorcycle and bicycle account for almost 73 % and 65 %, respectively.

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Table 6.2.1 Existing Traffic Volume of the Access Road in the Study Area

NR6 (at Got)

Unit: Number of Cars

Survey Year	Type of Vehicle									
	Car	Small Truck	Medium Truck	Heavy Truck1)	Heavy Truck2)	Mini Bus	Bus	Sub-Total	Motorcycle	Bicycle
1992	318	222	822	177	39	-	177	1,755	-	-
1993	271	237	699	71	18	-	159	1,455	-	-
1994	221	155	742	76	18	-	131	1,343	-	-
1995	223	182	784	79	33	-	175	1,476	-	-
1996	232	201	669	98	36	-	266	1,502	-	-
1997	572	436	958	292	35	194	227	2,714	6,243	3,929

NR21A (at Xuan Mai)

Unit: Number of Cars

Survey Year	Type of Vehicle									
	Car	Small Truck	Medium Truck	Heavy Truck1)	Heavy Truck2)	Mini Bus	Bus	Sub-Total	Motorcycle	Bicycle
1992	154	186	412	34	6	-	26	818	-	-
1993	173	195	398	48	7	-	28	849	-	-
1994	159	153	440	105	13	-	30	900	-	-
1995	142	193	454	52	13	-	39	893	-	-
1996	266	280	585	220	132	-	173	1,656	-	-
1997	134	181	368	134	10	93	68	988	2,597	3,346

NR21A (at Hoa Lac)

Unit: Number of Cars

Survey Year	Type of Vehicle									
	Car	Small Truck	Medium Truck	Heavy Truck1)	Heavy Truck2)	Mini Bus	Bus	Sub-Total	Motorcycle	Bicycle
1994	266	65	199	39	18	-	21	608	-	-
1995	371	91	210	24	8	-	12	716	-	-
1996	257	83	303	18	7	-	22	690	-	-
1997	194	97	284	12	2	22	23	634	2,696	2,869

NR32 (at Tram Troi)

Unit: Number of Cars

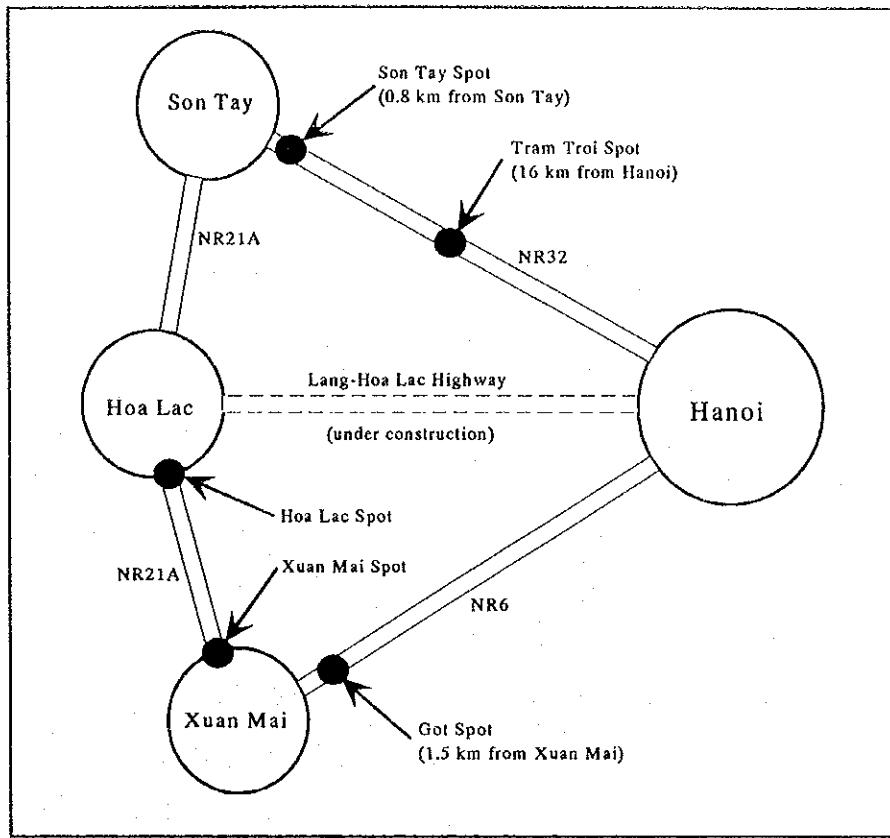
Survey Year	Type of Vehicle									
	Car	Small Truck	Medium Truck	Heavy Truck1)	Heavy Truck2)	Mini Bus	Bus	Sub-Total	Motorcycle	Bicycle
1992	464	194	373	104	67	-	171	1,373	-	-
1993	542	322	434	128	85	-	228	1,739	-	-
1994	613	412	623	259	172	-	537	2,616	-	-
1995	482	352	556	184	134	-	404	2,112	-	-
1996	515	310	385	170	150	-	445	1,975	-	-
1997	558	605	432	156	151	354	311	2,567	7,717	13,722

NR32 (at Son Tay)

Unit: Number of Cars

Survey Year	Type of Vehicle									
	Car	Small Truck	Medium Truck	Heavy Truck1)	Heavy Truck2)	Mini Bus	Bus	Sub-Total	Motorcycle	Bicycle
1992	203	156	390	24	7	-	96	876	-	-
1993	238	129	214	26	7	-	121	735	-	-
1994	808	172	189	44	25	-	138	1,376	-	-
1995	645	198	281	33	14	-	179	1,350	-	-
1996	780	390	390	30	9	-	247	1,846	-	-
1997	742	878	826	48	9	499	470	3,472	13,713	17,250

Source: Traffic Management Survey of Ha Tay Transport Authority



Source: Traffic Management Service of Ha Tay Transport Authority

Figure 6.2.2 Traffic Volume Survey Spot on Access Road

(2) Traffic Demand Forecast

1) Concept

According to socio-economic framework of the Hoa Lac new town proposed through this Study, the traffic demand of the Study Area is forecasted. In consideration of prospective interrelation between Hoa Lac new town and Hanoi area, the traffic demand of east-west traffic section axis including NR6, NR32 and Lang-Hoa Lac Highway is projected. In addition, the traffic demand of north-south traffic section axis on the NR21A is also forecasted to serve as a main corridor of the new town. As a result of the traffic demand projection, the necessity of road improvement is examined to cope with the future transport infrastructure facility.

