Chapter 3

Flow Rates and Demands

Chapter 3 discusses four aspects of flow rates and demands:

1. Flow rates for fixtures
2. Water conservation
3. Possible and probable demands
4. Water usage

Flow Rates for Fixtures

Information regarding flow requirements for fixtures and possible and probable demands can be found in various design standards as well as manufacturers' technical data. The design engineer must make the final decision regarding flow rates for a given project based on his/her own local knowledge and experience.

It should not be assumed that by using minimum requirements as set down in design standards that the desired result will necessarily be achieved, or that good engineering practices will automatically prevail. For example, some standards as well as local authorities responsible for setting minimum requirements, stipulate a 20mm water connection to residential premises with a recommended flow rate of 0.48 L/s. Chapter 4 demonstrates that in most cases both of these requirements are inadequate.

Residential premises are much larger than they were in the 1970s, when most homes had a single bathroom. Two and three bathrooms are now common. More fixtures and modern appliances add to the probable demand, as does automatic garden watering systems. In the past, little thought has been given by authorities to the high velocities caused when undersized pipes carry the additional flow. The resulting water hammer causes significant damage to the hot and cold water system, which in turn can damage the structure of the building.

Table 3-1 provides recommended guidelines for flow rates for fixtures, that meet government standards and good design practices.

Fixture	Commercial L/s	Domestic L/s	Conserve L/s
Water Closet	0.10	0.10	0.08
Sink	0.20	0.20	0.12
Bath	0.30	0.30	0.15
Basin	0.10	0.10	0.08
Shower	0.20	0.15	0.10
Laundry Tub	0.20	0.15	0.10
Washing Machine	0.30	0.20	0.15
Dishwasher	0.30	0.20	0.12
Drinking Fountain	0.10	0.10	n/a
Glass Washer	0.20	n/a	n/a
Urinal	0.10	n/a	n/a
Cleaners' Sink	0.20	n/a	n/a
Lab Sink	0.15	n/a	n/a
Slop Hopper	0.20	n/a	n/a
Sanitizer	0.10	n/a	n/a
Utensil Washer	0.15	n/a	n/a
Ultrasonic Washer	0.15	n/a	n/a
X-ray Processor	0.10	n/a	n/a
Hose Tap 15mm	0.20	0.20	n/a
Hose Tap 20mm	0.30	0.30	n/a

Table 3-1 Flow Rates for Fixtures

Water Conservation

Water is a valuable commodity and there is an increasing emphasis on saving water. Many shower roses are designed to deliver 0.3 L/s (18 L/m), giving a firm spray with plenty of water. It has been established that showers can deliver as low as 0.10 L/s (6 L/m) without loss of comfort, in fact the spray is considered by many to be softer on the body. Choosing the right shower rose for the situation is important when taking water conservation into consideration.

The Conserve Flow Rates recommended in Table 3-1 should only be used when a decision has been made by the design team to use appropriate taps with an approved efficiency rating, or inserts that reduce the flow of water to the outlet.

It is also important for the design engineer to apply the reduced flows when sizing the pipes.

When water saving devices are used there is a reduction in flow which provides the opportunity for the use of smaller pipes throughout the project, thus providing a cost saving on construction.

Designers should be wary of manufacturers who claim large water savings without a reduction in flow. It is impossible to save water without reducing flow. It is, however, a fact that water savings can be claimed through reduced flows without a loss of comfort to the end user. This is achievable by the use of specially designed flow restrictors that allow a fixed flow to pass through the orifice at a predetermined pressure.

Possible and Probable Demands

Calculations for demands on water services are based on the theory that while it is possible for every tap in a building to be turned on at the same time and there could be a 100% flow requirement, it is more probable that the demand at any one time will be on a reduced scale. The greater the number of occupants in a building, or group of buildings, the lower the probability of a 100% possible demand on the main water services at any given time. It is more likely that demand will be spread more evenly over a longer period of time than over a shorter period.

Although the demand may be 100% to each and every amenities block within a building over a twenty four hour period, the possibility of every fixture in all amenities blocks being activated at one time is highly unlikely. The same theory applies to residential housing, apartment buildings and townhouses, as well as commercial buildings.

The possible demand as it relates to a public building can be an exception and the designer must take into account the patrons' pattern of water usage. A racecourse, picture theatre, or similar venue has definite patterns of water usage where the demand is 90 to 95% for a period of approximately thirty to forty minutes at a time, such as during interval or between races.

Technology is available to calculate and assess the sliding scale of probability. It is the author's opinion that the tables provided in some standards understate the demand and will not allow for sufficient water for the required task. Tables 3-2 and 3-3 provide an accurate and reliable equivalent to probable flow guidelines.

Residential projects are good examples of high probability factors that all taps could be in use at the one time. It is possible the washing machine could be filling while the garden hose is being used to water the lawn, a bath is filling and the water closet is being flushed.

As the number of residences in the street, or the number of apartments in a building increases, the possibility of this happening reduces considerably. The probable flow could be reduced to as low as 16%.

