CE412 A

Water Supply & Wastewater Disposal Systems

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Sanitary and Stormwater Sewer Design - Notes

Table Format

Line	Location	Manhole		Ground Level of the Start Manhole	Length	Area Served in ha		Population	Sewage Flow	Infiltration
		From	To			Increment al	Total			

Peak Flow		Diameter	Slope	Discharge when flowing full		d/D for Ultimate Peak Flow	Velocity		Invert Level	
Present	Ultimate			MLD	LPS		Present	Ultimate	Upper	Low

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Invert Drops from Incoming Sewers

Sewers < 400 mm	Half the difference in diameters
400 – 900 mm	2/3 the difference in diameters
≥ 900 mm	4/5 the difference in diameters

Minimum Velocity

At initial peak flow = 0.6 m/s
At ultimate peak flow = 0.8 m/s
Maximum Velocity 3 m/s

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Peak Factor

Up to 20,000	3.00
20,001 to 50,000	2.50
50,001 to 7,50,000	2.25
> 7,50,001	2.00

Recommended Slopes

150	0.6 (1 in 170)
200	0.4 (1 in 250)
250	0.28 (1 in 360)
300	0.22 (1 in 450)
375	0.15 (1 in 670)
450	0.12 (1 in 830)
>525	0.10 (1 in 1,000)

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Infiltration

In	Minimum	Maximum
L/ha/d	5,000	50,000
L/km/d	500	5,000
L/manhole/d	250	5,000

Storm Frequency

Peripheral area	Twice a year
Central and comparatively high priced areas	Once a year
Commercial and high priced area	Once in 2 years

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Sewer Appurtenances

- Manholes : Normal Manholes; Drop Manholes; Flush Manholes
- Inverted Siphons
- Sump Wells

Location of Manholes

- At all junctions and whenever there is change in diameter or change in slope of sewers
- At 30m interval up to 300 mm of sewer
- At 100m interval for larger sewers

Depth of flow

Velocity at 0.8 d/D = 1.14
Discharge at depth of flow 0.8 D = 0.98%

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Tables from Meteorology Data on Frequency of Storm of a Particular Rain Fall Intensity and of a Particular Duration

Rain Fall Intensity – Duration Relations

$$i = \frac{a}{t^n} \text{ or } i = \frac{a}{t+b}$$

$t = t_c$ = *time of concentration*

t_c

= *Inlet time* (5 *to* 30 min depending upon shape, slope & *surface chracteristics of catchment*;

in highly developed sections 3 minutes) + Flow time

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Storm Runoff - Rational Formula

Q = 10 C i A

$'Q'$ *is storm under flow in* $\frac{m^3}{h}$

$'i'$ *is rainfall intensity in* $\frac{mm}{h}$

$'A'$ *is catchment area served by a manhole in hectares*

$'C'$ *is runoff coefficient and is a function of percent imperviousness* (I) & *time of concentration*

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Recommended Values of Percent Imperviousness

- Commercial & industrial area 70-90
- Residential Area
  - High Density 61-75
  - Low Density 35-60
- Parks and undeveloped area 10-20

Area-Weighted Percent Imperviousness

$$I = \frac{A_1 I_1 + A_2 I_2 + \ \ldots\ldots\ldots\ldots\ldots + \ A_n I_n}{A_1 + A_2 + \ \ldots\ldots\ldots\ldots + A_n}$$