



DIGITALNXT CASE

BAM Infra Nederland: Making roads safer with smart technology

When BAM Infra Nederland, a multinational construction company, needed a more efficient and cost-effective way to visually inspect and maintain asphalt paving, it turned to OrangeNXT. Working together, we they developed a smart solution that uses Microsoft Azure, machine learning, and AI to train custom designed algorithms to accurately detect and classify various types of damages on paved surfaces. The new solution improves the speed, quality, efficiency, and accuracy of visual road checks, enables predictive asphalt maintenance, and reduces costs-freeing inspectors to focus their expertise where it is really needed.

Costly repairs & safety issues

As soon as a road is paved, harsh weather and heavy traffic start to erode and degrade the surface. Small cracks, abrasions, or other defects, left undetected, may quickly become big problems, leading to costly repairs, major traffic delays, and potential safety issues. To help make these road-condition issues less certain and less problematic, we partnered with BAM Infra Nederland, a subsidiary of the Royal BAM Group (BAM), a European construction company that operates worldwide. Together we set out to increase

efficiency and reduce costs by applying advanced imaging and analytics technology to the never-ending challenge of inspecting and maintaining highways, city streets, parking lots, and other paved surfaces that people walk, drive, and ride on every day.

National and local governments in the Netherlands routinely check the condition of roads, especially the top asphalt layer, to improve public safety, vehicle performance, and traffic flow. BAM has performance based maintenance contracts with



many of those governments, which require the company to regularly inspect and repair paved roads throughout the Netherlands.

Visual inspections of roads

BAM performs visual inspections of roads as part of its maintenance contracts, according to John Koot, our Alliance Director. In the past, BAM sent out drivers in cars equipped with cameras to travel the roads they wanted to inspect, record photos and videos on disks, and then have inspectors review the images to identify damaged pavement or pinpoint anomalies. When they found a problem, the inspectors would mark it, and then make a plan to repair the damage.

“This process was time-consuming, costly, and tedious,” says Kitting Lee, Director of Commerce and Innovation at BAM Infra Nederland. “We needed a smarter solution.”

“Most roads were being checked just once per year,” John says. “We knew that if we could check more frequently, we could prevent small defects from becoming big holes, which would improve public safety, enable predictive maintenance, and reduce emergency repairs that shut down roads and cause traffic jams.” After looking at the major cloud platforms, the two companies chose Microsoft Azure because they believed assistance from Microsoft would get the project up and running more quickly, because Microsoft is making deep investments in intelligence and the Internet of Things (IoT), and because Azure offers exceptional flexibility



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and extraordinary support for open-source tools. “Without Azure, we had no business case,” Koot says. “It is Microsoft’s commitment to supporting open-source technology that makes it work. It would not have been possible as a single vendor solution.”

“We had to process huge volumes of data very quickly, almost in real time, because the sooner the inspectors see the damage, the sooner the company can act,” he continues. “Azure was essential for both computing power and data analytics, and it would have been impossible and unaffordable if we had tried to do this outside the cloud. Azure was the only platform that could give us everything we needed.”



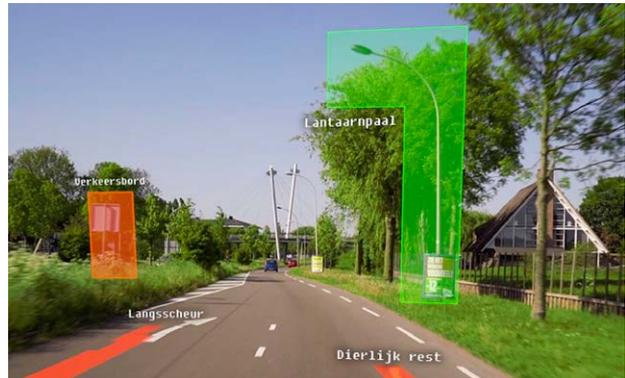


Intelligent IoT solution accelerates efficiency

Working with BAM experts, we developed specialized algorithms and used machine learning to start training the algorithms to distinguish the often subtle differences between damaged and undamaged asphalt. Using the new solution, vehicles equipped with 360-degree cameras drive down roads that are scheduled for inspection and record video footage from every angle. Those images are enriched with geospatial data, so inspectors not only know where road damage appears on a certain image, but also where each of those pixels is located in the real world.