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2) Method

The future traffic demand on each traffic section axis comprises of the following two components’.

- The traffic demand attributed to natural increase, and
- The traffic demand attributed to development of the New Town.

The future traffic demand on each traffic axis is projected as a total of two components above. For the traffic demand forecast of east-west section axis, Son Tay, Xuan Mai and Mieu Mon is considered in the aspects of mainly natural increase because the development plan is mouth conducted focusing on Hoa Lac Urban Area. In the result of traffic demand by mode, three cases are reviewed in consideration of modal change of vehicles along with future trend of developing public transport (mainly bus) in the area as follows:

Case-1: No transferring motorcycle mode into bus system,

Case-2: Transferring 50 % of motorcycle traffic into bus system, and

Case-3: Transferring 100 % of motorcycle traffic into bus system.

(a) East-West Section Axis (Lang-Hoa Lac Highway, NR6 and NR32)

The traffic demand attributed to natural increase

According to the existing traffic volume on NR6 and NR32 in 1997, the total traffic volume on the sections of both national roads is about 5,000-6000 vehicles/day excluding motorcycles and bicycles. Based on the ratio of current natural increase of traffic volume, the future natural demand is forecasted by regression analysis. As the result of the forecast by natural increase, the traffic demand will reach 11,700 vehicles/day in 2005, 12,100 vehicles/day in 2010, and 12,700 vehicles/day in 2020 (See Table 6.2.2).

The share of modal split is applied based on the result of social survey conducted in this Study. Furthermore, the modal split in 2010 and 2020 is applied to the growth ratio in consideration of future vehicle growth rate in Hanoi. As a result, the ratio of modal split by phase is shown below as Table 6.2.3.

Table 6.2.2 Traffic Demand Projection by Natural Increase

East-West Section		Unit: Vehicle/day				
	Passenger Car	Truck	Bus	Sub-total	Motorcycle	Total
Vehicle Mode Ratio	5.0 %	13.3 %	5.3 %		76.3%	
1997	1,314	3,482	1,390	6,186	19,956	26,142
Phase-1A	2,477	6,565	2,621	11,662	37,623	49,285
Phase-1B	2,568	6,805	2,717	12,090	39,002	51,092
Phase-2	2,694	7,138	2,850	12,682	40,912	53,594

East-West Section		Unit: Vehicle/day				
	Passenger Car	Truck	Bus	Sub-total	Motorcycle	Total
Vehicle Mode Ratio	3.7 %	19.3 %	4.5 %		72.4 %	
1997	134	693	161	988	2,597	3,585
Phase-1A	191	793	317	1,409	3,703	5,112
Phase-1B	202	837	334	1,486	3,907	5,394
Phase-2	216	897	358	1,594	4,189	5,783

Source: JICA Study Team

Table 6.2.3 The Share of Modal Split by Development Phase

	Unit: %			
	Passenger car	Truck	Bus	Motorcycle
Ratio (social survey)	13.5	0.0	13.9	72.5
Phase-1A	13.5	0.0	13.9	72.5
Phase-1B	15.2	0.0	15.5	69.2
Phase-2	17.9	0.0	18.3	63.7

Source: JICA Study Team

The traffic demand attributed to development of New Town

a) Development Framework

The traffic demand by the development is confined to Hoa Lac Urban Area. For the trip purpose, three components are considered; i) commutation to work and school, ii) work-related business and iii) private business purpose. The purpose of work-related business trip is for commercial/office facilities and high-tech industrial facilities. Based on the development framework of the Hoa Lac new town, the future commuting population from/to Hoa Lac Urban Area, land use area and development area, and soon by phase are summarized in Table 6.2.4.

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Table 6.2.4 Development Framework of Hoa Lac Urban Area

Year	Phase-1A (2005)	Phase-1B (2010)	Phase-2 (2020)
Commuter to school & work from /to outside of Hoa Lac Urban Area (including Hanoi area)	7,700 persons	9,400 persons	35,700 persons
Commuter to school & work within Hoa Lac Urban Area	48,500 persons	76,000 persons	136,000 persons
Development area for commercial and office (floor area)	27 ha	54 ha	115 ha
Development lot for high-tech industrial zone	50 ha	80 ha	130 ha
Development lot for Put Cat industrial area	80 ha	100 ha	300 ha

Source: JICA Study Team

b) Trip generation and attraction

Commutation to work and school

According to the framework, the person trip of commuter to work and school from outside of Hoa Lac Urban Area including Hanoi area is available as shown in former Table 6.2.4. Nevertheless, the person trip to school is included in the number of work commutation because the school commuters between Hanoi and Hoa Lac Urban Area is a minor factor within the range of 150-300 students in 2005-2020. The person trip by commuters to work is 15,000 trip/day, 19,000 trip/day and 71,000 trip/day in 2005, 2010 and 2020, respectively. In addition, the person trip to work and school from Hoa Lac Urban Area is 97,000 trip/day in 2005, 152,000 trip/day in 2010 and 272,000 trip/day in 2020.

Business (commercial and office)

According to the manual of "Transport Plan for the Large-Scale Development District" by Ministry of Construction in Japan, the average trip generation and attraction model unit in commercial facility is about 16,000-trip end/ha/day. Under the assumption of long distance from railway station, the modified unit is 12,000-trip end/ha/day. From the same source, the average trip generation and attraction model unit (per floor area) of office is about 4,500-trip end/ha/day. Under the assumption

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of long distance from railway station and no commercial area around office, the modified unit is 2,400-trip end/ha/day.

In addition, according to the manual of "The Survey on Trip Generation and Attraction of Building" by Ministry of Construction in Japan, the average model unit of trip generation and attraction per floor area is; office (1,700 trip end/ha/day), commercial facility (department store 6,800 trip end/ha/day), Hotel (mixed-use: 1,200 trip end/ha/day) and public hall and cultural center (2,200 trip end/ha/day).

