PROUDLY SUPPORTED BY

Roadmarking Industry Association of Australia

Australasian Corrosion Association Inc.

Traffic Management Association of Australia

iMOVE

itsaustralia Intelligent Transport Systems

AustStab Pavement Recycling and Stabilisation Association

National Precast Concrete Association Australia

HIGHWAY ENGINEERING AUSTRALIA

DECEMBER 2023

V55.1

HIGHWAY ENGINEERING AUSTRALIA hea SINCE 1968

TRANSPORT
INFRASTRUCTURE
ITS TECHNOLOGY

SINCE 1968

PRINT POST APPROVED - 100001888

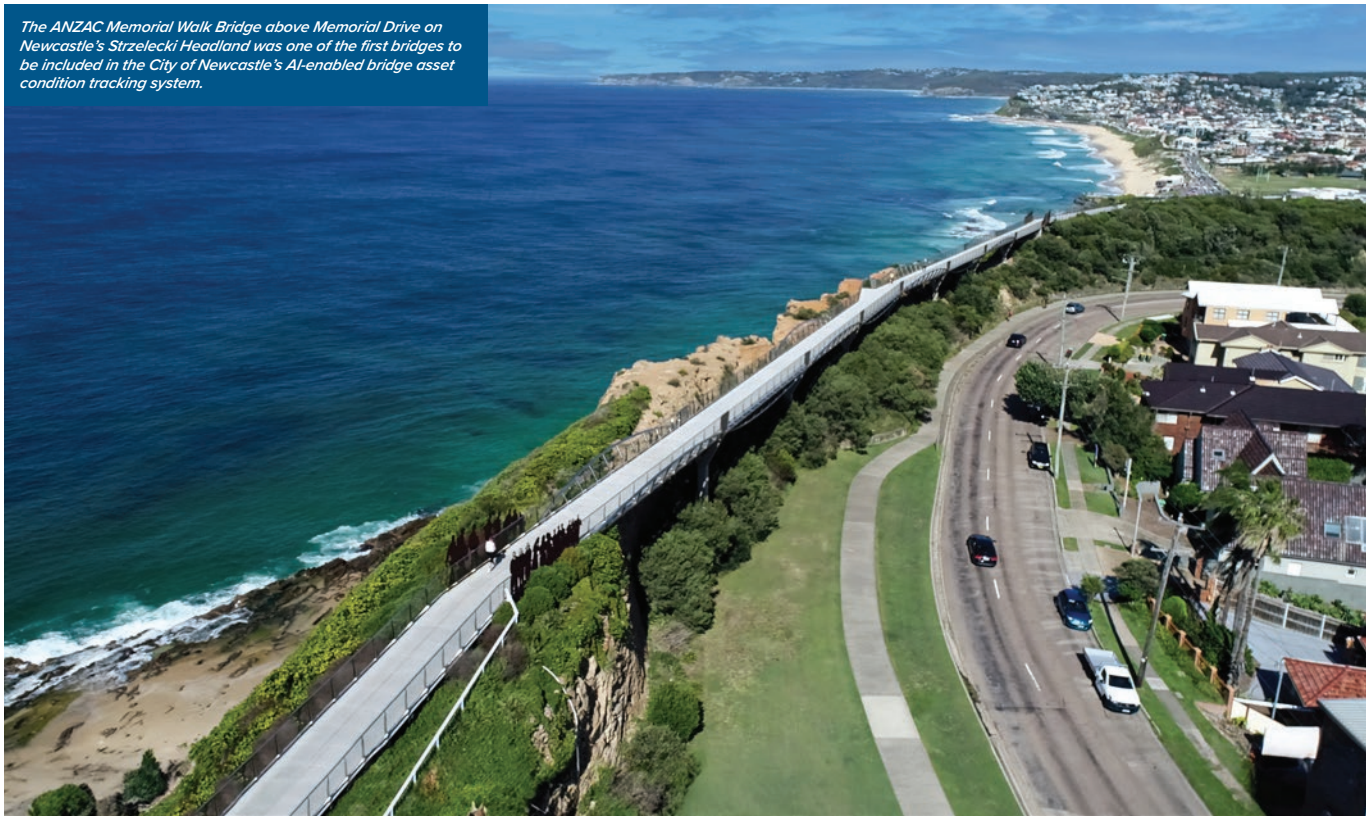
REAPING THE REWARDS OF THE DIGITAL REVOLUTION

The City of Newcastle, NSW, has implemented a cutting-edge AI-enabled Digital Infrastructure system to streamline bridge infrastructure data management, defect identification and maintenance planning

Many would argue – and most in Local Government would agree – that one of the biggest challenges facing councils and authorities across Australia, is the ever-increasing demand to 'do more with less'. The combination of tight budgetary constraints, often coupled with limited opportunities for growth in revenue and increased demand for infrastructure, services and facilities can make budgeting and planning a significant challenge - particularly when it comes to monitoring and maintaining major infrastructure assets.

