

**PROJECT ON RENOVATION AND UPGRADING OF NAVIGATION CHANNEL ON
DAY ESTUARY
IN THE FORM OF PUBLIC PRIVATE PARTNERSHIP**

1. General Information of the project

1.1 Project name: Renovation and upgrading of navigation channel on Day estuary

1.2 Location of investment: navigation channel on Day estuary – Ninh Binh province

1.3 Form of investment (expected): in the form of BOT, BT

1.4 Necessity of the project

Ninh Binh locates at the southern gateway of Hanoi with the North - South rail axis and National Highway 1A running through, sea- river shipping route via Day estuary, Inland Waterway Ninh Phuc – Ninh Binh port system which is the largest port system in the Northern region, etc. These are extremely favorable conditions for economic exchanges within Northern Delta area, central coastal provinces and the Southern Vietnam.

As the focal area with abundant natural resources, plentiful laborers and relatively complete infrastructure of several industries and transport sector, Ninh Binh has become a fascinating area with great potentials of attracting socio- economic development projects, particularly the industries of cement and construction materials.

Ninh Binh – Ninh Phuc port complex has been funded from state budget to invest in infrastructure and modern handling facilities and equipments in order to carry out tasks for cargo transition for the region and cooperate to transport among road, rail and waterway. It is predicted that the capacity of Ninh Binh – Ninh Phuc port complex will reach 3.0 million tons to 2020 and 4.0 million tons to 2030.

The waterway route from Day estuary to Ninh Phuc – Ninh Binh port complex is one of the four crucial strategic waterway routes of Northern Delta region. With total length of 76 km, Day estuary – Ninh Binh waterway route directs to the sea, is eligible for the exploitation of sea- river ships of 300 tons, can reduce transport duration and more cost- effectiveness compared to waterway routes originating from the North (decrease 60 km compared to Quang Ninh – Ninh Binh inland waterway route via Luoc River) and extremely convenient for transporting cargos from the Southern region as it is not necessary to transit via Hai Phong port. Cargo volume is predicted to reach 3.6 million tons to 2020.

Since 1994 – 2000, Vietnam Inland Waterway Administration implemented the project “Upgrading waterway route from Day estuary to Ninh Phuc – Ninh Binh”. Overall, the project achieved some certain efficiency such as clearance of navigation channel and route, increasing transport volume of cargos and waterway vehicles via Day estuary (accounted for 35-40% of volume of cargo via Ninh Phuc), securing navigation safety, etc. However, there remained some shortcomings such as unstable channels, limited depth, ships < 1000 T to take tidal advantages of over 1.5m to navigate, dredged channels filled with sedimentation after 4 - 6 months, etc.

Therefore, the renovation and upgrading of navigation channel via Day estuary aims to meet increasing waterway demands, reduce pressure for road and rail transport, in accordance with the master plan on development for Vietnam inland waterway transport to 2020 and orientations toward 2030 approved by the Ministry of Transport. This will greatly contribute to promote the socio- economic development of the region in the period from present to 2030.

1.5 Project Objectives

- Renovation, upgrading and maintenance of navigation channel on Day estuary in order to meet the increasing demand of waterway transport sector and reduce pressure for road and rail transport.

- Develop an efficient transport mode, operational condition, exploitation management and maintenance for navigation channels on Day estuary for sea- river ships.

1.6 Preliminary assessment on current status of navigation channel via Day estuary

1.6.1 Navigation channel status and hydrological dynamics situation of Day estuary

+ Day River with the length of 267 km from Hat Mon estuary to Day estuary. In which, section from Ninh Phuc – Ninh Binh to Day estuary with the length of 76 km has a lot of advantages for waterway transport. Located in Con Thoi commune, Kim Son District, Ninh Binh province, Day estuary has geographic coordinate $190^{\circ} 52' 26''$ north latitude and $106^{\circ} 6' 3''$ east longitude.

+ *Topographic features*

The topography of Day estuary is relatively flat. Average altitude is from $-0.80 \div -1.0$ m; The highest location is +1,7m, the deepest location is -2.0m. The end of river self has altitude of $-5.00m \div -7.00m$.