And because the algorithms need to keep learning and getting smarter, when inspectors see things that need to improve, they feed that information back into the algorithms.

Jeroen Delcour, one of our data scientist, credits Microsoft Azure with the solution's success. "We use Azure virtual machines to extract the geospatial data overnight in an automated run," he says. "After the images are preprocessed, the heavy lifting of training the neuronets begins. There, we use the GPUs [graphics processing units] that are available on Azure. Every step of the process runs in Azure." Current estimates show that only 2 percent of asphalt in the Province of Northern Netherlands is damaged, according to Delcour. "By automating the inspection process, BAM can quickly eliminate the 98 percent of roads that are in good repair and concentrate on the 2 percent that require attention," he says.



'Because our inspectors only need to look at pictures that the model selects instead of a complete video, we now do in hours what used to take days or weeks'

Kitting Lee

Director of Commerce and Innovation at BAM Infra Nederland

Weather is another big factor in both accuracy and the need to process data quickly, according to Delcour, because weather can change images a lot, so even the experts are unable to see the damage on wet roads. "BAM can only record on dry days, and when they drive, they record about 40 gigabytes a day," he says. "There are many days when they can't record, because the roads are wet or there is some other condition that makes recording impossible. So when the recordings come in, they have to be processed quickly. Sometimes you need 10 or 15





GPUs running at the same time, quickly scanning the images, and providing results as soon as possible.”

Greater efficiency also leads to happier employees, according to Lee, and makes BAM more competitive when searching for highly qualified employees. “Rather than viewing countless hours of video showing mile after mile of undamaged road and looking for problems in a small percentage of images, our inspectors can focus on only those sections of road that the algorithm has identified as having some kind of damage, and then provide expert assessments to help us make repairs more quickly,” Lee says. “They are much happier in their work now that we are using the new solution.”

Margins in the construction business are razor thin, due to the rising cost of labor and materials, Lee explains. As a result, maintenance contracts are an important source of revenue for companies like BAM, but resources are still often scarce. “With unemployment dropping, it is hard to find qualified inspectors,” Lee shares. “By automating the asphalt inspection process, we are able to provide better service in a shorter period at lower cost, improve our profit margin, and attract more qualified employees.”

Looking ahead

Given the success of the new automated asphalt-inspection solution, OrangeNXT and BAM are considering selling the new process as a software-as-a-service solution in other countries and for other purposes. “The materials used to pave streets, parking lots, airport runways, and other surfaces



“These companies are responsible for keeping roads open and in good repair, so any time they have a maintenance contract on a road that is closed, they pay a serious penalty: €20,000 per 15 minutes of downtime”

John Koot
Alliance Director OrangeNXT

vary from country to country,” Koot says. “But the solution can be adapted for any surface, simply by feeding the right information and images into the algorithms and training them to distinguish damaged from undamaged surfaces.”

Furthermore, the solution isn’t limited to inspecting only paved surfaces, Koot explains. “A version of this solution could be used to examine almost anything that requires frequent inspection,” he says, “That could include inspecting street signs and





traffic signals, trees and shrubs beside roads and along rail lines, or conducting safety inspections at factories and other production facilities. We could even develop and train an algorithm to inspect offshore oil rigs for corrosion and other damage using images recorded by drones.”

For BAM, this solution has much larger implications than providing a more efficient way to inspect and maintain asphalt paving; it is part of the company’s drive toward digital transformation and finding a smarter way of doing business by streamlining inefficient business processes to become more agile and competitive. “Our motto is ‘Building the Present, Creating the Future,’” Lee says. “From my perspective, digital transformation is the best way to help our people work better together, which brings more value to customers and shareholders, and prepares us to excel in an increasingly competitive market.”

More info?

To learn more about digitalNXT and its capabilities, feel free to contact us at any time – you will find our contact details below.

‘If you can reduce the need for unscheduled emergency repairs and increase planned repairs and scheduled maintenance, the cost savings are substantial’

John Koot

Alliance Director OrangeNXT

Want to know more about this case?



John Koot

Alliance Director OrangeNXT

✉ john.koot@orangenxt.com

☎ [+31\(0\)6 27 08 74 06](tel:+31(0)6 27 08 74 06)