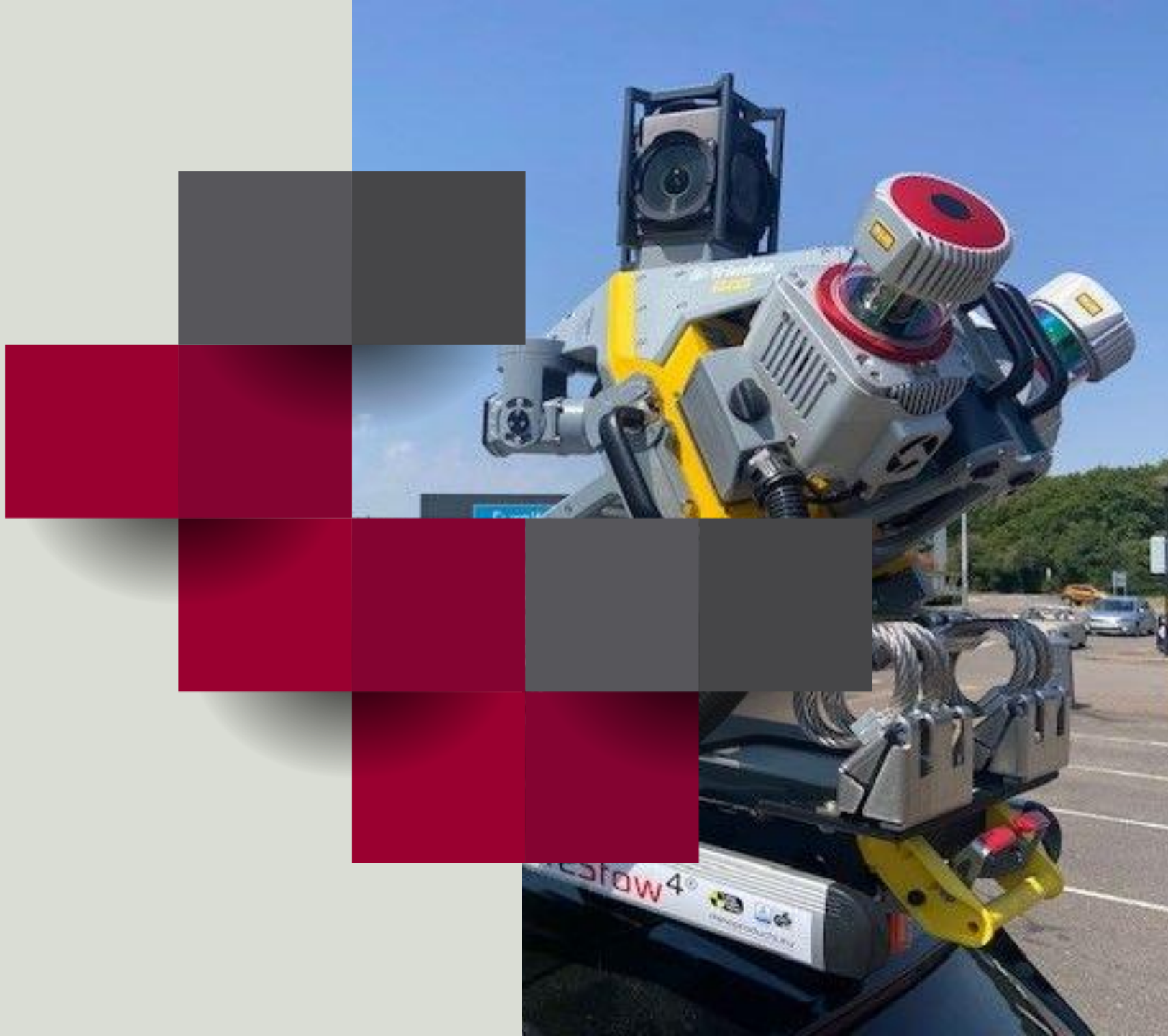
national highways

Driving Digital Transformation



Mark Reid

Professional Services Director

KOREC

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Concrete Roads Programme

Replacing our concrete roads

- 4% of England's Strategic Road Network nearing end of working lives
- £400 Million Strategic Road Network investment up to 2025
- Programme will run until RIS 6 2045
- Life extension schemes – repair roads giving a 5-15 years life extension
- Reconstruction schemes – reconstruct roads giving a 40 year life
- Being delivered by the Concrete Roads Framework, Operations Directorate

TARMAC A CRH COMPANY

COLAS

DYER & BUTLER A part of MGroupServices

VolkerFitzpatrick

AECOM

ATKINS Member of the SNC-Lavalin Group

MORGAN SINDALL

BUILDERS SISK CONTRACTORS

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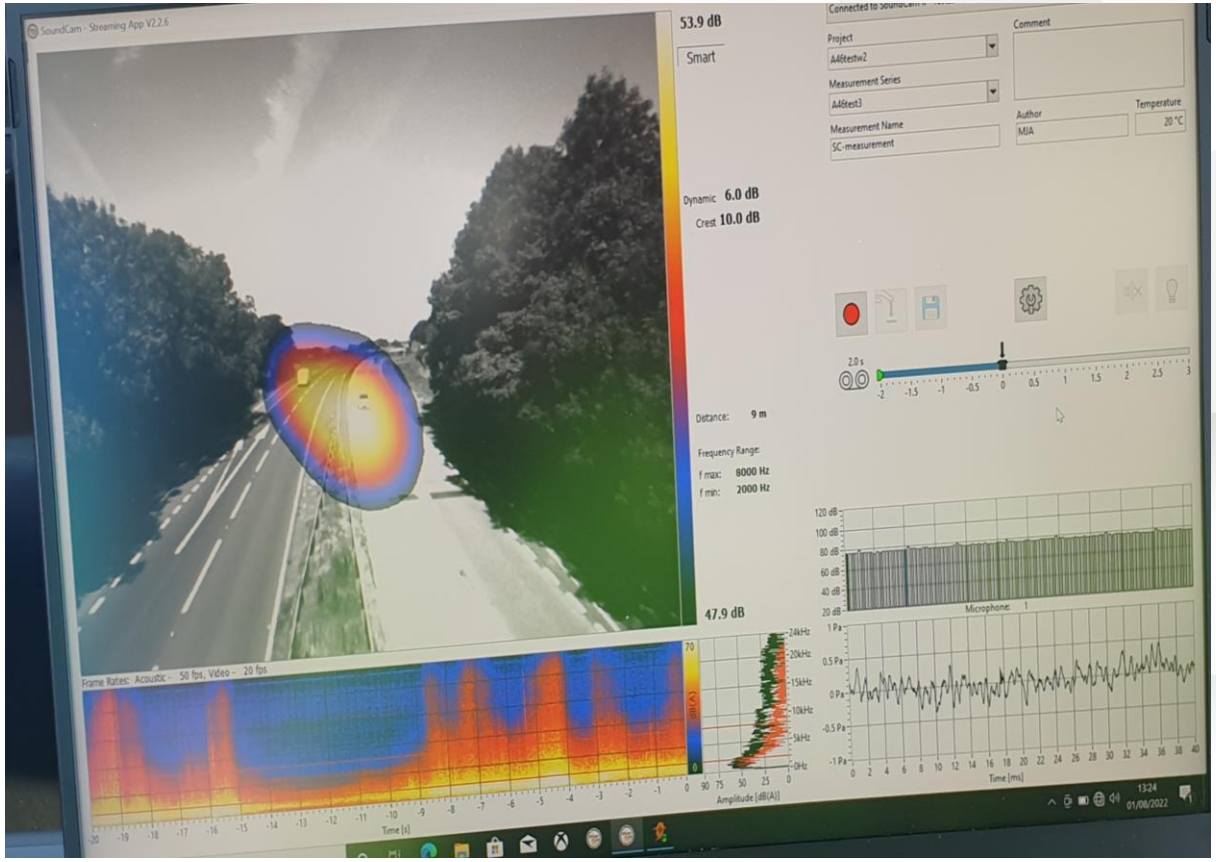
Concrete Centre of Excellence

Driving Innovation

Identifying innovative new methods that can reduce both the cost of the works, carbon, and the impact of construction on roads users and communities.

- Driven Surveys
- Digital Twins
- IOT
- Augmented/Mixed Reality
- New forms of non-destructive testing - noise



Digital Roads - 2025 Roadmap

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Design

Our activities will be increasingly automated, modular and conducted off-site. This will result in safer production, reduced network disruption, increased productivity and smoother journeys for our customers.