It is the author's observation, that inexperienced design engineers often miscalculate demand requirements for peak periods, as compared to the daily requirements.

Table 3-2 provides the equivalent probable flow for 0.5 L/s to 50.0 L/s. The results are computer generated using ***'WaterFlow pipe sizing'*** software and confirmed in on site research.

Possible L/s	***Probable L/s***	Possible L/s	***Probable L/s***	Possible L/s	***Probable L/s***	Possible L/s	***Probable L/s***
0.5	***0.50***	13.0	***3.73***	25.5	***5.58***	38.0	***7.06***
1.0	***0.80***	13.5	***3.81***	26.0	***5.65***	38.5	***7.10***
1.5	***1.02***	14.0	***3.90***	26.5	***5.72***	39.0	***7.14***
2.0	***1.21***	14.5	***3.98***	27.0	***5.78***	39.5	***7.18***
2.5	***1.39***	15.0	***4.06***	27.5	***5.84***	40.0	***7.22***
3.0	***1.55***	15.5	***4.14***	28.0	***5.91***	40.5	***7.26***
3.5	***1.70***	16.0	***4.22***	28.5	***5.97***	41.0	***7.30***
4.0	***1.84***	16.5	***4.30***	29.0	***6.03***	41.5	***7.34***
4.5	***1.97***	17.0	***4.38***	29.5	***6.10***	42.0	***7.38***
5.0	***2.10***	17.5	***4.46***	30.0	***6.16***	42.5	***7.42***
5.5	***2.22***	18.0	***4.53***	30.5	***6.22***	43.0	***7.46***
6.0	***2.34***	18.5	***4.61***	31.0	***6.28***	43.5	***7.50***
6.5	***2.46***	19.0	***4.68***	31.5	***6.34***	44.0	***7.54***
7.0	***2.57***	19.5	***4.75***	32.0	***6.40***	44.5	***7.58***
7.5	***2.68***	20.0	***4.83***	32.5	***6.46***	45.0	***7.62***
8.0	***2.79***	20.5	***4.90***	33.0	***6.52***	45.5	***7.66***
8.5	***2.89***	21.0	***4.97***	33.5	***6.58***	46.0	***7.70***
9.0	***2.99***	21.5	***5.04***	34.0	***6.64***	46.5	***7.74***
9.5	***3.09***	22.0	***5.11***	34.5	***6.70***	47.0	***7.78***
10.0	***3.18***	22.5	***5.18***	35.0	***6.75***	47.5	***7.82***
10.5	***3.28***	23.0	***5.25***	35.5	***6.81***	48.0	***7.86***
11.0	***3.37***	23.5	***5.32***	36.0	***6.87***	48.5	***7.90***
11.5	***3.46***	24.0	***5.39***	36.5	***6.93***	49.0	***7.94***
12.0	***3.55***	24.5	***5.45***	37.0	***6.98***	49.5	***7.98***
12.5	***3.64***	25.0	***5.52***	37.5	***7.02***	50.0	***8.00***

Table 3- 2 Possible Flows and Probable Equivalents 0.50 L/s to 50 L/s

Table 3-3 provides the equivalent probable flow for 50.5 L/s to 100 L/s. The results are computer generated using ***'WaterFlow pipe sizing'*** software and confirmed in on-site research.

Table 3-4 should be considered as a guide only for houses and residential buildings. Chapter 4 demonstrates that 0.50 L/s per residence is low.

Possible L/s	***Probable L/s***	Possible L/s	***Probable L/s***	Possible L/s	***Probable L/s***	Possible L/s	***Probable L/s***
50.5	***8.08***	63.0	***10.08***	75.5	***12.08***	88.0	***14.08***
51.0	***8.16***	63.5	***10.16***	76.0	***12.16***	88.5	***14.16***
51.5	***8.24***	64.0	***10.24***	76.5	***12.24***	89.0	***14.24***
52.0	***8.32***	64.5	***10.32***	77.0	***12.32***	89.5	***14.32***
52.5	***8.40***	65.0	***10.40***	77.5	***12.40***	90.0	***14.40***
53.0	***8.48***	65.5	***10.48***	78.0	***12.48***	90.5	***14.48***
53.5	***8.56***	66.0	***10.56***	78.5	***12.56***	91.0	***14.56***
54.0	***8.64***	66.5	***10.64***	79.0	***12.64***	91.5	***14.64***
54.5	***8.72***	67.0	***10.72***	79.5	***12.72***	92.0	***14.72***
55.0	***8.80***	67.5	***10.80***	80.0	***12.80***	92.5	***14.80***
55.5	***8.88***	68.0	***10.88***	80.5	***12.88***	93.0	***14.88***
56.0	***8.96***	68.5	***10.96***	81.0	***12.96***	93.5	***14.96***
56.5	***9.04***	69.0	***11.04***	81.5	***13.04***	94.0	***15.04***
57.0	***9.12***	69.5	***11.12***	82.0	***13.12***	94.5	***15.12***
57.5	***9.20***	70.0	***11.20***	82.5	***13.20***	95.0	***15.20***
58.0	***9.28***	70.5	***11.28***	83.0	***13.28***	95.5	***15.28***
58.5	***9.36***	71.0	***11.36***	83.5	***13.36***	96.0	***15.36***
59.0	***9.44***	71.5	***11.44***	84.0	***13.44***	96.5	***15.44***
59.5	***9.52***	72.0	***11.52***	84.5	***13.52***	97.0	***15.52***
60.0	***9.60***	72.5	***11.60***	85.0	***13.60***	97.5	***15.60***
60.5	***9.68***	73.0	***11.68***	85.5	***13.68***	98.0	***15.68***
61.0	***9.76***	73.5	***11.76***	86.0	***13.76***	98.5	***15.76***
61.5	***9.84***	74.0	***11.84***	86.5	***13.84***	99.0	***15.84***
62.0	***9.92***	74.5	***11.92***	87.0	***13.92***	99.5	***15.92***
62.5	***10.00***	75.0	***12.00***	87.5	***14.00***	100.0	***16.00***