This model unit is for mainly commutation for office/commercial, business and shopping. As the trip for commutation to school and work is already considered above, the trip for shopping is only taken into account. Nevertheless, the shopping trip is assumed to conduct within the Hoa Lac Urban Area, the trip to outside of Hoa Lac Urban Area is not considered. The accurate share of trip for business and commutation is not available with current data. For this reason, the trip for business purpose is assumed to be tentatively 50 % of trip. Thus, the model unit (per floor area) of person trip for business is about 1,200-trip end/ha/day.

Based on the building coverage for commercial use, the trip generation and attraction is estimated as about 32,000 (trip end per day), 64,000 (trip end per day) and 137,000 (trip end per day) in 2005, 2010 and 2020, respectively as shown in Table 6.2.5.

Industry (high-tech industry)

The cargo traffic demand of industrial zones from "M/P and F/S on the High-Tech park (HHTP) Project in Hoa Lac" by JICA, (January 1998), is utilized for the traffic demand in HHTP. In addition, the traffic demand for Put Cat industrial Zone was estimated based on the development area for industrial use by HHTP project as shown Table 6.2.6. As a result of cargo demand of the industrial area, the total cargo demand was calculated. The proportion of cargo truck is assumed to be 3-ton truck (50 %) and 4-ton truck (50 %). The future cargo traffic of HHTP and Put Cat industrial zone is 1,600 trucks/day in 2005, 1,900 trucks/day in 2010 and 6,400 trucks/day in 2020, in total as shown in Table 6.2.7 under the assumption of loading capacity of truck (50 %), of which the truck loading ratio is considered as 100 %.

c) Trip Distribution

The trip distribution from outside of Hoa Lac Urban Area for commutation to work, school and business is estimated as shown in Figure 6.2.3 based on the Gravity Model

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method in consideration of the interrelation of population and distance of each area. The trip distribution by purpose from/to Hanoi area accounts for about 90 % in 2010. In addition, the trip distribution for Son Tay and Xuan Mai direction occupies about 5 %, respectively.

In terms of industrial distribution from HHTP and Put Cat industrial zone, the direction of cargo traffic movement is considered for only Hanoi area on the assumption that the destination of cargo traffic is made for mainly Hai Phong seaport and Noi Bai International Airport.

Table 6.2.5 The Total Generation and Attraction of Commercial and Office

	Phase-1A (2005)	Phase-1B (2010)	Phase-2 (2020)
Commercial/office development floor area (ha)	27	54	115
Person trip model unit (TE/ha/D)	1,200	1,200	1,200
Generation trip and attraction (TE/day)	32,040	64,560	137,880

Source: JICA Study Team

Table 6.2.6 Cargo Demand by HHTP Report by JICA

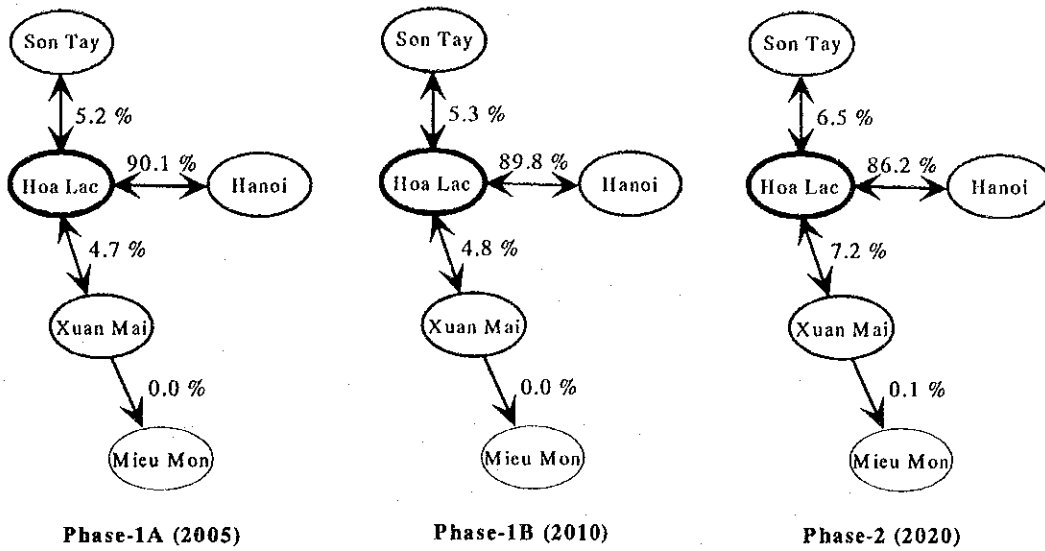
	Unit: ton/day		
	Phase-1A (2005)	Phase-1B (2010)	Phase-2 (2020)
Cargo Demand (outflow)	540	710	1,630
Cargo Demand (inflow)	600	780	1,790
Average	570	745	1,710

Source: JICA Study Team

Table 6.2.7 The Traffic Generation and Attraction by Cargo Truck

	Phase-1A (2005)	Phase-1B (2010)	Phase-2 (2020)
The average cargo volume in Vietnam (ton/vehicle)	3.5	3.5	3.5
Cargo loading ratio (%)	50 %	50 %	50 %
Average capacity of truck loading (ton/vehicle)	1.75	1.75	1.75
Traffic generation by cargo truck (vehicle/day)	847	958	3,232
Traffic generation and attraction by cargo truck (vehicle/day)	1,600	1,900	6,400

Source: JICA Study Team



Source: JICA Study team

Figure 6.2.3 The Ratio of Trip Distribution

d) Modal Split

The mode of vehicles is classified into 4 categories; passenger car, truck, public transport (e.g.: bus) and motorcycle. As the result of the social survey conducted by JICA Study Team through interview of residents both in Hanoi and Hoa Lac, the identical future modal split ratio is applied to the work and private business as shown in Table 6.2.8. In addition, the traffic for industrial activity to/from high-tech industrial park is assumed to use only truck mode. The traffic demand by mode and purpose is shown in Table 6.2.9.