Optimal network planning options are identified in a **cost and time effective** manner

Our digital twin **is** used to conduct **long term planning** and develop more effective **asset strategies**

Our contractors' **feedback is integrated** into our digital designs to **improve accuracy**

Digitised design standards combined with databases such as topographical and environmental data are used to create **initial designs faster**

More virtual consultations with our customers and stakeholders **improve accessibility**

Machine-led, human aided tools are used to create **automated designs** to improve efficiencies

Construction

Digital designs are produced as standard to **improve efficiencies**

Off-site, modular construction is default method, where practical, resulting in **faster construction** times

Construction sequence simulated and optimised with rehearsals to **improve efficiencies**

Predictive analytics to manage and plan work appropriately, **improving delivery** speed

Greater data sharing enables collaboration with construction partners to **reduce duplication**

Use of **standard components** in design where possible to **improve efficiencies**

Asset digital twin **information is accessible** to those who need it to **support maintenance planning**

Connected construction site providing accurate and regular data exchange on construction activities to improve delivery

Use of **connected and autonomous solutions**, where possible, to **improve safety**

Collection and sharing of detailed incident information with the Emergency responders to reduce incident clearance times

Operations

We **pre-emptively prepare and respond to changes** in operational conditions to **improve safety**

More automated traffic management through **electronic signage** to minimise impact of roadworks

Incident Detection is used at scale to automatically **identify incidents**

Updated control room technology provides **greater oversight and control of the network**

'Any desk, any operator' integrated network control and **enhanced situational awareness**

Incursions are minimised when on-road workers are near live traffic to **improve safety**

Digitally-enabled maintenance workers can access Work Management Systems and **expert advice** when undertaking activities

Asset and environmental condition data is embedded in operational process and used to inform **decision making**

On road workers can **access and update our central systems** whilst on the road in **real-time**

On-road workers' **patrols conduct asset condition surveys** and fault reporting

Optimum operational interventions are identified and implemented

Maintenance

Autonomous maintenance tools carry out repetitive tasks to **improve safety**

Remote diagnostics and maintenance of our technology assets to reduce network disruption

Coordination of construction and maintenance activities to reduce customer disruption

Timely, accurate and fit-for-purpose asset data is used to keep our roads in **good condition**

Experience

Our customers will be better informed and have trust in the journey information they access, ensuring that they feel safe and in control of their journeys.

More automated signals, signs and lane closures are used to manage traffic flow more effectively

Our customers are kept informed in-journey (consistently across the SRN) through collaborating with third parties (e.g. wayfinding service providers)

Impact of roadworks is assessed and mitigated to reduce disruption

We receive better quality data from our customers, which enhances our own asset and operational data to **inform decision making**

We work with the **supply chain and wider private sector** (e.g. vehicle manufacturers) to identify and test new opportunities to improve customer service

Our customers access reliable **pre-journey information** (consistently across the SRN) through their preferred digital channel, **personalised for their needs**

We work harmoniously with our surroundings to deliver an **improved environment**

We provide our customers **end-to- end journey support** in collaboration with local highways authorities, transport operators and 3rd party service providers

Large scale **connected corridor trials based on customer insights** are underway throughout the country to **improve customer experience**

Our **call centre staff have access to fit-for-purpose information**, that enables them to provide **excellent customer service**

Digital Design & Construction

- **Digitally enabled design**
- **Modular and standardised approaches**
- **Automated construction**

Digital Operations

- **Intelligent asset management**
- **Enhanced operational capability**
- **Digitally enabled workers**

Digital for Customers

- **Information provision**
- **Customer engagement**
- **Partnership and alliances**

End to End Digital (E2ED)

NH COE undertook an evaluation of digital technology for the construction, repair, operation, and maintenance of the CR network

- Data driven decision making is central to;
  - Increased productivity
  - Improved Safety
  - Reduced Network disruption
  - Staff enablement
  - Lower Carbon footprint
  - Empowerment for Design and Delivery
- Identified the need for a golden thread, a single source of truth (digital twin) to be used throughout the lifecycle of the road

E2ED - Evaluation of technology

Different survey technology and platforms were evaluated for developing the digital twin.

Key considerations included;

- Data Capture (Speed, Accuracy, Coverage, Safety, Disruption to network)
- Data Extraction (Automation, Potential deliverables/applications)
- Data Dissemination (Data management, sharing with stakeholders)
- Data updating (How to keep evergreen, data amalgamation from different sources)
- Data Adoption (training needs and ease of use)

E2ED

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Digital Survey

Mobile Mapping

Digital Design

Works Management

Digital Construction

Digital field capture/Supervision

Digital Handover

Automated Realtime Reporting

K-Portal

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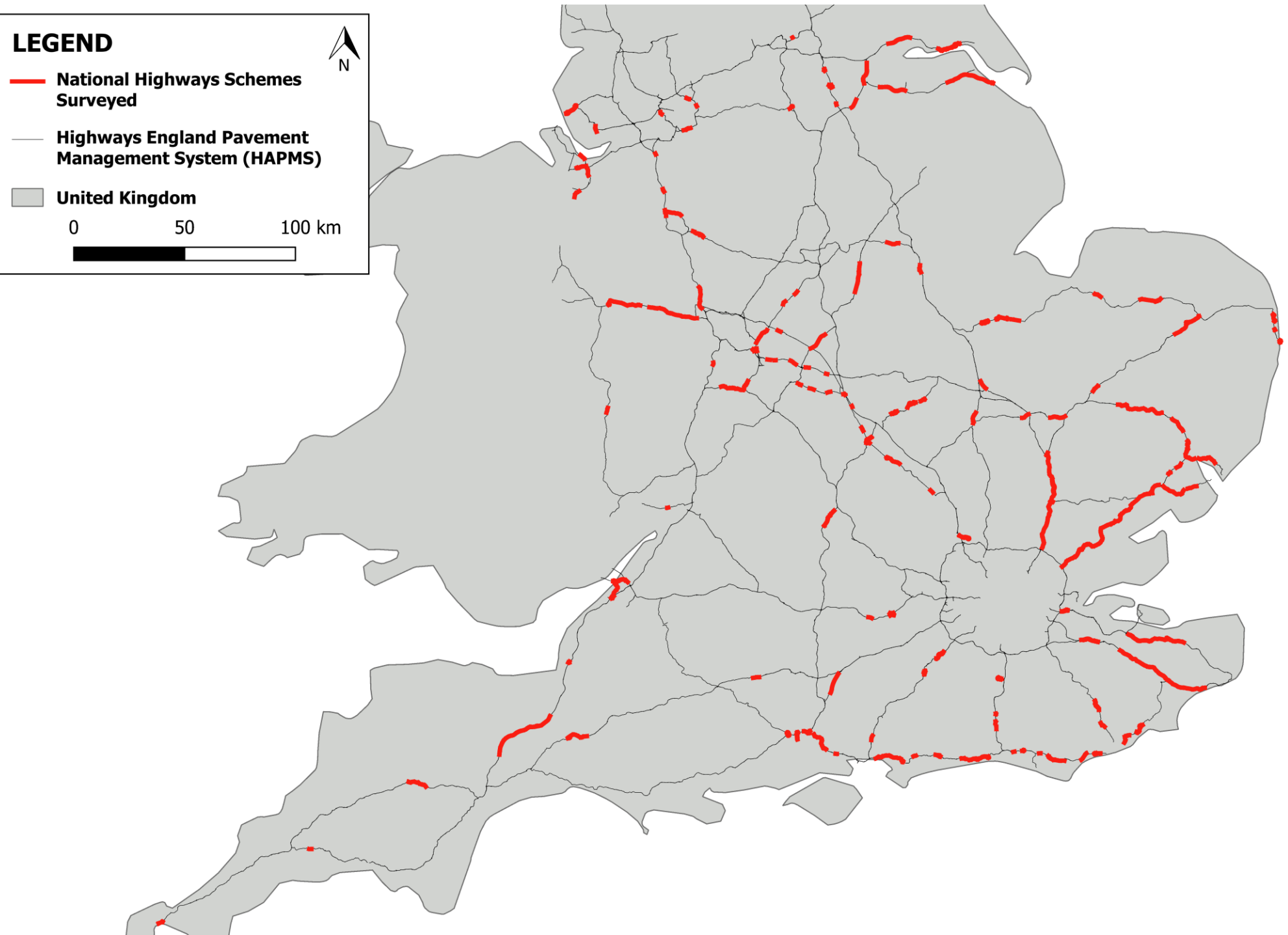
Mobile Mapping – Trimble MX9

