

Investigation on safety countermeasure of Furou River trunk line manhole of Arakawa right bank river-basin sewerage

Period

2003.1 ~ 2003.3

(Purpose)

Though Furou river trunk line is main sewerage pipe of Arakawa right bank river-basin sewerage Saitama Prefect until now, its manhole lids were surfaced and scattered in the rainy weather, for that, improvement of fixing the manhole lid had been carried out.

However, heaving phenomenon arose at several places such as frames and nearby pavements of fixed manhole lid for the typhoon in 2002 (the largest amount of rainfall at 24mm/h), and that the sanitary drain ran out manhole in some place was also confirmed, though the levitation of the lid was not confirmed.

In this research, by collection and arrangement of the relational materials, confirmation of damage trace and structures of utilities by the site reconnaissance, and reproduction (simulation) of flow condition in trunk line with the analysis software (? PSWMM) when the damage generate , the cause of the mentioned phenomenon will be clarified, the necessary policy and the method of the examination for improving utilities will be decided on the basis of above.

(Result)

(1) Features of the damaged manhole.

It was confirmed that all of pavement levitation, air leakage and water flooding happened in the siphon culverts of the damaged manhole (7 sites), for being large scale and complicated shape of manhole, high head, abrupt changing of direction of downstream.

(2) Result of measurement of discharge.

On the inflow observation of each inflow sites (the 10 sites), because the measurement of discharge can only be carried out for water depth of about 30 ~ 60% of pipe diameter, when the measuring value need to be adopted in the simulation, the maximum discharge had to be assumed as a correlation with rainfall in respect of the discharge of impossible measuring high water level.

(3) Reproduction of the flow condition in trunk line (simulation).

On the basis of the observation values of typhoon in 2002, sewage discharge situation in Shingashigawa River trunk line of Fujimi relay pump station upstream and Furou river trunk line was analyzed for simulation, as result the followings were identified.

1) Downward flow amount in the trunk line

The sewage discharge which flowed over each damaged manhole became water quantity of about 100-200% of the utilities' flow capacity, and large quantity of about 250 ~ 400% in comparison with in fair weather. This discharge exceeds by far the water pumping ability of "the Fujimi relay pump station" which is located in the trunk line downstream.

2) Estimation of the cause of manhole lid levitation.

Within the damaged manholes, the water level of only one exceeded over the earth surface by numerical simulation, the others including the result of the water level rising to near earth surface are assumed, that the situations of inflows and runoff for upstream and downstream of manhole, and complicated manhole structure made inner air pressure of manhole rise, thus reached the damage.

(4) Examination of policy for the utilities improvement

According to the simulation result, it was assumed that the levitation of manhole lid was caused by air pressure of manhole rising due to proper hydraulic phenomenon of every manhole, which caused by rapid flow diverter in trunk line and manholes structure, etc.

And, Because the largest amount of rainfall in typhoon as an object of the simulation was about 24mm/h, the hydraulic model experiment was conducted with the following purposes. by considering the processing condition and structure examination, utilities are supposed to be improved on the basis of experimental result.

"Purpose of the hydraulic model experiment".

? Peculiar hydraulic phenomenon of the every manhole and fluctuation of manhole inner air are confirmed, and the reason of damage is specified.

? Flow situation in trunk line in rainfall which the largest amount of storm-fall is over 24mm/h is confirmed as an object of the simulation.

(Future program)

It is necessary to classify the cause of levitation phenomenon of manhole lid on the basis of manhole structure and pipe alignment, and determine improvement technique of every utility considering very generating reasons.

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Key Words

manhole lid levitation phenomenon, reproduction (simulation) of flow condition, utilities improvement, hydraulic model study

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