Table 3-3 Possible Flows and Probable Equivalents 50.50 L/s to 100 L/s

Home Units	L/s	DIA	Home Units	L/s	DIA	Home Units	L/s	DIA
1	0.50	**20**	**34**	4.38	**65**	**67**	6.58	80
2	0.80	**25**	**35**	4.46	**65**	**68**	6.64	80
3	1.02	**32**	**36**	4.53	**65**	**69**	6.70	80
4	1.21	**32**	**37**	4.61	**65**	**70**	6.75	80
5	1.39	**40**	**38**	4.68	**65**	**71**	6.81	80
6	1.55	**40**	**39**	4.75	**65**	**72**	6.87	80
7	1.70	**40**	**40**	4.83	**65**	**73**	6.93	80
8	1.84	**40**	**41**	4.90	**65**	**74**	6.98	80
9	1.97	**40**	**42**	4.97	**65**	**75**	7.02	80
10	2.10	**40**	**43**	5.04	**65**	**76**	7.06	80
11	2.22	**50**	**44**	5.11	**65**	**77**	7.10	80
12	2.34	**50**	**45**	5.18	**65**	**78**	7.14	80
13	2.46	**50**	**46**	5.25	**65**	**79**	7.18	80
14	2.57	**50**	**47**	5.32	**65**	**80**	7.22	80
15	2.68	**50**	**48**	5.39	**65**	**81**	7.26	80
16	2.79	**50**	**49**	5.45	**65**	**82**	7.30	80
17	2.89	**50**	**50**	5.52	**65**	**83**	7.34	80
18	2.99	**50**	**51**	5.58	**65**	**84**	7.38	80
19	3.09	**50**	**52**	5.65	**65**	**85**	7.42	80
20	3.18	**50**	**53**	5.72	**65**	**86**	7.46	80
21	3.28	**50**	**54**	5.78	**65**	**87**	7.50	80
22	3.37	**50**	**55**	5.84	**65**	**88**	7.54	80
23	3.46	**50**	**56**	5.91	**65**	**89**	7.58	80
24	3.55	**50**	**57**	5.97	**65**	**90**	7.62	80
25	3.64	**50**	**58**	6.03	**65**	**91**	7.66	80
26	3.73	**50**	**59**	6.10	**65**	**92**	7.70	80
27	3.81	**50**	**60**	6.16	**80**	**93**	7.74	80
28	3.90	**50**	**61**	6.22	**80**	**94**	7.78	80
29	3.98	**50**	**62**	6.28	**80**	**95**	7.82	80
30	4.06	**65**	**63**	6.34	**80**	**96**	7.86	80
31	4.14	**65**	**64**	6.40	**80**	**97**	7.90	80
32	4.22	**65**	**65**	6.46	**80**	**98**	7.94	80
33	4.30	**65**	**66**	6.52	**80**	**99**	7.98	80

Table 3-4 Simultaneous Flows and Pipe Sizes for Residences

Flow rates for fixtures will change over time as new technology is introduced and the design engineer must always remain conversant with local standards and take any amendments into consideration. In the 21st century there is an increasing emphasis on conserving water. Local authorities are introducing regulations that limit the flow to fixtures and manufacturers are working toward lowering flow rates for their taps and fixtures. The design engineer must also consider the effect of water savings on the drainage system in order to avoid blockages.

Water Usage

Most local authorities throughout the world keep their own records on water usage in their area, therefore it is not possible to accurately state these figures. The following should be considered as a guide only.

Fixture	Approximate % of Total Domestic Use
Water Closet	32%
Kitchen Sink	15%
Bath	15%
Washing Machine	12%
Basin	9%
Shower	5%
Garden and Car Washing	8%
Other	4%

Table 3-5 Domestic Water Usage

For the purpose of estimating the likely consumption of potable water, local authorities estimate water usage to be between 200 and 350 litres per person per day. This will vary depending on the climate, warmer climates being at the top end of the scale and cooler climates at the lower end of the scale.