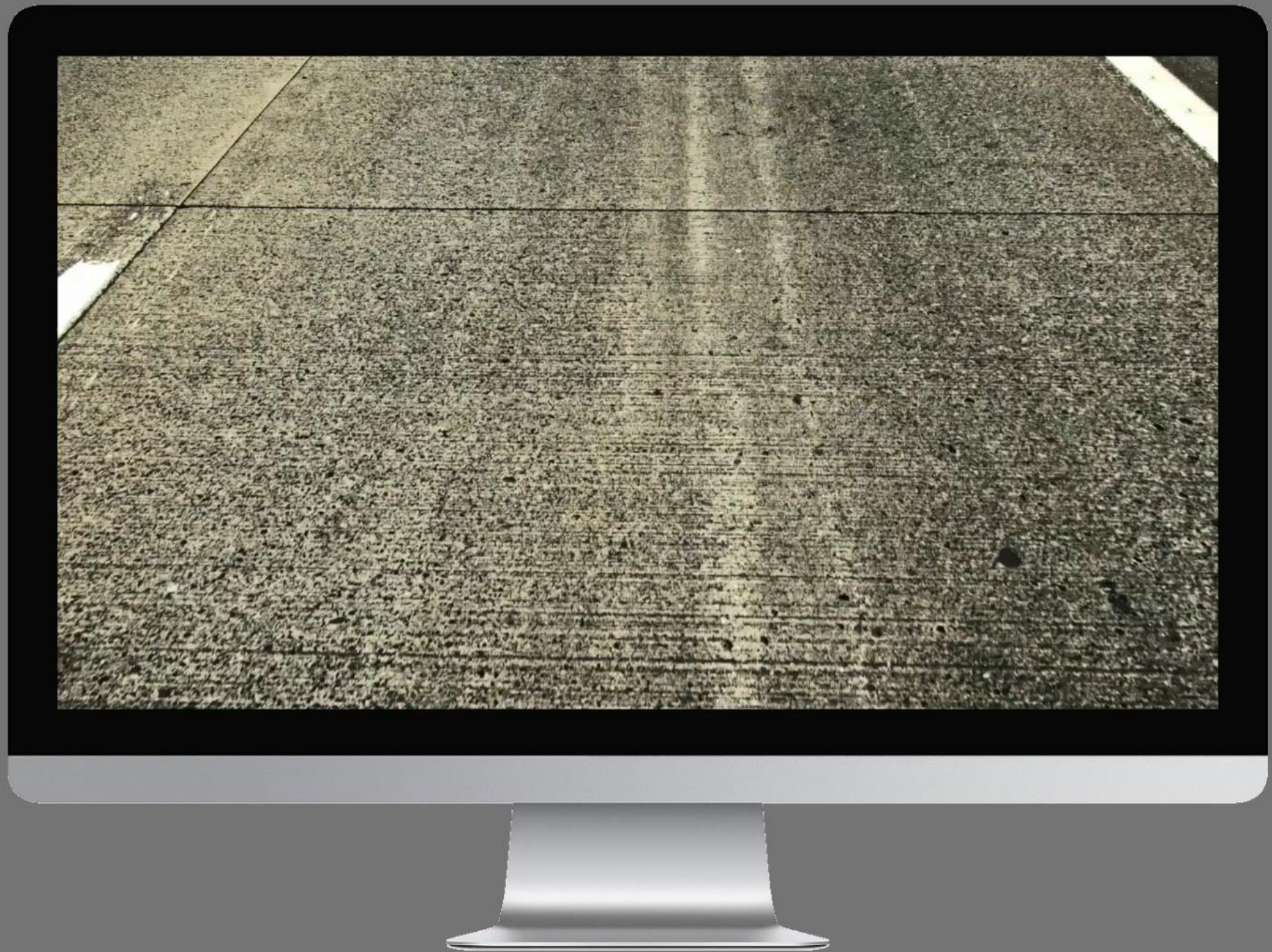
Rapid survey grade highway surveys at normal traffic operating speeds – No Traffic management required


LEGEND
N
National Highways Schemes Surveyed
Highways England Pavement Management System (HAPMS)
United Kingdom
0
50
100 km

KOREC™

3D Topo

20 m



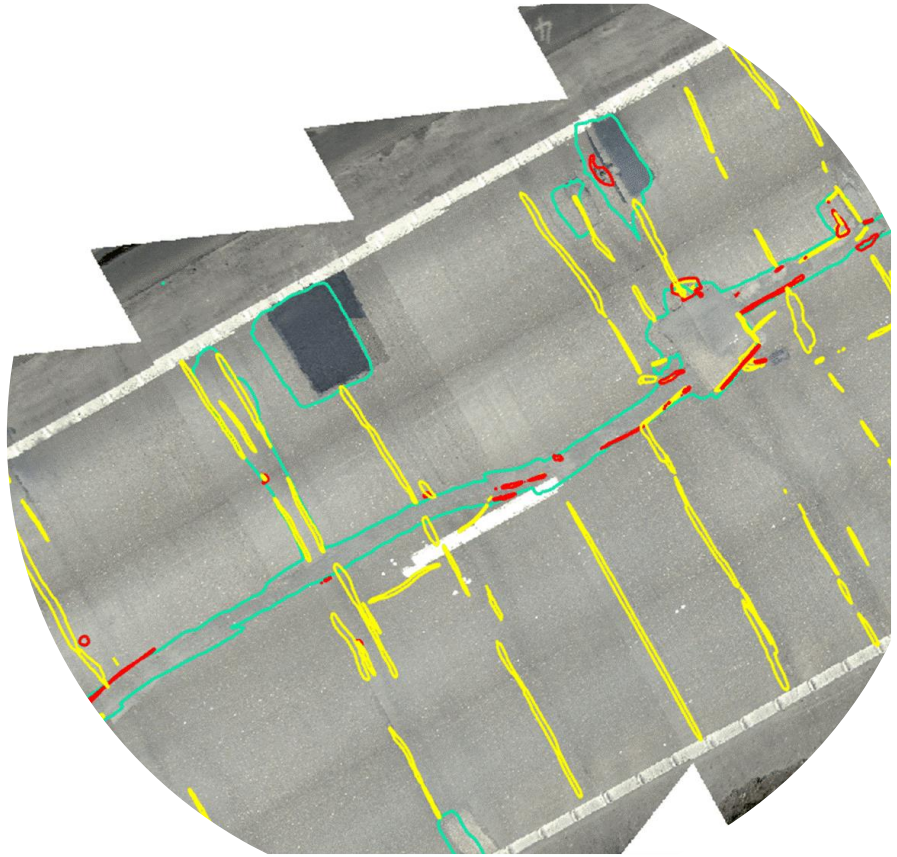
Defect Machine Learning

New levels of efficiency with AI and Machine Learning

Data-led Training

Defect Machine Learning

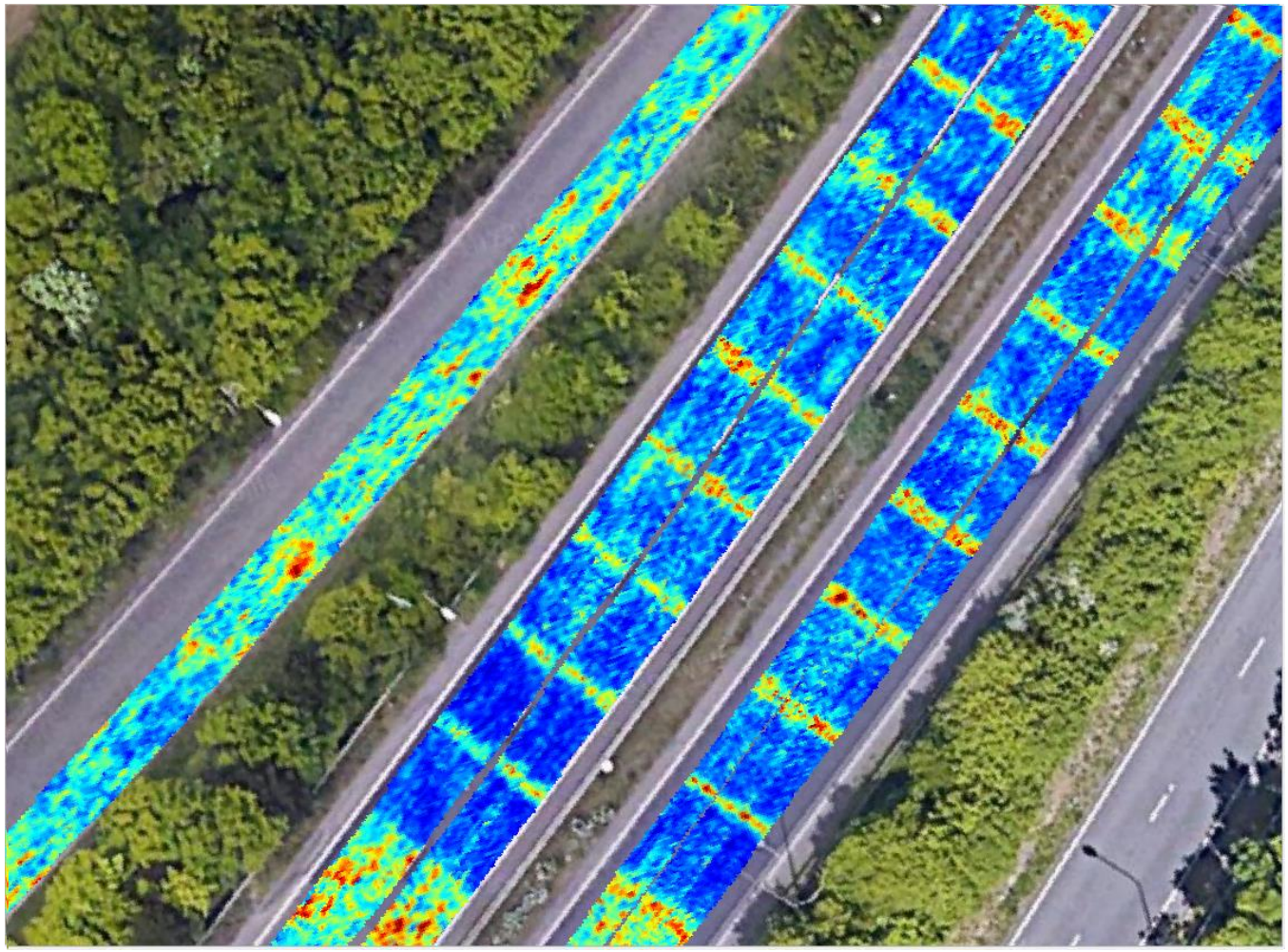
Defect types automatically detected from pavement imagery



Defect Type
Spalling
Transverse Crack
Corner Crack
Pothole
Failed repair
Diagonal Crack
Good condition repair
Longitudinal Crack
Scaling
Ravelling