With that in mind, the City of Newcastle in the New South Wales Hunter Region is utilising a new AI-enabled bridge asset condition tracking system to help optimise its defect identification, maintenance planning, budgeting and data management processes for 56 of its bridges and major culverts.

Known as Dynamic Infrastructure (DI), the cloud-based system uses current and historic bridge inspection data from multiple digital and paper-based sources including photos, reports, drawings and plans, to build a detailed chronological 'health record' for each bridge asset. The system then utilises cutting-edge technology to analyse the images – detecting, categorising and defining the severity of defects across each structure.



The ANZAC Memorial Walk Bridge above Memorial Drive on Newcastle's Strzelecki Headland was one of the first bridges to be included in the City of Newcastle's AI-enabled bridge asset condition tracking system.

THE VALUE OF DIGITISATION

Regardless of the type of business operation, the ability to digitise workflows not only helps to boost productivity and efficiency, it can also play a major role in optimising service delivery and budgeting.

Put simply, in the digital world 'data is gold', and the shift towards digital workflows and digitisation in general is crucial when it comes to delivering maximum value for all stakeholders. Digitisation is also proving to be a critical factor in enabling councils to keep up with the ever-increasing demands being placed on their services and facilities.

The City of Newcastle's focus on innovation has seen it place a strong emphasis on digitisation in recent years. From its massive 'Paper Light' project in 2017 (which saw the council digitise and downsize its entire document archive), through to the implementation of innovative software solutions for GIS, project management, planning, BIS and asset data management, innovative digital solutions play a critical role in helping the City of Newcastle to streamline and optimise its operations across a range of key areas.

But it's not just about 'going digital'. To truly be of value, digital systems have to be functional, efficient and, perhaps most importantly, easy to use. And it's on this point in particular, where the Dynamic Infrastructure system is proving itself to be of particular value.

Speaking about the new system, Sam Nearey, Assets Coordinator - Support Services for City of Newcastle, commented:

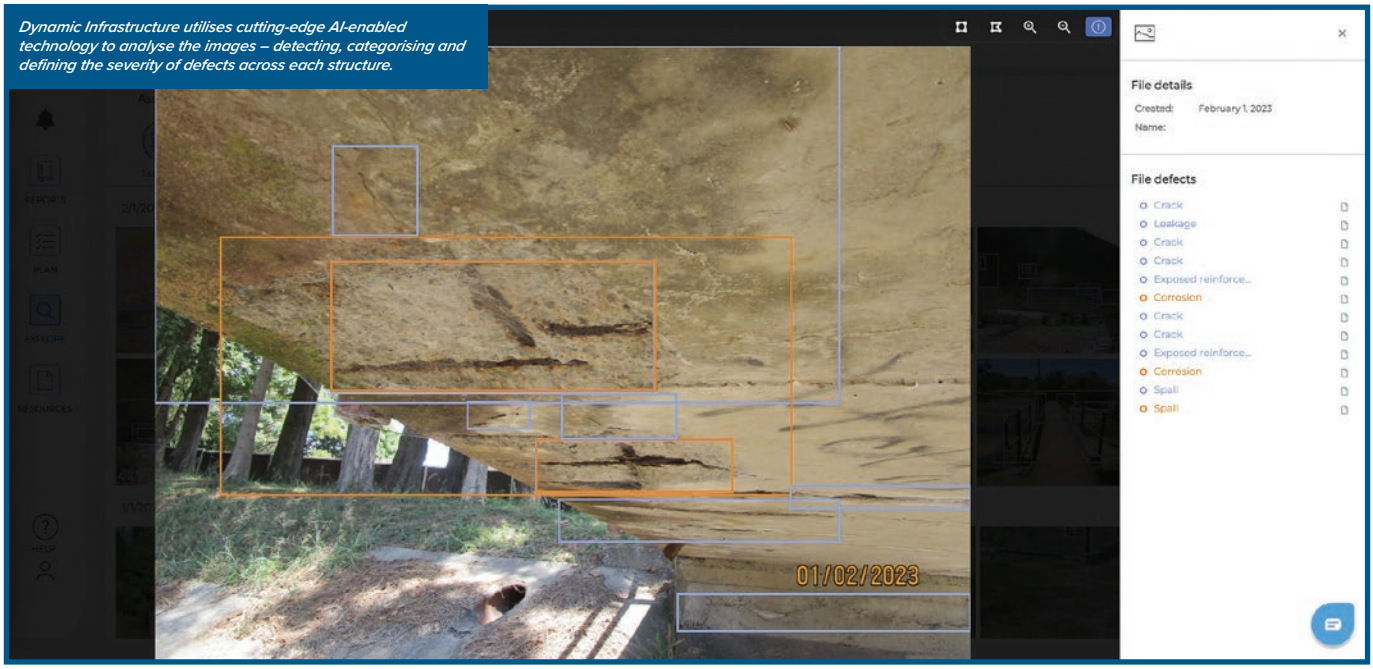
"For us, one of the key benefits of the Dynamic Infrastructure system is that it is extremely quick and easy to use. After all, it's all good and well to have all of your data loaded onto a software platform, but in reality, the KPI for any digital system is how quickly and easily you can access the data you want, in the format in which you need it."