Under frequency of water level P95% = +0.40m, navigation channel at Day estuary has average depth of 3 -:- 5m, threshold of shallow area is 2.5 km long, the threshold top has the smallest depth of 0.7m. Navigation channel at Day estuary has bend sinusoidal shape, curvature radius of 800-1000 m. Mudflats along the channel are increasing and unstable.

+ *Flow regime*

Day river is a major tributary of Red River system. In addition to key role in inland waterway transport, Day River has the role of flood diversion for Red River.

Flood regime from June to October, flood water accounts for a huge volume in this season, approximately 19-23% of total volume of yearly flows.

Dry season is less rainy season. Flow on Day river is mainly provided from Red River. In this season, the downstream section is affected by high tides. Saline water from the sea entered and went deeper into the continent.

+ *Tidal regime*

Tial regime at Day estuary is under the regime of irregular diurnal tide, each month has 20 – 22 days of diurnal tide, tidal amplitude of high water level is from 2.2 to 2.8m, tidal amplitude of low water level is from 1.2 to 1.4m.

+ *Velocity regime*

The data of velocity regime recored in phase 1 (low water season) and phase 2 (flood season) showed that: highest vertical line velocity is 0,722 m/s at vertical line I; 0,743 m/s at vertical line II and 0,736 m/s at vertical line III recorded at lowe tides dated 7 November 2001.

+ *Sediment regime*

Sediment levels on the river at vertical lines change over time, when high tides, small velocity reduces sediment levels significantly. There is a big difference between high tides and low tides. Sediment levels oscillated from 100-260 mg/l in low water season and 1111.1-2872.5 mg/l in flood season

+ *Salinity*

The changes of salinity are relatively clear. At high tides, saline area is formed and deepened to rivers, salinity changes according to the vertical, horizontal and depth of rivers. At each vertical line, changes of salinity are relatively clear, from 0.3 – 0.5%.

- *Geological features*

The geology of Day estuary area is relatively homogeneous, major components are clay mud and sand of small particles ($d < 0.063\text{mm}$) accounted for 65-92%, the average diameter of particles is 0.02mm.

1.6.2 Features of navigation channels through survey periods

According to the collected data, before 1992, navigation channels at Day estuary had three branches: Western branch, (to Hon Ne direction), Southern branch (middle estuary or called Ba Cang estuary) and Eastern branch (to Lach Giang estuary direction).

In 1995, the channels was branched at Km 11+600m. At the branched location, mainstream flowed towards branches periodically. From November to February of following year, due to impacts of Northeastern monsoon, the mainstream directed to the Western branch. From March to June, the mainstream directed to the Eastern branch.

Since 1997, the channels redirected last time at Km 11+800. Scope of oscillation was toward the direction of more narrow channel. The mainstream mainly directed to the South.

1.6.3 Preliminary causes of changes and sediment at Day estuary

- It can be identified that major reasons causing changes for navigation channel on Day estuary are monsoon waves with two main directions: Northeastern and Southeastern monsoon. Two main frequent and relatively stable directions are:

+ Channel of Southeastern direction: From June to November

+ Channel of South-West Western direction (towards Hon Ne): from January to March

At the period between the two monsoons, movement of the channels shifts from the Southeast to the South and vice versa.

- Causes of sediments for navigation channel on Day estuary as well as other estuaries are the complex of many factors: topography - flow - mud and sand - wave, but some particular features at Day estuary are below:

+ Factors of river dynamics have weak impact. Factors of the coastal estuary dynamics have more predominant effects.

+ Day estuary belongs to open sea estuaries. The estuary has shape of speaker, expands on shallow water areas, beaches and mudflats are slightly steep, natural channels have small depth, threshold of shallow area outside the estuary is under the dynamic equilibrium state with relatively high altitude.

- Causes of shallow and alluvia situation and sediments at Day estuary include:

+ Sediments brought from alluvial sources in rivers.

+ Coastal sediments movement in the direction from North to South, the source of these sediments was mainly from alluvial sediments in estuaries of Red River system, Thai Binh river, partly due to coastal erosion in Hai Hau.