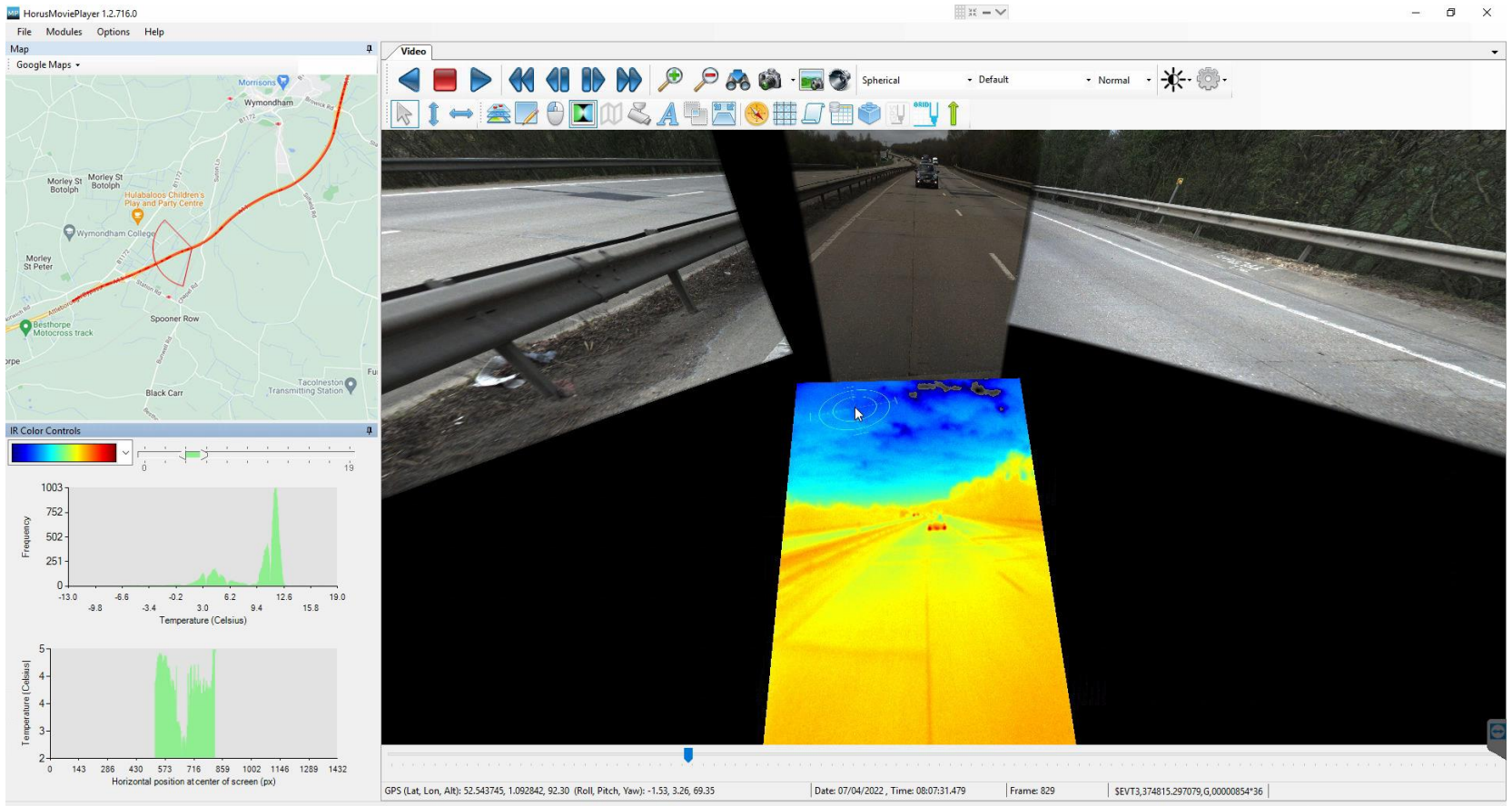
Ground Penetrating Radar

Concrete Joints, Voids, Moisture, and Utilities



Thermal Imaging

Road and structure assessment



New Tab | K-Portal

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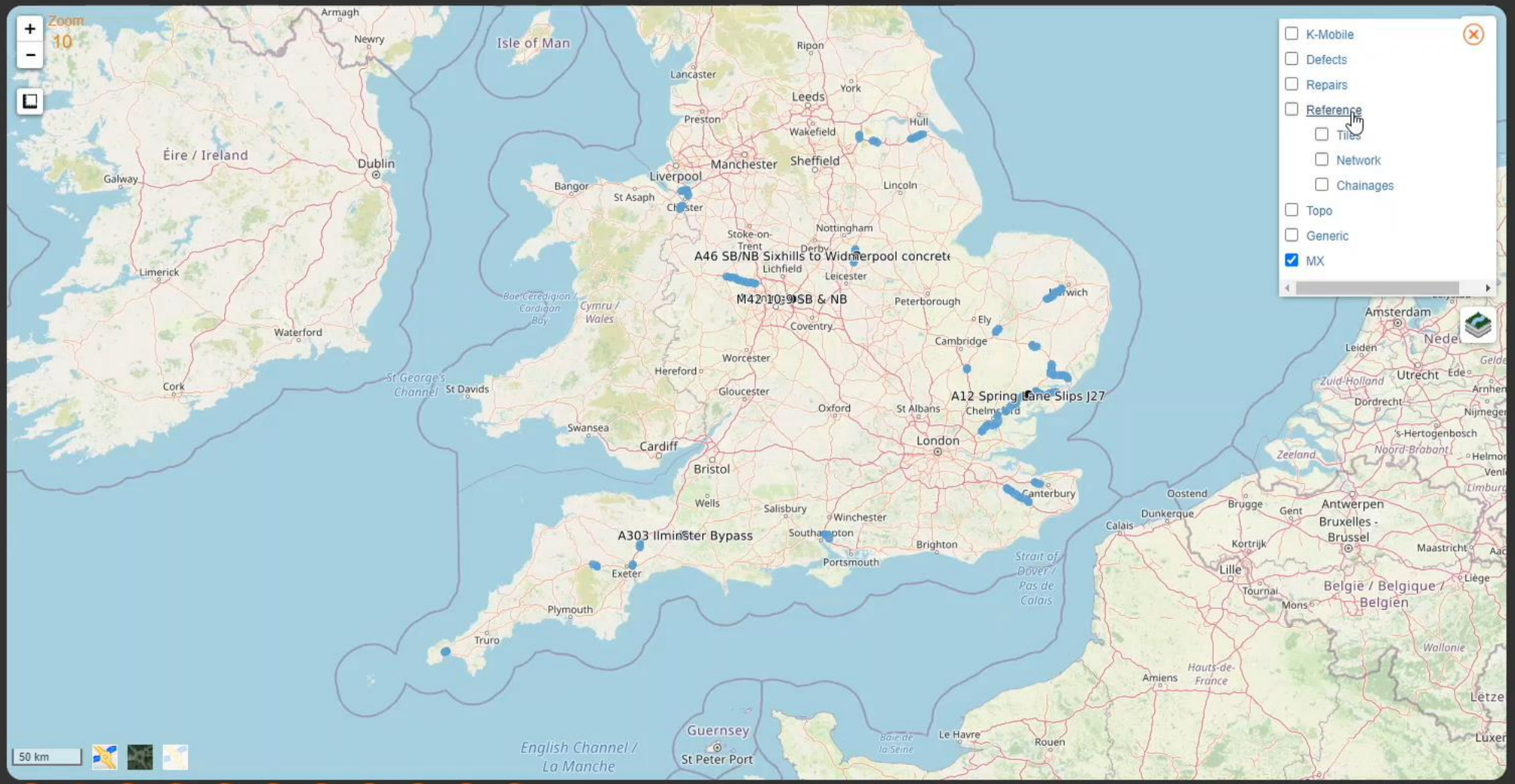
K-Portal | Scheme | User: superuser | Logout

HE-National

- Home
- Dashboard
- User Admin
- Message Centre
- Form Editor
- Task Status Overview
- Scheduled Task Assignment
- Ad-hoc Task Assignment
- Map Review
- Excel Analysis
- Downloads
- Upload
- Config Editor
- Digitiser Queue
- Data Viewer
- Support

