

A Study on the Water Gate Operation in the Canal System by MIKE 3 FM

Dongwoo Jang¹, Hyoseon Park¹

¹ * Civil & Environmental Engineering, Incheon National University, 119 Academy-ro, Songdo-dong, Yeonsu-gu, Incheon, South Korea
nightray@paran.com

Abstract. Water Circulation system in canal has a great importance in Songdo Waterfront. There is a need to ensure that consistent water flows occur in the canal. In this study, MIKE3 FM was setup and used to investigate the water circulation system with respect to the operation of the water gates will present at the ends of the canal system. The model was computed under various tidal conditions in Incheon coastal. The numerical modeling of the water flow helped to determine the gate operation that will play an important part in the water circulation in the canal. Water gate operation was possible to maintain the specific water level. Optimal water gate operation was decided for the Songdo waterfront canal system.

Keywords: Gate operation, MIKE 3 FM, Water circulation, Songdo waterfront

1 Introduction

Songdo Waterfront is a project supported by IFEZ (Incheon Free Economic Zone) with maintains the water circulation system. The main focus of this project is to develop a canal system with a continuous water circulation that will guarantee a higher water quality but also an easily manageable water level. Songdo city is currently developing the waterfront near the coastline which is in line with its goal of being a world class eco-friendly green city in Incheon area. The city planned to have a canal system surrounding it where clean sea water will flow. This proposed canal will be managed by 4 water gates which will regulate the flow inside the system. In this study using a MIKE 3 FM, analyze the water gate operation possibility. Using a water gate and weir structure module, we implement water circulation system in the Songdo city canals.

The Songdo's water system is shown in Figure 1.

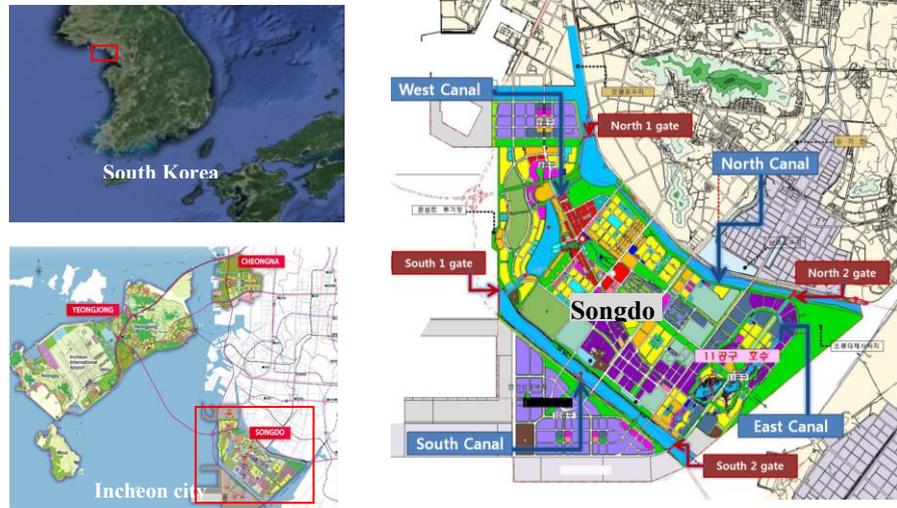


Fig. 1. Location of Songdo waterfront's canal

2 Model Set-up

The bathymetry of the channel system was built with the Mesh Generator from MIKE 3 FM using as input values the coordinates taken from elevation given for each channel.

In the Mesh Generator by Mike Zero, the UTM-52 projection was selected. The boundaries were imported from a .xyz file and the arcs that are connecting the nodes were created. After importing all the arcs that are compiling the outline of the mesh, the boundaries at each inflow and outflow are set. Each one is given a different name so that it can be easier to distinguish them in MIKE 3 FM, when the boundary conditions are added.

