EXPERIMENTAL STUDY FOR INTERCEPTION EFFICIENCY OF STREET DRAINAGE GRATE INLET

SEIEUI YOON[1], JONGTAE LEE[2], JAEYOOK JUNG[3] and JOONHO LEE[4]

[1]Professor, Department of Civil & Environmental Engineering, Kyonggi University, 94-6 Yiui-Dong, Yeongtong-Gu, Suwon, Kyonggi-do, 443-760, Korea (Tel: +82-031-249-9707, Fax: +82-031-244-6300, e-mail: syyoon@kyonggi.ac.kr)
[2]Professor, Department of Civil & Environmental Engineering, Kyonggi University, 71, 2-Ka, Chungjung-Ro, Seodaemoon-Gu, Seoul, 120-702, Korea (Tel: +82-02-390-5194, Fax: +82-02-393-8424, e-mail: jtlee@kyonggi.ac.kr)
[3]Lecture, Department of Civil & Environmental Engineering, Kyonggi University, 94-6 Yiui-Dong, Yeongtong-Gu, Suwon, Kyonggi-do, 443-760, Korea (Tel: +82-031-249-9719, Fax: +82-031-244-6300, e-mail: jwj@msn.com)
[4]Lecture, Department of Civil & Environmental Engineering, Kyonggi University, 94-6 Yiui-Dong, Yeongtong-Gu, Suwon, Kyonggi-do, 443-760, Korea (Tel: +82-031-249-9719, Fax: +82-031-244-6300, e-mail: sof814@paran.com)

Rapid industrialization and urbanization since 60's in Korea had changed the characteristics of urban runoff events and decreased both the base flow of the stream and travel time for runoff. Peak discharge in street gutter may increase due to reduction of the infiltration of rainfall into ground, loss of buffering vegetation, and reduced evaporation.

In order to convoy the excess storm water on streets, it is imperative to install street drainage inlet with the appropriate spacing and type. They can be made of cast-iron, steel, concrete, and pre-cast concrete. And they are installed on the edge of the street adjacent to the street gutter. There are four major types of inlet: grate, curb opening, combination, and slotted. Every country has their own design manuals for these inlet spaces and types.

Federal Highway Administration(1996), Hotchkiss(1994), Brown(1996), Wong(1994 and 1997), Guo(1998 and 2000), and WWE(2001) studied the interception efficiency and street drainage inlet space.

However, the results of these studies cannot be directly adopted in Korea because of different characteristics of rainfall, traffics, street conditions, and design frequencies. Few studies have been found in Korea about interception efficiency and street drainage inlet space (Lee, 2003a and 2003b). The design criteria of street drainage inlet space for longitudinal slope, transverse slope, and street lane are not clearly suggested in Korea. Moreover, the study of interception efficiency based on the different shapes of grate inlet has hardly been found.

In this study, experiments were conducted as two parts: (1) experiments for interception efficiencies and design spaces of grate inlet (40 x 50cm: shape 1) and (2) experiments for interception efficiency based on four different inlet shapes with same external size (40 x 50cm: shape 1~4). The experimental flume is manufactured for this study with 1.2m of width and 7.3m of length.

With the consideration of rainfall intensity in Seoul city, width and length of street, gutter discharges were estimated the ranged of 4~15ℓ/sec using SWMM. The transverse slopes of gutter were selected the range of 4~10%. The range of longitudinal slope of street were 0~8%. Total 304 experimental tests were conducted to measure the

interception efficiencies.

Interception efficiencies of grate inlet were more influenced by gutter transverse slopes than by street longitudinal slopes and discharges. As the transverse slopes of gutter were increased and discharges decreased, interception efficiencies were increased. As the longitudinal slopes of street were increased, interception efficiencies were decreased.

The appropriate spaces of street drainage grate inlet(40 x 50cm) in Seoul area were suggested with the factors of street lanes, transverse slopes of gutter, and longitudinal slopes of street in Table 1.

The empirical equation with the factors of total inflow discharge, the longitudinal slopes and the transverse slopes of gutter were derived for shape 1 and this equation can be used to estimate the interception discharges or interception efficiencies of grate inlet.

Among the four shapes of inlets, shape 1 is efficient in gentle longitudinal slope of street and shape 2 is in steep slope(more than 8 %).

Table 1. spaces of grate inlet(shape 1) for street lanes, longitudinal slopes of street, and transverse slopes of gutter.

(m)

Slope[1]	Slope[2]	Street lanes		
		2	3	4
0	4	15	10	NA
	7	30	20	15
	10	30	30	30
2	4	15	10	NA
	7	30	30	25
	10	30	30	30
5	4	15	10	NA
	7	30	25	20
	10	30	20	15
7	4	10	10	NA
	7	30	20	15
	10	20	15	10

(* Slope[1] : longitudinal slope of street, Slope[2] : transverse slope of gutter)