Map Review



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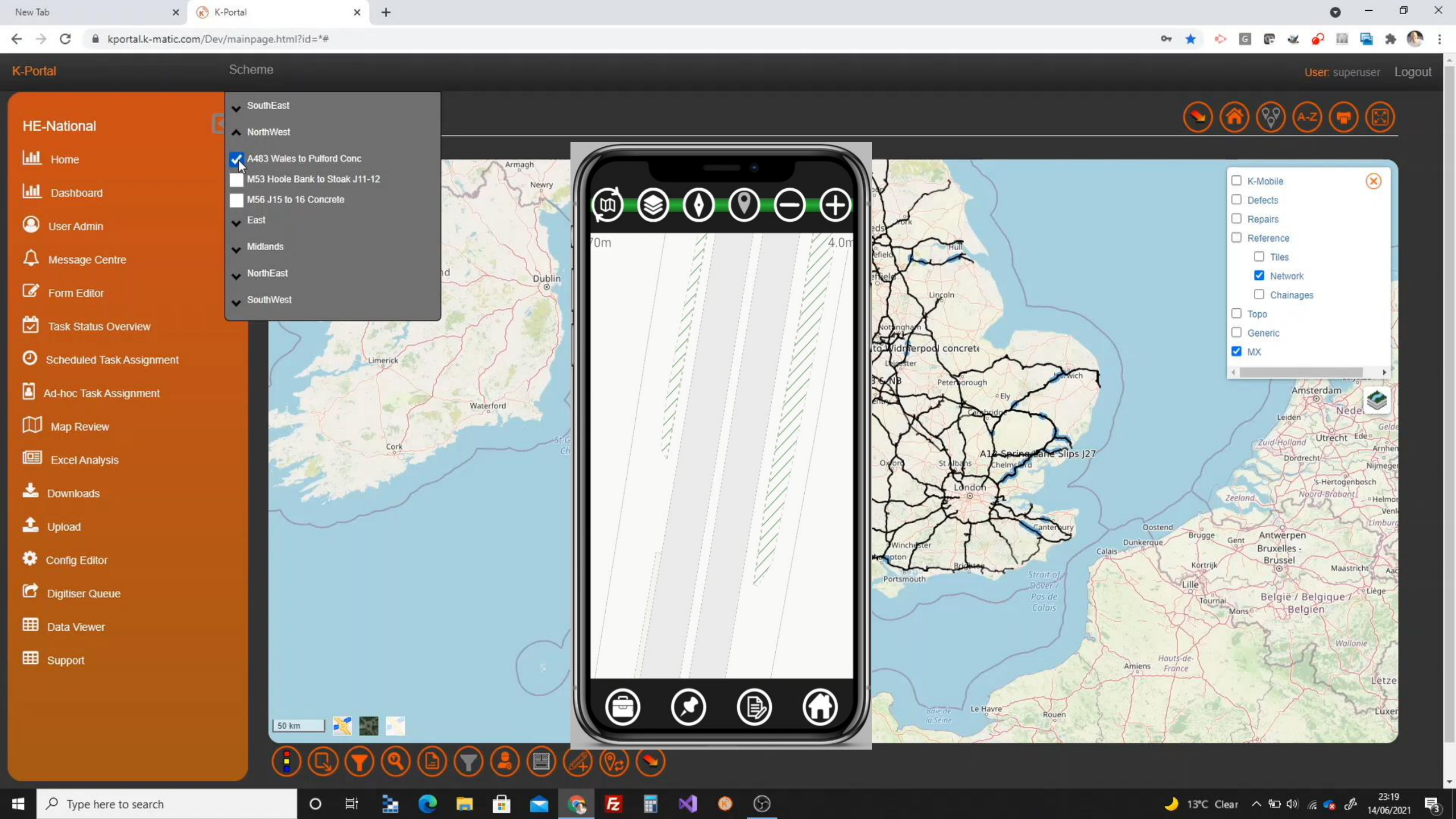
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K-Portal
Scheme
User: superuser
Logout
HE-National
Home
Dashboard
User Admin
Message Centre
Form Editor
Task Status Overview
Scheduled Task Assignment
Ad-hoc Task Assignment
Map Review
Excel Analysis
Downloads
Upload
Config Editor
Digitiser Queue
Data Viewer
Support
SouthEast
NorthWest
A483 Wales to Pulford Conc
M53 Hoole Bank to Stoak J11-12
M56 J15 to 16 Concrete
East
Midlands
NorthEast
SouthWest
K-Mobile
Defects
Repairs
Reference
Tiles
Network
Chainages
Topo
Generic
MX
A1(M) Springfield Slips J27
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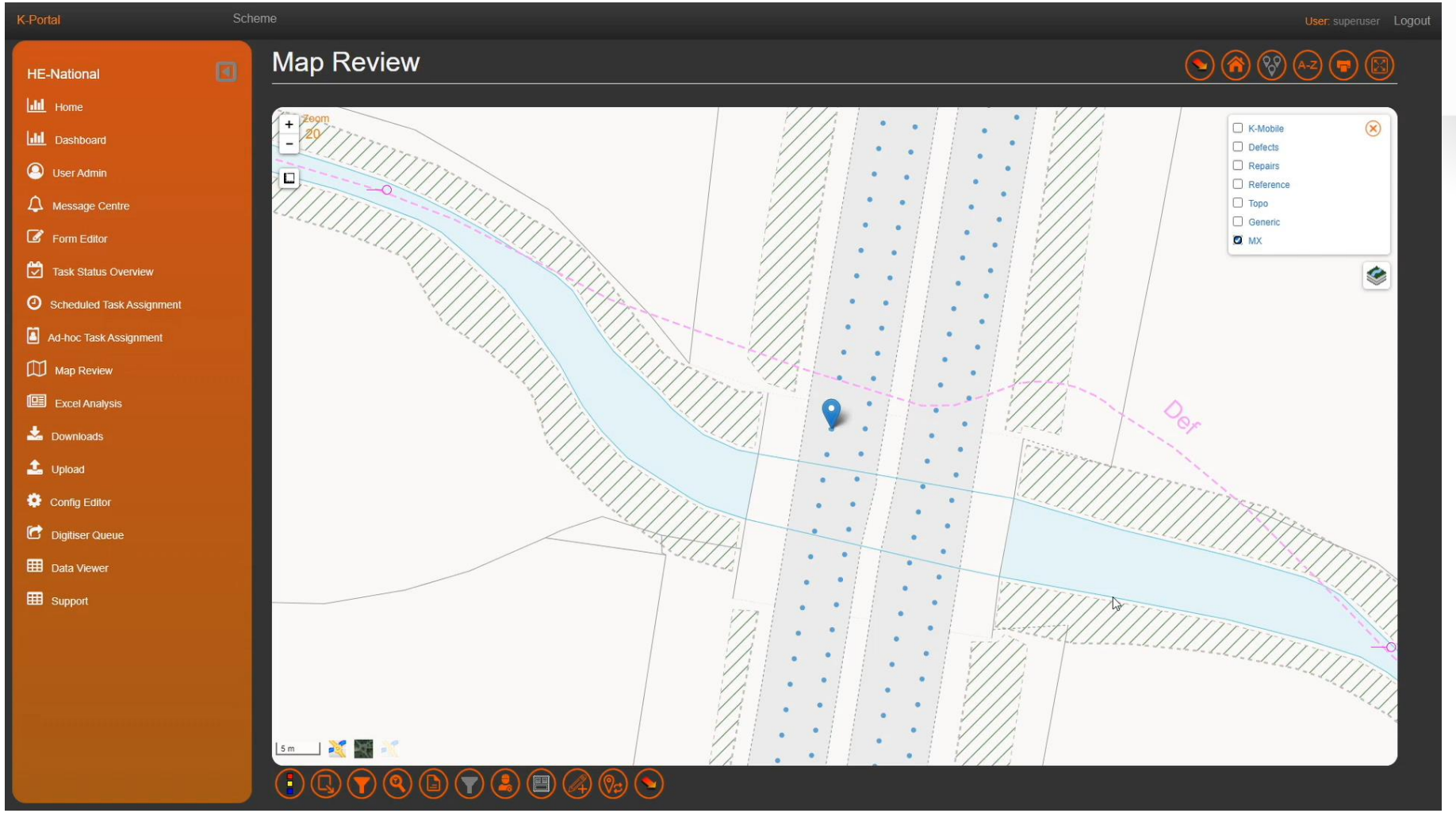
14/06/2021

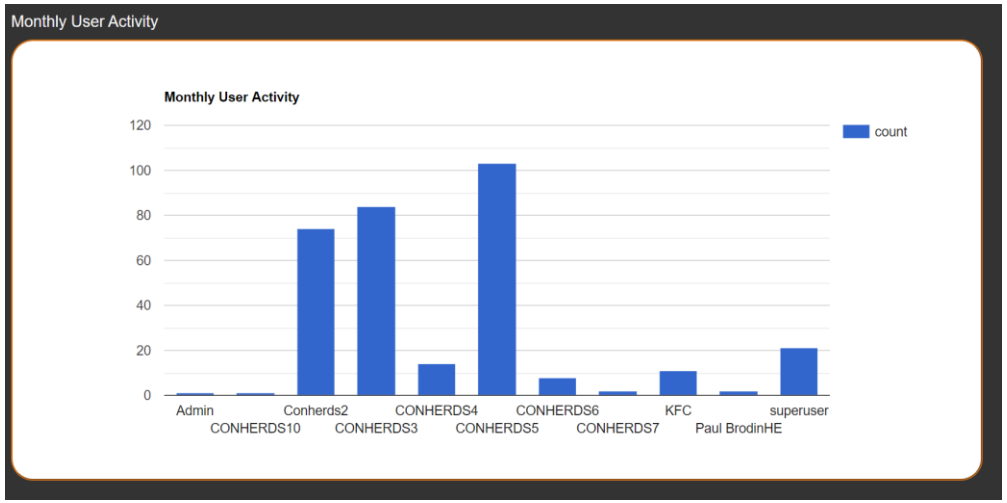
Design

Repair design directly inside Portal or imported from 3rd party design software



Works Management

- Issue work packages directly to contractors
- Track progress
- Automated production of shift reports
- Speed up approvals/Handover



