PART III

MASTER PLAN FOR IWT SYSTEM IN HANOI SEGMENT FOR 2020

Chapter 23 Roles and Functions of the IWT System in Hanoi Segment

23.1 Basic requirements for developing the IWT system in Hanoi segment

23.1.1 Navigation channel

Basic requirements for navigation channel in the Hanoi segment can be summarized as follows:

(1) To make it possible for increasing traffic to pass through waterways

Cargo transport volume in Hanoi segment: 7.3 million tons (2001)
12.6 million tons (2010)
20.3 million tons (2020)
Note) Containers are excluded.

Vessel traffic:
Dong Lai: approx. 200 vessels/day (2001)
approx. 320 vessels/day (2010)
approx. 480 vessels/day (2020)
Phu Dong: approx. 130 vessels/day (2001)
approx. 190 vessels/day (2010)
approx. 240 vessels/day (2020)
Yen My: approx. 30 vessels/day (2001)
approx. 50 vessels/day (2010)
approx. 130 vessels/day (2020)
Note) Vessels carrying containers are excluded.

(see **Table 23.1.1** through **Table 23.1.6**)

Dong Lai will be one of the heaviest traffic sections in the RRD where some 480 vessels a day will pass through the waterway. It is estimated that there will be shortage of capacity on this stretch unless average vessel size becomes larger and average vessel speed becomes faster.

As far as Duong Bifurcation is concerned, vessel traffic will be concentrated from downstream of Duong River and Red River in addition to that from Dong Lai. Special attention should be paid to Duong Bifurcation in terms of vessel traffic capacity and safety.

Table 23.1.1 Cargo Flow in Hanoi Segment (2001)

(1000tons)

Origin \ Destination	Dong Lai	Phu Dong	Yen My	Hanoi Port Group	Total
Dong Lai		203	187	3,501	3,891
Phu Dong	728			2,139	2,867
Yen My	195			353	547
Hanoi Port Group	0	3	0	0	3
Total	923	206	187	5,993	7,309

Source) JICA Study Team

Table 23.1.2 Section Traffic (2001)

Section	Cargo Traffic (1000tons)	Vessel Traffic (1000DWT)	Daily Vessels Traffic (vessels/day)
Dong Lai	4,814	9,190	197
Phu Dong	3,074	5,836	125
Yen My	734	1,341	29

Source) JICA Study Team

Table 23.1.3 Cargo Flow in Hanoi Segment (2010)

(1000tons)

Origin \ Destination	Dong Lai	Phu Dong	Yen My	Hanoi Port Group	Total
Dong Lai	0	436	415	6,114	6,965
Phu Dong	1,114	0	0	3,480	4,594
Yen My	405	0	0	623	1,028
Hanoi Port Group	0	6	0	0	6
Total	1,519	442	415	10,217	12,593

Note) Containers are excluded.

Source) JICA Study Team

Table 23.1.4 Section Traffic (2010)

Section	Cargo Traffic (1000tons)	Vessel Traffic (1000DWT)	Daily Vessels Traffic (vessels/day)
Dong Lai	8,484	16,178	324
Phu Dong	5,036	9,553	191
Yen My	1,443	2,612	52

Note) Containers are excluded.

Source) JICA Study Team

Table 23.1.5 Cargo Flow in Hanoi Segment (2020)

(1000tons)

Origin \ Destination	Dong Lai	Phu Dong	Yen My	Hanoi Port Group	Total
Dong Lai	0	744	911	10,106	11,761
Phu Dong	1,531	0	0	4,936	6,467
Yen My	845	0	0	1,997	2,842
Hanoi Port Group	0	9	182	0	191
Total	2,375	752	1,093	17,039	21,260

Note) Containers are excluded.
Source) JICA Study Team

Table 23.1.6 Section Traffic (2020)

Section	Cargo Traffic (1000tons)	Vessel Traffic (1000DWT)	Daily Vessels Traffic (vessels/day)
Dong Lai	14,136	26,929	475
Phu Dong	7,219	13,677	241
Yen My	3,935	7,224	127

Note) Containers are excluded.
Source) JICA Study Team

(2) To make it possible for larger vessels/barge trains to pass through waterways

Barge train: 2units@600DWT + Pushing Tug@200CV
(Length=115m, Breadth=11m, draft=1.8m, Speed=8-12km/h)
Barge train: 4units@400DWT + Pushing Tug@250CV
(Length=95-109m, Breadth=18-19m, draft=1.2-1.6m, Speed=8-12km/h)
Self-propelled vessel: 300DWT (400DWT - 600DWT of shallow draft type)
(Length=38-50m, Breadth=7-10m, draft=1.9-2.1m, Speed=14-20km/h)

All the waterways in the Hanoi segment will be improved and maintained for these larger vessels/barge trains to pass through.

Sea-cum-river vessel: 1,000DWT
(Length=73-81m, Breadth=10-11m, draft=3.0-3.2m, Speed=18-20km/h)

Corridor 4 (from sea up to Hanoi Port) will be improved and maintained for Sea-cum-river vessels to pass through.

(3) To meet the technical standard of waterway classification for major corridors

Corridor 1: Quang Ninh - Hai Phong - Hanoi - Viet Tri (through Duong River)
Classification: Quang Ninh - Hai Phong: II

Hai Phong - Hanoi: II (LAD=2.5m)
Hanoi - Viet Tri: II (LAD=2.5m)

Corridor 4A: Lach Giang - Hanoi
Classification: I (LAD=3.6m)

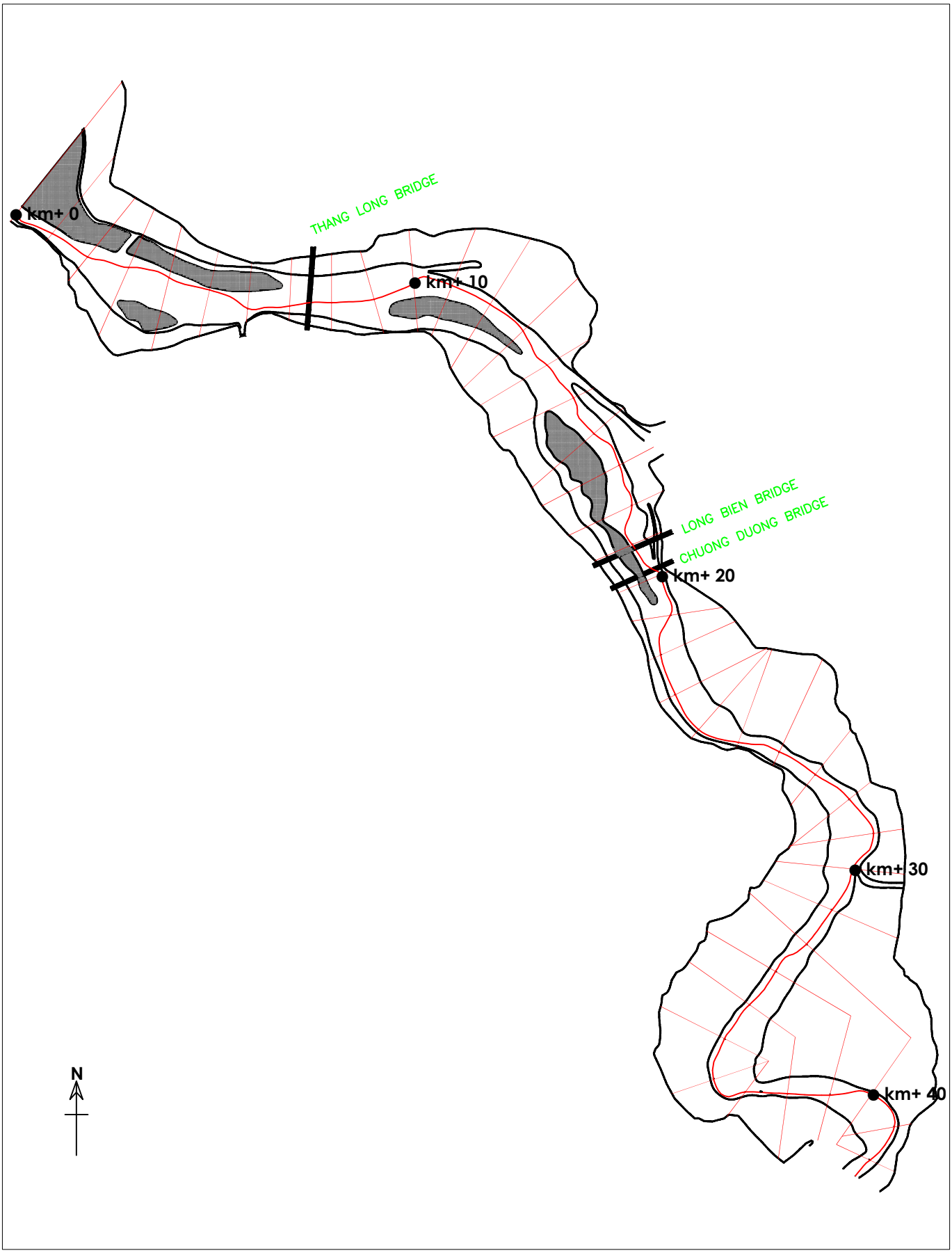
Corridor 4B: Cua Day - Hanoi (through Day - Nin Co Canal)
Classification: I (LAD=3.6m)

Special attention should be paid to the vertical clearance of Duong Bridge which causes a major bottleneck to IWT on Corridor 1 during flood season. The traffic regulation is conducted by IWMS No.6 when water level becomes more than +6.8m for about 75 days a year.

(4) To stabilize the alignment of waterway in Red River Hanoi segment

Comparison of bathymetric surveys conducted in December 1999 and January 2002 suggests that the river alignment of the section between Thang Long Bridge and Hanoi Port may drastically change in the near future. Accordingly, the section should be given urgent and necessary countermeasures.

In stabilizing the alignment of waterway, maintaining functions of existing facilities should be taken into account.



Note) Kilometerage goes downstream along the talweg of January 2002.
Source) JICA Study Team

Figure 23.1.1 Kilometerage & Coordinates for Hanoi Segment

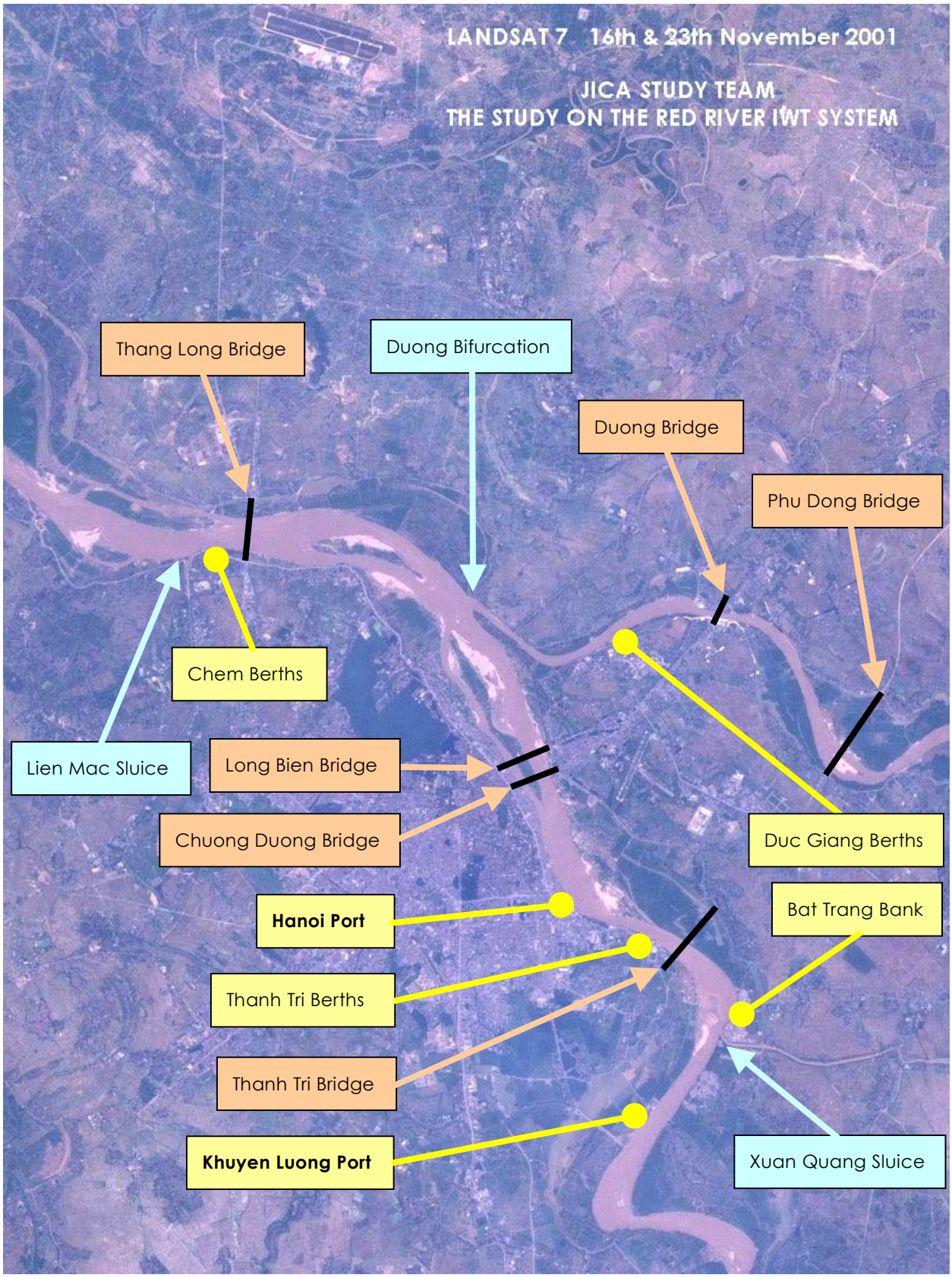


Figure 23.1.2 Location of Major Landmark in Hanoi Segment

23.1.2 Ports

Basic requirements for ports in the Hanoi segment can be summarized as follows:

(1) To handle increasing traffic at port groups

Expected future cargo throughput in the Hanoi segment is so great that special attention should be needed in port master planning.

