FLOOD ANALYSIS IN URBAN AREA OF THE EASTERN BANGKOK METROPOLITAN AREA

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BACKGROUND AND OBJECTIVE

The Bangkok Metropolitan is the capital city of Thailand, where has been developed in the lower flat plain of the Chao Phraya River. More than 25 million people live and work in the river basin of 163,000 km^2. Because of its economic and social development, the modernization have accelerated the city word drifting of population and extended the urbanized area into the outskirt of Bangkok. However, the safety level of Bangkok is not so high that the Chao Phraya River Basin has experienced so many floods. According to the flood occurred in 1995, the flood capacity near Bangkok was about 3,600 m^3/s. It corresponds to about a 3-year return period of discharge. It is beyond credibility.

The study area of 650 km^2, is located in the left of the Chao Phraya River. It is enclosed by the left bank of Chao Phraya River, the King's Dike, and the boundaries of Bangkok Metropolitan Administration. Because of the human intervention such as huge changes of land use in the last two decades, the hydrological and hydraulic water balance has greatly changed and the flooding has frequently occurred in the Eastern Bangkok Metropolitan Area. The drainage system of the study area is a complicated network of klongs (= canals in Thai Language) with a large variety of dimensions, retention reservoirs, pumping stations and so on. For the purpose of the study, a mathematical model has been prepared with the aim to analyze hydrological and hydraulic features in the present and future drainage system and verify the effects of improvement options of the system.

To assure of the safety level of a 5-year return period, the following alternatives have been proposed; A-1 (improved klong bottom by excavation), A-2 (additional reservoirs with improved klong) and A-3 (underground tunnel for reservoir facilities). One-dimensional mathematical models: RUBICON and ISIS were used. Both models are hydrodynamic models for simulating discharges and water levels in the time dependent channel systems.

Firstly, the simulation was carried out under the present drainage network system. Since the computed water level is higher than the klong bank, the water in the klong flows over bank in the whole study area. At present, large areas in the east and north of Bangkok exist of low-lying (abandoned) rice fields, which act as temporary storage areas. Because of the availability of temporary storage, the runoff toward the pumping stations is significantly

reduced and delayed. The simulations show that the present drainage system cannot cope with the 5-year return period of rainfall under the field conditions.

The simulation of alternative A-1 in Klong Lat Phrao demonstrates that the water level falls to be below the klong bank if the improved bottom level is about -5.5 m MSL. Improved klong works is an effective method to increase flow capacity.

For such storms with 5-year return period of design rainfall, the storage in the klongs is assumed that the initial water level in the klongs during the rainy season set at -1.0 m MSL. This is essential to avoid flooding of the study area affect to water levels in the secondary klongs. The simulation result of water levels in Klong Lat Phrao will be below the klong bank, when three existing reservoirs and two additional reservoirs are applied. In this simulation, the improved bottom level is between -3.0 and -3.5 m MSL.

The selected alternative is a mixture of the three alternatives. It comprises the increase of capacity of the canal system by deepening it, the construction of a tunnel to drain the Klong Prem Prachakorn to the Chao Phraya River and the incorporation of storage reservoirs, particularly in the north and east of the study area.

Numerical simulations are carried out in the Eastern Bangkok Metropolitan Area for examining flood protection system subject to a 5-year return period of rainfall. In the proposed alternatives, the water level of the primary klongs can be maintained below the level needed to drain the secondary drainage systems. However, even though the improvement of drainage system can be done by adding extra reservoirs and tunnels, the primary drainage is capable of just only 5-year return period of rainfall. Therefore, to make the drainage system more successful before or after the rainy seasons, the operations of canals, reservoirs, and pumping stations must be systematically synchronized.

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