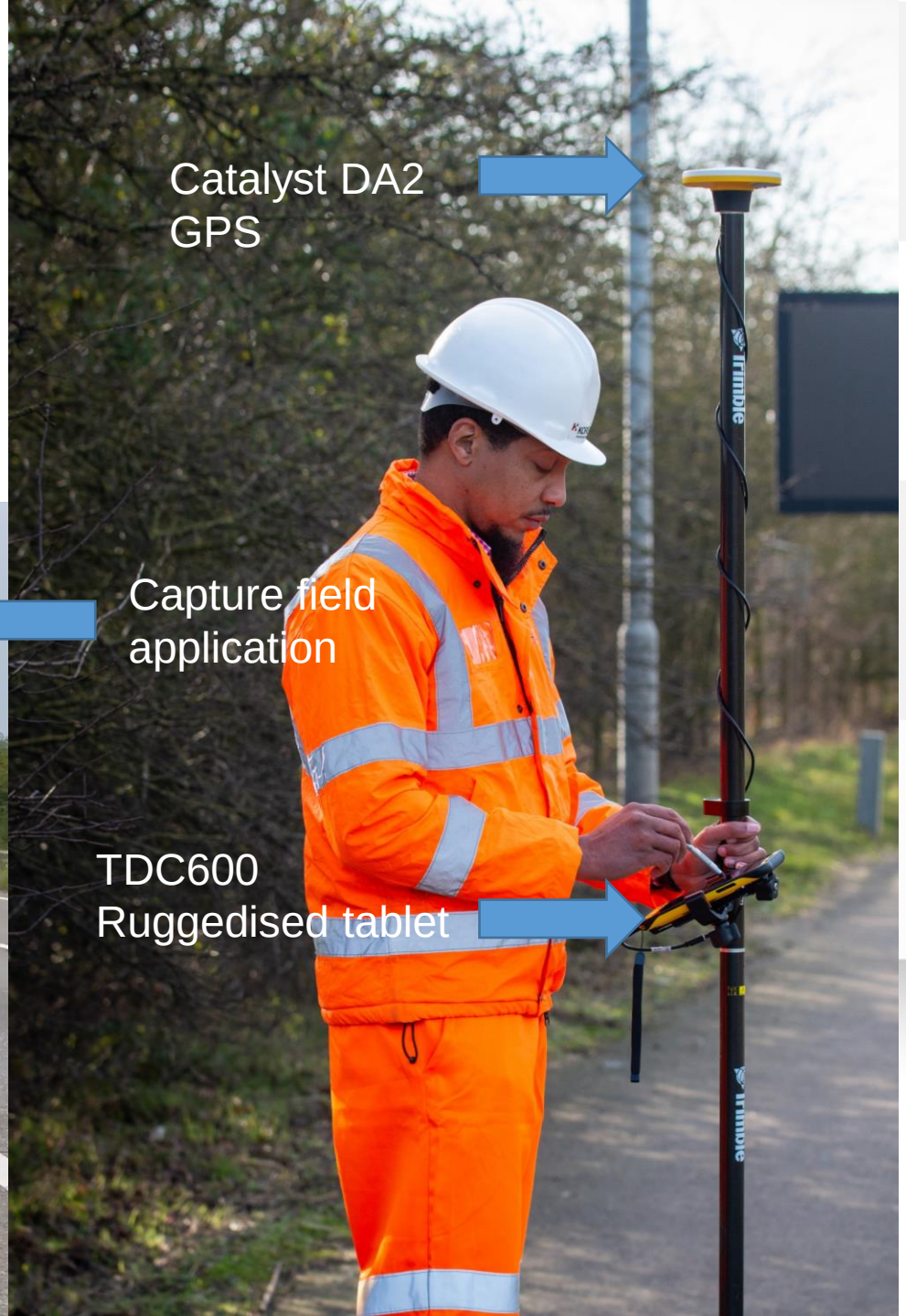
Defects Recorded

Defect ID	PKH-173-YRK			
	New or Existing	New		
	Location	L1	Other	
	Chainage	27.0 41.4	Section	1500A12/236
	Dimensions	@area 14.332	Depth	@depth
	DefectType	Longitudinal crack	Severity	3 - Poor
	Surface	Concrete		
Comments	Edge line failure			

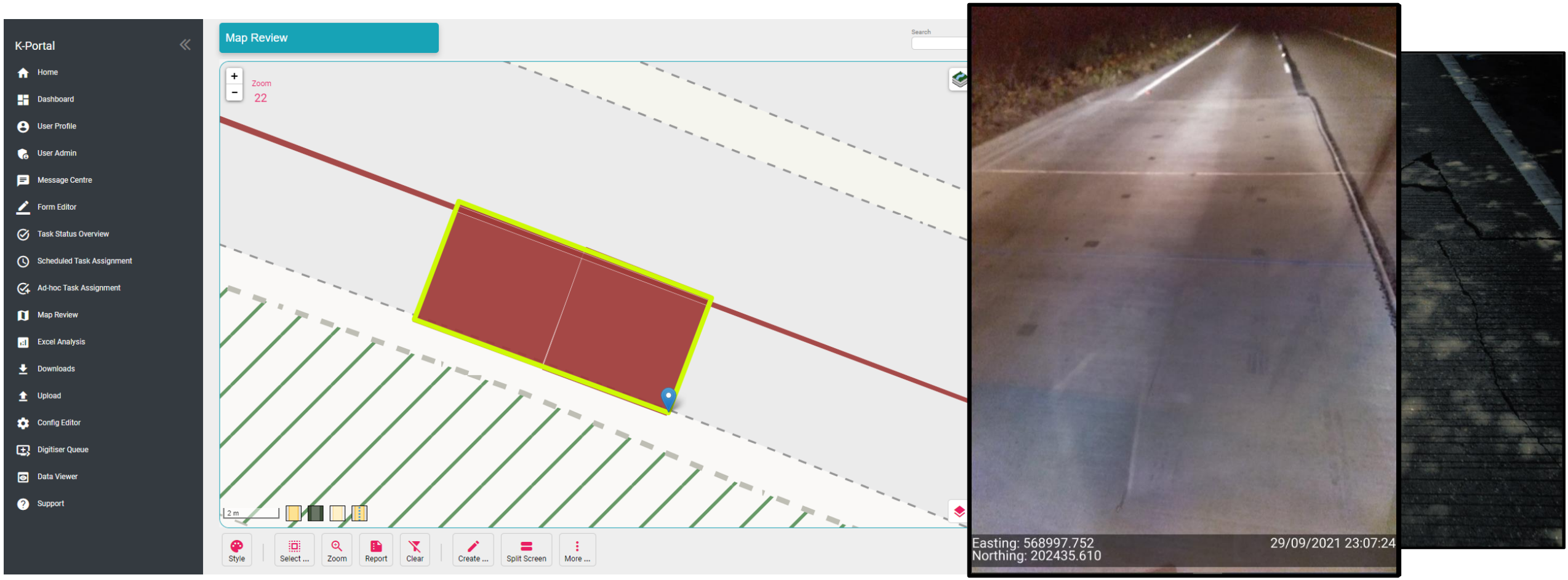
Defect Detailed Location plan

Digital field capture/Supervision

Positioning as a service with Trimble Catalyst DA2 plus the KOREC Capture field collection app



