

Investigation research on steep gradient sewerage pipe of public sewerage Zao trunk line

Period

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109P ~ 114P

(Purpose).

The Yamagata City carried out design for authorization which incorporated the sanitary sewage of Zao hot spring process zone into Mogami River river-basin sewerage in the year 1996. The sewer of the authorization design will have been laid in about extension 11.0km along the main local road Zao park line (of the following, main road). Since this main road has steep slope with longitudinal gradient of 7.0~ 8.5% and many curves, it becomes also higher cost on construction because of the considerable constraint in traffic regulation and installation method, etc.

Then, Yamagata City and this organization carried out the examination of shortening of the pipe line extension, reduction of construction period and construction expenses, etc., by utilizing new technology of laying steep gradient sewerage pipe and energy dissipater, as well as the evaluation of material of pipe.

(Result)

1. Materials collection and field reconnaissance survey

The consolidation of materials and buried object materials, etc. was done as a necessity for the examination. And, the field reconnaissance survey was carried out for a grasp of crossings buried object and geographical features, etc., and the conditions for route setting of steep gradient sewerage pipe were arranged.

2. Examination of sewer

1) Examination of shortening route.

The laying route of pipeline was examined that it is laid to parallel to surface gradient as much as possible without considering the constraint of 3.0m/s in respect of the maximum discharge. As the interval of which the shortening was possible, there were 3 intervals mentioned. By considering economical efficiency, workability, flow condition of water course, etc., each route was examined. On these routes, to avoid the main road with heavy traffic by laying it along city road and forest road in which the construction is easy, the alignment that the construction is comparatively easy and there are no curves as much as possible was proposed.

2) Examination of pipe kind

The evaluation of the pipe kind was carried out the abrasion test which sanitary sewage flowed in high discharge.

3) Setting of pipe diameter

The pipe diameter was decided from discharge in the interval with the gentlest gradient, because the discharge increase as gradient gets gentle, and the discharge is calculated by the formal of Cotar.

4) Study of hydraulic model

The following is the most hydraulically severe of this route,

Changing location of the gentle gradient to steep gradient.

Changing location of steep gradient to gentle gradient

Hydraulic models of above were produced on the experimental models, and observation and examination of various flow conditions were carried out.

3. Examination of energy dissipater

The energy dissipater was planned in downstream end of steep gradient sewerage pipe so that adverse effect may not reach the junction of trunk line sewer in the downstream. The type of the energy dissipater was made to be the hydraulic jump type in comparison with various methods. And, the dimension was decided by the numerical calculation from results of energy dissipater until now. On the detail dimensions, the hydraulic model was produced, various flow conditions were observed and the shape was decided.

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Key Words

Steep gradient sewerage sewer, energy dissipater, high discharge, abrasion test