Investigation research on examination and hydraulic model study of downward flow facilities of Dainijuunisya trunk line and second Zousigaya trunk line		
Period	1999.10～2000.6	125P～130P

(Purpose).

The Dainijuunisya trunk line and second Zousigaya trunk line of funder construction have the steep gradient interval, and there is danger phenomenon such as the followings. In this research, the selection of downward flow facilities stabilized downward flow is made to be a purpose, after the hydraulic test is carried out for the steep gradient interval and the hydraulic phenomenon is sufficiently grasped.

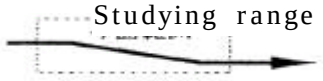
①Downward flow inhibition due to phenomenon of hydraulic jump

②Energy dissipater for high discharge.

③Spouting phenomenon due to air entrainment

④Compression and spouting phenomenon of air in pipe due to the hydraulic bore phenomenon.

(outline) outline is shown in the following.

	Dainijuunisya trunk line	Zousigaya trunk line
Longitudinal alignment outline	A part of long and large Siphon culvert sewer 	Open channel in downstream 
Diameter	3500mm Circular pipe	2800mm Circular pipe
Pipe gradient	140 ‰	75‰
Steep gradient interval	248.34m	156.20m
Plan discharge	15.376 m^3/s	11.319 m^3/s
Plane alignment outline	300m straight interval in downstream of steep gradient interval	• curve radius R=60m in steep gradient interval • 900m straight interval in downstream
Flow characters	Rain water flow down	Combined sewer Sewage discharge 0.2~0.3 m^3/s

(Result)

The followings were proven as a result of the hydraulic model study (contraction scale : Dainijuunisya: 1:15.9 Second Zousigaya 1:12.9).

①In point of changing from steep gradient, flow condition was not largely disturbed, even if there is no vertical curve, and there was no remarkable phenomenon of hydraulic jump.

②It became reversely a obstruction, when the energy dissipater for high-speed flow was founded in identical service area without extending cross section, and there were intense hydraulic jump and turbulence of flow condition. Therefore, it should be made flow down as naturally without installing the energy dissipater.

③As there is large spouting of the residual air once after the pipe was full of water, the installation of the exhaust hole which can deal with the large air spouting is the necessary in the downstream manhole of Dainijuunisya.

④Since there is air spouting due to the hydraulic bore by air entrainment before the pipe of Dainijuunisya becomes full, the installation of the plumbing stoma is the necessity in the manhole of the up-down stream.

From the above results, it seems to be the peculiar phenomenon of circular pipe that the flow condition was not largely disturb and the remarkable hydraulic jump did not appear, even if there is no a vertical curve. On this point we want to continue to confirm it for air entrainment (spouting) and problem of large discharge by future demonstration experiment, etc.. And, the extension of the cross section seems to be the necessity when the energy dissipater is founded.

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Key Words | Steep gradient, invert siphon, hydraulic jump, high discharge, air entrainment