"The DI system has a well-designed and extremely intuitive user interface which allows us to access every piece of data we have on a specific bridge or group of bridges – from the oldest photos, drawings and inspection reports, right through to the latest digital photos and scan data – in a manner of seconds."

"To put that into context, before DI, accessing that kind of historical data for just one bridge would have been a major undertaking, let alone for the entire stock of bridge assets. Having this data so readily accessible can, quite literally, save us hours or even days of work," he said.

"What's more, with the DI system we're able to sort and extract that data using a wide array of reporting parameters quickly and easily," Sam added.

"Whether we want to look for a specific type of fault across all bridge assets, track the condition or find defects on a particular bridge, or even monitor the performance over time of repairs that were made using specific materials or techniques, the DI system allows us to collate that information in seconds."



Dynamic Infrastructure utilises cutting-edge AI-enabled technology to analyse the images – detecting, categorising and defining the severity of defects across each structure.

EASY IMPLEMENTATION

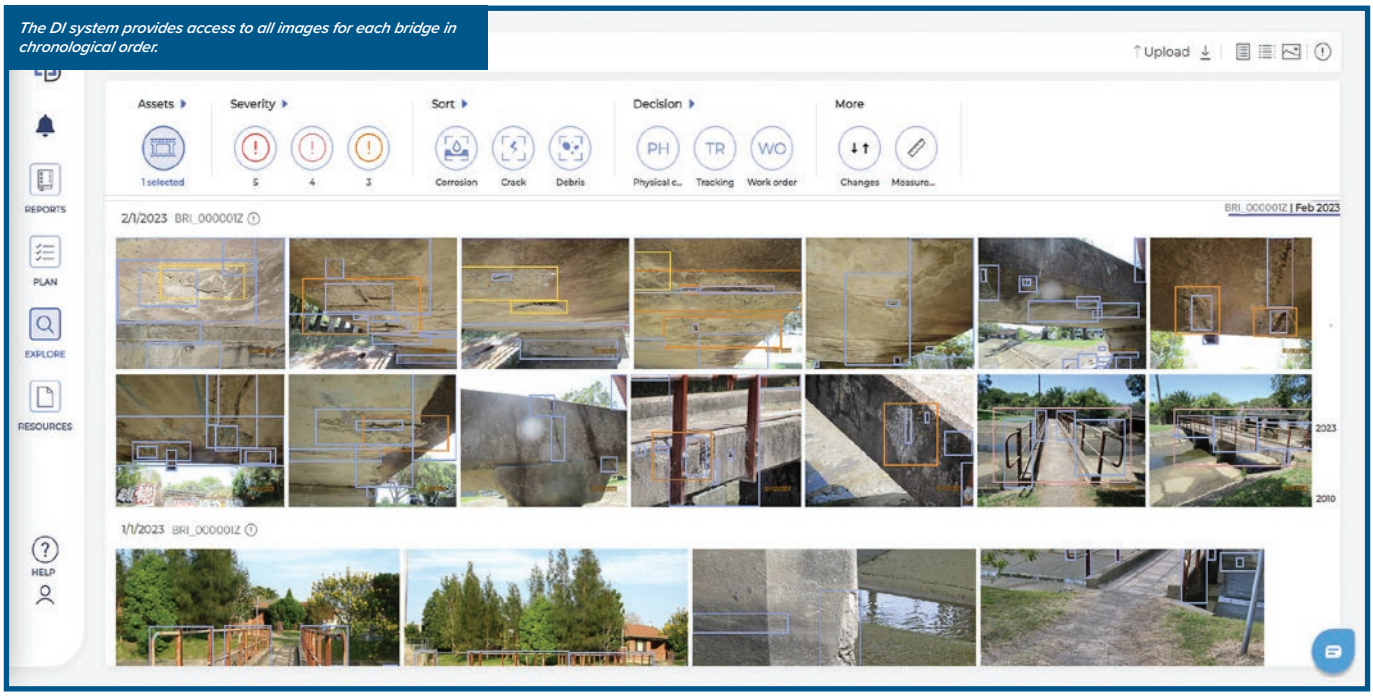
While the biggest challenge with most new digital systems is usually the set-up and implementation, one of the major benefits of the DI system is that the process of creating the detailed chronological digital 'health records' for each of the bridge assets is carried out by the team at DI, rather than by the client.

