Adjustable Berthing and Trestle Facility for High Tidal Range Region

Chul H. Jo, Kwang S. Chae, Seung H. Song
Department of Naval Architecture & Ocean Engineering, Inha University
Inchon, Korea
Won C. Cho
Department of Civil Environmental Engineering, Chung-Ang University
Seoul, Korea
Ro S. Park
School of Naval Architecture & Ocean Engineering, Ulsan University
Ulsan, Korea

ABSTRACT

With more than 70% of trade logistics in South Korea has concentrated in the Seoul metropolitan area where there is Incheon harbor as the main trade gate. The quantity of trade in Incheon harbor has been increased annually with the fastest-growing trade volume between Korea and China. It has been announced as the gateway hub harbor for the international trade in the East Asia. To confirm the hub harbor and to enhance the national competitiveness, it is urgently required to improve the harbor facilities. However, Incheon area is characterized as the high tide range of up to 10m that restricts the duration of access to the loading facilities. It is critical condition if the cargo ship is to wait for high tide losing time and chance to operate the ship. Other disadvantage of the area is the shallow water depth that also restricts the size of vessel for navigation and berthing. To accommodate large vessel in Incheon harbor, new concept and breakthrough idea are required as introduced in the paper. The secure 24 hour access without dredging and waiting, the ABTF (Adjustable Berthing and Trestle Facility) for high tidal region is introduced.

KEY WORDS: high tidal range, loading/unloading, adjustable berthing facility, intelligently controlled trestle facility, eco-friendly harbor.

INTRODUCTION

Incheon area in Korea is geographically very important being located on the west facing China and near to North Korea. As the trade volume has been increasing annually between Korea and China and the more than 70% of logistics is concentrated to the capital area, Seoul, the capacity of harbor is to be increased and modernized to accommodate large container cargo vessels. However, the conventional harbor construction method with dredging and land reclamation requires tremendous construction cost and generates great environmental impacts. The importance of ports in the western coast of Korea is well described in the reports (Ministry of Maritime Affairs and Fisheries, 2004 and 2009). Jo et al(2009) has performed the concept research of harbor berthing facility and trestle facility coping with large tidal difference.

To cope with increase of trade volume and to minimize the environmental impact and to overcome the tidal difference, the new harbor that can operate 24 hours in the region is to be implicated. The ABTF is now introduced as the solution to solve the problems stated above and to meet the requirements. Also this would be the most cost effective harbor facility under the adverse environmental conditions of the region.

This paper introduces the ABTF for high tidal region to facilities large container cargo vessels without dredging nor natural damage for 24 hours during high and low tides.

THE FEATURES OF THE ABTF CONCEPTS

The ABTF is the intelligent control trestle facility that can adjust the berthing height according to the sea level by buoyancy. The draft of floating berthing body and level can be controlled by water intake into the divided ballasting tanks. This system enables the ships to unload and load for any time of the day during high and low tides. The intelligent buoy trestle is the sub-body supporting upper road or bridge which can manipulate the incline angle and level of the bridge by water intake and discharge through the several ballasting tanks in real time as per the change of sea level. It can elevate up and down through the vertical bar fixed on the vertical piles and also can rotate with the horizontal circular bar on both sides of the buoy. The rotating angle is adjusted by intake water amount in the several ballasting tanks in the buoy. Fig. 1 shows the concept of ABTF system.

Fig. 1 Concept of the ABTF system