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Table 6.2.8 Person Trip by Mode and Purpose (Development)

Business and Others		Person Trip (trip end/day)	Person Trip by vehicle mode (trip/day)			
			Passenger Car	Truck	Bus	Motorcycl e
Phase-1A	East-West	28,881	3,928	0	4,014	20,939
	North-South	1,503	204	0	209	1,090
Phase-1B	East-West	57,997	8,823	0	9,031	40,143
	North-South	3,153	480	0	491	2,183
Phase-2	East-West	118,845	21,262	0	21,797	75,785
	North-South	10,066	1,801	0	1,846	6,419

Work		Person Trip (trip end/day)	Person Trip by vehicle mode (trip/day)			
			Passenger Car	Truck	Bus	Motorcycl e
Phase-1A	East-West	9,501	1,292	0	1,321	6,888
	North-South	722	98	0	100	524
Phase-1B	East-West	16,889	2,569	0	2,630	11,690
	North-South	918	140	0	143	636
Phase-2	East-West	61,543	11,010	0	11,288	39,245
	North-South	5,212	933	0	956	3,324

Source: JICA Study Team

Table 6.2.9 Traffic Demand by Development

Total Person Trip of Section						Unit: Trip/day
East-West Section	Passenger Car	Truck	Bus	Sub Total	Motorcycl e	Total
Phase-1A	5,220	0	5,335	10,555	27,827	38,382
Phase-1B	11,393	0	11,661	23,054	51,833	74,887
Phase-2	32,273	0	33,085	65,358	115,030	180,388

Total Person Trip of Section						Unit: Trip/day
North- South	Passenger Car	Truck	Bus	Sub Total	Motorcycl e	Total
Phase-1A	303	0	309	612	1,613	2,225
Phase-1B	619	0	634	1,253	2,818	4,071
Phase-2	2,733	0	2,802	5,535	9,743	15,278

Total Traffic Volume of Section						Unit: Vehicle/day
East-West Section	Passenger Car	Truck	Bus	Sub Total	Motorcycl e	Total
Phase-1A	1,338	1,600	213	3,151	19,877	23,028
Phase-1B	2,921	1,900	466	5,287	37,023	42,310
Phase-2	8,275	6,400	1,322	15,997	82,164	98,161

Total Traffic Volume of Section						Unit: Vehicle/day
North- South	Passenger Car	Truck	Bus	Sub Total	Motorcycl e	Total
Phase-1A	78	0	12	90	1,152	1,242
Phase-1B	159	0	25	184	2,013	2,197
Phase-2	701	0	112	813	6,959	7,772

Average Occupancy Rate						Unit: Persons
	Passenger Car	Truck	Bus		Motorcycl e	Bicycle
	3.90	2.18	25.03		1.40	1.05

Source: JICA Study Team

e) Traffic Demand Forecast

Traffic Demand by modes

The total of person trip and traffic demand (vehicle/day) by natural inverse and development is summarized in Table 6.2.10. In consideration of number of trips and average occupancy rate, the traffic demand by mode is calculated. The traffic demand of HHTP is projected based on the average truck occupancy rate and number of trucks converted from cargo volume. The average occupancy rate of vehicles is applied based on the "M/P of Hanoi Urban Transport Plan" by JICA in 1996. The average occupancy rate of modes is as follows:

- passenger car (3.9 persons/vehicle),

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- truck (2.2 persons/vehicle),
- public transport (25.1 persons/vehicle), and
- motorcycle (1.4 persons/vehicle).

The result of traffic demand by modes

In the section of east-west axis, the traffic demand including motorcycle is about 72,000 vehicles/day in 2005 and 93,000 vehicles/day in 2010. In addition, traffic demand including motorcycle in 2020 is 151,000 vehicles/day. When converted this traffic volume into Passenger Car Unit (PCU), the traffic demand is estimated about 50,000 PCU/day in 2005, 62,000 PCU/day in 2010 and 101,000 PCU/day in 2020. The PCU is assumed as passenger car (1.0 vehicle), truck (2.5 vehicle), bus (1.5 vehicle) and motorcycle (0.3 vehicle) based on the "M/P of Hanoi Urban Transport Plan."

(b) North-South Section Axis (NR21A)

Basically, identical concept (total of natural increase and development) is applied to the traffic demand projection for north-south section axis by utilizing same method as that of east-west section axis.

The traffic demand attributed to natural increase

According to the existing traffic volume on NR21A 1997, the total traffic volume on the sections of both national roads is less than 1,000 vehicles/day excluding motorcycles and bicycles. As the result of the forecast by natural increase, the traffic demand including motorcycle will reach about 6,300 vehicles/day in 2005, 7,500 vehicles/day in 2010, and 13,500 vehicles/day in 2020. The share of future vehicle mode is decided by applying to future vehicle growth ratio used for the traffic forecast in east-west section axis.

The traffic demand attributed to development of new town

The share of trip distribution among four towns in the Study Area and Hanoi area by purpose is estimated based on the Gravity Model method. The trip distribution between Hoa Lac and Son Tay occupies about 5%, and Hoa Lac and Xuan Mai direction occupies about 5 % in 2005 and 2010.

Table 6.2.10 Traffic Demand by Natural Increase and Development

(Case 1: No transferring motorcycle traffic into public transport)

East-West Section							Unit: trip/day
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total	
Phase-1A	17,799	21,317	91,181	130,297	76,059	206,356	
Phase-1B	25,954	24,519	111,177	161,650	99,482	261,132	
Phase-2	50,174	38,647	155,624	244,445	160,923	405,368	
							Unit: vehicle/day
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total	
Phase-1A	4,564	9,778	3,643	17,985	54,328	72,313	
Phase-1B	6,655	11,247	4,442	22,344	71,059	93,403	
Phase-2	12,865	17,728	6,217	36,810	114,945	151,755	
							Unit: PCU/day
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total	
Phase-1A	4,564	24,446	5,464	34,474	16,298	50,772	
Phase-1B	6,655	28,118	6,663	41,436	21,318	62,754	
Phase-2	12,865	44,320	9,326	66,511	34,483	100,994	
North-South Section							Unit: trip/day
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total	
Phase-1A	1,262	2,653	7,743	11,658	6,306	17,964	
Phase-1B	1,743	3,068	9,353	14,164	7,509	21,673	
Phase-2	4,131	3,762	13,666	21,559	14,314	35,873	
							Unit: vehicle/day
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total	
Phase-1A	324	1,217	309	1,850	4,504	6,354	
Phase-1B	447	1,407	374	2,228	5,363	7,591	
Phase-2	1,059	1,726	546	3,331	10,224	13,555	
							Unit: PCU/day
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total	
Phase-1A	324	3,042	464	3,830	1,351	5,181	
Phase-1B	447	3,518	561	4,526	1,609	6,135	
Phase-2	1,059	4,314	819	6,192	3,067	9,259	

Source: JICA Study Team

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6.2.4 Concept for the First Phase Center Area Development

(1) The necessity of road improvement

The road improvement is one of the most significant infrastructure facilities for the development of Hoa Lac new town. In this regard, improvement plan of the access road for the new town should be provided to cope with urban population, scale and functions. In addition, the road network will be improved in accordance with the development phase of Hoa Lac Urban area in 2005, 2010 and 2020, respectively with high priority.