Total cargo throughput in Hanoi segment: 6.0 million tons (2001)
10.2 million tons (2010)
17.2 million tons (2020)

Note) Containers (2010:32,000TEUs, 2020:67,000TEUs) are excluded.

As to passenger traffic, the following service routes have potential to be realized in the Hanoi segment as mentioned in **Chapter 20 (1)**. In order to become obvious potential passenger demand of these service routes, it is indispensable to provide a service almost as same as that of bus service in terms of transit time and fare.

Service route : Hanoi - downstream of Red River (Hung Yen, Thai Binh)
Potential passenger demand (million PAX): 0.4 in 2010, 0.6 in 2020
Hanoi - Hung Yen: 0.21 in 2010, 0.31 in 2020
Hanoi - Thai Binh: 0.16 in 2010, 0.22 in 2020
Hung Yen - Thai Binh: 0.03 in 2010, 0.06 in 2020

Service route : Hanoi - upstream of Red River (Viet Tri, Phu Tho)
Potential passenger demand (million PAX): 0.2 in 2010, 0.3 in 2020
Hanoi - Viet Tri: 0.14 in 2010, 0.19 in 2020
Hanoi - Phu Tho: 0.10 in 2010, 0.14 in 2020
Viet Tri - Phu Tho: 0.00 in 2010, 0.01 in 2020

In addition to normal passenger traffic, it is important to promote the river cruse for international and domestic tourists in the Hanoi segment in particular.

(2) To raise cargo handling efficiency

Bulk cargo at major ports: 2,000 tons/m/year (2001)
4,800 tons/m/year (2020)
Non-bulk cargo at major ports: 900 tons/m/year (2001)
2,400 tons/m/year (2020)

Mechanization rate: almost 100% (excluding hooking process, 2020)
Unitization: introduction of the unitization in cargo handling

(3) To reduce total vessel staying time at port

- Reduction of waiting and idle time
  By constructing adequate numbers of permanent berths, operating ports 24 hours a day and handling cargoes in 3 shift.
- Reduction of handling time
  By raising cargo handling efficiency at berth and providing adequate handling equipment

(4) To accommodate larger vessels/barge trains

Barge train: 2units@600DWT + Pushing Tug@200CV
(Length=115m, Breadth=11m, draft=1.8m, Speed=8-12km/h)
Barge train: 4units@400DWT + Pushing Tug@250CV
(Length=95-109m, Breadth=18-19m, draft=1.2-1.6m, Speed=8-12km/h)
Self-propelled vessel: 300DWT (400DWT - 600DWT of shallow draft type)
(Length=38-50m, Breadth=7-10m, draft=1.9-2.1m, Speed=14-20km/h)
Sea-cum-river vessel: 1,000DWT
(Length=73-81m, Breadth=10-11m, draft=3.0-3.2m, Speed=18-20km/h)
For: Khuyen Luong Port and Hanoi Port

(5) To clarify role and function of each port within a port group

When planning several ports within a certain area, it is important to clarify the role and function of each port and to arrange them in rational places taking into account the connection with hinterland, the access roads and conditions of navigation channel. Ports handling dirty and dusty cargo should be arranged outside of the city center.

Characteristics of port:

General port:	port handling many kinds of cargo
Construction material port:	port handling mainly construction material
Specialized port:	port handling particular cargo for a factory

Special attention should be paid to Duong Bifurcation where vessel traffic concentration will become an essential issue in terms of vessel traffic capacity and safety in future. On the other hand, Dong Anh District is intended by HNPC to

become new core of Hanoi City. Furthermore, the industrial development plan by HNPC shows the northern and eastern part of Hanoi City will be developed.

In distributing roles and functions among ports/Berths, easing vessel traffic concentration at Duong Bifurcation as well as contributing to these urban and industrial development plans should be taken into account.

23.2 Distribution of roles and functions among Ports/Berths

23.2.1 Geographic arrangement of ports/berths

Current ports/Berths in the Hanoi segment are unevenly distributed at the right bank of Red River. Cargo throughput of ports/Berths located at the right bank of Red River accounts for some 70% (see **Table 23.2.1** and **Figure 23.2.1**).

The uneven distribution of ports/Berths in the Hanoi segment is considered to be rational taking into account the structure of Hanoi City. For example, some 70% of population in Hanoi is registered at districts (Citadel districts, Tu Liem and Thanh Tri Districts) located at the right bank of Red River (see **Table 23.2.2**).

On the other hand, expected future cargo throughput in the Hanoi segment is so great that construction of new ports will be needed in addition to the increase of handling efficiency and the extension of facilities at the existing ports/Berths.

Total cargo throughput in Hanoi segment: 6.0 million tons (2001)
10.2 million tons (2010)
17.2 million tons (2020)

Note) Containers (2010:32,000TEUs, 2020:67,000TEUs) are excluded.

As to the urban and industrial development plans, HNPC intends Dong Anh District to become a new core of Hanoi City. The industrial development plan by HNPC shows the northern and eastern part of Hanoi City (Dong Anh, Gia Lam and Soc Son Districts) will be developed. Furthermore, future skeleton roads in Hanoi City are planned (see **Figure 23.2.2**) in consistent manner with these urban and industrial development plans.

Taking into account above situation, JICA Study Team proposes to construct new ports where they could contribute to the urban and industrial developments, as well as to extend Khuyen Luong Port. Evaluation of sites along riverbanks is shown in **Table 23.2.3** through **Table 23.2.6** and **Figure 23.2.3**.

New North Port: To be constructed at Hai Boi - Vinh Ngoc in order to serve mainly for Dong Anh and Soc Son Districts.
New East Port: To be constructed at Phu Dong in order to serve mainly for Gia Lam District.
Khuyen Luong Port: Extending southward of existing facilities.

Table 23.2.1 Cargo Throughput of Ports/Berths in Hanoi Segment (2001)

Port/Berth Group	Location (River km+) (Bank)	Throughput in 2001 (1000 ton)					Note
		Construction Material	Cement	Coal	Others	Total	
Hanoi Port	Red +23.2 -25.0 Right	439	43	227	8	717	Unloading
Khuyen Luong Port	Red +33.0 Right	72	24	52	47	195	Unloading: 192 Loading: 3 (others)
Chem Berths	Red +6.5 - 7.0 Right	1,330	263	0	88	1,681	Unloading
Thanh Tri Berths	Red +25.5 - 25.8 Right	567	150	0	3	720	Unloading
Duc Giang Berths	Duong +4.5 - 5.0 Right	20	240	80	0	340	Unloading
Bat Trang Bank	Red +29.0 - 30.0 Left	0	0	84	336	420	Unloading
Other Berths (upstream of Duong Bifurcation)	Red	420	143	18	20	600	Unloading
Other Berths (downstream of Duong Bifurcation)	Red	546	186	23	26	780	Unloading
Other Berths (downstream of Duong Bridge)	Duong	378	129	16	18	540	Unloading
Total		3,771	1,177	499	546	5,993	

Note) km+ of Red River is set by JICA Study Team (cf: Thang Long Bridge = +7.5, Chuong Duong Bridge = +19.8, Xuan Quang Sluice = +30.0).
Note) km+ of Duong River is based on ADB study in 1998 (cf: Duong Bridge = +8.0).
Note) Cargo type balance of other berths are assumed to be the same as that of Chem, Thang Tri and Duc Giang Berths.

Table 23.2.2 Basic Data of Hanoi City

Zone	District	Major Port/Berth	Population in 2000 (1000)	Area (sq.km)	Population Density (pers/sq.km)	Paddy Sown Area (sq.km)
Citadel	Ba Dinh		204	9	22,086	
	Tay Ho		94	24	3,908	
	Hoan Kiem		172	5	32,533	
	Hai Ba Trung		359	15	24,491	
	Dong Da		339	10	34,046	
	Thanh Xuan		157	9	17,223	
	Cau Giay		135	12	11,238	
	sub-total	Hanoi	1,460	84	17,323	
Suburb (North)	Soc Son		246	307	804	171
(North)	Dong Anh		262	182	1,436	147
(East)	Gia Lam	Duc Giang & Bat Trang	343	174	1,968	99
(West)	Tu Liem	Chem	196	75	2,597	54
(South)	Thanh Tri	Khuyen Luong & Thanh Tri	227	98	2,311	55
	sub-total		1,274	837	1,522	527
Whole City			2,734	921	2,969	

