Promotion of Effective Inundation Countermeasures to Prepare for the Future Increase of Heavy Rain

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(Key words) Increase of heavy rain, Inundation countermeasure, Unsteady flow model

1. Introduction

In recent years, heavy rainfalls of 50 mm/h or more and heavy rainfalls concentrated into short time spans of 10 minutes have occurred more frequently throughout Japan. Although various cities have been developing inundation countermeasures to prevent inundation damage, looking at the long term, the characteristics of rainfall are changing, and existing inundation prevention measures alone might not be able to handle the future increase of heavy rain. Accordingly, the NILIM is studying the countermeasures for the increase of heavy rain and is extracting problems on making the rainfall countermeasure plan, considering all the above and improvement measures.

2. Countermeasures to deal with the increase of heavy rain

In the result for the past year [1)], 10-minute rainfall intensity and 60-minute rainfall intensity of 5 or 10 year probability are likely to increase, and the increasing rates are estimated 1.3 or 1.4 times in 50 years at most. Based on this result, we have made out patterns about the rainfall scenario in the following table with the view point of the effected appearance of inundation countermeasures and practice potentialities. Peak cut type countermeasures such as storm water storage pipes and storm water reservoirs for flood control, and countermeasures to increase the discharge capacity such as supplementary pipes and by-pass pipes were evaluated as being effective in every Rainfall scenario. To the Rainfall scenario A, mutual connections of pipe channels and replacing street inlet covers with grating covers were also evaluated as being effective. To the Rainfall scenario B, making networks of large scale trunk sewers, new constructions and additional constructions of storm water pumps were evaluated as being effective.

Furthermore, we have made a simulation using two virtual discharge areas of different discharge dimensions in order to classify quantitatively the contents of the inundation countermeasures pursuant to the inundation caused in respective areas. It has revealed that peak cut type reservoir facilities are effective to branch discharge areas and short time heavy rain. To the heavy rain continuing over a long period in trunk line discharge areas, it has revealed that it is important to combine the countermeasure facilities such as flow down facilities and reservoir facilities in order to upgrade the whole discharge area.

3. Problems and improvements in making methods of rainfall countermeasure plans

To study the combination of plural inundation countermeasures to meet the future increase of heavy rain, we consider that there will be increased need for unsteady flow models. Accordingly we have implemented the query survey and the like aiming at 24 local governments so as to file up the application cases of the unsteady flow model and its merits and demerits. We have also made a proposition on most appropriate selection method of design in accordance with the countermeasure study with the target of the method using rational formulas and the method using unsteady flow analysis models.

The error of the flow items in calibration such as total flow rate, peak flow rate and waveform are one of the points of concern on using the unsteady flow models. From now, we have scheduled to file up quantitatively effects on the scale of the facility plan and countermeasure effect caused by the error of the flow items in calibration by means of the simulation using the data of actual discharge area.

【Reference】
1) TECHNICAL NOTE of NILIM No.654 pp.21-36
http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0654.htm

Table Setting of Rainfall scenarios

		Rainfall scenario A	Rainfall scenario B	Rainfall scenario C
Objective rainfall intensity	10 minutes	Over scheme	Within scheme	Over scheme
	60 minutes	Within scheme	Over scheme	Over scheme
Characteristics of the rainfall over schemes		● Short rainfall continuation ● Strong 10-minute rainfall intensity ● Small total rainfall volume ● Limited area rainfall	● Long rainfall continuation ● Strong 60-minute rainfall intensity ● Large total rainfall volume ● Large area rainfall	● Long rainfall continuation ● Strong 10- and 60-minute rainfall intensity ● Large total rainfall volume ● Large area rainfall
Assumed rainfall		Local and short time focused heavy rain	Heavy rain that passes over current sewerage construction standard (60 minutes rain volume) (such as typhoon).	Focused heavy rain such as the largest rainfall as ever that largely passes over current sewerage construction standard
Assumed main inundation causes		Flow down capacity shortage of branch sewers	Flow down capacity shortage of trunk sewers	Flow down capacity shortage in the whole discharge area composed of trunk sewers and branch sewers