

Making Better Infrastructure Decisions with AI & the Cloud



The City of Hampton, Virginia A Case Study Vignette



The City of Hampton, Virginia, is a thriving city located on the water in Chesapeake Bay. Dating back 416 years, Hampton is the oldest continuously inhabited English-speaking city in the country. And according to the Jamestown-Yorktown Foundation, many of the streets, neighborhoods, and even schools still bear the name of many groups of Virginia Indians that have lived here for even longer. Infrastructure is old there to say the least. Today, under the leadership of Public Works Director Jason Mitchell, Wastewater Operations Superintendent Rodney Kiefert, Collection Systems Manager Angel Perez, and Senior Civil Engineer Dr. David Powell, ensuring a safe, clean environment to live, work, and play is the mission – and it is paying off. Just recently in June, Hampton was named an All-America City by the National Civic League due in large part to its actions from listening to the voices of young people in the community. With its beautiful waterfront parks and marinas, centuries-old streets and attractions like the Air & Space Science Center and Hampton University founded in 1861, building and maintaining the City's infrastructure is key to its success.

CHALLENGE: Implement best practices relating to sewer inspection, the evaluation and repair of significant defects, and to minimize unpermitted sanitary sewer overflows.

One of the new technologies helping the City maintain its infrastructure has been the application of **Artificial Intelligence and Machine Learning** to its pipeline condition assessment program. In 2014, Hampton and 13 other nearby localities agreed on a “hybrid regionalization approach” to implement best practices relating to sewer inspection, the evaluation and repair of significant defects, and to minimize unpermitted sanitary sewer overflows. Being in such close proximity to the Chesapeake Bay ecosystem requires proactive vigilance and compliance with the Virginia Department of Environmental Quality.

Starting over a year ago in 2022, the City began using a service from CUES, Inc. (a leading manufacturer of infrastructure inspection equipment, software and professional services) called Defect Coding-As-A-Service (DCAAS). The service provides automated defect recognition that is substantially performed by machines that have been taught to recognize visible problems in pipelines using AI. It's also important to note that people are not taken out of the equation - inspections and data are still reviewed by CUES and the Hampton staff.

Today, the City's inspections are transmitted wirelessly from the field to the Cloud using the GraniteNet software platform from CUES, making the process automatic and simple for the inspectors who can complete work faster, reduce the time people spend working in the streets, save on traffic detail costs, and improve coding quality - because people often see things inconsistently. Additionally, the City's data security is strengthened from using secure encrypted data transmissions, removing the danger often seen in traditional procedures where portable USB drives are commonly used on vehicles and then plugged into the network where malware/ransomware can be spread. CUES provides the defect coding service in accordance with NASSCO's PACP coding rules, the industry's recognized standard for pipeline assessment.

Hampton: “making the process automatic and simple for the inspectors who can complete work faster, reduce the time people spend working in the streets, save on traffic detail costs, and improve coding quality.”

SAVINGS

"We have less consultant review. Currently, our dataset shows that approximately 40% of the inspected pipes require no activity at this time, so that's about 40% less consultant time spent when reviewing inspection data. To date this is about 200 hours of consultant time saved."

Angel Perez



In addition to receiving automated AI coding for PACP, the City also receives weekly recommendation reports to identify the pipelines believed to be at risk of failing, as well as the suggested methods of repair/ replacement for the many unique situations a pipeline may be in, based on the City's preferred decision logic. Implemented by CUES for the City, this added service is called "**Prescriptive Planning**" and it helps utilities make defensible, data-driven decisions about what to fix and when. Hampton's decision makers can quantify work visually in their GIS maps to infer consequence of failure, create budgets and streamline contractor bids for the specific type of work needed to be done (like issuing bids for a relining project) according to established service level requirements and the City's budget.

For example, the City contracts out its chemical root treatment program and has been using the same list of pipelines for many years. Since implementing the Prescriptive Planning Service, the data has suggested that the City needed to update its list and treat the pipes that clearly need it, not just the pipes that have historically been on the list. Per Angel Perez, "Having it consistent through prescriptive planning allows us to update the list holistically, not having to look at the information pipe-by-pipe. This saves time." Consequently, the City updated much of the year's root treatment list to make sure its budget is focusing on treating the appropriate pipes and not wasting money on those that don't.

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Dr. Powell

According to Dr. Powell, the benefits have been multiple and significant, especially from a proactivity standpoint. With respect to Prescriptive Planning, Dr. Powell says, "We can quickly develop round-number budgets and extrapolate project costs for neighborhood projects, so I have begun to use the suggested decision planning tool for long-term financial planning. Having quick returns on coded pipelines allows the department to keep up with the inspection work and focus on what's important."

Becoming proactive instead of reactive is what every Public Works department seeks to achieve, and the CUES service is helping to provide it to the City. Dr. Powell continues, “we are regularly contacted by other divisions doing projects in an area. When they ask if we anticipate work being done in a given area, our Prescriptive Planning analysis shown in our GIS map already gives us a first-look view into the location. We can quickly say, “no, we’re good in that area,” or “yes, we need to be involved in your project.” Our staff time is therefore efficiently used, as we do not need to automatically get involved in every project.”

Having a tool that recommends the type of rehabilitation to use is also an important efficiency gain for the City. Prescriptive Planning does not perform mathematical calculations such as “Grade 5” or “Grade 10”. Instead, it utilizes an algorithm with formulas embedded in GraniteNet’s Prescriptive Planning Module to determine the preferred courses of action to take based on the noted observation codes and the categories they fall into. Courses-of-action such as “Replace”, “Point repair”, “Full Lining”, “Clean and Reinspect”, “Heavy Clean and CIPP”, “Re-inspect (5 yrs),” “Re-inspect (10 yrs),” etc., help the City quantify budget estimates and arrive at an automated decision for rehabilitation/replacement. The work has become more streamlined. Angel Perez says: “Seeing that 30% of the system needs point repairs instead of full CIPP lining has allowed us to save money. Point repairs cost less than a quarter of what full pipe CIPP costs, and they are often less disruptive than full CIPP.”

The City of Hampton, VA, has implemented a truly forward-thinking Asset Management program that takes full advantage of automation technologies, security, and real time, map-driven, task-oriented workflows for greater efficiency and productivity. The results are helping it maintain service levels, reduce sanitary sewer overflows (SSO’s), and meet its compliance requirements with both its CMOM and its Consent Order obligations to the Regional Wet Weather Management Plan under the VA Department of Environmental Quality.

For more information and a live demonstration, please visit the CUES website or scan the QR code.



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