Source) Hanoi Statistical Yearbook 2000

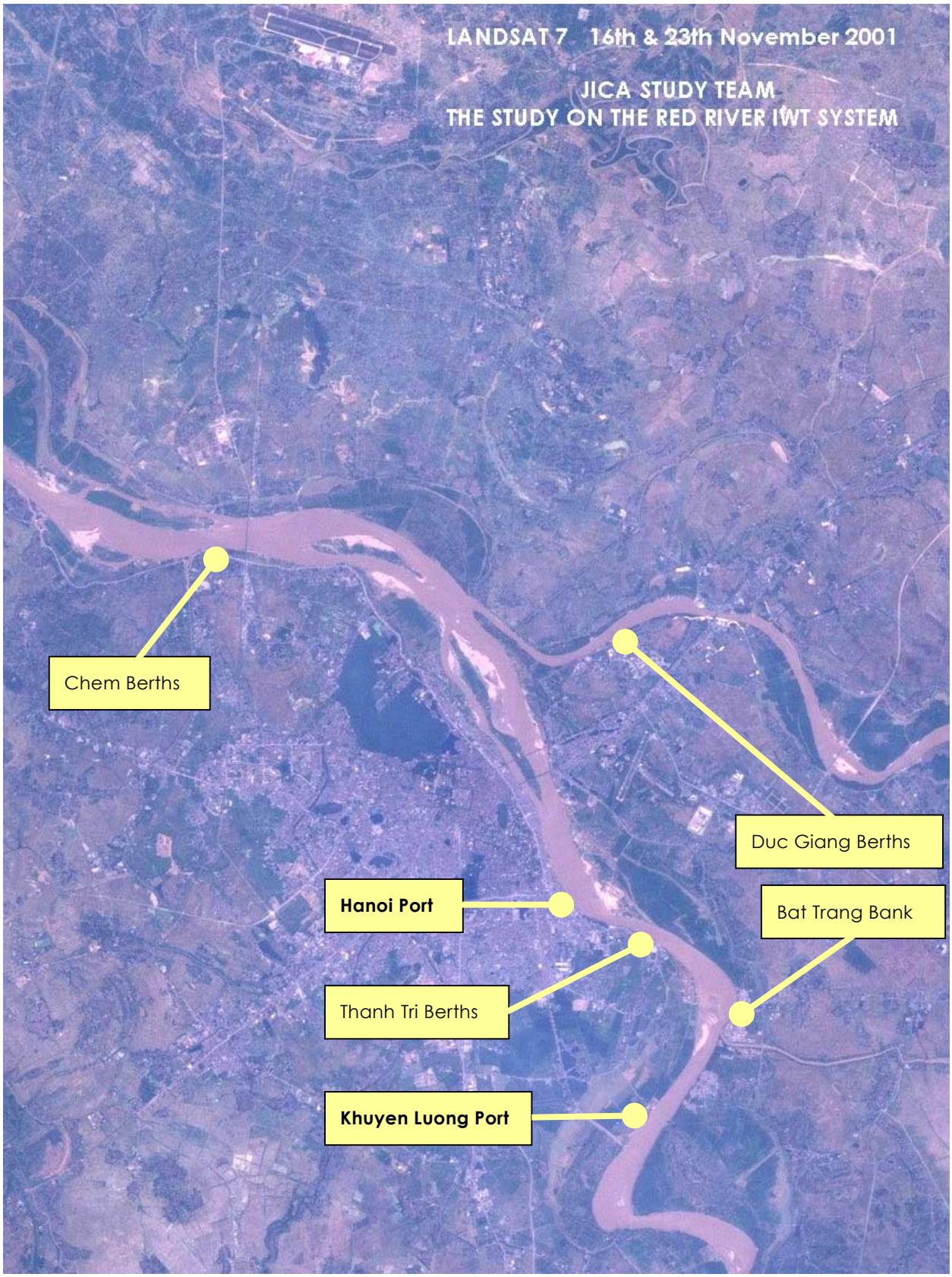


Figure 23.2.1 Location of Ports and Berth Groups in Hanoi Segment

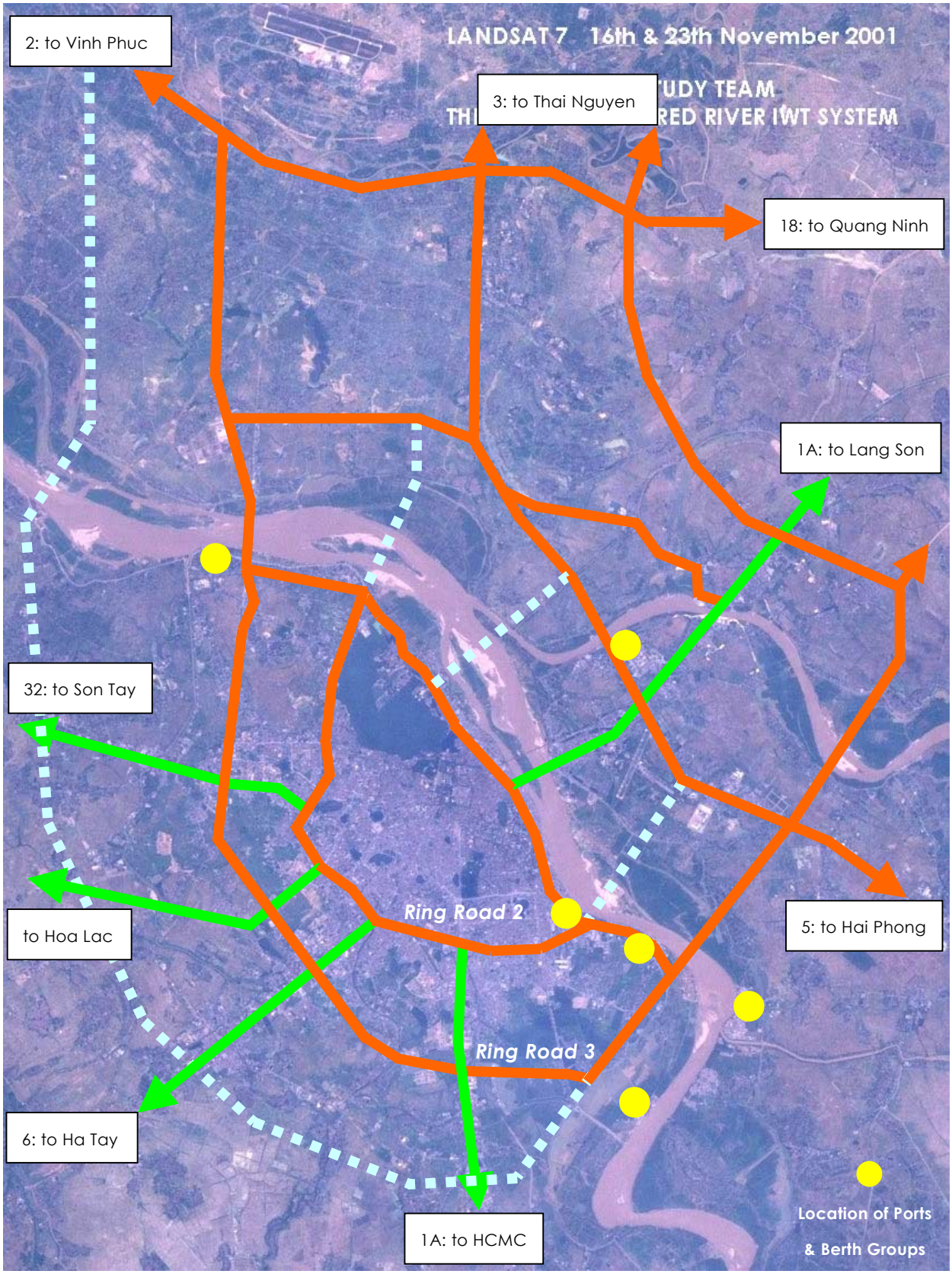


Figure 23.2.2 Skelton Roads in Hanoi City

Table 23.2.3 Distance between Dykes in Hanoi Segment

km+	Major Landmark		Right Side (m)					Talweg	Left Side (m)					Total (m)
	Right Bank	Left Bank	Dyke	Bank	Sand Bar Edge	Sand Bar Edge			Sand Bar Edge	Sand Bar Edge	Bank	Dyke		
0			110	100				250	2,260		80	1,430		4,230
1			40	190				180	820		110	1,250		2,590
2			360	370				360	540		80	820		2,530
3			590	1,010				320	440		80	660		3,100
4			440	70	500	830		170	330		170	500		3,010
5			260	860				80	370		160	340		2,070
6	Lien Mac Sluice Chem Berths		20	300				420	420		140	100		1,400
7	Thang Long Bridge		150	190				750				370		1,460
8			250	400				660				490		1,800
9			100	710				740				500		2,050
10			40	290	440	370		440				830		2,410
11			150	320	440	370		140				1,320		2,740
12			800	350	300	320		170				1,660		3,600
13			1,170	290	140	360		150				1,650		3,760
14			1,170	650				330				1,020		3,170
15		Duong River	960	330	170	620		110				-		2,190
16			610	250	770	300		350				-		2,280
17			680	390	590	400		100				-		2,160
18			470	260	170	760		120				700		2,480
19	Long Bien Bridge		300	250	320	90		360				400		1,720
20	Chuong Duong Bridge		260	290	160	370		90				130		1,300
21			210	670				200				800		1,880
22			170	170				640				1,300		2,280
23			270	160				670				1,750		2,850
24	Hanoi Port		190	90				780				1,870		2,930
25			70	110				260				2,190		2,630
26			70	300				190				1,980		2,540
27	Thang Tri Berths		530	340				260				1,070		2,200
28			1,210	640				240				420		2,510
29		Bat Trang Bank	960	1,070				140				570		2,740
30		Xuan Quang Sluice	1,160	680				200				1,030		3,070
31			1,400	340				150				1,620		3,510
32			1,380	370				230				3,320		5,300
33	Khuyen Luong Port		1,770	170				530				-		2,470
34			1,630	130				600				-		2,360
35			1,660	130				890				-		2,680
36			990	80				990				-		2,060
37			510	170				420				-		1,100
38			1,310	110				430				-		1,850
39			-	260				420				-		680
40			-	840				80				-		920

Note) km+ is set by JICA Study Team

Table 23.2.4 Land Use of Flood Plane in Hanoi Segment

km+	Major Landmark		Land Use (1: Farm area, 2: Populated area, 3: Pond area, 4: Port area, 5: Sand bank)												
	Right Bank	Left Bank	Distance from Right Bank (up to m)							Distance from Left Bank (up to m)					
			500	400	300	200	100	50	0	50	100	200	300	400	500
0							5	5		5	5	2	2	2	1
1								2		5	5	5	2	2	1+3
2				2	2	2	2	2		2	2	2	2	1	3
3			1	3	1	1	1	1		1	1	1	1	1	3
4				3	1	1	1	1		2	2	2	1	1	1
5					3	3	2	2		5	5	1	1		
6	Lien Mac Sluice Chem Berths							4+2		1	1				
7	Thang Long Bridge					2	2	2		2	2	2	2	1	
8					3	3	2	2		1	2	2	1	1	1
9							2	2		1	1	2	2	2	2
10								2		1	1	1	2	2	1
11						2	2	5		1	1	1	1	1	1+2
12			2	1	5	5	5	5		1	1	1	1	1	1
13			1+2	1	5	5	5	5		1	1	1	1	1	1
14			1+2	1	1	1	5	5		1	1	1	1	1	1
15		Duong River	2+3	2	2	1	1	1		1	1	1			
16			2	2	2	3	2	1		1	1	1	1		
17			2	2	2	2	2	5		1	1	1	1	1	1
18			2	2	2	2	2	2		5	5	5	2	2	2
19	Long Bien Bridge				2	2	2	2		5	5	2	2	2	
20	Chuong Duong Bridge					2	2	2		2	3				
21						2	2	2		2	2	2	2	3	3
22						2	2	2		1	1	1	1	1	1+2
23					2	2	2	2		1	1	1	1	1	1
24	Hanoi Port					4	4	4		1	1	1	1	1	1
25							4	4		1	1	1	1	1	1+2
26							2	2		1	1	1	1	1	1+2
27	Thang Tri Berths		2	2	2	2	2	4+2		1	1	1	2	2	1
28			1	1	1	1	1	1		1	1	1	1	1	
29		Bat Trang Bank	1	1	1	1	1	1		4+2	2	2	2	2	3
30		Xuan Quang Sluice	1+2	1	1	3	3	1		2	2	2	2	2	1+2
31			1+2	1	1	1	1	1		2	2	2	2	2	2+3
32			1	1	1	1	1	1		2	2	2	2	2	2
33	Khuyen Luong Port		1	1	1	1	4	4		1	1	2	2	2	1
34			1+2	1	1	1	1	1		1	1	1	1	1	1
35			1+2	1	1	1	1	1		1	1	1	1	1	1
36			1+2	1	1	2	2	2		1	1	1	1	1	1
37			1	1	1	1	1	1		1	1	1	1	1	1
38			1	1	2	2	2	2		1	1	1	1	1	1
39			1+2	2	2	2	2	1		1	1	1	1	1	1
40			2	2	1	1	1	1		1	1	1	1	1	1

Note) km+ is set by JICA Study Team

Table 23.2.5 Evaluation of River Bank for Port Site in Hanoi Segment (Right Bank)

km+	Major Landmark		Channel Curve	Distance from Talweg	Width of Flood Plane (m)	Land Use of Flood Plane 100m zone	Bank Elevation	Access Road	Primary Hinterland	Evaluation for Port Site
	Right Bank	Left Bank								
0			straight		110	sand bank	+11 : +12		W + SW	Poor
1			straight		40	populated	+10 : +11		W + SW	Poor
2			straight		360	populated	+12 : +14		W + SW	Poor
3			straight	too far	590	farm	+10 : +13		W + SW	-
4			straight	too far	440	farm	+10 : +13		W + SW	-
5			straight	too far	260	populated	+10 : +13		W + SW	Poor
6	Lien Mac Sluice Chem Berths		outside		20	berth + dyke	+09 : +12		W + SW	existing
7	Thang Long Bridge		outside		150	populated	+10 : +13	Ring Road 3	W + SW	Poor
8			straight		250	populated	+10 : +13	Ring Road 3	W + SW	Poor
9			straight	too far	100	populated	+10 : +11		W + SW	Poor
10			inside	too far	40	populated	+10 : +11		inner city	Poor
11			inside	too far	150	s. b. + pop.	+10 : +13	Ring Road 2	inner city	Poor
12			inside	too far	800	sand bank	+05 : +08	Ring Road 2	inner city	Poor
13			inside	too far	1,170	sand bank	+07 : +10	Ring Road 2	inner city	Poor
14			inside	too far	1,170	sand bank	+07 : +10	Ring Road 2	inner city	Poor
15		Duong River	straight	too far	960	farm	+08 : +10	Ring Road 2	inner city	Poor
16			straight	too far	610	farm + pop.	+08 : +13	Ring Road 2	inner city	Poor
17			straight	too far	680	s. b. + pop.	+07 : +11	Ring Road 2	inner city	Poor
18			straight	too far	470	populated	+08 : +11	Ring Road 2	inner city	Poor
19	Long Bien Bridge		straight	too far	300	populated	+10 : +12	Ring Road 2	inner city	Poor
20	Chuong Duong Bridge		straight	too far	260	populated	+11 : +12	Ring Road 2	inner city	Poor
21			inside		210	populated	+10 : +12	Ring Road 2	inner city	Poor
22			outside		170	populated	+11 : +12	Ring Road 2	inner city	Poor
23			outside		270	populated	+10 : +12	Ring Road 2	inner city	Poor
24	Hanoi Port		outside		190	port	+11 : +12	Ring Road 2	inner city	existing
25			outside		70	port + dyke	+11 : +12	Ring Road 2	inner city	existing
26			straight		70	populated	+10 : +12	Ring Road 2	inner city	Poor
27	Thang Tri Berths		straight		530	berths + pop.	+09 : +12		S + E	existing
28			inside	too far	1,210	farm	+06 : +10	Ring Road 3	S + E	Poor
29		Bat Trang Bank	inside	too far	960	farm	+07 : +11	Ring Road 3	S + E	Poor
30		Xuan Quang Sluice	inside	too far	1,160	farm + pond	+07 : +09	Ring Road 3	S + E	Poor
31			straight	too far	1,400	farm	+08 : +10	Ring Road 3	S + E	-
32			straight	too far	1,380	farm	+09 : +10	Ring Road 3	S + E	-
33	Khuyen Luong Port		straight		1,770	port	+09 : +10	Ring Road 3	S + E	existing
34			straight		1,630	farm	+08 : +11		S + E	+
35			straight		1,660	farm	+08 : +10		S	+
36			outside		990	populated	+08 : +09		S	Poor
37			outside		510	farm	+08 : +10		S	+
38			straight		1,310	populated	+09 : +10		S	Poor
39			straight		-	farm + pop.	+08 : +10		S	Poor
40			inside	too far	-	farm	+08 : +09		S	Poor

