

# Managing Above and Below Ground Infrastructure Requires Innovation and Coordination

By Bill DiTullio

The American Society of Civil Engineers (ASCE) estimates \$2.2 trillion will be required over the next five years to bring the nation's infrastructure to a "good" level. Of this staggering amount, it is estimated that at least \$255 million will be required each year for drinking water and wastewater and \$930 million for roadways and bridges. While funding to this level may be difficult to come by, it is important to best leverage the resources that are available.

By coordinating efforts and pooling resources to look at your community on a street-by-street or neighborhood-by-neighborhood basis, you can more effectively and efficiently manage your assets. If you mobilize once and collect all of the information on all of the assets that exist in that system, it is possible to get more value out of your community's money. Imagine having a holistic picture, knowing what assets exist and their pinpointed location, as well as their condition. You could then look at your entire city or town, block by block, to evaluate potential risks and prioritize projects needed to meet the desired service level.

It sounds good, right? But obviously it is not a simple project to tackle. However, there are some tools and strategies that can help you start to see the forest, instead of getting lost in the trees.

The management approach for above and below ground infrastructure is evolving. New technologies and software will bring the field to our computers, providing planners, engineers, operators and other decision-makers real-time access to information that will improve the performance and condition of our "public health" infrastructure and turn the page on our past.

We are continuing to see advances in technologies that will allow more comprehensive analysis of assets using non-destructive methods, allowing for better prediction of remaining useful life and maximizing the usage of the assets while reducing the number emergency calls.

For the management of above ground assets, mobile mapping vehicles provide street-level images of the agency's road network for use in asset extraction. The data collection process allows for the collection of asset data using geospatially referenced imagery in the field, from which positional and attribute information can be extracted in the office. Asset extraction is performed in a GIS environment that can be seamlessly integrated into the agency's asset management system. Mobile mapping combines the power of GPS, inertial measurement, LIDAR and digital video to create a virtual field presence without impacting the everyday operations of a transportation facility. Imagine being able to bring the field to your desktop computer and creating geospatial databases just by clicking the mouse.

This data is used to create infrastructure features that a user can select and view important information relat-

ed to its location, age and size. Combined with inspection, condition and sufficiency ratings, this information can help determine how well an asset is performing in the field. Poor roadway conditions cost motorists nearly \$70 billion per year in repairs and operating costs. With mobile mapping inventory and condition data, public works departments can evaluate the risk of roadway assets and prioritize their investments based on their risk of failure. Now the condition of our roadways and bridges can be determined quickly and capital investments can be prioritized to minimize the risk of failure.

Now let's consider the condition and financial needs of buried assets. Insufficient maintenance and chronic underfunding of our water infrastructure results in leaking water pipes costing an estimated \$11 billion per year nationally. The condition of our wastewater systems are also in a deteriorated state. Aging wastewater systems discharge billions of gallons of untreated wastewater into our surface waters, impacting our environment for many years.

New pipeline inspection technologies rapidly identify pipelines that require maintenance and repair or replacement. Inspection vehicles are equipped with GPS equipment for locating manholes, catch basins, outfalls, fire hydrants and valves along with zoom camera equipment to document with video the maintenance and structural condition of gravity sewer structures and pipelines. Inspection teams can map, inventory and determine the condition of gravity sewer manholes and pipelines at a rate of 1 to 2 miles per crew day for road pipelines and 0.5 to 1 mile per crew day for most off-road pipelines independent of pipe size.

Recent advancements in metal pipe inspection technology permits non-destructive testing of buried pressure pipelines. This information can produce wall thickness contour maps that identify pipeline imperfections; providing useful information for calculating the remaining useful life of buried water and gas mains.

Geographic information systems are being used to manage the information gathered as part of these infrastructure assessment initiatives. One of the benefits of using GIS is that information can be presented visually so a user can more effectively view data, identify trends and focus on problem areas. The geographic display of data in an asset management system offers the ability to make maintenance and capital planning decisions based on spatial relationships of assets and their associated risk and condition information. This capability allows decision-making at the "street" level as opposed to "asset specific" level, focusing on one particular type of infrastructure.



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The GIS provides information about the location of the asset and information that describes it, but there is more information that is required to prioritize maintenance and capital improvement activities for that specific asset. For example, public works directors want to know information about the asset's performance, which is a function of life-cycle maintenance costs, condition inspections and how all of this compares to the "expected" performance of the asset.

Believe it or not, most agencies do not have a solid handle on what they own. Even fewer know how their assets are performing. A fortunate, but slim, minority know both of these things, plus how much that infrastructure is actually worth! These are the questions that can be answered through the implementation of an asset management system.

Asset management systems (AMS) are used in conjunction with GIS to store additional, non-spatial data related to an asset. An AMS is used to manage information related to the asset maintenance: when it was placed in service, its current condition and the plan for the future rehabilitation or disposition. In addition, this data continues to be more portable and accessible to a larger cross section of stakeholders, increasing the benefits of the invested dollars. This accessibility further expands the value of the asset management system for achieving the ultimate goal of providing information needed to manage assets controlled by different groups or departments.

New management approaches that include planned coordination between departments and innovation are warranted as the condition of water, sanitary and storm sewers, roadways, bridges and traffic controls and signals continue to deteriorate. Can utility and asset managers afford to manage individual asset classes without regard to addressing the condition and needs of other asset classes within the same street segment? The answer to this question, most definitely, is "no." Mobilization costs, as well as excavation costs, represent more than 50 percent of the cost of construction. To get the most for each construction dollar, street segments will need to be evaluated in a more holistic manner. Street segments will be prioritized using an overall condition index. The condition index will consider the risk of failure for each asset class contained within the street segment. This approach to managing street assets will require coordination between departments, but it will provide a basis for a more systematic approach to managing above and below ground

infrastructure and a more effective and efficient use of available resources.

With proper coordination, innovation and management systems, the location and condition of the above and below ground assets can be made more visible and known to planners and engineers and capital improvements can be scheduled whereby mobilization and construction costs can be reduced.

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**Compiled by:** Center for Underground Infrastructure Research and Education (CUIRE) at the University of Texas-Arlington

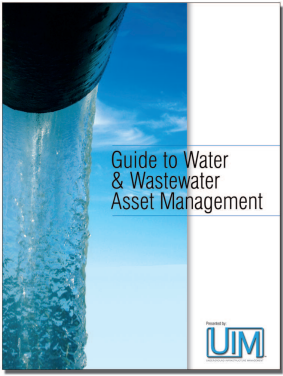
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