

Study on Helicoidal-ramp Type Dropshaft with Connect to Stormwater Storage Pipes in CHIBA CITY

Whole term

2006.7~2007.3

(Purpose)

The purpose of this study is to decide rational shape and obtain effective knowledge about general design method of a helicoidal-ramp type dropshaft with bidirectional inflow and a large head between inflow pipe and storage pipe. The later has more than 10.0Ds (Ds means dropshaft-diameter) in vertical distance without spiral guide plate. We chose three shapes as typical cases from actual storm sewer which is planning in Chiba city as follows.

- (1) large head type; set the spiral guiding plate between upper and lower ramp
 - No.1 Manhole(900mm in diameter, 25.23m in head)
 - No.7 Manhole(900mm in diameter, 24.25m in head)
- (2) bidirectional type
 - No.8-2 Manhole(900mm in diameter, 17.14m in head)

(Procedure and condition)

Initial hydraulic model shape was designed by means of standard design method at 2001. In large head type of dropshaft, we set the only upper and lower spiral guide plates in the first. Then we compared the hydraulic performances between standard type and revised type, in which another spiral guide plate was set at the middle part between upper and lower ramp in the vertical pipe. On the other side, we confirmed the effectiveness of a vertical guiding plate for the purpose of smoothly water transmission and air exhaust in bidirectional type. The test conditions are shown as follows.

- Discharge: 3 cases including design discharge
- Shape: Standard shape and a few revised shapes
- Tail water depth: dry condition and high water level in down stream storage pipe.

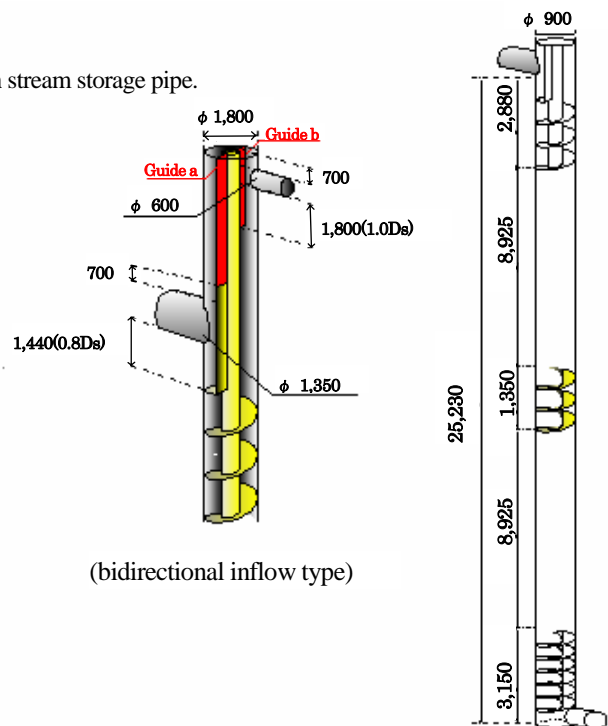
(Results)

- (1) Large head type

We made clear the flow characteristics in the middle part of the vertical pipe. The vortex-flow which was formed by upper spiral guide plate was maintained until distance of 10.0Ds from upper ramp, then was dissolved completely. In this situations, negative pressure and a large of air entrainments occurs in the vertical pipe. We proposed countermeasure that set the spiral guide in the middle.

- (2) Bidirectional type

We observed that a waterfall of an upper inflow reached a lower inflow inlet so that upper inflow obstructed lower inflow. In order to avoid the influence of waterfall in upper pipe and separate each other upper and lower inflow, vertical guide plate was set in the dropshaft.



(bidirectional inflow type)

(Large head type)

Fig- 1 Initial shape of dropshaft

Research funded by Chiba City.

Researchers: Masayuki Matsuura, Shizuo Yoshikawa, Katsuyuki Yorioka, Takeshi Okamoto

Key words

Downstream storage pipe, Helicoidal-ramp type dropshaft, hydraulic model test