



City of Cambridge

Saving millions through proactive infrastructure repair

Smart is...

Giving the Department of Public Works deep visibility into the city's infrastructure, allowing proactive asset management—saving millions in the process.

The City of Cambridge, Ontario, is using a **sophisticated work and asset management system** to become more proactive in its efforts to maintain the city's water, sewer and transportation infrastructure. By drawing on data from many sources, including the knowledge base of veteran workers, and using **powerful optimization techniques**, managers expect to be able to **eliminate a CAN\$71 million maintenance backlog** while avoiding millions in new costs.

The City of Cambridge, Ontario, has a long and proud tradition of fiscal responsibility, balancing its annual budget even in the face of hard economic times. Thanks to the creative use of available resources—such as deferring non-critical spending—the city of 130,000 avoided going into debt.

Over time, however, the cumulative effect of this practice began to be felt. The city's public works department found itself less and less able to do inspections and preventive maintenance because its resources were increasingly being used to respond to emergency repair calls.

“We were heading towards a crisis point,” says Michael Hausser, director of Asset Management and Supporting Services for the Transportation and Public Works Department in Cambridge. “Not only were we slowly losing the ability to stay ahead of ordinary wear and tear on our infrastructure, we didn't actually know what the state of things was at any given time. We were on the way to becoming completely reactive.”

The challenge of the unknown

The city had become acutely aware that there existed an “infrastructure gap.” Everybody knew there was a problem, but nobody knew how big it was, what risk it posed or even how to quantify it. The results of a study that examined the issue were alarming. The city had accumulated a repair backlog of CAN\$54 million in its water system alone, and another CAN\$17 million in its sewer system. Beyond this, the sub-par condition of the water and sewer infrastructure was costing the city millions each year—CAN\$2 million worth of fresh water and CAN\$4 million in costs related to infiltration of the sewer lines.





Business benefits

- An increase in number of roads rated “good” of 50 percent
- A reversal of trend that is expected to eliminate over CAN\$71 million in repair backlog
- Potential savings of over CAN\$6 million in annual costs due to poor infrastructure condition
- Support of proactive planning and maintenance through continuously updated data set
- Optimization of workflows for field workers for increased productivity

To address the issue, Cambridge established a division devoted to asset management and put Hausser and his team in charge. They immediately saw that the key to reversing the maintenance trend was to transform how maintenance was done. “We were basically at zero. We had no accurate inventory, no proper valuation of assets, and no real maintenance program.” A disconnect existed between the city’s records and the situation in the field, Hausser says. “Our records didn’t reflect what was actually out there.”

In addition, veteran workers possessed a wealth of untapped knowledge from years of work in the field. This represented a priceless resource, and it was in danger of being lost as these employees retired. Hausser points out that “It’s not at all uncommon in cities to get a repair call, go out, dig a hole and find something underground that isn’t on the map or in any record... but somebody in the department is aware of it. These workers know what’s actually out there, and how to keep things running smoothly. That’s the kind of information that we desperately need to understand our infrastructure.”

First things first—setting a baseline

The project team knew it had to gain an understanding of the state of the infrastructure. “Our vision was—and is—to gain total visibility into the infrastructure so that we can manage it as effectively and efficiently as possible,” Hauser says. “To get there, we need three things: information, technology to record and manage that information, and processes to put it to work. The key is the first part—information.”

The solution envisioned by Cambridge is centered on a geographical information system (GIS) database containing data on the city’s civil infrastructure—some 250,000 assets ranging from roads and sidewalks to

Smarter cities:

Optimizing infrastructure management



Instrumented

Information from field sensors and workers is transmitted to the city’s asset management system in near-real time



Interconnected

Data from a myriad of sources, including work crews, survey cameras, GPS sensors, geographical databases and asset schedules is combined and used to create optimized work orders



Intelligent

Proactive planning for preventive maintenance and asset replacement is made possible through end-to-end insight into the infrastructure and predictive analysis of infrastructure asset condition



Solution components:

Software

- IBM Maximo® Asset Management

Servers

- IBM System x® 3850 M2

IBM Business Partner

- The Createch Group
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—Michael Hausser, director of Asset Management and Supporting Services, Transportation and Public Works Department, City of Cambridge

sewers and water pipes. It covers not only location and condition, but associated data such as when the asset was installed, inspected, last repaired, what was done, who did it, and so on.

Building the database was a major project, involving the transcription of every record, engineering drawing and map in the city’s files. Then, crews were sent out to physically inspect the actual assets and fill in the gaps. This three-year effort revealed that some 25 percent of the information on hand was either incorrect or missing.

Today, the database contains a rich set of data that goes far beyond anything the city has ever had. Photographs show actual asset condition and GPS has provided very accurate location information. In addition, employees were interviewed and their knowledge was incorporated to create a detailed, living picture of every asset in the city.

