

DFU and Sizing Sanitary Piping

Sanitary Sewers and Vents

Important for maintaining the quality of the indoor environment of a building

Correct sizing is crucial to their proper functioning

Sizing is made easier using the set of charts published in the California Plumbing Code (CPC) or International Plumbing Code (IPC)

Steps for Properly Sizing Sanitary Sewer Pipes and Vents

1. Add up the total number of drainage fixture units (DFU) for each sanitary branch
2. Determine the sanitary branch sizes using the DFU values
3. Calculate the size of the main building drain using the total of all DFU values
4. Size the vents using the 2016 CPC Table 703.2 and the DFU values

**TABLE 703.2
MAXIMUM UNIT LOADING AND MAXIMUM LENGTH OF DRAINAGE AND VENT PIPING**

SIZE OF PIPE (inches)	1¼	1½	2	3	4	5	6	8	10	12
Maximum Units										
Drainage Piping ¹										
Vertical	1	2 ²	16 ³	48 ⁴	256	600	1380	3600	5600	8400
Horizontal	1	1	8 ³	35 ⁴	216 ⁵	428 ⁵	720 ⁵	2640 ⁵	4680 ⁵	8200 ⁵
Maximum Length										
Drainage Piping										
Vertical, (feet)	45	65	85	212	300	390	510	750	—	—
Horizontal (unlimited)										
Vent Piping										
Horizontal and Vertical ⁶										
Maximum Units	1	8 ³	24	84	256	600	1380	3600	—	—
Maximum Lengths, (feet)	45	60	120	212	300	390	510	750		

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm

Notes:

¹ Excluding trap arm.

² Except sinks, urinals, and dishwashers – exceeding 1 fixture unit.

³ Except six-unit traps or water closets.

⁴ Only four water closets or six-unit traps allowed on a vertical pipe or stack; and not to exceed three water closets or six-unit traps on a horizontal branch or drain.

⁵ Based on ¼ inch per foot (20.8 mm/m) slope. For ⅓ of an inch per foot (10.4 mm/m) slope, multiply horizontal fixture units by a factor of 0.8.

⁶ The diameter of an individual vent shall be not less than 1¼ inches (32 mm) nor less than one-half the diameter of the drain to which it is connected. Fixture unit load values for drainage and vent piping shall be computed from Table 702.1 and Table 702.2(2). Not to exceed one-third of the total permitted length of a vent shall be permitted to be installed in a horizontal position. Where vents are increased one pipe size for their entire length, the maximum length limitations specified in this table do not apply. This table is in accordance with the requirements of Section 901.3.

Lavatories in Sets. Two or three lavatories that are served by one trap.

Lavatory [HCD 1 & HCD 2]. "Lavatory" shall mean a plumbing fixture used for washing the hands, arms, face and head.

<https://up.codes/viewer/california/ca-plumbing-code-2016/chapter/2/definitions#2>

Drain and Sewer Pipe Size Calculation

Example 1. Assume a new, four bedrooms, 2 1/2 bathrooms, home with the plumbing fixtures described in the following table. The full bathrooms are on the second floor. The remaining fixtures are on the first floor.

Fixture	# of Fix.	Minimum Trap Size and Trap Arm (inches)	DFU	
			EACH	THIS JOB
SHO	1	2"	2.0	2.0
BT	1	1 1/2"	2.0	2.0
WC FT	1	3"	3.0	3.0
LAV	2	1 1/4"	1.0	2.0
BT	1	1 1/2"	2.0	2.0
LAV	2	1 1/4"	1.0	2.0
WC FT	1	3"	3.0	3.0
KS	1	1 1/2"	2.0	2.0
DW	1	1 1/2"	2.0	2.0
LAV	1	1 1/4"	1.0	1.0
WC FT	1	3"	3.0	3.0
CW	1	2"	3.0	3.0
TOTALS				27.0