For example, as part of its initial implementation covering 56 of the City's bridges and major culverts, the City of Newcastle assets team simply had to provide DI with all of the data that they had for each of the assets, including scanned paper-based reports, drawings, photos and other data, together with more recent digital images, inspection reports, and data from the City's asset management system. This data was then uploaded to the dedicated secure Dynamic Infrastructure cloud server, from where the DI implementation team set about collating the data into individual 'health records' for each bridge asset, with all of the data and imagery included in each record in chronological order.

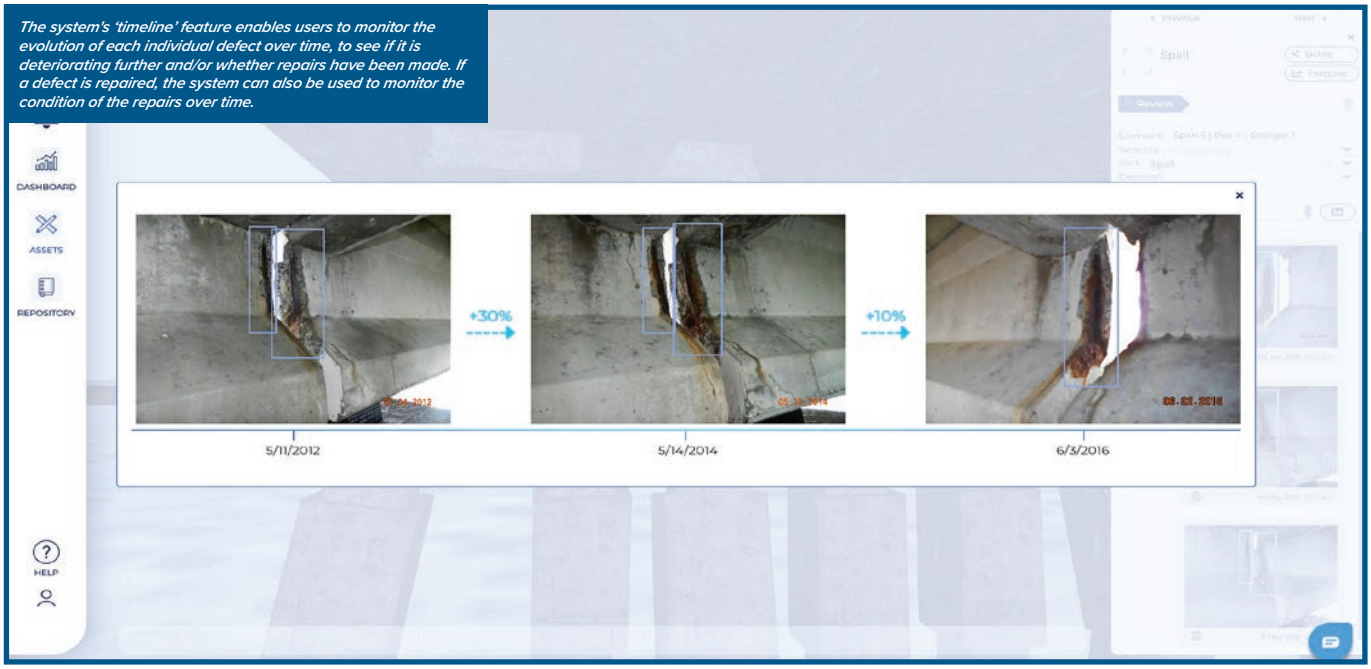
As these 'health records' are created, they're made available to the City of Newcastle assets team for a final 'quality control check' to ensure that all of the data in each record pertains only to that one specific bridge asset.