Although three main access roads including Lang-Hoa Lac Highway, RN6 and RN32, extend between Hanoi and the New Town in east-west direction, the first priority for the improvement is given to Lang-Hoa Lac Highway because the highway provides direct linkage between Hanoi and the Hoa Lac new town.

As the result of the future traffic demand, the necessity of road improvement plan is reviewed by comparing future road capacity and traffic demand as shown in Table 6.2.11. In the regional context of the transport network of Hoa Lac Urban Area, the traffic is classified into east-west axis and north-south axis.

Table 6.2.11 The Road Traffic Capacity

Name of Road	Road Class	Lane	Design Capacity (vehicle/day)	Proposed Capacity (vehicle/day)	Proposed Capacity (PCU/day)	Implementation Period		
						Phase-1A 2005	Phase-1B 2010	Phase-2 2020
Lang-Hoa Lac Highway	Class I-II	2	9,000	9,000	6,500	○		
		4	36,000	36,000	25,900		○	
		6	54,000	54,000	38,800			○
NR6	Class I-II	2	8,000	6,400	4,600			
		4	32,000	25,600	18,400	○	○	○
NR32	Class I-III	2	8,000	6,400	4,600	○	○	
		4	32,000	25,600	18,400			○
East-West Section Axis			Future			29,500 (PCU/d)	48,900 (PCU/d)	75,600 (PCU/d)
NR21A	Class I-II	2	8,000	6,400	4,600			
		4	36,000	28,800	20,700	○	○	○
North-South Section			Future			20,700 (PCU/d)	20,700 (PCU/d)	20,700 (PCU/d)

Source: JICA Study Team

1) East-West Section Axis (Lang-Hoa Lac Highway, NR6 and NR32)

According to the estimation of traffic capacity (PCU/day) of the access road as shown in Table 6.2.10, the road capacity is about 30,000 PCU/day on the east-west section axis.

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This capacity is estimated under the condition that the completion of Lang-Hoa Lac Highway is completed with 2-lane by 2000 and expansion plan of NR6 to 4-lane by 2005. The result of total traffic demand on the east-west section axis shows about 50,000 PCU/day, 62,000 PCU/day and 101,000 PCU/day in 2005, 2010 and 2020, respectively.

Considering the change of vehicle mode share in consideration of future trend, another two alternatives are made as shown in Table 6.2.12 to Table 6.2.13. On the assumption that 50% of motorcycle traffic is transferred into public transport (bus), the traffic demand is estimated about 45,000 PCU/day in 2005, 55,000 PCU/day in 2010 and 88,000 PCU/day in 2020 in the east-west section. Furthermore, a similar assumption was made to transfer 100% of motorcycle traffic into bus system. This result shows the traffic demand of about 39,000 PCU/day in 2005, 47,000 PCU/day in 2010 and 76,000 PCU/day in 2020, respectively.

Although the road capacity is expected to reach about 50,000 PCU/day in 2005, the traffic demand exceeds the future road capacity. Under the MOT improvement plan, Lang-Hoa Lac Highway will be 2-lane, NR6 will be 4-lane and NR32 will be 2-lane by 2005. Nevertheless, Lang-Hoa Lac Highway should be improved to 4-lane highway with the highest priority by 2005 to serve as a major direct access highway between Hanoi and Hoa Lac Urban Area.

The road capacity seems to cope with traffic demand in 2010 under the development plan: Lang-Hoa Lac Highway (4-lane), RN6 (4-lane) and NR32 (2-lane). Also, the road capacity manages to cope with traffic demand under the development plan in 2020: Lang-Hoa Lac Highway (6-lane), RN6 (4-lane) and NR32 (4-lane) as shown in Figure 6.2.4 and Table 6.2.12 on the condition that the public transport system is reinforced.

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Table 6.2.12 Traffic Demand by Natural increase and Development

(Case 2: Transferring motorcycle traffic (50 %) into public transport)

East-West Section							Unit: trip/day
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total	
Phase-1A	17,799	21,317	129,210	168,326	38,030	206,356	
Phase-1B	25,954	24,519	160,918	211,391	49,741	261,132	
Phase-2	50,174	38,647	236,085	324,906	80,461	405,367	

Unit: vehicle/day						
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total
Phase-1A	4,564	9,778	5,162	19,504	27,164	46,668
Phase-1B	6,655	11,247	6,429	24,331	35,529	59,860
Phase-2	12,865	17,728	9,432	40,025	57,472	97,497

Unit: PCU/day						
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total
Phase-1A	4,564	24,446	7,743	36,753	8,149	44,902
Phase-1B	6,655	28,118	9,644	44,417	10,659	55,076
Phase-2	12,865	44,320	14,148	71,333	17,242	88,575

North-South Section							Unit: trip/day
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total	
Phase-1A	1,262	2,653	10,897	14,812	3,153	17,965	
Phase-1B	1,743	3,068	13,108	17,919	3,754	21,673	
Phase-2	4,131	3,762	20,822	28,715	7,157	35,872	

Unit: vehicle/day						
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total
Phase-1A	324	1,217	435	1,976	2,252	4,228
Phase-1B	447	1,407	524	2,378	2,682	5,060
Phase-2	1,059	1,726	832	3,617	5,112	8,729

Unit: PCU/day						
Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total
Phase-1A	324	3,042	653	4,019	676	4,695
Phase-1B	447	3,518	786	4,751	805	5,556
Phase-2	1,059	4,314	1,248	6,621	1,534	8,155

