Department of Construction Management ❀ California State University, Chico
Discussion No. 16 – Storm Drainage Systems

Example: Roof Drain Sizing

Size a horizontal roof drain serving 5,000 square feet of roof area on a building located in Dallas, Texas.

Step 1. Determine the Rainfall Rate

CPC 2016 Appendix D. Table D 101.1
Houston, TX
Rainfall rate of 4.6" per hour

TEXAS	–
Corpus Christi	4.6
Dallas	4.2
El Paso	2.0
Houston	4.6
Lubbock	3.3
San Antonio	4.4

CHECK LOCAL CODE FOR ADMENDMENTS FROM THE CITY

City of Houston

1101.11.1 Primary Roof Drainage. Roof areas of a building shall be drained by roof drains or gutters. The location and sizing of drains and gutters shall be coordinated with the structural design and pitch of the roof. Unless otherwise required by the Authority Having Jurisdiction, roof drains, gutters, vertical conductors or leaders, and horizontal storm drains for primary drainage shall be sized based on a storm rainfall rate of 8 inches per hour ~~of 60 minutes duration and 100-year return period. Refer to Table D-1.1 (in Appendix D) for 100-year, 60-minute storms at various locations~~.

Must be based on a Rainfall Rate of 8" per hour

Step 2. Select number of roof drains and calculate the roof area sloped to each drain.

1 drain to serve 5,000 square feet.

Step 3. Table 1101.8 to determine the required size horizontal rainwater pipe.

From the chart, for 1/8" slope per 12" of pipe, for 5,000 square feet of roof area, with an 8" per hour rainfall rate, the required pipe size is 8". Use Column 1: 46 000 / 8 = 5,750 square feet

TABLE 1101.8
SIZING OF HORIZONTAL RAINWATER PIPING[1, 2]

SIZE OF PIPE	FLOW (⅛ inch per foot slope)	MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)					
inches	gpm	1 (in/h)	2 (in/h)	3 (in/h)	4 (in/h)	5 (in/h)	6 (in/h)
3	34	3288	1644	1096	822	657	548
4	78	7520	3760	2506	1880	1504	1253
5	139	13 360	6680	4453	3340	2672	2227
6	222	21 400	10 700	7133	5350	4280	3566
8	478	46 000	23 000	15 330	11 500	9200	7670
10	860	82 800	41 400	27 600	20 700	16 580	13 800
12	1384	133 200	66 600	44 400	33 300	26 650	22 200
15	2473	238 000	119 000	79 333	59 500	47 600	39 650

Step 4. Table 1101.12 to determine the vertical drain (leader pipe)

From the table the minimum size for the leader pipe is 6"

However, Section 101.5 of the IPC tells us not to reduce the pipe size in the direction of flow. This means that because our horizontal pipe from Step 3 was 8" our vertical pipe will be also 8".

TABLE 1101.12
SIZING ROOF DRAINS, LEADERS, AND VERTICAL RAINWATER PIPING[2, 3]

SIZE OF DRAIN, LEADER, OR PIPE	FLOW	MAXIMUM ALLOWABLE HORIZONTAL PROJECTED ROOF AREAS AT VARIOUS RAINFALL RATES (square feet)											
inches	gpm[1]	1 (in/h)	2 (in/h)	3 (in/h)	4 (in/h)	5 (in/h)	6 (in/h)	7 (in/h)	8 (in/h)	9 (in/h)	10 (in/h)	11 (in/h)	12 (in/h)
2	30	2880	1440	960	720	575	480	410	360	320	290	260	240
3	92	8800	4400	2930	2200	1760	1470	1260	1100	980	880	800	730
4	192	18 400	9200	6130	4600	3680	3070	2630	2300	2045	1840	1675	1530
5	360	34 600	17 300	11 530	8650	6920	5765	4945	4325	3845	3460	3145	2880
6	563	54 000	27 000	17 995	13 500	10 800	9000	7715	6750	6000	5400	4910	4500
8	1208	116 000	58 000	38 660	29 000	23 200	19 315	16 570	14 500	12 890	11 600	10 545	9600

For SI units: 1 inch = 25 mm, 1 gallon per minute = 0.06 L/s, 1 inch per hour = 25.4 mm/h, 1 square foot = 0.0929 m²

Notes:

[1] Maximum discharge capacity, gpm (L/s) with approximately 1¾ inch (44 mm) head of water at the drain.

[2] For rainfall rates other than those listed, determine the allowable roof area by dividing the area given in the 1 inch per hour (25.4 mm/h) column by the desired rainfall rate.

[3] Vertical piping shall be round, square, or rectangular. Square pipe shall be sized to enclose its equivalent roundpipe. Rectangular pipe shall have not less than the same cross-sectional area as its equivalent round pipe, except that the ratio of its side dimensions shall not exceed 3 to 1.