Note) km+ is set by JICA Study Team

Table 23.2.6 Evaluation of River Bank for Port Site in Hanoi Segment (Left Bank)

km+	Major Landmark		Channel Curve	Distance from Talweg	Width of Flood Plane (m)	Land Use of Flood Plane 100m zone	Bank Elevation	Access Road	Primary Hinterland	Evaluation for Port Site
	Right Bank	Left Bank								
0			straight	too far	1,430	sand bank	+11 : +14		N	Poor
1			straight	too far	1,250	sand bank	+09 : +11		N	Poor
2			straight	too far	820	populated	+09 : +11		N	Poor
3			straight	too far	660	farm	+10 : +12		N	Poor
4			straight	too far	500	populated	+09 : +11		N	Poor
5			straight	too far	340	sand bank	+08 : +11		N	Poor
6	Lien Mac Sluice Chem Berths		inside	too far	100	farm	+09 : +10		N	Poor
7	Thang Long Bridge		inside	too far	370	populated	+09 : +12	Ring Road 3	N	Poor
8			straight	too far	490	farm + pop.	+10 : +13	Ring Road 3	N	Poor
9			straight	too far	500	farm	+10 : +13		N	-
10			outside		830	farm	+11 : +12		N	+
11			outside		1,320	farm	+06 : +12		N	+
12			outside		1,660	farm	+10 : +11		N	+
13			outside		1,650	farm	+09 : +10		N	+
14			outside		1,020	farm	+08 : +09		N	Poor
15		Duong River	straight		-	farm	+11 : +12		E	Poor
16			straight		-	farm	+10 : +12		E	Poor
17			straight		-	farm	+08 : +10		E	Poor
18			straight		700	sand bank	+06 : +09		E	Poor
19	Long Bien Bridge		straight		400	sand bank	+10 : +11		E	Poor
20	Chuong Duong Bridge		straight		130	pop. + pond	+10 : +11		E	Poor
21			outside		800	populated	+09 : +11		E	Poor
22			inside	too far	1,300	farm	+08 : +09		E	Poor
23			inside	too far	1,750	farm	+06 : +09		E	Poor
24	Hanoi Port		inside	too far	1,870	farm	+06 : +09		E	Poor
25			inside	too far	2,190	farm	+05 : +09		E	Poor
26			straight		1,980	farm	+08 : +10		E	Poor
27	Thang Tri Berths		straight		1,070	farm	+08 : +09	Ring Road 3	E	+
28			outside		420	farm	+08 : +09	Ring Road 3	E	+
29		Bat Trang Bank	outside		570	berths + pop.	+09 : +10		E	existing
30		Xuan Quang Sluice	outside		1,030	populated	+09 : +10		SE	Poor
31			straight		1,620	populated	+09 : +11		SE	Poor
32			straight		3,320	populated	+09 : +11		SE	Poor
33	Khuyen Luong Port		straight	too far	-	farm	+09 : +11		SE	Poor
34			straight	too far	-	farm	+08 : +09		SE	Poor
35			straight	too far	-	farm	+08 : +10		SE	Poor
36			inside	too far	-	farm	+08 : +10		SE	Poor
37			inside	too far	-	farm	+08 : +10		SE	Poor
38			straight	too far	-	farm	+08 : +10		SE	Poor
39			straight		-	farm	+08 : +10		SE	+
40			outside		-	farm	+08 : +10		SE	+

Note) km+ is set by JICA Study Team

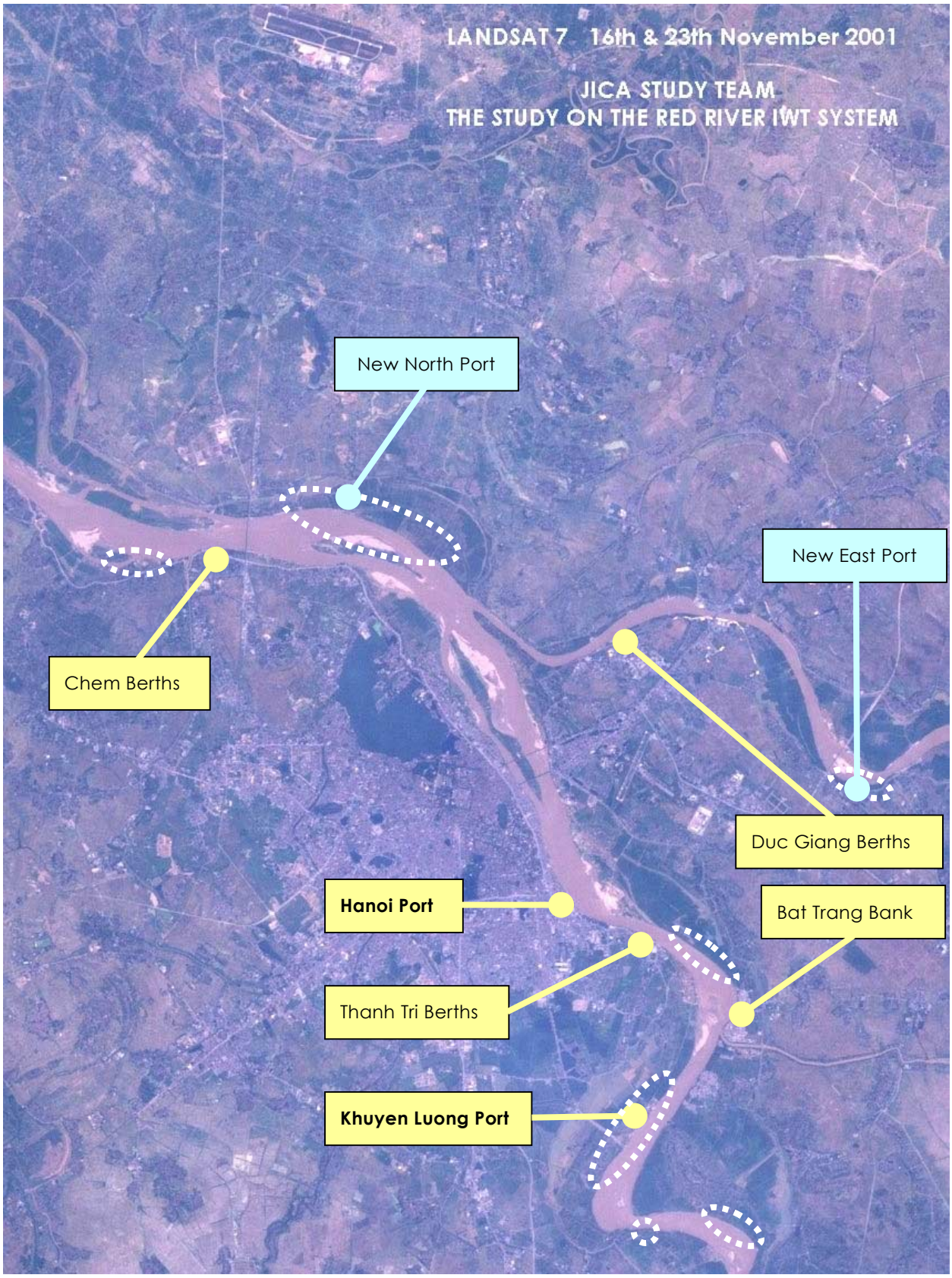


Figure 23.2.3 Alternatives for New Port Site in Hanoi Segment

23.2.2 Distribution of roles and functions among ports/berths

Principle for distributing roles and functions among ports/Berths in the Hanoi segment can be set as follows (see **Table 23.2.7**):

- Existing Berths shall be improved only in terms of safe and environmental aspects without extension of infrastructures. Temporally cargo Berths located between Thang Long bridge and Thanh Tri Bridge shall be removed and transferred to the outside by 2010 in principle.
- Bulk cargo handling at Hanoi Port shall be decreased taking into account the environmental preservation.
- Coal handling at Bat Trang Bank shall be stopped by 2010 since coal kilns will be replaced to gas kilns.
- Bulk cargo other than handled at existing Berths and Hanoi Port shall be handled at Khuyen Luong Port and new ports.
    + Khuyen Luong Port: Serving mainly for districts located at the right bank of Red River excluding the hinterland of Hanoi Port, as well as for a part of Ha Tay Province.
    + New North Port: Serving mainly for Dong Anh and Soc Son Districts.
    + New East Port: Serving mainly for Gia Lam District.
- Non-bulk cargo other than handled at existing Berths shall be handled at Khuyen Luong Port, Hanoi Port and new ports.
    + Khuyen Luong Port: Serving mainly for districts located at the right bank of Red River excluding the hinterland of Hanoi Port, as well as for a part of Ha Tay Province.
    + Hanoi Port: Serving mainly for a part of Citadel districts taking into account road traffic regulation.
    + New North Port: Serving mainly for Dong Anh and Soc Son Districts.
    + New East Port: Serving mainly for Gia Lam District.
- Cargoes transported by SRV (sea-cum-river vessel) shall be handled at Khuyen Luong Port and Hanoi Port.
    + Khuyen Luong Port: Serving mainly for whole city excluding the hinterland of Hanoi Port, as well as for a part of Ha Tay Province.
    + Hanoi Port: Serving mainly for a part of Citadel districts taking into account road traffic regulation.

- Containers transported from Hai Phong and Cai Lan Ports shall be handled at New East Port.
- Easing vessel traffic concentration at Duong Bifurcation shall be taken into account.
- Hanoi Port, Khuyen Luong Port, New North Port, New East Port and Chem Berths, which will undertake a large volume of cargoes and have a characteristic of "General Port", are designated as "Major Port", and others as “Minor Port/Berth”.

Table 23.2.7 Future Main Hinterland of Ports/Berths in Hanoi Segment

Hinterland / Port/Berth	Citadel districts	Soc Son District	Dong Anh District	Gia Lam District	Tu Liem District	Thanh Tri District	Ha Tay Privince
Hanoi Port (for SRV)	o (o)						
Khuyen Luong Port (for SRV)	x (x)	(o)	(o)	(o)	(o)	o (o)	x (x)
New North Port		o	o	x			
New East Port (for Container)	(o)	x (o)	x (o)	o (o)	(o)	x (o)	
Chem Berths	x				o	x	
Other Berths in Zone-1							
Other Berths in Zone-2					o		
Other Berths in Zone-3				o		o	
Other Berths in Zone-4				o			

Note) o: primary hinterland, x: secondary hinterland

Zone-1: Red River between Thang Long Bridge and Thanh Tri Bridge

Zone-2: Red River upstream of Thang Long Bridge

Zone-3: Red River downstream of Thanh Tri Bridge

Zone-4: Duong River

Source) JICA Study Team

Based on the principle for distributing roles and functions among Ports/Berths in the Hanoi segment, concrete distribution of cargo to each Port/Berth is summarized as

follows (see **Table 23.2.8**, **Figure 23.2.4** and **Figure 23.2.5**):

(1) Construction Material

Construction material accounts for 63% of the total throughput in 2001 and will increase to 11.0 million tons in 2020.

a. Hanoi Port: To decrease current throughput by 50% taking into account the environmental preservation.
b. Existing Berths: To increase current throughput by 60% taking into account the increase of handling efficiency.
c. Khuyen Luong Port: To handle 35% of the remaining throughput (total minus Hanoi Port & existing berths).
d. New North Port: To handle 50% of the remaining throughput (total minus Hanoi Port & existing berths).
e. New East Port: To handle 15% of the remaining throughput (total minus Hanoi Port & existing berths).