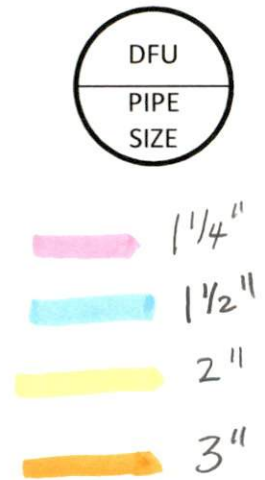
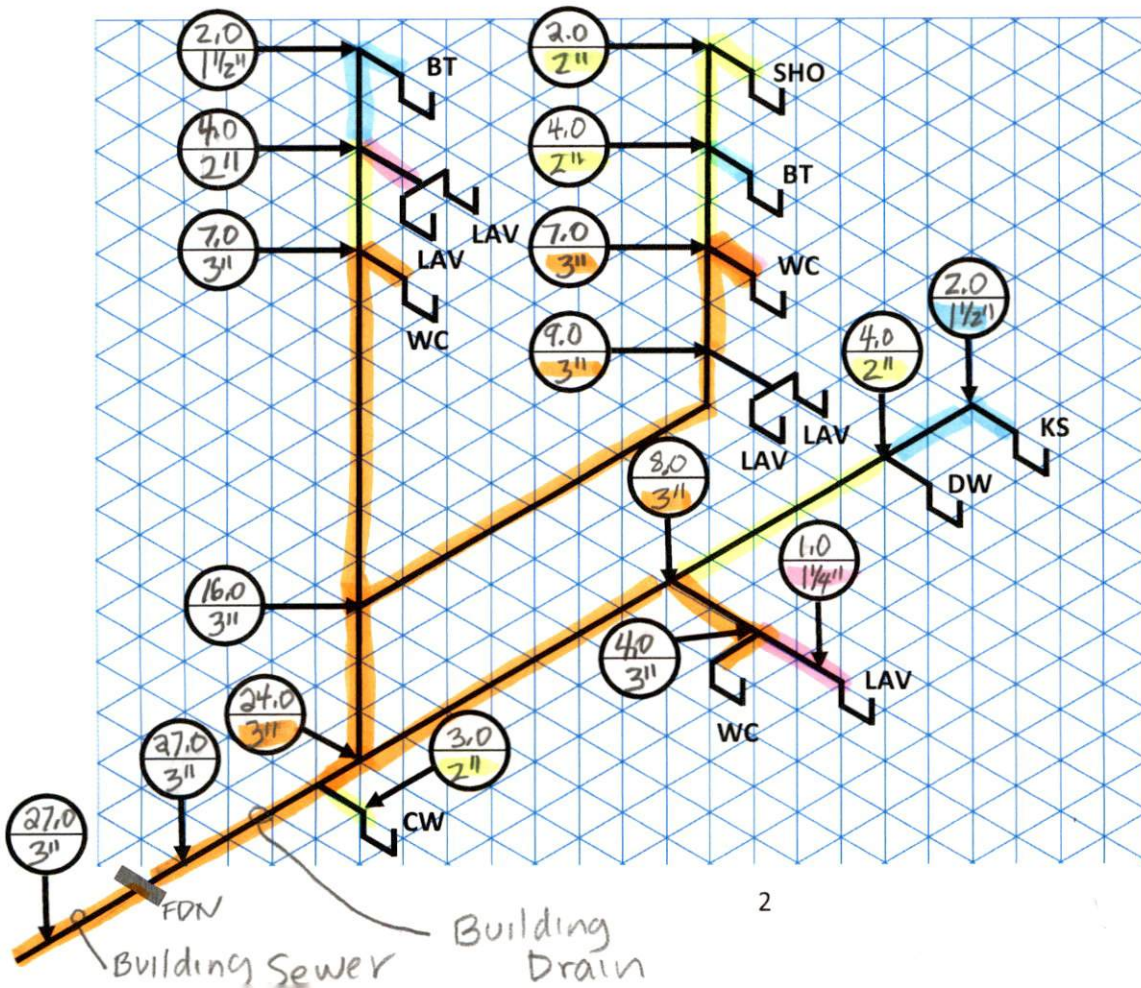
Appendix C

Bathroom Group #1
 5.0 dfu
 + 2.0 SHO
7.0

Bathroom Group #2
 5.0 dfu

1/2 Bathroom
 2 1/2 Bathroom 8.0
 + SHO 2.0
10.0

17.0



C 303.0 Fixture Unit Values for Private or Private Use Bathroom Groups.

C 303.1 Fixtures. Table C 303.1(1) and Table C 303.1(2) reflect the fixture unit loads for the fixtures in bathrooms as groups, rather than as individual fixtures. Such fixtures include water closets, lavatories, and bathtubs or showers. The tables reflect diversity in the use of fixtures within a bathroom and between multiple bathrooms.

