

## MANHOLE INSPECTION TECHNOLOGIES

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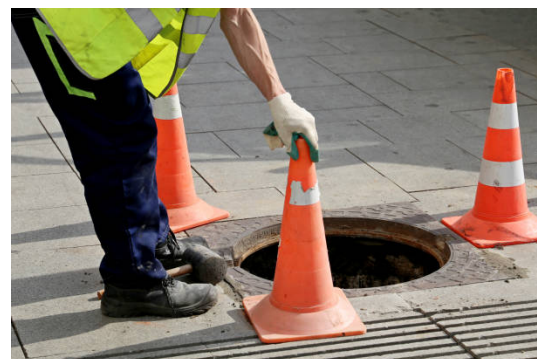
If you attend a wastewater conference or read any sewer industry magazine, you will undoubtedly see multiple technologies for inspecting sewer manholes or underground structures. Each one has its main salespoints or technologies, but what are they providing you? How can you utilize these technologies to streamline and improve your inspection program?

The first question prior to seeking out any new technology is what do you want the deliverable to provide, and how do you plan to utilize this information? The answer to these questions will help you when engaging in conversations with technology or service providers. Are you mainly concerned with a visual inspection of the structure, or do you want not only the visual inspection, but also the ability to measure items like pipe sizes, depths, and defects at a later date? This decision will have an impact on the equipment or inspection cost for the project.

For visual inspections there are many options available on the market. From off-the-shelf action video cameras and 360-degree cameras, to industry specific inspection tools with multiple HD cameras. Regardless of the camera used, one key to any successful inspection is the lighting. You must be able to properly illuminate the structure for the camera without over-illuminating it, which can wash out the video or pictures.

When it comes to getting measurements from the inspection technologies, the two ways measurements are taken are either via photogrammetry, or with a LiDAR measurement. LiDAR stands for light detection and ranging.

- **Photogrammetry** involves taking multiple overlapping pictures of an object that are then stitched together or converted into a 2D or 3D model using algorithms. These models are then used by software to allow the end user to take desired measurements.
- **LiDAR** uses lasers that are transmitted from a source, then the laser reflects back to the source from the object being scanned. The unit then reads the reflected light at a receiver using a system called time of flight to calculate distances for measurement.



The main difference in the two technologies is that photogrammetry uses the images captured to construct the object being scanned versus LiDAR which uses a direct measurement based off physically hitting a feature with light and measuring the reflection.

Accurate pipe measurements are typically a must when it comes to inspecting a manhole. Both technologies are capable of providing accurate pipe measurements but have their limitations that should be kept in mind. For photogrammetry to get an accurate measurement it must be able to get multiple photos of each pipe to stitch together. Since most pipes are at the base of the manhole, it is imperative that you have a camera that is capable of getting multiple camera views of the base of the manhole to get those accurate measurements. On the LiDAR units, the laser beams sent out from the receiver cannot penetrate water, so if the pipe is more than half full of water, it will also be difficult to get an accurate measurement. This same rule applies for photogrammetry, as the photos also can not see through water.

Regardless of any limitation placed on either inspection technology, rest assured knowing that you are going to get accurate, quality inspection from both of them on the majority of structures, but understanding limitations of each style of unit will ensure whatever you choose to purchase will be the correct fit for your system or program.

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