(2) Cement

Cement accounts for 20% of the total throughput in 2001 and will increase to 3.4 million tons in 2020.

a. Existing Berths: To increase current throughput by 20% taking into account the increase of handling efficiency.
b. Hanoi Port: To handle 20% of the remaining throughput (total minus existing berths).
c. Khuyen Luong Port: To handle 20% of the remaining throughput (total minus existing berths).
d. New North Port: To handle 15% of the remaining throughput (total minus existing berths).
e. New East Port: To handle 45% of the remaining throughput (total minus existing berths).

(3) Fertilizer

Loading of fertilizer for the Southern and Middle region is expected once SRV (sea-cum-river vessel) of 1,000DWT is introduced to Corridor 4 (Hanoi - sea).

a. Khuyen Luong Port: To handle total throughput because of proximity from

fertilizer plant.

(4) Coal

Coal accounts for 8% of the total throughput in 2001 and will increase to 0.8 million tons in 2020.

a. Hanoi Port:	To decrease current throughput by 50% taking into account the environmental preservation.
b. Bat Trang Bank:	To stop handling because coal kilns will be replaced to gas kilns by 2010.
c. Existing Berths:	To increase current throughput by 60% taking into account the increase of handling efficiency.
d. Khuyen Luong Port:	To handle 40% of the remaining throughput (total minus Hanoi Port & existing berths).
e. New North Port:	To handle 15% of the remaining throughput (total minus Hanoi Port & existing berths).
f. New East Port:	To handle 45% of the remaining throughput (total minus Hanoi Port & existing berths).

(5) Paddy/Rice

Unloading of paddy/rice from the Southern region is expected once SRV (sea-cum-river vessel) of 1,000DWT is introduced to Corridor 4 (Hanoi - sea).

a. Hanoi Port:	To handle 50% of total throughput.
b. Khuyen Luong Port:	To handle 50% of total throughput.

(6) Others

Others accounts for 9% of the total throughput in 2001 and will increase to 1.1 million tons in 2020 of which 0.2 million tons are expected once SRV (sea-cum-river vessel) of 1,000DWT is introduced to Corridor 4 (Hanoi - sea).

a. Bat Trang Bank:	To maintain at current throughput.
b. Existing Berths:	To increase current throughput by 20% taking into account the increase of handling efficiency.
c. Hanoi Port:	To handle 20% of the remaining throughput (total minus Bat Trang Bank and existing berths).
d. Khuyen Luong Port:	To handle 20% of the remaining throughput (total minus

Bat Trang Bank and existing berths).

e. New North Port: To handle 15% of the remaining throughput (total minus Bat Trang Bank and existing berths).

f. New East Port: To handle 45% of the remaining throughput (total minus Bat Trang Bank and existing berths).

(7) Container

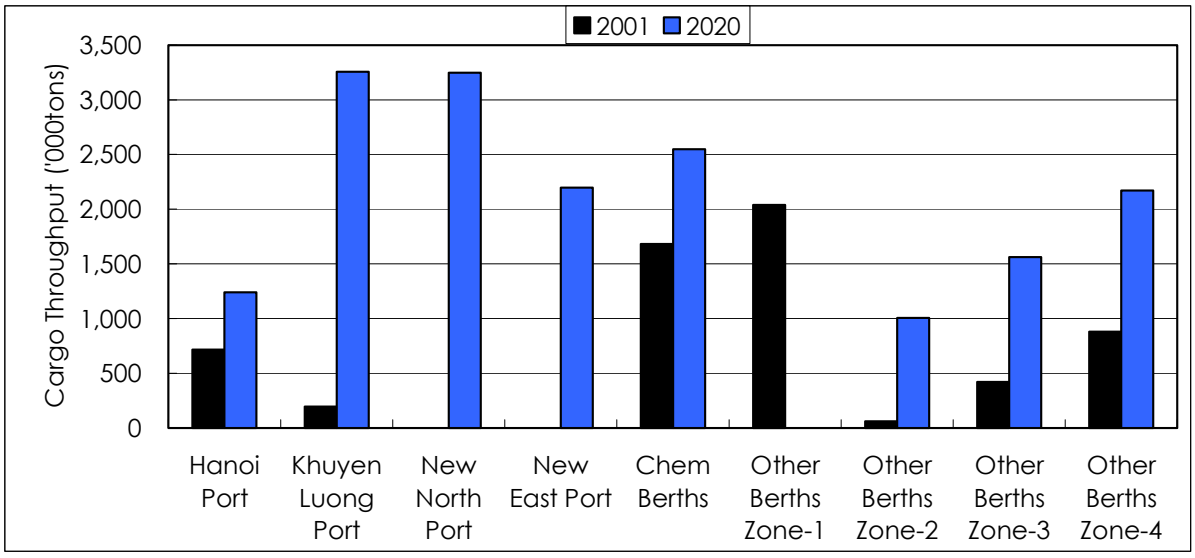
Loading and unloading of container from seaports in the Northern region is expected.

a. New East Port: To handle total throughput because of proximity from Hai Phong and Cai Lan Ports.

Table 23.2.8 Cargo Throughput of Ports/Berths in Hanoi Segment (2001, 2020)

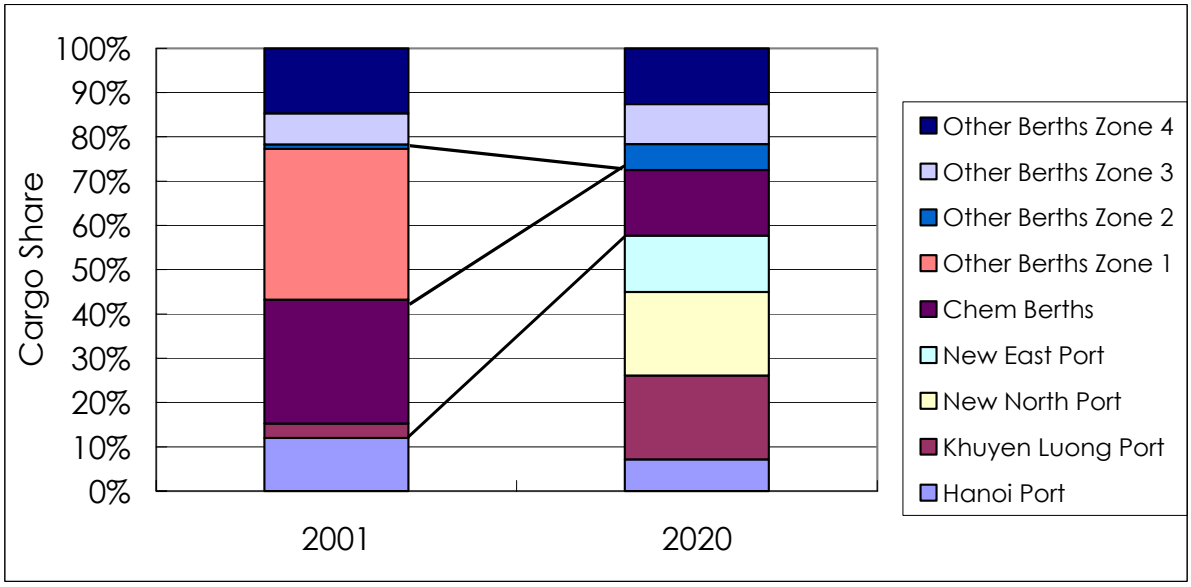
Ports/Berths	Throughput (1000 ton)						
	C. M.	Cement	Fertilizer	Coal	Paddy/Rice	Others	Total
Hanoi Port (2001)	439	43	0	227	0	8	717
Hanoi Port (2020)	220	415	0	114	307	183	1,238
Khuyen Luong Port (2001)	72	24	0	52	0	47	195
Khuyen Luong Port (2020)	1,958	415	182	212	307	183	3,257
New North Port (2001)	0	0	0	0	0	0	0
New North Port (2020)	2,797	311	0	79	0	62	3,250
New East Port (2001)	0	0	0	0	0	0	0
New East Port (2020)	839	934	0	238	0	185	2,197
Chem Berths (2001)	1,330	263	0	0	0	88	1,681
Chem Berths (2020)	2,128	316	0	0	0	106	2,549
Other Berths (2001)	1,930	847	0	220	0	403	3,400
Other Berths (2020)	3,088	1,017	0	218	0	416	4,738
Total (2001)	3,771	1,177	0	499	0	546	5,993
Total (2020)	11,030	3,408	182	861	614	1,135	17,229

Source) JICA Study Team



Note) Zone-1: Red River between Thang Long and Thanh Tri Bridges
Zone-2: Red River upstream of Thang Long Bridge
Zone-3: Red River downstream of Thanh Tri Bridge
Zone-4: Duong River
Note) Cargo transfer from Zone-1 (2020): Zone-1(0%), Zone-2(30%), Zone-3(40%), to Zone-4(30%), outside HN(0%).
Note) New East Port will handle another 32,000 TEUs in 2010 and 67,000 TEUs in 2020 of container.
Source) JICA Study Team

Figure 23.2.4 Cargo Throughput of Ports/Berths in Hanoi Segment (2001, 2020)



Note) Zone-1: Red River between Thang Long and Thanh Tri Bridges
Zone-2: Red River upstream of Thang Long Bridge
Zone-3: Red River downstream of Thanh Tri Bridge
Zone-4: Duong River
Note) Cargo transfer from Zone-1 (2020): Zone-1(0%), Zone-2(30%), Zone-3(40%), to Zone-4(30%), outside HN(0%).
Note) New East Port will handle another 32,000 TEUs in 2010 and 67,000 TEUs in 2020 of container.
Source) JICA Study Team

Figure 23.2.5 Cargo Share of Ports/Berths in Hanoi Segment (2001, 2020)

Temporary Berth restricted banks and potential areas for transferred temporary Berths are shown in **Figure 23.2.6**. Potential areas for transferred temporary Berths and preliminary features of these areas are summarized as follows:

Potential areas for transferred temporary Berths:

- Thuong Cat (Red km+2 Right Bank)
- Dong Du (Red km+28 Left Bank)
- Yen My (Red km+35 Right Bank)
- Dang Xa (Duong km+16 Right Bank)

Preliminary features of each area:

- Land area: length=about 200m - 300m, width= about 50m.
- The safety in vessel navigation and mooring as well as cargo handling, crane operation in particular, shall be made sure.
- Cargo storage volume in the area in flooding season shall be minimized.
- The distance between the area and populated area shall be long enough in order to avoid any negative environmental impact.
- Driving speed of truck along access roads shall be limited in order to avoid traffic accidents and any negative environmental impact.

