Study on Mitigation of Damage Caused by Localized Heavy Rainfalls

Year of research	2009～2010	Implementation of anti-inundation measures

(Purpose)

Changes in rainfall patterns have been observed in urban areas in recent years, and short-term localized heavy rainfalls of a scale beyond the levels expected in conventional drainage plans have been occurring with increasing frequency. In fiscal year 2009, the previous studies and the actual state of recent rainfall patterns were reviewed and studied, and the objective rainfall patterns to be studied were defined. The purpose of a following study in fiscal year 2010 was to review and classify effective measures for mitigating inundation damage using inundation simulation based on the defined inundation characteristics of rainfalls.

(Results)

The contents and results of this research are summarized below:

(1) Understanding of inundation damage characteristics (Result of evaluation with inundation simulation)

Inundation damage expands as the ratio of the 10-minute maximum rainfall amount to the 60-minute rainfall amount increases. This phenomenon most frequently occurs in areas where the terminal pipe is less than φ600mm. This type of inundation is not attributed to the effects of backwater along with rising water level in the trunk sewer, but mostly to a sudden rise in the water level inside a pipe in upstream areas with short concentration times. In this context, implementation of supplementary measures on the upstream side prove to be highly feasible and more immediately effective than conventional rainwater control measures such as constructing a sewer starting from the downstream side or taking large-scale measures against inundation. On the other hand, in areas with φ600mm or greater pipes, inundation areas are often limited to inundation-prone locations due to their geological features — in lowlands, depressions, or at the foot of a hill, etc.

(2) Quantitative evaluation of structural approaches (Results of evaluation using inundation simulation)

A list of structural measures along with geological condition and by state of development of drainage facilities is provided in Table 1.

Where surplus trunk sewer capacity exists:

- Stormwater storage facilities : It is expected to be effective regardless of location and geological conditions.
- Stormwater infiltration facilities : Combination with other measures is necessary because it is less effective in reducing peak runoff.
- Interconnection : No great effect is expected, as upstream pipe network is normally lack of surplus capacity.
- Flow type facilities : Locations are limited to the areas where a discharge destination is available in surrounding area.

Where no surplus trunk sewer capacity exists:

- Supplementary measures in the upstream side cannot mitigate damage due to backwater effects from the trunk sewer (reinforcement of trunk sewer mandatory).

Table 1. List of structural measures by geological features and by state of sewerage development

Item		Sewerage facilities: with allowance in trunk sewer				Sewerage facilities: without allowance in trunk sewer			
		Stormwater storage facilities	Stormwater infiltration facilities	Interconnection	Flow type facilities	Stormwater storage facilities	Stormwater infiltration facilities	Interconnection	Flow type facilities
Upstream area	Depression, wetland (foot of hill)	**A**	**C**	**D**	**B**	**C**	**C**	**D**	**D**
	Flatland	**A**	**C**	**D**	**B**				
Mid stream area	Depression, wetland (foot of hill)	**A**	**C**	**B**	**A**				
	Flatland	—	—	—	—				

*1: Upstream side: Areas with less than φ600mm terminal pipe, Midstream area: Areas with φ600mm or more and less than φ1,200mm pipe

*2: A: Measure expected to be effective; B: Measure expected to be less expensive and as effective as measure A depending on the state of drainage facilities development and cohesion with other projects in the neighborhood; C: Measure unlikely to be sufficiently effective by itself; D: Measure generally not expected to be effective

Joint study : Liaison Conference for Sewerage Technical Development (Cities of Sapporo, Sendai, Saitama, Chiba, Kawasaki, Yokohama, Sagamihara, Niigata, Shizuoka, Hamamatsu, Nagoya, Kyoto, Osaka, Sakai, Kobe, Hiroshima, Kitakyushu, Fukuoka, Tokyo Metropolitan Government and Japan Institute of Wastewater Engineering Technology)

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