C 303.2 Water Supply Fixture Unit Values. The listed water supply fixture unit values in Table C 303.1(1) reflect the load of entire bathroom groups on the cold water building supply. Individual hot and cold water branch piping to the fixtures shall be permitted to be sized in accordance with Chapter 6 and Appendix A.

C 303.3 Drainage Fixture Unit Values. The listed drainage fixture unit values in Table C 303.1(2) reflect the load of entire bathroom groups on the sanitary drainage system. Where fixtures within bathrooms connect to different branches of the drainage system, the fixture unit values for the individual fixtures shall be used, as listed in Table 702.1 of this code.

**TABLE C 303.1(1)
WATER SUPPLY FIXTURE UNITS (WSFU) FOR BATHROOM GROUPS^{1, 2}**

	PRIVATE USE BATHROOM GROUP		SERVING 3 OR MORE PRIVATE USE BATHROOM GROUPS	
	COLD	HOT ³	COLD	HOT
Bathroom Groups Having up to 1.6 GPF Gravity-Tank Water Closets				
Half-Bath or Powder Room	3.5	0.8	2.5	0.5
1 Bathroom Group	5.0	2.5	3.5	1.8
1½ Bathrooms	6.0	2.5	-	-
2 Bathrooms	7.0	3.5	-	-
2½ Bathrooms	8.0	3.6	-	-
3 Bathrooms	9.0	4.5	-	-
Each Additional ½ Bath	0.5	0.1	-	-
Each Additional Bathroom Group	1.0	0.5	-	-
Bathroom Groups Having up to 1.6 GPF Pressure-Tank Water Closets				
Half-Bath or Powder Room	3.5	0.8	2.5	0.5
1 Bathroom Group	5.0	2.5	3.5	1.8
1½ Bathrooms	6.0	2.5	-	-
2 Bathrooms	7.0	3.5	-	-
2½ Bathrooms	8.0	3.6	-	-
3 Bathrooms	9.0	4.5	-	-
Each Additional ½ Bath	0.5	0.1	-	-
Each Additional Bathroom Group	1.0	0.5	-	-
Bathroom Group (1.6 GPF Flushometer Value)	6.0	2.5	4.0	1.7
Kitchen Group (Sink and Dishwasher)	2.0	2.0	1.5	1.5
Laundry Group (Sink and Clothes Washer)	5.0	5.0	3.0	3.0

Notes:

¹ A bathroom group, for the purposes of this table, consists of one water closet, up to two lavatories, and either one bathtub or one shower.

² A half-bath or powder room, for the purposes of this table, consists of one water closet and one lavatory.

³ Multi-unit dwellings with individual water heaters use the same WSFU as for individual dwellings.

Example 2. Determine the total DFU for the house plan shown using (a) As individual fixtures using Table 702.1 and (b) as bathroom groups using Appendix C.

Fixture	# of Fix.	Minimum Trap Size and Trap Arm (inches)	DFU	
			EACH	THIS JOB
BT / SHD	1	1 1/2"	2.0	2.0
WC	1	3"	3.0	3.0
LAV	1	1 1/4"	1.0	1.0
BT	1	1 1/2"	2.0	2.0
WC	1	3"	3.0	3.0
LAV	1	1 1/4"	1.0	1.0
SHD	1	2"	2.0	2.0
WC	1	3"	3.0	3.0
LAV	1	1 1/4"	1.0	1.0
KS	1	1 1/2"	2.0	2.0
DW	1	1 1/2"	2.0	2.0
CW	1	2"	3.0	3.0
LT	1	1 1/2"	2.0	2.0
TOTALS				27.0