Source: JICA Study Team

Table 6.2.13 Traffic Demand by Increase and Development
(Case 3: Transferring motorcycle Traffic (100 %) into Public Transport)

Unit: trip/day

Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total
Phase-1A	17,799	21,317	167,240	206,356	0	206,356
Phase-1B	25,954	24,519	210,659	261,132	0	261,132
Phase-2	50,174	38,647	316,546	405,367	0	405,367

Unit: vehicle/day

Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total
Phase-1A	4,564	9,778	6,682	21,024	0	21,024
Phase-1B	6,655	11,247	8,416	26,318	0	26,318
Phase-2	12,865	17,728	12,647	43,240	0	43,240

Unit: PCU/day

Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total
Phase-1A	4,564	24,446	10,022	39,032	0	39,032
Phase-1B	6,655	28,118	12,624	47,397	0	47,397
Phase-2	12,865	44,320	18,970	76,155	0	76,155

Unit: trip/day

Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total
Phase-1A	1,262	2,653	14,050	17,965	0	17,965
Phase-1B	1,743	3,068	16,862	21,673	0	21,673
Phase-2	4,131	3,762	27,979	35,872	0	35,872

Unit: vehicle/day

Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total
Phase-1A	324	1,217	561	2,102	0	2,102
Phase-1B	447	1,407	674	2,528	0	2,528
Phase-2	1,059	1,726	1,118	3,903	0	3,903

Unit: PCU/day

Phase	Passenger Car	Truck	Bus	Sub-Total	Motorcycle	Total
Phase-1A	324	3,042	842	4,208	0	4,208
Phase-1B	447	3,518	1,011	4,976	0	4,976
Phase-2	1,059	4,314	1,677	7,050	0	7,050

Source: JICA Study Team

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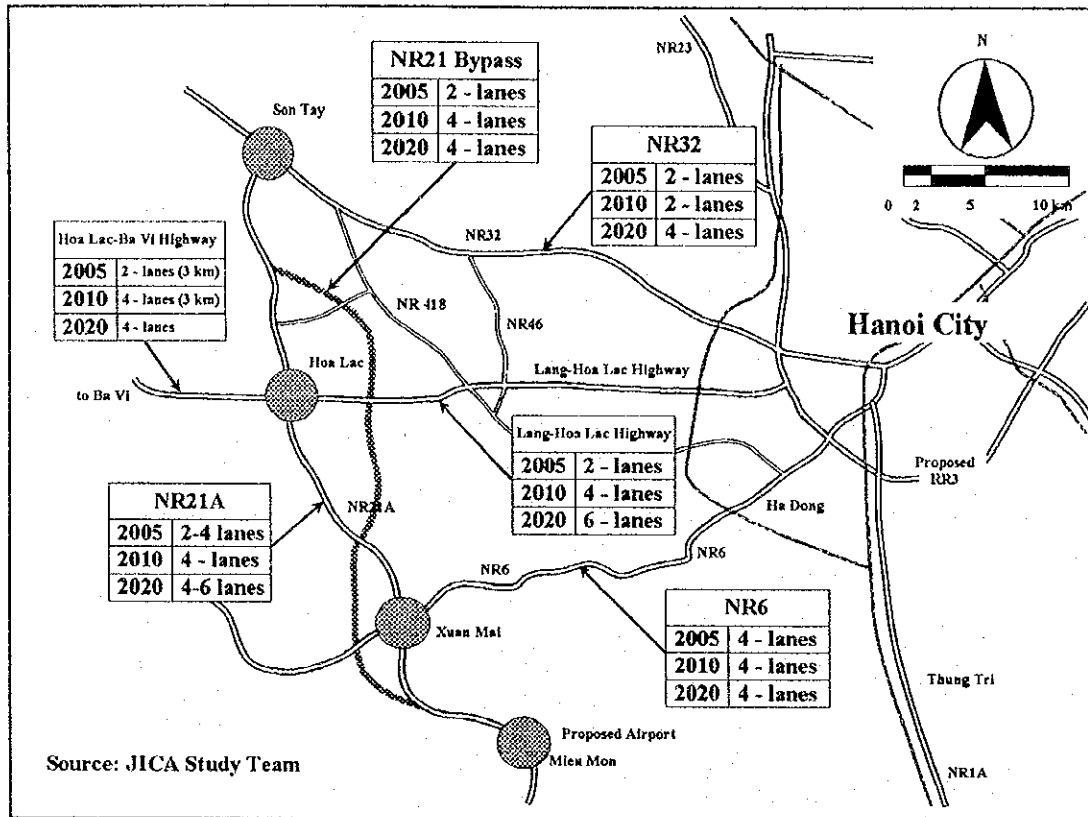


Figure 6.2.4 Improvement Plan of Access Road by Development Phase

Furthermore, the road improvement plan should include mass public transit facility reserve along the highway in consideration of introducing railway system in the future. The road improvement plan by development phase in 2005, 2010 and 2020 is illustrated in former Figure 6.2.4.

The main concept of road design in Lang-Hoa Lac Highway is to separate 4-wheel vehicles from motorcycle to enhance the traffic capacity. Furthermore, the exclusive bus lane system should be provided to conduct the efficient mass transit. In addition, the motorcycle access on the Lang-Hoa Lac Highway should be strictly controlled to function as a major highway. For this, the exclusive motorcycle lane should be provided along the highway and separated from 4-wheel vehicles by means of green stripe.

As the NR6 and NR32 run through several villages, it seems to be difficult to separate motorcycle lane from 4-wheel vehicles completely due to the insufficient road expansion width. However, it is desirable that exclusive motorcycle lane should be separated by means of guardrail.

2) North-South Section Axis (NR21A)

According to the estimation of traffic capacity (PCU/day) of road as shown in Former Table 6.2.10. The result of total traffic demand on NR21A shows about 5,000 PCU/day, 6,000 PCU/day and 9,000 PCU/day in 2005, 2010 and 2020, respectively, while the existing NR21A has the road capacity of about 5,000 PCU/day.