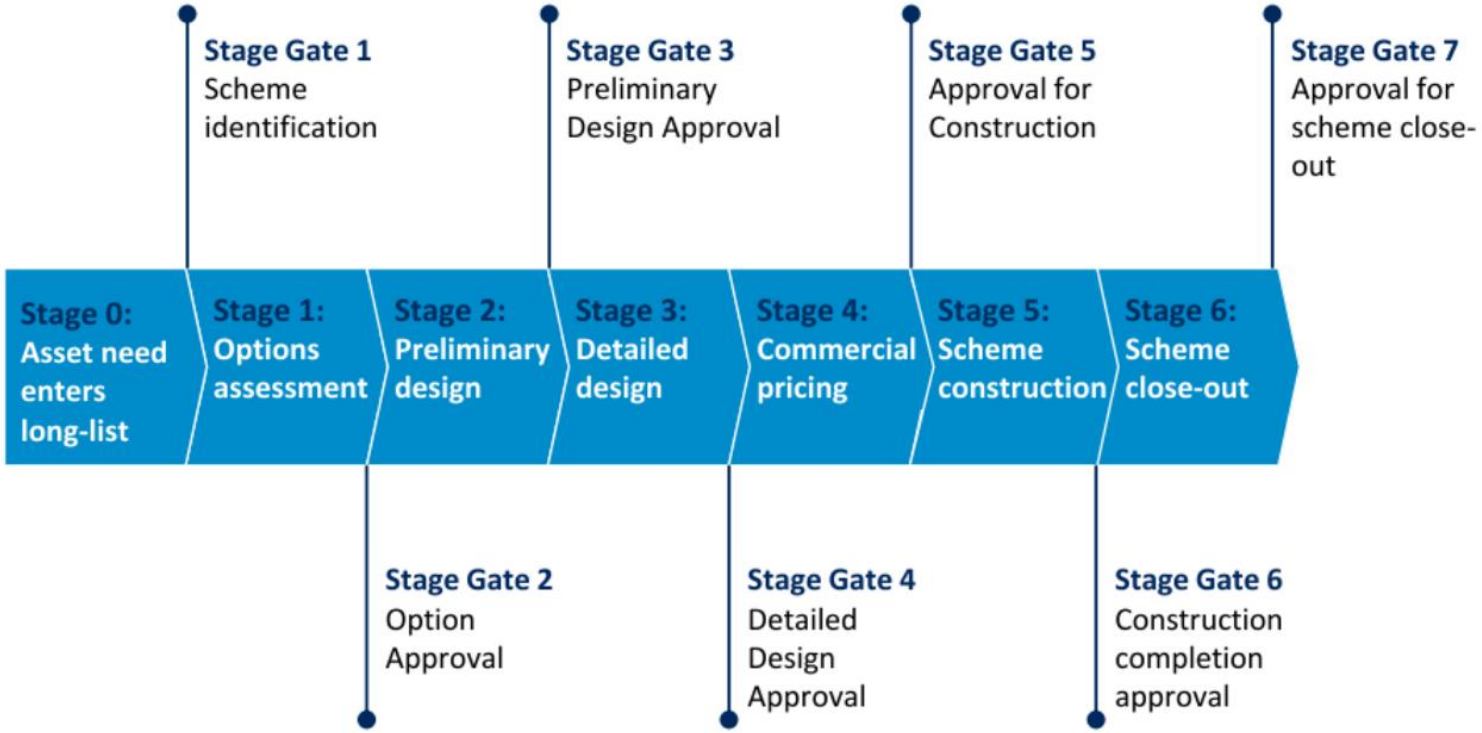
Digital field capture/Supervision

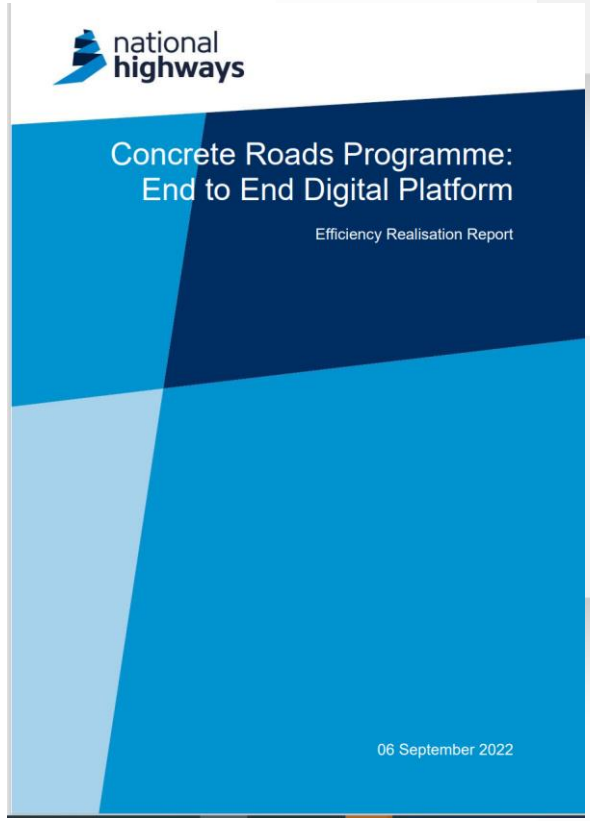


Efficiency Gains

Independent Report by Aecom

- Modelled on a typical 32 lane km Scheme





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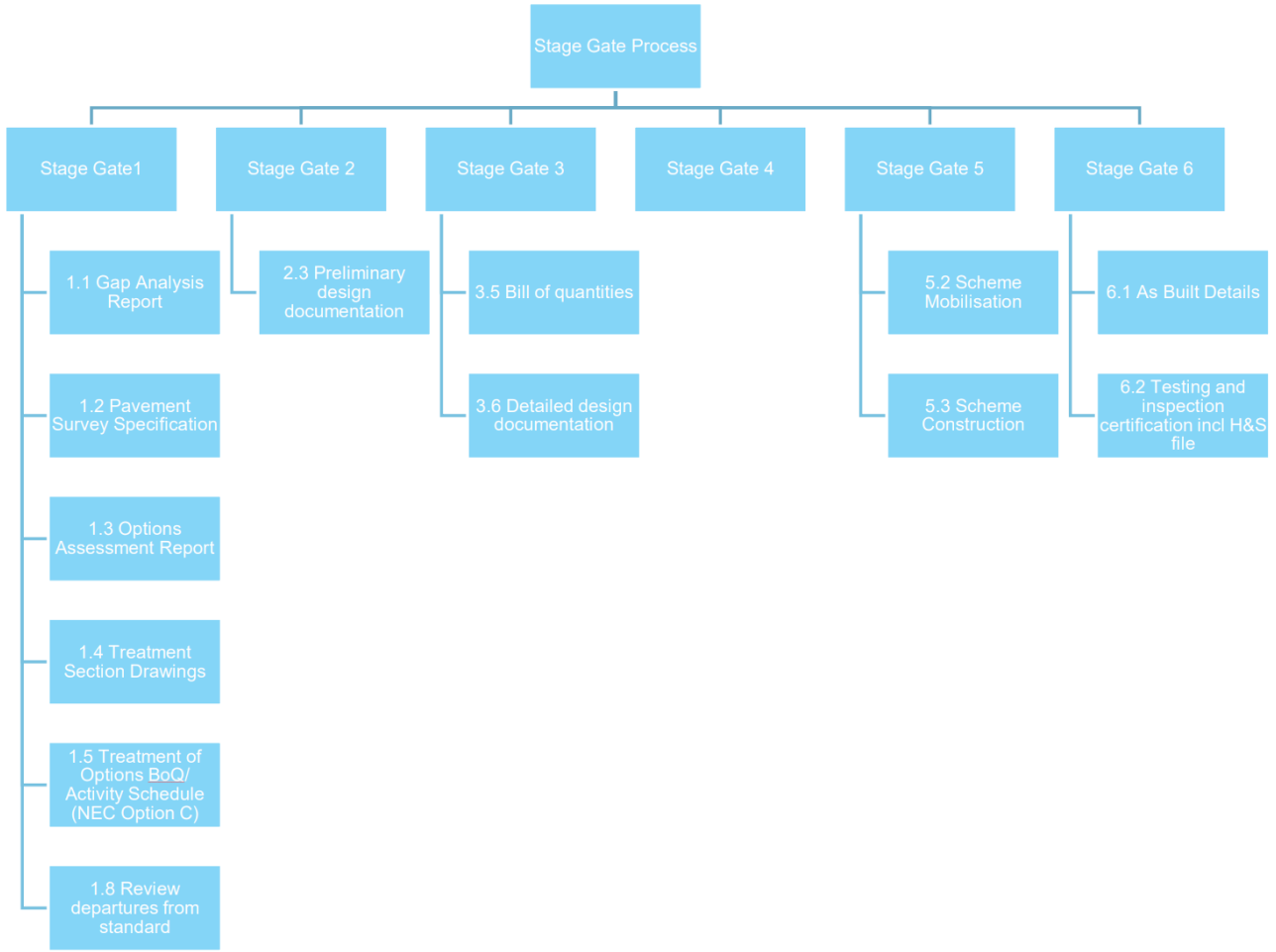
Core Products



Calculated Savings

Scheme Type	Savings under S1 for the model scheme	Savings under S2 for the model scheme
Life Extension Works	£52,000	£124,000
Reconstruction Works	£35,000	£87,000

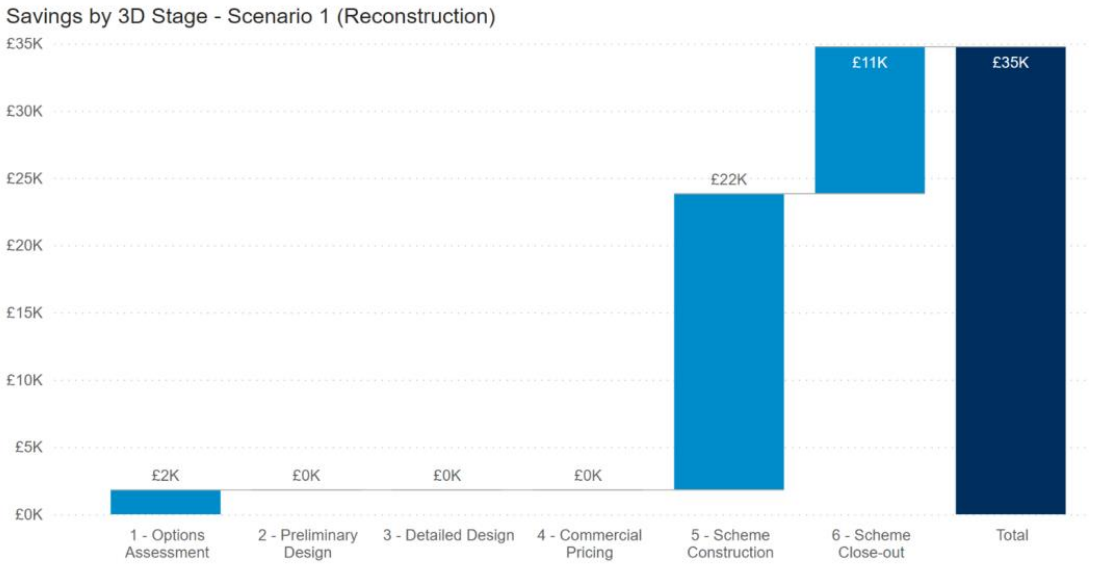
Table 5: Potential savings of using the E2ED platform for LEW and Reconstruction for the model scheme

