# Velocity

Velocity is the constant speed of a moving substance or object that travels a specific distance within a specific time.

Usual units of measure for water velocity are feet per second (fps) and metres per second (m/s).

Velocity can be determined using the following formula:

$$\textbf{Velocity (V)} = \frac{\textbf{Distance (D)}}{\textbf{Time (T)}}$$

**Flow Rate**

The terms velocity and flow rate imply movement.

Flow Rate is defined as the volume of substance or liquid, which passes a specific point within a set time period.

Flow rate is expressed usually in the following:

- Gallons per minute (gpm)
- Cubic feet per second (cfs)
- Litres per second (L/s)
- Cubic metres per second ($m^3/s$)

**Helpful Time Conversions**
60 seconds = 1 minute
60 minutes x 60 seconds = 1 hour
60 seconds x 60 minutes x 24 hours = 1 day
86400 seconds = 1 day
1440 minutes = 1 day

**Example:**

Find the velocity of water in a pipe if it takes 5 minutes for water to travel a distance of 800 feet in the pipe.

Solution: $\textbf{Velocity (V)} = \frac{\textbf{Distance (D)}}{\textbf{Time (T)}}$

$$\text{Velocity} = \frac{800 \text{ ft}}{5 \text{ min}}$$

Velocity = 160 ft/minute

*Since velocity is normally expressed in feet per second (fps), the velocity for this example would be:*

$$\text{Velocity} = \frac{160 \text{ ft/min}}{60 \text{ sec/min}} = 2.67 \text{ ft/sec} = 2.67 \text{ fps}$$

**Average Daily Flow**

The amount of water a community uses every day can be expressed in terms of *average daily flow* (ADF); that is the average of the actual daily flows that occur within a period of time, such as a week, a month, or a year.

The formula for finding the average daily flow is as follows:

$$\textbf{ADF} = \frac{\textbf{sum of all daily flows}}{\textbf{total number of daily flows used}}$$

Average daily flow is important because it is used in several treatment plants calculations.

**Example:**

**What is the average daily flow of the treatment plant for July 2003?**

In July 2003, a total of 68,920,000 L of water was treated at a plant.

The sum of all daily flows has already been determined – a total of 68,920,000 L was treated for the month. July has 31 days.

**Solution:**

$$\text{ADF} = \frac{\text{sum of all daily flows}}{\text{total number of daily flows used}}$$

$$= \frac{68{,}920{,}000 \text{ L}}{31 \text{ days}}$$

$$= 2{,}223{,}226 \text{ L/d}$$