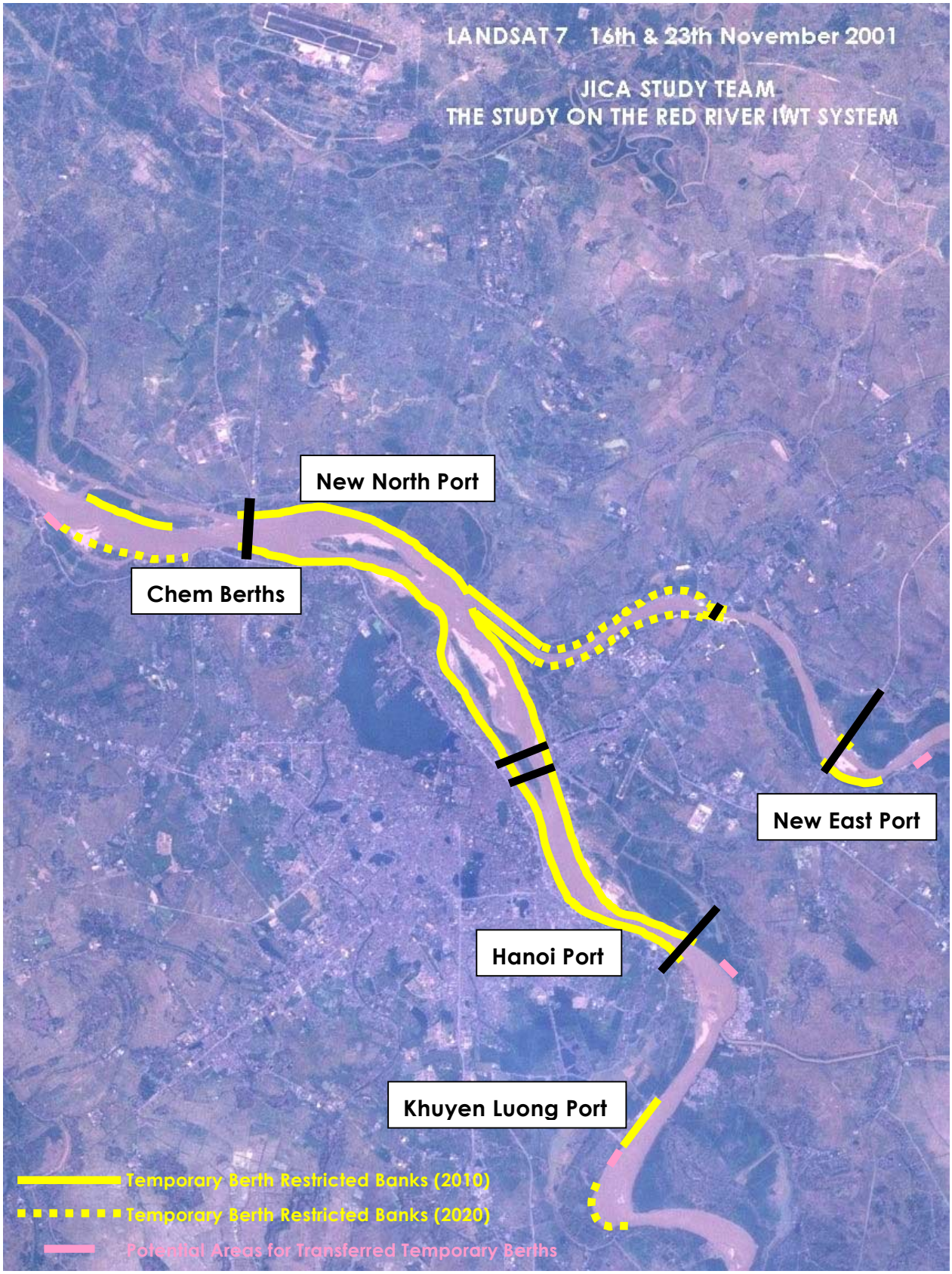


Figure 23.2.6 Temporary Berth Restricted Banks and Potential Areas for Transferred Temporary Berths

23.2.3 Location of passenger berth

As to the location of main passenger terminal, the right bank section of the Red River between Chuong Duong Bridge and Hanoi Port is considered appropriate taking into account the proximity from city center and easy maintenance of water depth.

Within the above appropriate section, the following 4 alternatives for main passenger terminal can be set (see **Figure 23.2.7**):

Alternative-1: Chuong Duong Do
Chuong Duong Passenger Berth is located here just downstream of the Chuong Duong Bridge (km+20.5). Port facilities consist of a pontoon and a slope way. It seems difficult to allocate enough space for passenger berth and relating facilities without relocation of residents.

Alternative-2: Van Kiep
Van Kiep is located on the extension of Tran Hung Dao Street which is connected with the Hanoi Railway Station. It seems difficult to allocate enough space for passenger berth and relating facilities without relocation of residents.

Alternative-3: Van Don
Van Don is located 0.5km downstream of Van Kiep. Small berths and residences occupy the bank here. It seems difficult to allocate enough space for passenger berth and relating facilities without relocation of residents.

Alternative-4: Lang Yen
Lan Yen is located at the northern section of Hanoi Port. Hanoi Port (port operator) is supporting to construct the passenger berth at Lang Yen.

JICA Study Team considers that Alternative-4 (Lang Yen) is the best among 4 alternatives taking into account easiness in allocating enough space for passenger berth and relating facilities.

In addition to the main passenger terminal, complement passenger berths provided with small pontoon at major tourist spots in the Hanoi segment are also proposed for tourist purpose.

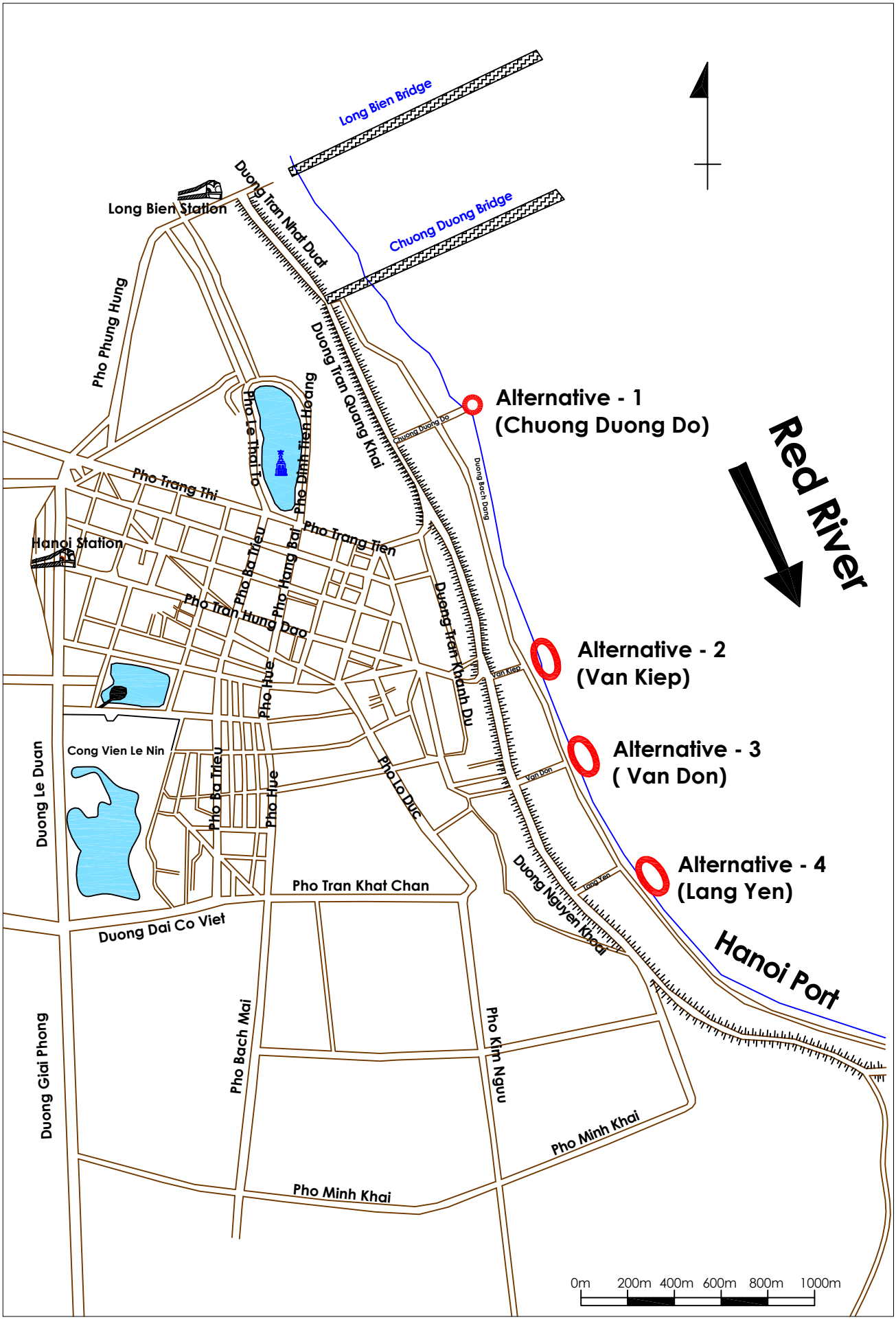


Figure 23.2.7 Alternative Locations of Passenger Terminal

Chapter 24 Transport Demand in Hanoi

24.1 Introduction

In Chapter 18, focus was given on cargo and passenger transport demand in the northern region. This chapter focuses on transport demand in Hanoi focusing on two factors which can have a substantial impact on cargo movement in Hanoi – potential demand of SRV (sea-cum-river vessel) and container. A potential benefit of introducing sea-cum-riverway to Hanoi or Ninh Binh has been debated since the 1990s. At present, most cargo from the central and southern regions are transported to Hanoi and neighboring provinces mainly via Hai Phong port through coastal shipping. A key concept of introducing sea-cum-riverway is that it could reduce total transport costs, composed of operating cost, transshipment cost, access/egress cost, etc., economically and financially. Regarding container demand, a possibility to carry container through inland waterway from Hai Phong to Hanoi is much less feasible due to the high financial cost. However, in terms of economic cost, it is more feasible. In this background, this chapter also estimates the potential demand of SRV and container.

24.2 Potential demand of SRV

24.2.1 Current issues on SRV

Sea-cum-riverways is a particular technical term used in Viet Nam. The concept entails the development of some inland and coastal waterways to enhance the integrated operation of both. The VIWA formulated the strategic development of the 1,500-km-long SRV up to 2010. It is expected that the SRV could reduce time- and labor-related costs needed to transship cargoes from coastal shipping transport to inland waterway transport. A typical SRV is of the 1,000 DWT self-propelled type, which can navigate both in inland waterways and the coastal area (within 50 km from the coastline, according to the VINAMARINE).

"The Master Plan Study on Coastal Shipping Rehabilitation and Development Project (JICA, 1997)" proposed a development plan of sea-cum-riverways (see **Table 24.2.1**). The outline of this plan in Red River Delta is as follows:

Lach Giang – Hanoi: Self-propelled vessels of 1,000 DWT used to operate on this route until 1983 when insufficient dredging and lack of route information made the route dangerous. Necessary dredging work should thus be urgently undertaken to allow at least 1,000 DWT vessels to use the route once again. According to the

TEDI, a dredging volume of about 2 million cu m is needed to make the section navigable for 2,000 DWT SRVs, while the dredging works for annual maintenance is estimated at 0.4 million cu m. The estimated cost of this plan, composed of the improvement of waterways up to Viet Tri from Lach Giang via Hanoi, was US$ 4.5 million as of 1997.

Viet Tri – Hanoi: This route needs to be deepened, from the current 1.8 m to 2.9 m, to enable year-round navigation of 600 DWT and 1,000 DWT vessels.

Cua Day – Ninh Binh: This route is proposed to accommodate 1,000 DWT vessels. Since the river flow and depth are quite navigable at the river mouth an adequate flow stabilization and depth control method will have to be employed, based on a detailed engineering study.

Quan Lien Canal: This canal will be developed to connect the Ninh Co River with the Day River. It is intended to provide SRVs with a stable navigational environment and to create a favorable condition for river transport. The estimated cost of the plan, composed of the improvement of waterways up to Ninh Binh from Cua Day including the Quan Lien Canal, was US$ 8.7 million as of 1997.

Table 24.2.1 Development Plan of Sea-Cum-Riverways

From	To	Distance (km)	Designed Allowable Ship Size (GRT)	Target Year for Improvement
Cua Lach Giang	Hanoi	199	2,000	2000
Cua Day	Ninh Binh	57	2,000	2000
Cua Cam	Hai Phong	36	5,000	Existing
Viet Tri	Hanoi	75	1,000	2010
Quan Lien Canal		3	2,000	2010
Total		370		

Source) "Master Plan Study on Coastal Shipping Rehabilitation and Development Project", JICA,1997

In this study, the potential demand will be forecast under an assumption that SRV can go through Day River to Ninh Binh and Hanoi.

24.2.2 Cargo movement of coastal shipping

Transport demand of SRVs can be generated from the cargo volume carried by coastal shipping. According to the VITRANSS, total cargo volume moving from/to the north by coastal shipping in 1999 was recorded at around 7 million tons per year. Most of the cargo volume was delivered to final destinations mainly via Hai

Phong Port. Looking at its composition by commodity item, it is largely dominated by paddy and other crops, cement, coal, and petroleum products (more than 70% of the total).