Considering the future transformation of modal split, another two alternatives are made similar to the case of east-west section traffic as shown in Table 6.2.12 and Table 6.2.13. On the assumption that 50 % of motorcycle mode is transferred into public transport (bus), the traffic demand is estimated about 5,000 PCU/d in 2005, 6,000 PCU per day in 2010 and 8,000 PCU/d in 2020. In addition, the traffic demand is forecasted as about 4,000 PCU/d in 2005, 5,000 PCU per day in 2010 and 7,000 PCU per day in 2020 on the assumption that 100 % of motorcycle traffic is transferred into bus system.

In accordance with C/P of development in the Hoa Lac Urban Area, the development corridor will be formed toward south-north axis along the NR21A. Moreover, NR21 Bypass is proposed towards south-north axis in nearly parallel with NR21A in the east to separate daily life traffic from mainly industrial and through traffic. As the result of the traffic demand forecast, the north-south section traffic demand is not that high, compared to the east-west traffic demand. Nevertheless, the road infrastructure improvement in Hoa Lac Urban Area is proposed in consideration of urban population, function and scale by development phase.

(a) Improvement of NR21A

The NR21A will be developed as a main corridor of Hoa Lac new town. The main function of NR21A is to serve mainly for daily life route for the Hoa Lac new town. The NR21A will serve as a major corridor, linking to Son Tay, Hoa Lac, Xuan Mai and Mieu Mon towns.

The main concept of NR21A road plan is to meet the traffic needs and urban function in Hoa Lac Urban Areas, particularly in the center areas. The road capacity is planned to cope with increasing traffic demand of internal trips in Hoa Lac Urban Area along with the development. As for the road section plan in north-south axis, the exclusive bus lane in the central section of this road is also offered. The space for the exclusive bus lane can be possibly converted into railway in the future. In addition, the motorcycle and passenger car traffic can share the lane in each side of

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carriage-way. However, it is desirable to control motorcycle traffic from passenger car by means of guardrail.

As for the improvement plan by phase, the improvement of exclusive bus lane has the first priority. In this sense, the improved NR21A can be utilized the bus lane. Moreover, the road for motorcycle and passenger car, and pedestrian street should be developed by the phases.

(b) Improvement of NR21 Bypass

The main role of this bypass is to serve as a regional industrial road. The improvement of NR21 Bypass implies significance because the bypass is directly connected with Lang-Hoa Lac Highway without penetrating into C-21 Urban Center Area. For this reason, the cargo distribution service by truck of HHTP Area and Put Cat Area is expected be efficiently carried out through proposed NR21 Bypass. Furthermore, the through traffic in the north-south direction can use this bypass, which will relieve the traffic congestion in NR21A. In the future, this NR21 Bypass will be linked toward north as a part of outer ring road in HMA. Moreover, the NR21 Bypass will be linked to the proposed North-South Highway to the southward in the future.

As for the bypass road plan by development phase, the improvement of this bypass is necessary to promote industrial activity in this area in accordance with development of the industrial zone and high-tech park in the future. Nevertheless, the arterial road that will be constructed in the early stage, in parallel with the proposed NR21 Bypass, seems to cope with the traffic demand in the near future. The full completion of proposed NR21 Bypass with about 14 km is expected to be after 2020.

(2) The necessity of public transport system

The necessity of public transport system is reviewed based on the traffic demand forecast. In consideration of changing current vehicle mode ratio along with the future trend, three cases are reviewed. The case-1 is no change of the modal ratio as forecasted, while case-2 is transferring 50 % of motorcycle traffic into public transport mode. The third case is transferring 100 % of motorcycle traffic into public transport mode. A comparison is made between traffic demand and transporting capacity of public transport system as shown in Figure 6.2.5.

1) East-West Section Axis (Lang-Hoa Lac Highway, NR6 and NR32)

The traffic demand of total public transport is about 206,000 trip/day, 261,000 trip/day and 405,000 trip/day in 2005, 2010 and 2020, respectively as shown in Table 6.2.10. Under the assumption that the traffic demand is concentrated in the morning peak time (per hour) in one way with 50 % of total traffic demand, the traffic demand of public transport is considered about 22,000 trip/hr., 27,000 trip/hr. and 38,000 trip/hr. in 2005, 2010 and 2020, respectively. Also, under the assumption of transferring 50 % of motorcycle traffic into public transport, the traffic demand of public transport is estimated 32,000 trip/hr. in 2005, 40,000 trip/hr. in 2010, and 59,000 trip/hr. in 2020, respectively. The higher traffic demand is observed in case of transferring 100 % of motorcycle traffic into public transport.

2) North-South Section Axis (NR21A)

The traffic demand of total public transport is about 17,000 trip/day, 21,000 trip/day and 35,000 trip/day in 2005, 2010 and 2020 (Table 6.2.10), respectively.

Under the identical assumption of the east-west section traffic axis for the traffic demand in peak hour, the traffic demand of public transport is 2,000 trip/hr., 3,000 trip/hr. and 4,000 trip/hr. in 2005, 2010 and 2020, respectively. In case that 50 % of motorcycle mode is transferred into bus system, the traffic demand of public transport is 3,000 trip/hr., 4,000 trip/hr. and 5,000 trip/hr. in 2005, 2010 and 2020, respectively. The maximum transport capacity of a bus on a regular route is about 3,000 trip/hour in general. Based on this result, the public transport by bus system seems to cope with the public transport demand by 2005. However, more efficient bus network is necessary after 2005 to make the best use of public transport system.

Public Transport Network

Along with the road improvement plan, the transport policy should be offered to establish an efficient transport system. In case of Lang-Hoa Lac Highway, the future road improvement plan includes 6-lane highway in 2020. Although the total road capacity of the access roads (Lang-Hoa Lac Highway, NR6 and NR32) seems to cope with the traffic demand in the east-west section in 2010-2020, the traffic volume is possibly concentrated on the Lang-Hoa Lac Highway in consideration of easy access and minimal trip distance between Hanoi and Hoa Lac Urban Area. For this reason, the reinforcement of public transportation is required on the Lang-Hoa Lac Highway to realize efficient transport system.

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Among the public transport, bus system is considered as one of the most economic and flexible transport mode. However, the rapid transformation from motorcycle mode to public transport seems to be difficult due to the lifestyle with high dependency on motorcycle mode in Vietnam. Thus, the partial control of motorcycle access in highway and arterial road is necessary to transfer to bus system.