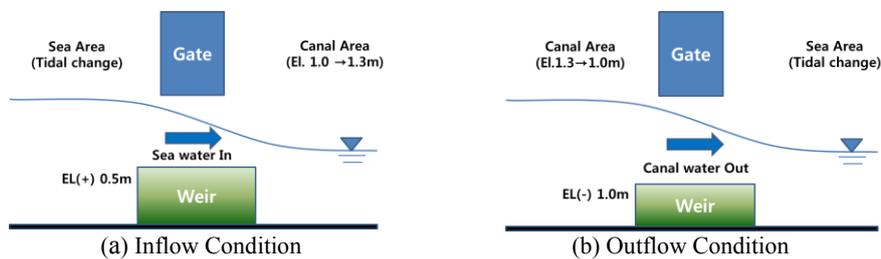


Fig. 2. Inflow and outflow boundary condition

The unstructured mesh and bathymetry were built in the model. Each canal of outside boundary is tidal level. The tidal wave for 15 days was provided by KHOA and tidal harmony is considered M2, S2, K1, O1 which is available only for the Incheon costal area. Tidal elevation is change from El. (+)4.45m to (-)4.45m. This is normal tidal condition in Incheon costal. And water level controlled from El. (+) 1.3m to El. (+) 1.0m in the canal by the gate operation tools

3 Results

The simulation for the water gate operation was run for maximum and minimum duration and it was analyzed for each channel main points. The result of MIKE 3 FM hydrodynamic module, we can see the water level and velocity changed in the canal system.

The following graph is showing how the water level changed at the canal during maximum tidal condition. It shows that in tidal increased duration, sea water was in flowed from sea; the canal's water level increased until El. (+) 1.3m. And tidal is lower than canal water level; the canal's water level was decreased by El. (+) 1.0m.

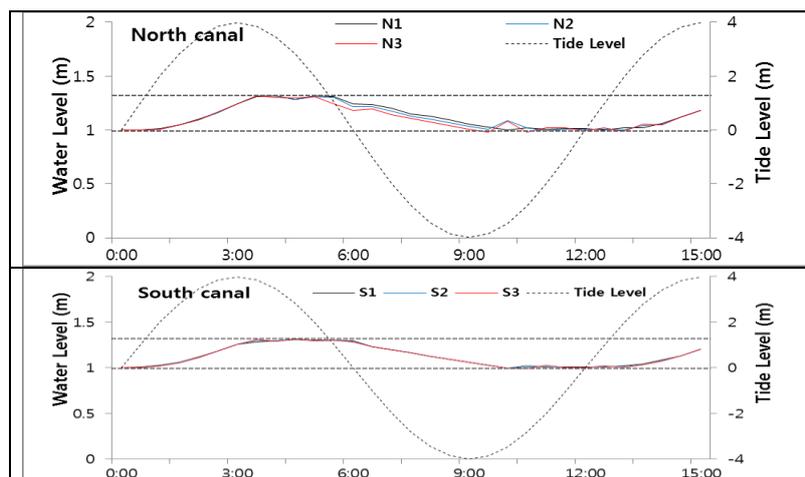


Fig. 3. Water level change at canal by gate operation

4 Conclusions

The purpose of this study was to applicate the gate operation in the canal system through the MIKE 3 FM simulation. Sea water can be inflow to the canal by gate operation.

The numerical modeling of the water flow helped to determine the gate operation that will play an important part in the canal system. For each inflow or outflow

boundary was set an opening and a closing level so that it can be used as a guide in the real situation.

South 1 gate input, North 2 gate operation condition was appropriate to be implemented in Songdo waterfront area. Water level at canal was maintained by their design criteria.

Acknowledgement. This research was supported by a grant (12-TI-C01) from Advanced Water Management Research Program funded by Ministry of Land, Infrastructure and Transport of Korean government.

References

1. DHI Water & Environment. MIKE 3 Flow Model, Hydrodynamic Module, User Guide. Horsholm, Denmark (2012).
2. Jang, D.W., Agafon, C., Choi, G. W.: Study for Water Circulation System in Songdo Waterfront Area. The Smart Water Grid International Conference. P. 251. Songdo (2013)