+ Large waves due to storm move sediments in the neighborhood down, causing

channels to be filled quickly (after dredging). It is the main source of mud and sand that caused sedimentation of channel. To overcome this problem, projects on wave reduction are necessary.

+ Flows to the south of the Gulf of Tonkin in winters and summers usually have the Southern and South-eastern direction, creating coastal line direction from the South to North, opposite to the flow along the northern Gulf of Tonkin with the North - South direction. Two flows in opposite directions caused vicious whirlpool area in the Western Bac Estuary, moved sediments of mud and sand to Cua Day estuary.

- In normal condition, Day estuary continues encroaching into the sea but with slower speed.

2. Scale and construction plan

2.1 Scale of construction:

+ Planned ship size: Sea- river ships of 1,000 - 3.000 tons

+ Scale of renovation and upgrading: special grade (TCVN 5664-2009), two – lane navigation channel.

2.2 The construction plan (expected)

2.2.1 Upgrading and renovation of navigation channel

+ Phase 1: Dredging navigation channel on Day estuary for ships of 1000-1500 tons to take tidal advantages to navigate conveniently.

Preliminary dredging volume corresponding to designed navigational water level is described in the following table:

Type of ships	Dimension		Preliminary dredging volume corresponding to designed navigational water level (m ³)				
			Channel (m)		+0,50m	+1,00m	+1,50m
	B	H	P 95%	P 85%	P 70%	P 40%	P 25%
1000 DWT	60	3,60	1.183.000	758.000	460.000	262.000	148.000
2000 DWT	65	4,90	3.107.000	2.300.000	1.607.000	1.069.000	666.000
3000 DWT	70	6,0	5.495.000	4.435.000	3.469.000	2.600.000	1.844.000

+ Phase II: Construction of channel regulation works at Day estuary, dredging in combination with taking tidal advantages for sea- river ships of 3,000 tons to navigate.

For regulating channels outside the estuary, scale and subjects of the project need to implement the following measures:

+ Reduce waves in the Eastern and East-northern directions, control sedimentation during the periods of storms.

+ Prevent coastal sedimentation, move sediments to deep areas outside navigation channel.

+ Centralize main stream at threshold of shallow area to erode deeply, shorten height of threshold. Meanwhile, reduce sedimentation and suspended sediments along navigation

channel.

2.2.2 Upgrade waterway signaling system

Upgrade, supplement signaling system on the basis of existing system. Including Signalling on shore (sea lamp pole) and underwater signaling (buoys), electric lights for night signaling, power source is from batteries or solar energy.

2.2.3 Investment in renovation, upgrading of inland waterway management station

+ Day estuary station: Construct new station with appropriate location and scale to management requirements of sea- river route, as a combination of towing pilot and rescue of sea – river ships.

+ Other inland waterway management station: Renovate and upgrade in accordance with practical requirements.

2.3.4 Construction of berth at Kim Dai station

Construction of berth at Kim Dai station for mooring, repairing and other operational works for large sized ships.

2.3.5 Automatic digital water level recorder station

Due to the characteristics of sea- river transport, the exploitation method of taking tidal advantages in combination with instant water level recording at Day estuary is essential and needs to be highly accurate.

2.3.6 Organize a rescue stations, support ships to navigate via Day estuary

+ Establish standing rescue stations in the area of Day estuary, equip rescue vessels and other devices.

2.3.8 Inland waterway communication

The communication system with communication devices is designed to be located at Ninh Phuc port, management station, transport enterprises and functional management agencies.

3. Total expected investment: 1.500.000.000.000 dong

(One thousand five hundred billion dong)

In which: Investment for dredging of the navigation channel at phase I is about 33 billion dong.

4. Preliminary assessment on payback plan, mechanisms and policies

- The source of revenue:

+ Collect charges from vehicles across the route and making use of dredged products (For the form of investment BOT)

+ Make payment by the land fund to implement other projects of investors (For the form of investment BT).

- Mechanisms and policies:

The state is recommended to financially support with preferential loans, offer mechanisms to encourage investors in accordance with the current regulations and specific mechanisms which are separately applicable to the project.