Appendix C

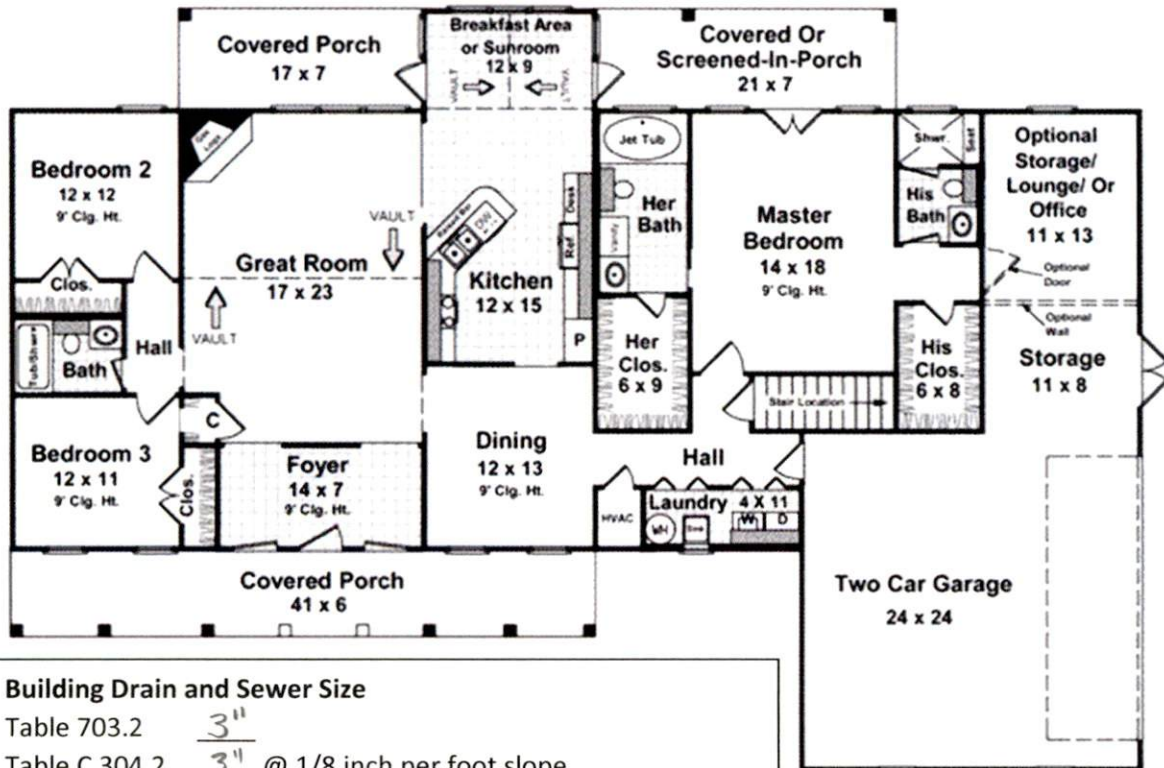
Bathroom Group #1

Bathroom Group #2

Bathroom Group #3

9.0 dfu Bldg Drain

18.0



Building Drain and Sewer Size
 Table 703.2 3"
 Table C 304.2 3" @ 1/8 inch per foot slope
 Table C 304.2 3" @ 1/4 inch per foot slope

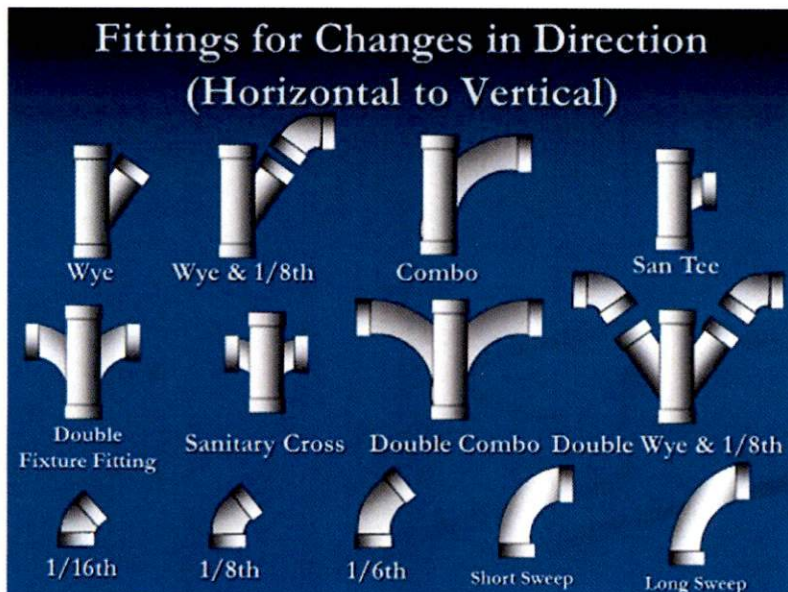
706.0 Changes in Direction of Drainage Flow.

706.1 Approved Fittings. Changes in direction of drainage piping shall be made by the appropriate use of approved fittings and shall be of the angles presented by a one-sixteenth bend, one-eighth bend, or one-sixth bend, or other approved fittings of equivalent sweep.