Putting a mountain of information to work

While the database project was under way, Hausser set about designing the means to allow Cambridge to leverage it. The team created a number of process and workflow templates covering all of the activities performed by the department, ranging from pothole repair to snow removal. These scenarios are highly detailed and incorporate analyses based on past experience. For example, knowing how often potholes appear in a particular place can help determine how often that stretch of road needs to be inspected—or even proactively reworked to avoid the pothole in the first place.

The direct employee knowledge aspect of the project has proven invaluable. During a snowstorm, for instance, managers know from experience that equipment needs to be put in certain locations and workers called in at a particular time before the weather gets too severe. They also know which roads need to be re-plowed first, and when, as the storm progresses. All of this information is now incorporated into established business rules and response plans.



The system in action

The final piece of the picture is the actual operational system, based on IBM Maximo® Asset Management software and running on the flexible and scalable IBM System x® 3850 M2 hardware. The solution brings all the hard preparatory work together and manages every aspect of infrastructure operations, maintenance and repair from end to end. It covers everything from call center-initiated response to public reports of problems, weather-driven responses, planned seasonal activities and preventative maintenance and inspection processes.

By doing away with inefficient manual processes and inconsistent paper recordkeeping, Cambridge can make better use of budgets and personnel. More importantly, the solution lays the foundation for managers to be proactive, by giving the intelligence and insight needed to perform timely preventive maintenance—which helps reduce spending because averting an issue is normally far less expensive than repairing a problem.

A typical scenario serves to illustrate the value of the solution and its transformative effect. Each day, data is taken in from many sources. These vary and may include weather forecasts, incoming repair calls, personnel and vehicle availability, time of last inspection for assets, maintenance standards, outstanding issues and exceptional circumstances. After analyzing and processing all of this input, Maximo Asset Management issues optimized work orders that detail work for the day, laying out a clear and efficient plan of action. Future development will result in even better use of time and resources to further reduce travel time and administrative effort, while increasing coordination between internal staff and external service providers.

For example, a work vehicle might be sent along a street that is due for inspection so that this task is taken care of in the process of performing a completely separate job within the scope of the crew's function. The workers will report status and completion via mobile computers, along



with their time, material and equipment utilization. The database will then be updated automatically so that it provides accurate, near-real-time information, reducing—or even eliminating—paper timesheets and the associated administrative overhead.

While it may take the city some time to measure the solution's full impact and leverage the funding opportunities the government has been able to uncover through greater knowledge of the infrastructure, its efforts are already delivering real results. "With our systematic approach to infrastructure renewal, we've been able to improve our roadways considerably," Hausser says. "When the project started, only 44 percent were rated 'good.' Three years later, that number has grown to 68 percent."

Making a difference, now and in the future

The city now has critical intelligence on the use of scarce financial, material and human assets that enables better planning. "We've gained insight into what work is being accomplished, the resources consumed and service levels achieved. But just as important is that we are now fully aware of what work is not being accomplished because of resource or budgetary shortfalls," Hausser says. That enables administrators to make management decisions related to rates, resources and priorities that will pay dividends far into the future.

This deeper level of knowledge is allowing the city to shift to a more effective and efficient proactive infrastructure management approach that is seen as an investment in the future. While it may mean rate increases for citizens until sustainable levels can be achieved, it is expected to result in significant long-term savings that will let the city avoid drastic and sudden future rate hikes.

Hausser believes the city's new approach marks a major turning point. "Not only does the system and our new processes let us make much better use of our resources and save money every day," he says, "It gives us incredibly valuable insight into what we can expect in the future. We're moving from a break-fix mentality to a proactive planning mentality. That's a major change for us, and it's going to pay off for decades to come—not only financially and from a sustainability standpoint, but in the quality of life for our citizens."



► The inside story: Getting there

Thought leadership builds a stronger solution

The key to success for Cambridge was the thought leadership displayed by Hausser and his team. “We knew we’d need sophisticated technology, but we also knew that no single off-the-shelf solution would do what we envisioned. To us, technology is a critically important tool and enabler, but the total solution comes from us. That’s why we put so much time and effort—three years—into laying the groundwork before we set up an actual asset management capability.”

Thinking differently about how maintenance is done

A key challenge for the city was getting its managers to think in terms of standardized methods. This represented a fundamental cultural change. “We had seven managers, each with their own way of doing things,” Hausser says. “Nothing was written down, and we didn’t even have common terminology—they just did things in the way that worked best for them. Getting them to think in the same terms and along the same lines was an important part of this, so we met with them both one-on-one and in progressively larger groups to garner understanding and consensus as part of our workflow design process.”

Changing the funding mindset

The immediate purpose of the asset management system was to reverse the negative trend in the state of Cambridge’s infrastructure, and it is succeeding. But beyond this, the insight provided by the project team convinced city leaders that increased spending on infrastructure is a wise investment in the future. This was a major shift for the city, one that required the vision and willingness to borrow money to create a sustainable infrastructure plan.

For more information

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