TECH TIPS FROM NASSCO

TECH TIPS BY NASSCO IS A BI-MONTHLY ARTICLE ON TRENDS, BEST PRACTICES AND INDUSTRY ADVICE FROM NASSCO'S TRENCHLESS TECHNOLOGY MEMBERSHIP PROFESSIONALS.

Sewer Flow Metering – What's New?

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When it comes to metering flow in the sewer, we are using a combination of digital high tech and technology from ancient Rome. Open channel flow monitoring is always challenging, and no single technology is suitable for every application. So the more tools in the toolbox, the better chance we have of getting some decent and reliable data. Fortunately, old and new metering technology is enhanced with a variety of digital communication technology.

Flumes would be the most basic device for measuring collection system flows. They've been around for about 150 years, you can read them with a yardstick, and you can visually determine when they are working well (if you know what to look for). Flumes are designed to convert level to flow; as the level increases in the flume, it indicates a corresponding increase in flow rate. The converse is also true.

Parshall Flume

Photo by Tracom

The Parshall Flume is the most popular for its range of flows and ability to pass flow without taking much energy from it. Also useful is the Palmer-Bowlus Flume which comes in an insert version (see photo); the insert Palmer-Bowlus flume can be mounted in a manhole invert for collection system flow monitoring. The flume in the picture also shows a down-looking ultrasonic sensor mounted above, which is measuring level.

Palmer-Bowlus Insert Flume

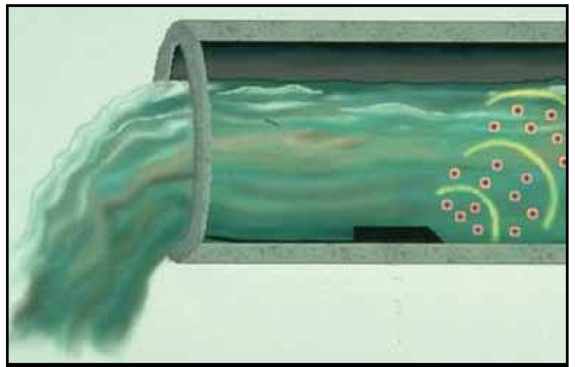
Photo by Isco

Installation is crucial to having a flume work properly. The flume must be level, and the approach flow must be quiescent (laminar hydraulics). High velocity approach flow and/or excessive turbulence will impart a lot of inaccuracy that may not be noticed. Free flow at the flume discharge is important. Measuring level at the right spot is crucial. The level measuring spot must be free from debris, or you'll get an artificially high flow rate. And don't forget to occasionally (annually, twice annually or quarterly) check the calibration of your level sensor. Rule of thumb says that a good flume provides accuracy of about +/- 10%, and could be better (+/- 5% is reasonable if conditions are carefully met).

The area/velocity flow monitor has been in use since about the middle of the 1980's. It got its name because it is solving the basic flow equation: Q = A X V where Q = flow in your favorite unit, A = area and V = velocity. By measuring area (derived from level) and velocity, the meter calculates flow. Most of the area/velocity meters provide a combination sensor like the one in the picture. It measures level using a pressure sensor, and converts level-to-area.

For example, if the pipe is a 12" round pipe and the level is 10" then the area of the flow is ~83% of the total. Velocity is measured using the Doppler Ultrasonic Frequency shift, which is similar to police radar. An ultrasonic frequency is transmitted into the flow, and the velocity of entrained bubbles or solids reflects and shifts the frequency proportional to their velocity. This velocity measurement is bi-directional, so flow going the other direction can be accounted. Area/velocity meters can be used on a temporary basis, carried from site-to-site to check the system.

They are typically battery powered and designed to be mounted under the manhole lid. With an onboard data logger, you can visit them from time-to-time to download the flow information for later analysis.



Area/velocity flow meter

Photo by Isco

The area/velocity meter described here needs at least 1" of level and somewhere between 0.25 to 0.5 feet/second minimum velocity (depending on the manufacturer). Flow needs to be straight, meaning swirls and curls and dropped flow will mean bad data. So, site selection is crucial. It's not a bad idea to maintain each metering site weekly, meaning check to make sure the sensors are calibrated and the meter hasn't been beaten-up by a surcharge.

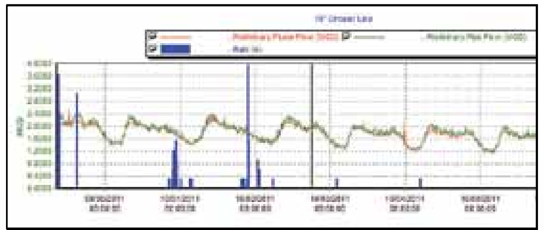
The 21st Century brings us a promising new technology for sewer flow: non-contact laser and ultrasonic. The laser penetrates the flow to check more of the velocity profile down deep while the ultrasonic handles the level-to-area part, all without touching that stuff in the sewer.

Non-contact laser flow meter

Photo by Isco

Whatever century's technology you choose, there is sewer-ready technology to capture the data and bring it to your computer, tablet or smart phone.

The RTU (recording telemetry unit) is a multi-platform device that can take almost any output, log the data, and send it to the internet. The most common one that we use can take inputs from all of the major flow meter manufacturers, and can even take control of some of the flow meters. It can handle up to seven instruments such as an independent ultrasonic sensor, pressure level sensor, rain gauge, and other devices used for collection system measurement and accounting. The RTU provides battery-powered data storage for about three months, so this gives us redundant data logging. But it sends the data to our enterprise server using the cellular data stream, the same data stream that provides caller ID and text messaging. So data from the sewer is available in (almost) real time, and can be read by any device with an internet browser. The system can also alarm on any measured variable in real time, so it's easy to know when an overflow is about to erupt. The RTU is sewer ready, designed to be mounted under the manhole lid. Data is typically sent via buried antenna to enhance reliability. Online data can be read in graphical or tabular form, and any date range can be picked by the user. Data is secured by a user name and password.



Example of online data from metering chamber

Screenshot from Flow Assessment