Investigation research on drop shaft with super high head in Tameike trunk line		
Period	1999.12～2000.5	119P～123P

(Background and Purpose)

Tokyo has planned the spiral guideway style drop shaft (following: the drop shaft) in 2 manholes (Shimizudani manhole and 119 manhole) in Tameike trunk line.

Because these drop shafts with one has about 46m high head, another is plan quantity of water flow 6.6m^3/s, there is no case in past, and it is difficult to use present design technique for such ultra-high head and large capacity. In this foundation, though the design material (draft) of the drop shaft has been arranged, the plan discharge and the head high (3.0 M^3/s, 46m and 6.6mm3/s, 31m) of drop shaft in Tameike trunk line exceed the object range (within 2m3/s, 20m or less) of the material, so the hydraulic model study is carried out for investigation of characteristic, geometries and employed material of the drop shaft, etc. and make that determines the structure of the drop shaft based on the results to be a purpose this time.

(Result)

(1) Center guide plate is installed in the middle guideway

Because the head is 46m high, the spiral flow is formed in the upper of guideway, and became the falling water course, so the center guide plate is installed in the middle guideway

The effect by installation of the guide plate is shown in next

1) Stability of the falling water

Since in the condition that the center guide plate was not installed, the spiral flow is formed in the upper guideway which the distance is about 31m over the double of design data (draft), and lapsed on the way, at last it became falling water course along the pipe wall. Therefore, when center guide plate was installed, the water course which the vortex was re-formed in center guide plate was able to ensure flow as the vortex to the lower guideway.

2) Control of pressure (negative pressure) acting to wall surface of the middle guideway

In the condition that the center guide plate is not installed, the pressure acting to sewer wall surface (near head high about 1/3) where the inflow head high of the upper guideway is changed was negative pressure in most observation point of the cross section, while the plan discharge was (1Q) and excess discharge (1.2Q) at inflow head high 2D of which the acting pressure is the highest.

However, the pressure acting to wall became approximately positive pressure at 2D, when center guide plate was installed.

3) Reduction effect of the air entrainment quantity

The velocity of falling flow was about 13m/s in the case of not installed center guide plate.

By measuring, the air entrainment quantity to the storage pipe was able to be reduced by 1/4-1/25, when installed the center guide plate, and the flow velocity was lowered to (9～10m/s) . since that the air entrainment quantity rapidly increases by the water course becoming over 7m/s of flow velocity from the medical history experiment conducted by the Ministry of Construction Public Works Res. Inst., is known.

(Future problem)

In the hydraulic model study of present kiyonagadani manhole, it was proven that by installing middle guide plate in addition to the upper and lower guide plate, the flow can be made in stabilized flow condition in respect of the drop shaft, and in the current stage, a grasp was not possible how much head high it is necessary to installed the middle guide plate. Therefore, we want to coordinate collection the test data of drop shaft with such high head, and expand the design range in future.

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