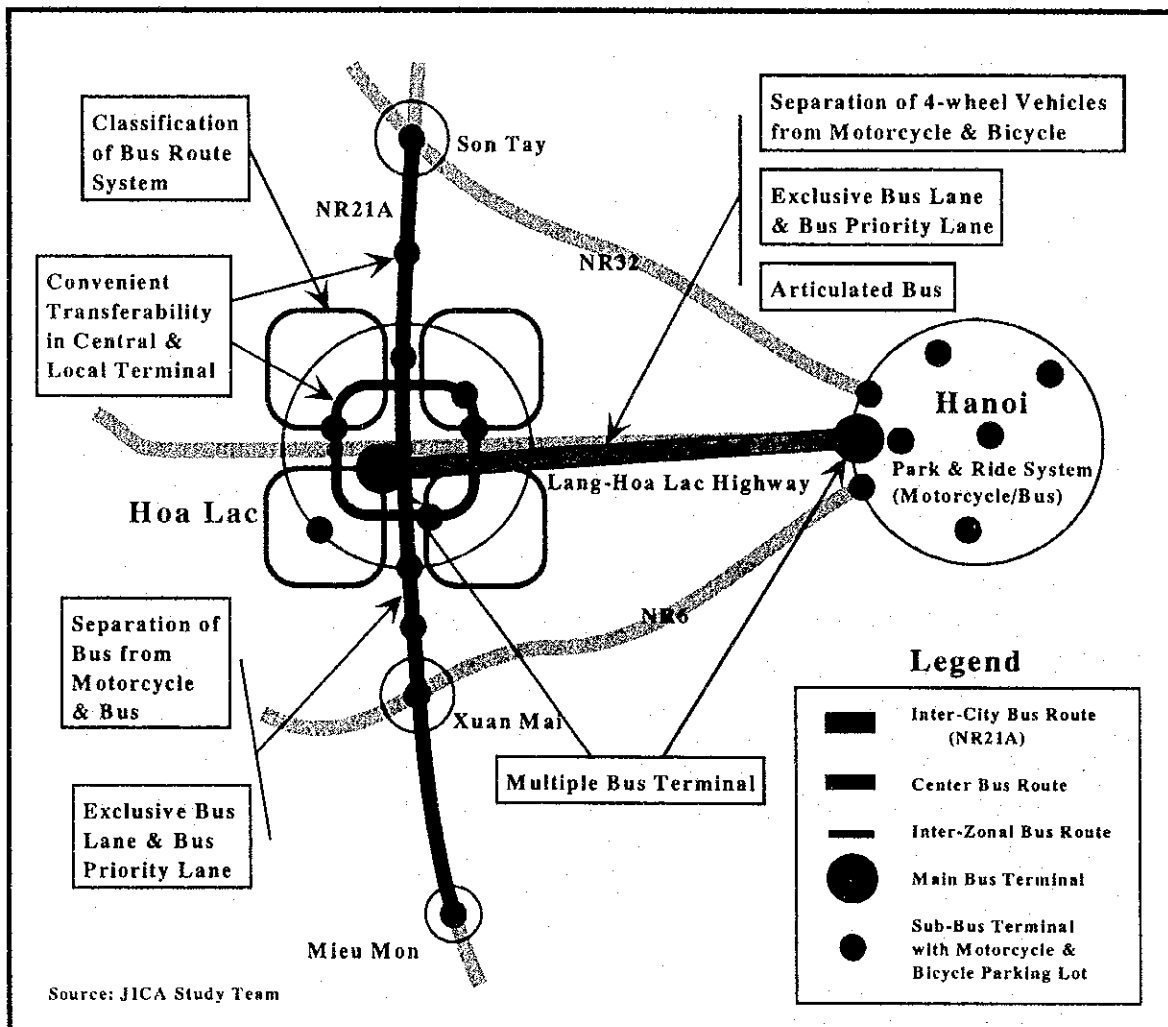


Figure 6.2.5 The Concept of Public Transport Network

In addition, the railway system should be introduced in the east-west section in the long-term view. However, it is noted that the first priority of public transport system by bus in the initial development stage should be highly taken into consideration. This idea implies that public transport system by bus mode reflects the minimal capital investment compared with other public transport system. Furthermore, the bus system can be applied to flexible route modification in accordance with the future traffic demand. In this regard, the

following measures should be carefully considered in order to encourage public bus transportation system.

A successful phenomenon by public bus system has been observed in Curitiba City with a population of approximately 1.6 million in Brazil. The transportation system has been secured in consideration of transit-oriented road network and land use control, etc. In addition, various countermeasures have been taken by introducing articulated buses, efficient bus terminal layout, exclusive bus lane to encourage efficient public transport, and release traffic congestion in urban areas.

6.3 Concept Plan of Water Supply System

6.3.1 General Conditions

There have not been existing public water supply systems in the Study Area, except Son Tay town. Generally in areas other than Son Tay, people use shallow groundwater which is taken through private dug wells located nearby their houses.

Availability of the groundwater in the area except Son Tay town, however, is very limited due to geological characteristics, although it can be used for the private use with small quantity.

For the public water supply system to be newly constructed for the Study Area, which will have such large water demand as 100,000 - 400,000 m³/d, river water with sufficient flow must be inevitably introduced to this area as a water source¹.

Fortunately, there exist two big rivers in the vicinity of the Study Area. They are i) the Red River flowing in west-toward-east direction about 20 km north of the Study Area center, and ii) the Da River, a tributary of the Red River, flowing in south-toward-north direction about 20 km west of the center. The both rivers have huge amount of water flow, therefore water intake from the rivers for the public water supply systems would not affect so much in terms of river flow discharge. Major subject to be discussed is water quality of rivers, which was studied by a sub-contracted research institute. The result of the study is discussed later.

¹ Surface water: There exist within or nearby the Study Area two lakes (Suoi Hai Lake and Dong Mo Lake) and Tich River. The flow discharge from these water bodies is, however, too small to be used for the public water supply system of the Study Area. Furthermore, the discharge of above-mentioned water has been fully used by irrigation purpose, and the water use for public water supply systems requiring big amount would not be certainly allowed.