706.2 Horizontal to Vertical. Horizontal drainage lines, connecting with a vertical stack, shall enter through 45 degree (0.79 rad) wye branches, 60 degree (1.05 rad) wye branches, combination wye and one-eighth bend branches, sanitary tee or sanitary tapped tee branches, or other approved fittings of equivalent sweep. No fitting having more than one inlet at the same level shall be used unless such fitting is constructed so that the discharge from one inlet cannot readily enter any other inlet. Double sanitary tees shall be permitted to be used where the barrel of the fitting is not less than two pipe sizes larger than the largest inlet, (pipe sizes recognized for this purpose are 2 inches, 2½ inches, 3 inches, 3½ inches, 4 inches, 4½ inches, 5 inches, 6 inches, etc.) (50 mm, 65 mm, 80 mm, 90 mm, 100 mm, 115 mm, 125 mm, 150 mm, etc.).

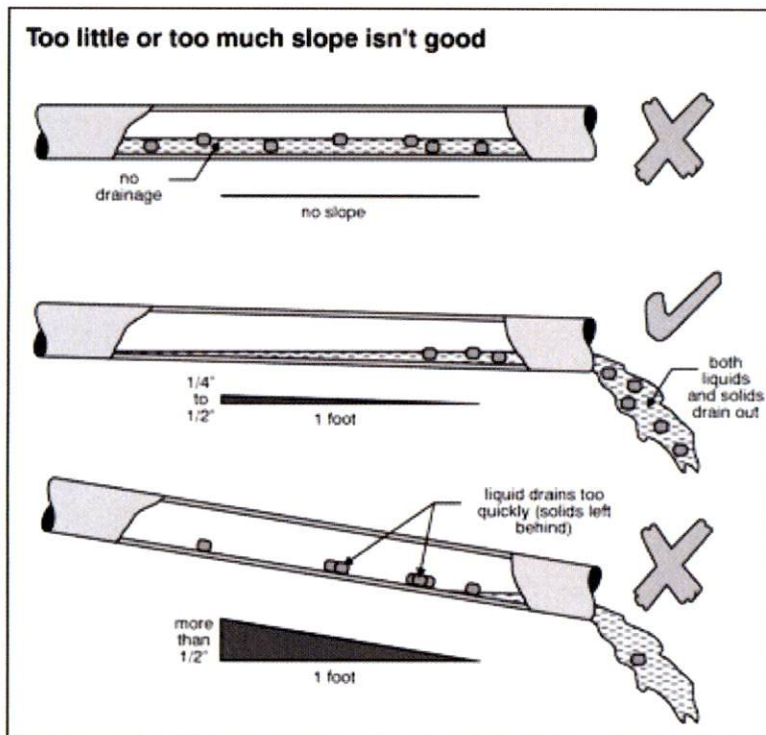
706.3 Horizontal to Horizontal. Horizontal drainage lines connecting with other horizontal drainage lines shall enter through 45 degree (0.79 rad) wye branches, combination wye and one-eighth bend branches, or other approved fittings of equivalent sweep.

706.4 Vertical to Horizontal. Vertical drainage lines connecting with horizontal drainage lines shall enter through 45 degree (0.79 rad) wye branches, combination wye and one-eighth bend branches, or other approved fittings of equivalent sweep. Branches or offsets of 60 degrees (1.05 rad) shall be permitted to be used where installed in a true vertical position.



708.0 Grade of Horizontal Drainage Piping.

708.1 General. Horizontal drainage piping shall be run in practical alignment and a uniform slope of not less than $\frac{1}{4}$ inch per foot (20.8 mm/m) or 2 percent toward the point of disposal provided that, where it is impractical due to the depth of the street sewer, to the structural features, or to the arrangement of a building or structure to obtain a slope of $\frac{1}{4}$ inch per foot (20.8 mm/m) or 2 percent, such pipe or piping 4 inches (100 mm) or larger in diameter shall be permitted to have a slope of not less than $\frac{1}{8}$ inch per foot (10.4 mm/m) or 1 percent, where first approved by the Authority Having Jurisdiction.



709.0 Gravity Drainage Required.

709.1 General. Where practicable, plumbing fixtures shall be drained to the public sewer or private sewage disposal system by gravity.

Public