Table 24.2.2 Cargo Volume by Coastal Shipping, 1999

(Unit: million tons/year)

	South-North	Central-North	Total
Paddy and Other Crops	1.3	0.0	1.3
Steel	0.3	0.0	0.3
Construction Materials	0.2	0.1	0.3
Cement	0.9	0.8	1.7
Fertilizer	0.6	0.1	0.7
Coal	0.7	0.4	1.1
Petroleum Products	1.0	0.0	1.0
Manufacturing Goods	0.3	0.3	0.6
Total	5.3	1.7	7.0

Source) VITRANSS

Although cargo volume by coastal shipping amounts to 7 million tons, most commodity items that can be transported by SRV will, considering location of industrial plants, transported type, and produced and consumed area, be identified. The following commodity items will be difficult to transport by SRV:

- Steel, plants of which are scattered around Hai Phong, Quang Ninh and Thai Nguyen and its deficit will be complemented from these provinces.
- Construction materials, which are produced in the northern region but are unprofitable to transport to the central or southern regions. Therefore, their amount will be not so much.
- Coal, most of which is mined in Quang Ninh and transported to the central or southern region by coastal shipping. It should be noted, however, that transporting coal by SRV from Quang Ninh to Ninh Binh will be more profitable.
- Petroleum products, most of which come from the southern region and are delivered through pipelines from Hai Phong.

Excluding the above, major commodity items that could make use of SRV include paddy and other crops, cement and fertilizer. Until now, the RRD has been self-sufficient in rice but the northeast and northwest are not, needing regular supply from the south. As the north's consumption is expected to further exceed production, more rice supply will be needed from the south. Regarding cement, a plan to extend its production capacity in Ninh Binh is under progress. It can be transported to the central or southern regions by SRV.

24.2.3 SRV's preferred areas

Transport demand of SRV will generate from the converted demand from coastal shipping. In determining each mode's share, transport cost would be the most important factor. In this study, OD pair's transport cost, which includes all the costs from origin to destination such as access cost by truck or inland waterway, operating cost and transshipment cost, was calculated according to transport mode, as shown in **Table 24.2.3**. Operating costs of SRV and coastal shipping were assumed at 126 VND/ton-km and 69 VND/ton-km, respectively.

Table 24.2.1 shows an example of transport cost calculation from HCMC to the northern region. As SRV can go through to Ninh Binh and Hanoi, SRV will be the choice in the neighboring areas of Hanoi and Ninh Binh, especially in the northwest. This means that if SRV's preferred areas need supply from HCMC, it will be preferred more than coastal shipping from the viewpoint of economic transport cost.

Table 24.2.3 Economic Transport Cost

Mode		Operating Cost (VND/ton-km)	Loading/unloading and other Mobilization Charge(VND/ton)
Truck		546	55,000
Inland Waterway		221	104,000
Coastal Shipping	1000 DWT	126	199,000
	3000 DWT	84	
	5000 DWT	69	
	10000 DWT	61	

Note) Operating cost of truck and loading/unloading cost come from the VITRANSS and the rest was calculated by the study team.

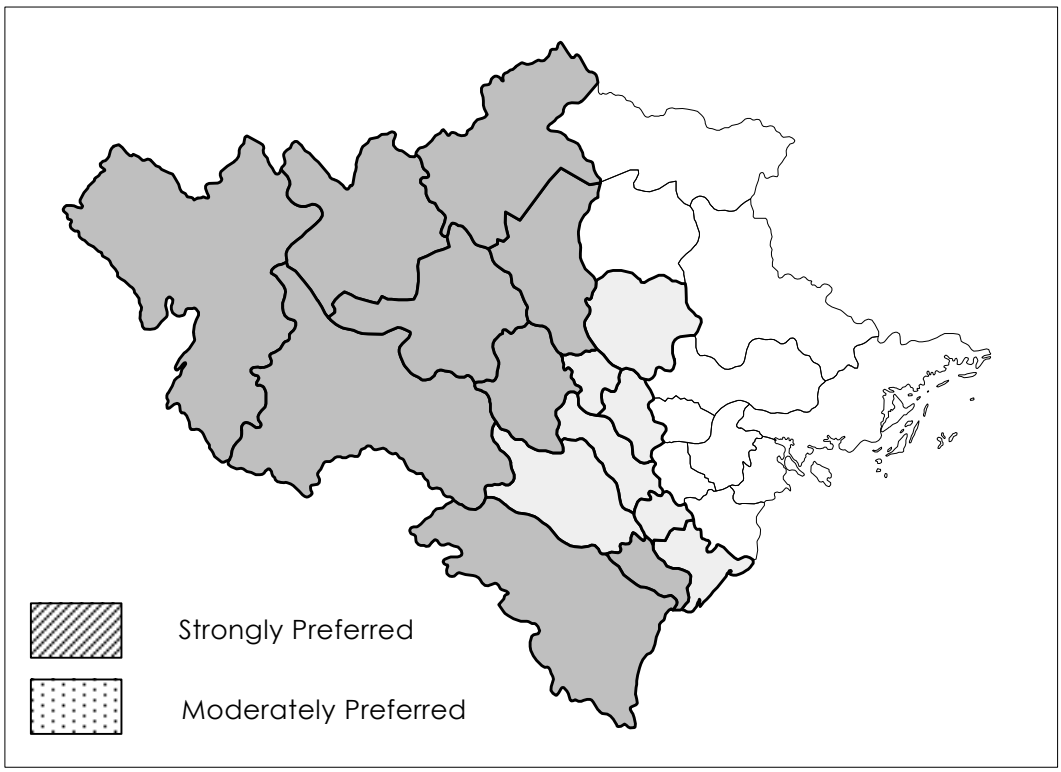


Figure 24.2.1 SRV's Preferred Areas from HCMC

24.2.4 Potential transport demand of SRV

The same formula mentioned in Chapter 18 was adopted here in order to estimate the potential transport demand of SRV. In determining the modal share of SRV, the following formula was used after calculating OD pair's transport cost of each mode.

$$P_i = C_i^{-a} \Big/ \sum_m C_m^{-a}$$

Where, P_i : Probability to choose mode i
C_i : Transport cost of mode i
a : parameter

Parameter "a" was set up at 1.0 – 1.2 according to transport mode and commodity type taking into account the present situation.

Table 24.2.4 shows the summary of SRV transport demand forecast. A total of cargo volume moving from/to the north was estimated to increase by around 3 times in 2020, a quarter of which would be converted to SRV. As a result, SRV was estimated to have a potential demand of around 1 million tons toward Hanoi in 2020.

Table 24.2.4 Summary of SRV Transport Demand Forecast

(Unit: '000 tons/year)

Commodity Item	2010		2020	
	Ha Noi	Ninh Binh	Ha Noi	Ninh Binh
Paddy/rice	373.1	293.6	613.5	464.7
Steel	1.1	0.6	4.5	2.8
Construction Material	0.0	86.9	0.0	133.2
Cement	0.0	144.2	0.0	338.4
Fertilizer	55.6	113.6	181.8	266.8
Coal	0.0	438.9	0.0	1,092.0
Others	110.4	66.2	197.3	113.5
Total	540.2	1,144.0	997.2	2,411.4

24.3 Container

24.3.1 Export and import at northern ports

The VITRANSS analyzed commodity production and consumption at provincial level, using provincial statistics, trade statistics, government documents, and results of various surveys. Further, future production and consumption were also estimated taking into account socio-economic data, such as population, sectoral GDP, etc., agricultural/industrial development policy and trade policy. Based on the data on surplus and deficit of each commodity, the VITRANSS also forecast export and import prospects. According to it, the amount of export and import will increase from 38.5 million tons in 1997 to 51.3 million tons in 2010 and 98.9 million tons in 2020.

On the other hand, the amount of export and import in the northern region is listed in **Table 24.3.1**. One of the forecast results is that the amount of manufactured and other miscellaneous goods, the value added of which is comparatively high, will substantially rise in the future as industrial economy grows. The amount was estimated to expand by 6.0 times for manufacturing goods and 6.4 times for other miscellaneous goods until 2020 (see **Figure 24.3.1**). The increase in volume of these commodities will have a direct impact on container demand. In this study, it was assumed that all the manufacturing goods and some miscellaneous goods would be transported in containers.

Table 24.3.1 Export and Import by Commodity Item at Northern Ports

(Unit: '000 tons/year)

		1997		2010		2020	
		Hai Phong Port Group	Quang Ninh Port Group	Hai Phong Port Group	Quang Ninh Port Group	Hai Phong Port Group	Quang Ninh Port Group
Steel, Iron Ore	Export						
	Import	680	21	255	511	400	1200
Cement, Clinker	Export			1500	1500	1500	1527
	Import						
Fertilizer	Export						
	Import	525		0	230		230
Coal	Export		3454		4500		4500
	Import						
Oil	Export						
	Import		1420				1100
Manufacturing Goods	Export	594	66	571	1711	806	3226
	Import	739	82	693	2078	979	3917
Other Miscellaneous Go	Export	143	16	225	673	445	1780
	Import	456	51	215	643	404	1617
Total	Export	737	3536	2296	8384	2751	11033
	Import	2400	1574	1163	3462	1783	8064

Source) VITRANSS

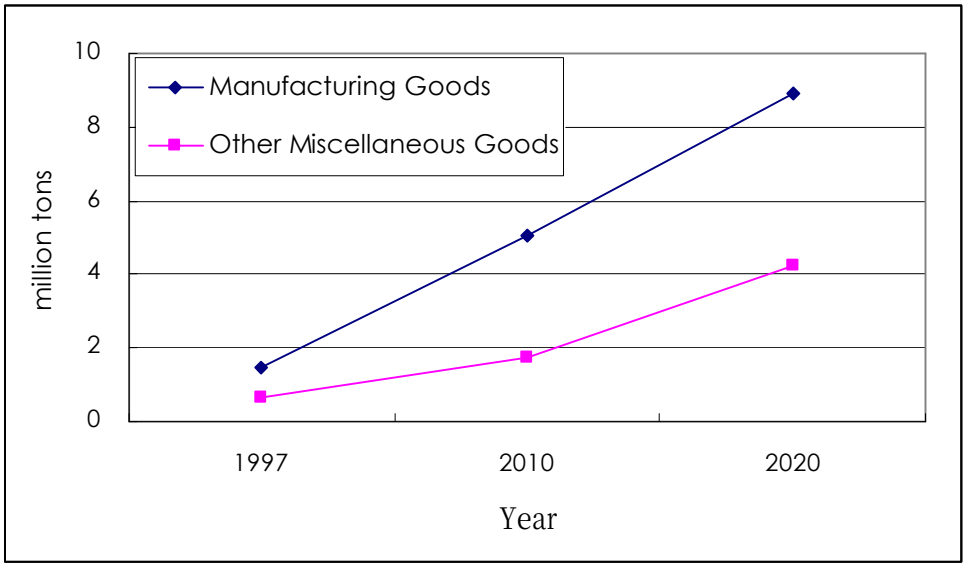


Figure 24.3.1 Increase in Manufactured and Other Miscellaneous Goods

24.3.2 Potential container demand toward Hanoi

It was assumed that all the manufactured goods would be transported to destinations in containers. Regarding other miscellaneous goods, usage of container was assumed to progressively increase over time, reaching 70% in 2010 and 90% in 2020. Under these assumptions, a total volume of container was, as shown in **Table 24.3.2**, calculated as 6.2 million tons in 2010 and 12.7 million tons in 2020.

Table 24.3.2 Volume of Container Cargo

(Unit: '000 tons/year)

Item	2010			2020		
	Hai Phong Port Group	Quang Ninh Port Group	Total	Hai Phong Port Group	Quang Ninh Port Group	Total
Export	729	2,182	2,911	1,207	4,828	6,035
Import	844	2,528	3,372	1,343	5,372	6,715
Total	1,572	4,710	6,282	2,549	10,200	12,749

Import and export commodities will be distributed or accumulated to/from Hanoi and Quang Ninh port based on supply and demand. It was herein assumed that manufactured goods for export would accumulate at each provincial port in proportion to secondary GDP of each province. However, manufactured goods for import and miscellaneous goods both for import and export will depend on the total GDP rather than secondary GDP.

Table 24.3.3 Volume of Container Cargo between Hanoi and Port Group

(Unit: '000 tons/year)

Item	2010			2020		
	Hai Phong - Ha Noi	Quang Ninh - Ha Noi	Total	Hai Phong - Ha Noi	Quang Ninh - Ha Noi	Total
Export	227	681	908	389	1,557	1,946
Import	239	715	954	399	1,596	1,995
Total	466	1,396	1,862	788	3,153	3,941

The above assumptions resulted in container demand between Hanoi and Hai Phong and Quang Ninh port groups as shown in **Table 24.3.3**. It was estimated at 1.8 million tons in 2010 and 3.9 million tons in 2020.

24.3.3 Potential container demand through IW

In order to examine the possibility of inland waterway carrying containers, the transport cost and time of truck and IWT were roughly compared based on a users' interview survey of financial cost. The results are summarized in **Table 24.3.4**. In total, transport costs are almost same but transport time of inland waterway is about thrice longer than that of truck. One of the reasons why inland waterway transport is costly is vessels have to pay an additional amount when moving from one province to another. In summary, using inland waterway for container transport is difficult from the viewpoint of financial cost.