"As is the case with any digitisation project, the most important part of the DI system implementation was the initial set-up," Sam Nearey said. "While this task was made easier for us due to the fact that the majority of this data had been digitised in 2017 as part of the 'Paper Light' project, gathering all of the data for 56 bridges is still a major undertaking, and we wanted to be sure that we were including all of the data."

Importantly, even though the City of Newcastle had the added advantage of already having the majority of its data scanned and digitised, that is not a prerequisite for the DI system. Indeed, the DI implementation team is able to establish the bridge asset 'health records' using both digital and hard copy data sources including documents, reports, photos and drawings.



The DI system provides access to all images for each bridge in chronological order.



The system's 'timeline' feature enables users to monitor the evolution of each individual defect over time, to see if it is deteriorating further and/or whether repairs have been made. If a defect is repaired, the system can also be used to monitor the condition of the repairs over time.

USING AI TO ESTABLISH ASSET CONDITION

Once the bridge asset 'health records' are created, the system's cutting-edge AI-enabled technology analyses the images, detecting defects and recording the exact location of the defect on the structure.

Once identified, each defect is categorised (in terms of both defect type and severity) and then prioritised with a recommended action according to parameters that are set by the user. The chronological nature of the asset health records means that the DI system can also be used to monitor the evolution of each individual defect over time, to see if it is deteriorating further and/or whether repairs have been made. If a defect is repaired, the system can also be used to monitor the condition of the repairs over time.

Importantly, the DI system's AI-enabled technology has a globally proven track record, and its performance is underwritten by world-leading reinsurer Munich RE - ensuring comprehensive and reliable asset health data tracking for each bridge.

"The AI technology has proven to be extremely good at identifying and categorising a range of defects including cracks, spalling, corrosion, efflorescence and other physical damage - even on scanned images that aren't that great quality," Sam Nearey said.

As well as providing an objective bridge inspection process – rather than a subjective process that relies on someone manually checking images to find defects - another major benefit of the DI system is the speed and ease with which the asset records can be updated. Rather than requiring a specific asset inspection regimen or program, the DI system accepts data inputs from a variety of sources, including RPAS/ Drone data, LiDAR and digital images. In fact, updating a bridge asset 'health record' can be as simple as submitting digital images taken on a camera phone by a field maintenance crew member... a feature that is particularly useful if there is an incident involving a bridge structure.

The asset team simply uploads the digital images or scan data to a unique secure cloud address for the specific bridge, and the DI system analyses the images, locates them on the structure and adds them to the bridge's 'health record'. This not only significantly reduces the amount of time required to collate data following an inspection, it also means that councils can continue on with their current bridge inspection processes or service providers if they wish.

REVOLUTIONISING DATA CAPABILITY

"Even though we've only been using the DI system for less than a year, the system is already revolutionising the way we utilise our bridge asset condition data," Sam Nearey said.

"Having all of the asset condition data – including images - readily accessible in one centralised 'health record', means we can now complete a wide range of tasks in a fraction of the time it would have taken previously," Sam added.

"In fact, it's fair to say that having all of bridge inspection data and reports - including images where each of the defects are identified and highlighted - immediately available, in chronological order, in one central record, is providing us with a data capability which would have previously been too onerous and time-consuming to even contemplate."

"For example, if we want to do a 'deep dive' condition assessment for one bridge or a group of bridges, it's simply a matter of selecting the bridge or bridges we want to look at, and it's all there, ready to output in a matter of seconds," he said.

"Same as if we want to look at all of the bridges that currently have a specific type of defect (spalling damage, corrosion, cracking, etc). We simply enter the criteria for the defect type we want to see, and it's all there, complete with images that show the damage and in some cases its location on the bridge," Sam added.

Interestingly, this highly flexible reporting capability not only makes it significantly easier for councils to plan for a program of targeted repairs, it can also assist with budgeting. The fact that the data is accompanied by detailed imagery of the defects provides 'tangible' evidence, which, in turn, makes it much easier to convey need.

In addition, once any damage is repaired, the system will recognise the repair in future images or scans, thereby allowing the performance and longevity of the repair to be monitored. This feature can also be used to monitor the performance of a specific group of repairs, which can be extremely useful for comparing the long-term performance of different repair methods or materials.

"While it's only early days, we're very happy with the performance of the Dynamic Infrastructure system. Not only has it helped us to significantly streamline a number of critical workflows, it has also enabled us to expand our capabilities across a number of key areas, including asset condition analysis, reporting, planning, budgeting and works scheduling," Sam Nearey concluded.