Table 24.3.4 Cost and Time Comparison, Hanoi - Hai Phong

Item	Truck	IWT
Transport Cost ($US)1/	110	111
Transport Time (hr)2/	3	22

Note) 1/ calculated from interview survey in terms of financial cost.
2/ assumed that average speeds are 35 km/h for truck and 7.5 km/h for IW.

However, a comparison of their economic cost provides much more possibility to inland waterway transport. The transport cost of inland waterway is about 30% lower than that of truck. IWT could thus be an alternative to transport containers of low value-added products or less time-sensitive products or empty ones.

Comprehensively, it was, under assumptions that Vietnam would take a transport strategy to enhance economically preferred transport mode and travel time of truck would progressively increase in the future due to traffic congestion on National Highway No.5, judged that inland waterway could be capable of transporting 15% of containers moving betwee Hanoi and Hai Phong and 10% of those between Hanoi and Quang Ninh. Conclusively, potential container demand was forecast at 0.2 million tons in 2010 and 0.4 million tons in 2020 (see **Table 24.3.5**). Assuming that an average tonnage of a container is 10 tons, they are converted into around 20,000 TEU in 2010 and around 40,000 TEU in 2020. Container demand will increase at a growth rate of more than 7.5%, which is higher than GDP's (see **Table 24.3.6**).

Table 24.3.5 Potential IWT Container Demand

(unit: '000 tons/year)

	2010			2020		
	Hai Phong - Ha Noi	Quang Ninh - Ha Noi	Total	Hai Phong - Ha Noi	Quang Ninh - Ha Noi	Total
Export	34.1	68.1	102.2	58.4	155.7	214.1
Import	35.8	71.5	107.3	59.8	159.6	219.4
Total	69.9	139.6	209.5	118.2	315.3	433.5

Table 24.3.6 Comparison Between Growth Rates and Other Indicators

ITEM		2010	2020	AGR(%)
Total Container Demand('000)	Export	2,911	6,035	7.6
	Import	3,372	6,715	7.1
	Total	6,282	12,749	7.3
IWT Container Demand ('000)	Export	102	214	7.7
	Import	107	219	7.4
	Total	210	433	7.5
GDP(VND bil.)	Primary	27,764	36,623	2.8
	Secondary	63,654	118,108	6.4
	Tertiary	59,577	116,853	7.0
	Total	150,996	271,584	6.0

24.4 Summary of transport demand in Hanoi

In conclusion, transport demand in Hanoi is summarized in **Table 24.4.1**. Total cargo transport demand, which has its origin or destination in Hanoi, will become 10.5 million tons in 2010 and 17.6 million tons in 2020. On the other hand, passenger transport demand will reach 0.6 million passengers in 2010 and 0.9 million passengers in 2020. It should be noted, however, that traffic flow moving over rivers in Hanoi will be much bigger due to a bypass cargo traffic, as shown in **Figure 24.4.1**.

Table 24.4.1 Summary of Transport Demand in Hanoi

Item		2001	2010	2020	AGR(01-10)	AGR(10-20)
IWT Demand ('000 tons)	CM	3,772	6,574	11,030	6.4	5.3
	Cement	1,177	1,769	3,408	4.6	6.8
	Coal	500	698	861	3.8	2.1
	Others	546	739	933	3.4	2.4
	Sub-total	5,996	9,781	16,231	5.6	5.2
SRV Demand ('000 tons)	Paddy/Rice	-	373	614	-	5.1
	Steel	-	1	5	-	14.7
	Fertilizer	-	56	182	-	12.6
	Others	-	110	197	-	6.0
	Sub-total	-	540	997	-	6.3
Container Demand ('000 tons)	Export	-	102	214	-	7.7
	Import	-	107	219	-	7.4
	Sub-total	-	210	433	-	7.5
Total ('000 tons)		5,996	10,530	17,662	6.5	5.3
Passenger Demand ('000)		-	641	932	-	3.8

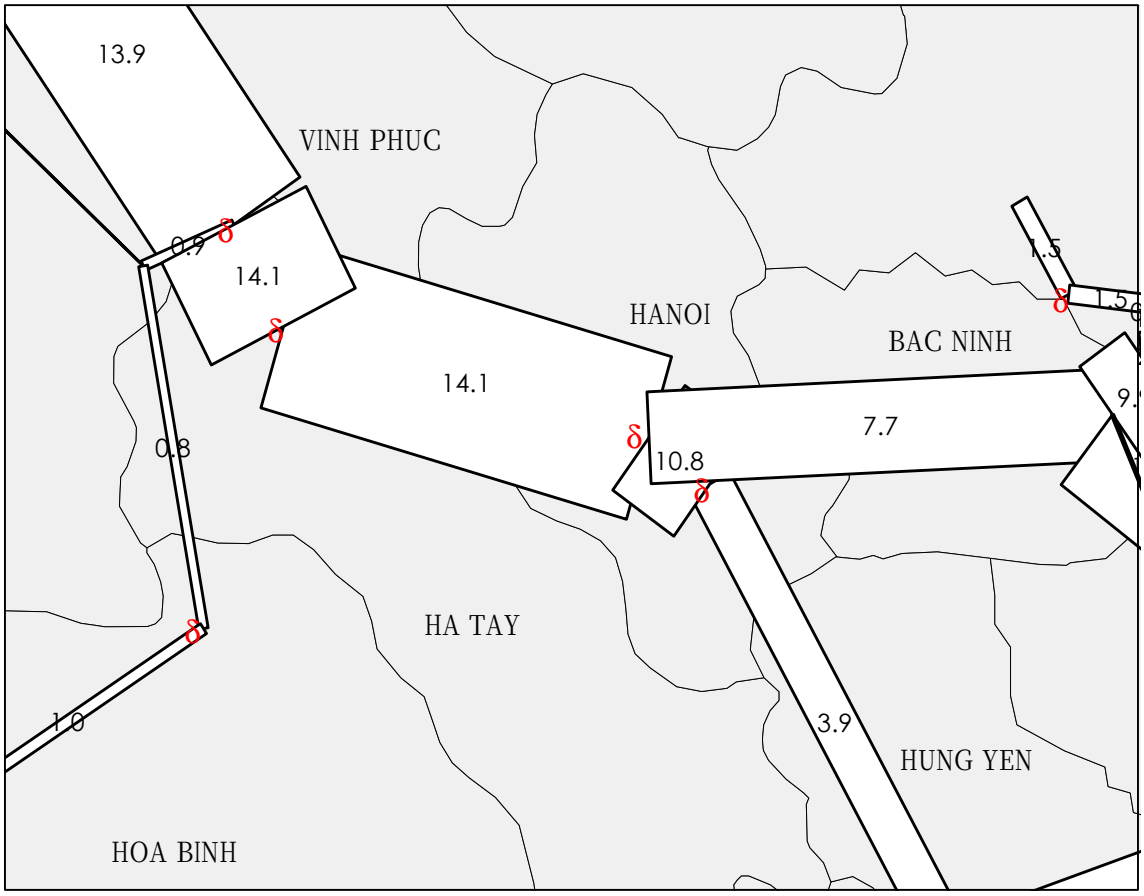


Figure 24.4.1 Cargo Traffic Flow in Hanoi Segment

24.5 Potentiality of river cruise in and around Hanoi city

The river cruise in Asia has been gaining recognition by the tourism market as an attractive tourism product. For instance, the number of river boat (speed boat) and tourism activities along the Chao Praya River of Bangkok in Thailand has been increasing dramatically and drawing the tourist's interest year by year.

The potential use of the Red River as a tourism product by an introduction of river cruise not only for the international tourists but also for sharply increasing domestic tourists was assessed in this part of the study.

1) Tourist arrival in Hanoi (1996 – 2000)

Annual tourist arrival to Hanoi in 2000 is estimated at approximately 1.9 million in total, which is composed of 0.45 million foreign tourists and 1.45 million domestic tourists. The number of tourist visiting Hanoi has been drastically increasing at an annual growth rate of around 18 % in 1999 – 2000 and around 20 % in 2000 – 2001

as shown in **Table 24.5.1**.

Table 24.5.1 Change of Tourist Arrival by Year (1996 – 2000)

Annual Tourist Arrivals (,000 pax)						
	Hanoi			National Total		
Year	Foreign	Domestic	Total	Foreign	Domestic	Total
1996	352	700	1,052	1,607	8,400	10,007
1997	391	809	1,200	1,716	10,480	12,196
1998	352	937	1,289	1,520	12,560	14,080
1999	380	1,050	1,430	1,782	14,925	16,707
2000	450	1,450	1,900	2,140	17,692	19,832
Annual Growth Rate (%)						
1996-97	11.1	15.6	14.1	6.8	24.8	21.9
1997-98	-10.0	15.8	7.4	-11.4	19.8	15.4
1998-99	8.0	12.1	10.9	17.2	18.8	18.7
99-2000	18.4	38.1	32.9	20.1	18.5	18.7
Average	6.9	20.4	16.3	8.2	20.5	18.7

Source) VNAT

The average share of foreign tourist arrival to Hanoi in the total foreign tourist arrivals of Vietnam during the period of 1996 - 2000 accounted for around 22.0 % and domestic tourist accounted for around 7.7 %.

2) Projection of tourist arrivals to Hanoi

The annual tourist arrival to Hanoi at 2010 and 2020 and the changes of annual growth rate are projected as shown in **Table 24.5.2** below.

Table 24.5.2 Projection of Tourist Arrivals to Hanoi

(Unit: 000 pax)

	Hanoi			National Total		
Year	Foreign	Domestic	Total	Foreign	Domestic	Total
2000	450	1,450	1,900	2,140	17,700	19,840
2010	760	4,021	4,781	3,615	49,083	52,699
2020	1,082	8,038	9,120	5,146	98,118	103,264
Projection of Annual Growth Rate						
	Hanoi			National Total		
Period	Foreign	Domestic	Total	Foreign	Domestic	Total
AGR 2000-10	6.0%	12.0%	10.8%	6.0%	12.0%	11.5%
AGR 2011-20	4.0%	8.0%	7.4%	4.0%	8.0%	7.8%

Source) JICA Study Team

Some part of those tourists visiting Hanoi is assumed to choose the river cruise attraction along the Red River, if the river cruise operation is made available to the tourist as one of attractive tourism products. The probable number of tourist

who would choose the river cruise attraction is assumed based on probable share of such tourist in total tourist arrivals to Hanoi for 2010 and 2020 as shown in Table **24.5.3**.

Table 24.5.3 Projection of River Cruise Tourism in Hanoi

	Annual Demand (,000 pax)		
Year	Foreign	Domestic	Total
2010	45	73	118
2020	114	201	315
	Daily Demand (pax)		
Year	Foreign	Domestic	Total
2010	200	322	522
2020	507	894	1,400
	Share in Total Visitor to Hanoi		
Period	Foreign	Domestic	Total
AGR 2000-10	10.0%	5.0%	6.2%
AGR 2011-20	15.0%	5.0%	3.5%

Source) JICA Study Team

3) Type of river cruise service

The type of river cruise service can be categorized in three (3) types such as Longer Cruise, Dinner Cruise and Over-night Cruise in general by voyage time or typical size or type of vessel used for such river cruise. Although the element composing such river cruise vary so much depend on local conditions and objective of tourism products, type of cruise can be categorized by following criteria as shown in **Table 24.5.4**.

Table 24.5.4 Type of River Cruise

	Longer Cruise	Dinner Cruise	Over-night Cruise
Duration of Voyage	2 – 4 hours	4 – 6 hours	1 night/2 days
Number of Passengers	10 - 20	20 – 50	< 50
Facility	Light Meal	Dining	Dining and Bar
Accommodation	Chairs	Chairs with Table	Cabin
Standards	Simple	Cozy	Delux

4) Possible destination of river cruise in and around Hanoi

The attractions of river cruise in Hanoi for the tourists by type of cruise are tabulated in **Table 24.5.5** below:

Table 24.5.5 Typical Attraction for River Cruise in Hanoi

Longer Cruise	Dinner Cruise	Over-night Cruise
River bank of the Red River along Hanoi City	River bank of the Red River along Hanoi City	River bank of the Red River along Hanoi City
Bridges	Bridges in the night	Bridges in the night
City life	City and rural life	City and rural life
	Bat Chan Village	Bat Chan Village and beyond
		Temples
		Viet Tri, Ninh Vinh

5) Typical design of river boat

Various designs of boats for river cruise have been adopted in major cities of the world. The recommended design of boats for river cruise in Hanoi by cruise type taking into consideration of both local natural and business conditions of Hanoi will be studied later.