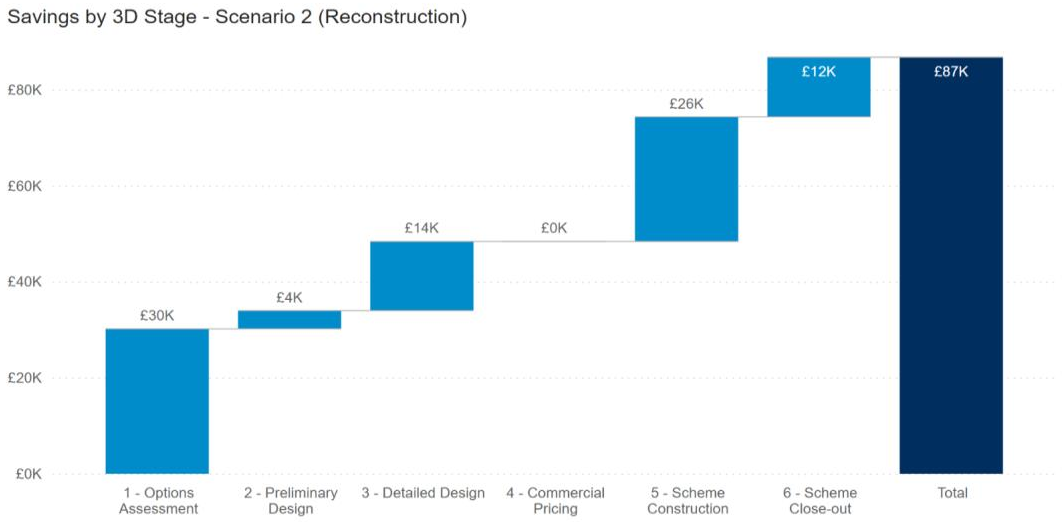
The outputs benefit per linear lane-km for LEW and reconstruction works for S1 and S2 are presented in Table 6 below.

Scheme Type	Savings in S1 per linear lane km	Savings in S2 per linear lane km
Life Extension Works	£1,600	£3,900
Reconstruction Works	£1,100	£2,700

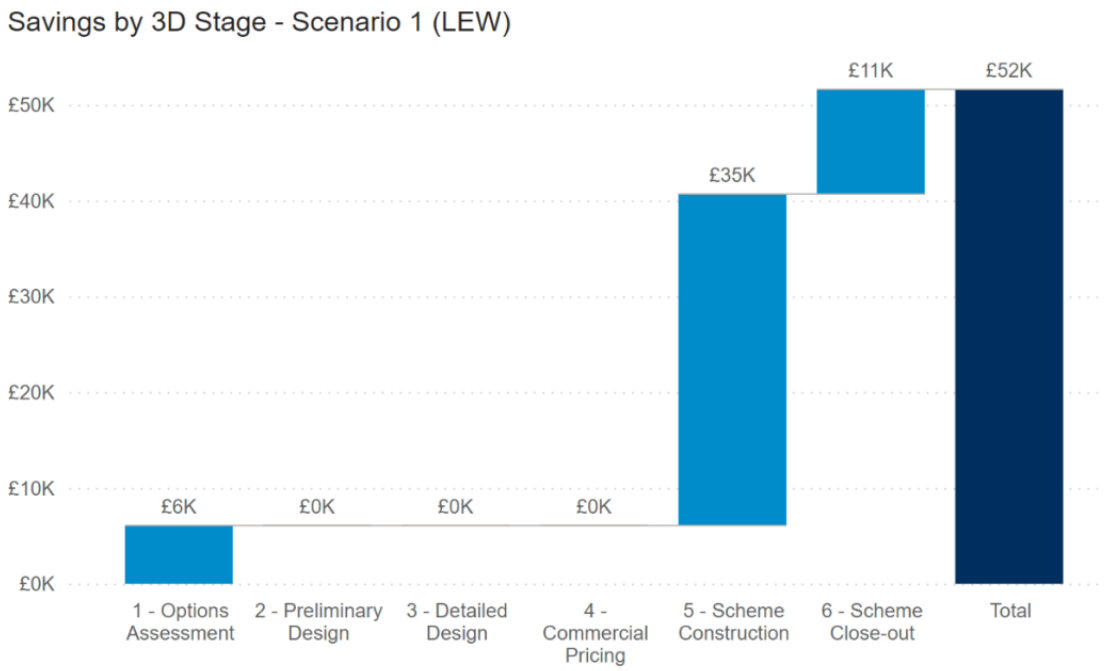
Table 6: Linear lane km savings of using the E2ED platform for LEW and Reconstruction schemes

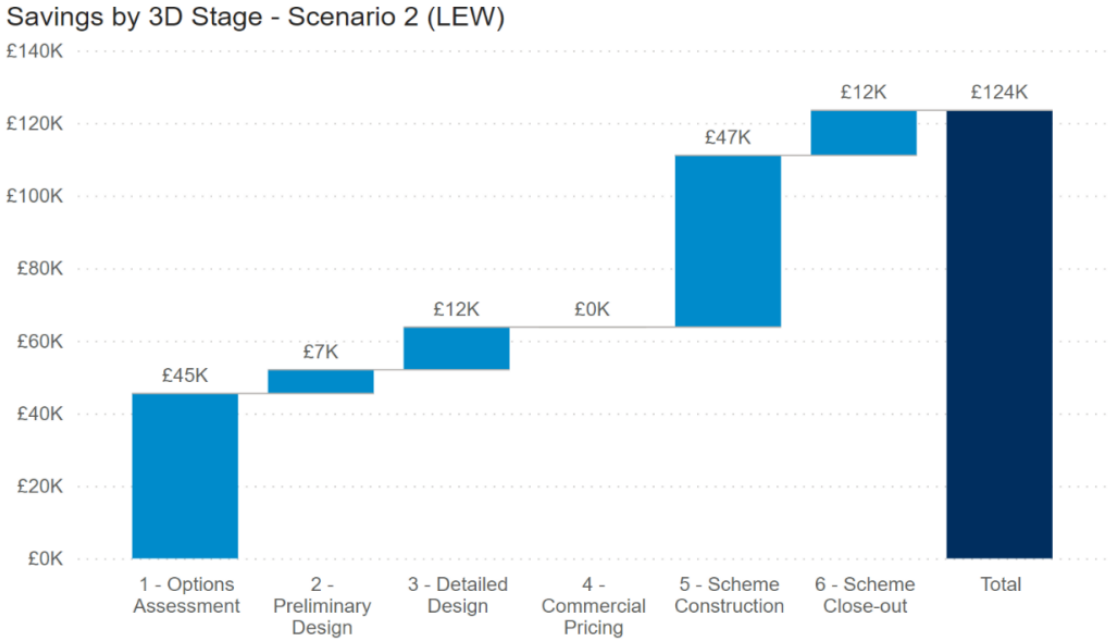
Reconstruction savings





LEW Savings


Savings by 3D Stage - Scenario 1 (LEW)
£50K
£40K
£30K
£20K
£10K
£0K
£6K
£0K
£0K
£0K
£35K
£11K
£52K
1 - Options Assessment
2 - Preliminary Design
3 - Detailed Design
4 - Commercial Pricing
5 - Scheme Construction
6 - Scheme Close-out
Total


Savings by 3D Stage - Scenario 2 (LEW)
£140K
£120K
£100K
£80K
£60K
£40K
£20K
£0K
£45K
£7K
£12K
£0K
£47K
£12K
£124K
1 - Options Assessment
2 - Preliminary Design
3 - Detailed Design
4 - Commercial Pricing
5 - Scheme Construction
6 - Scheme Close-out
Total

“Every time we use the solution, we save money”

- Early days of adoption on CRP
- LEW – Significant benefits in stage 1, 5 and 6 already
- Reconstruction - Stage 5 & 6 mainly (Options Assessment Report and Gap Analysis)
- Treatment design in the platform would drive further efficiencies (stages 0 to 3) – will require further development and a move away from traditional methods of design

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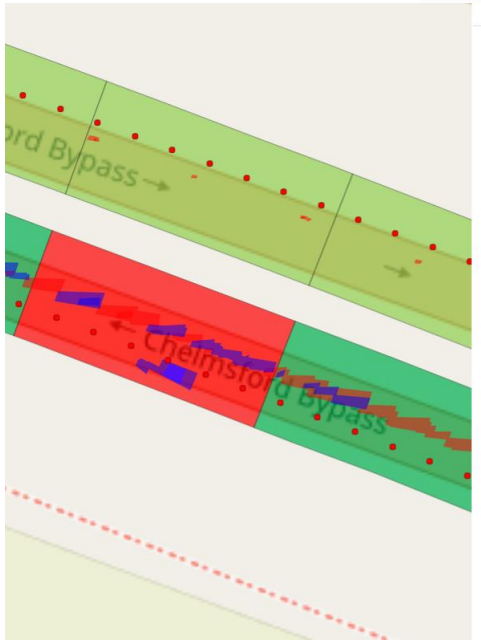
Other identified intangible efficiencies

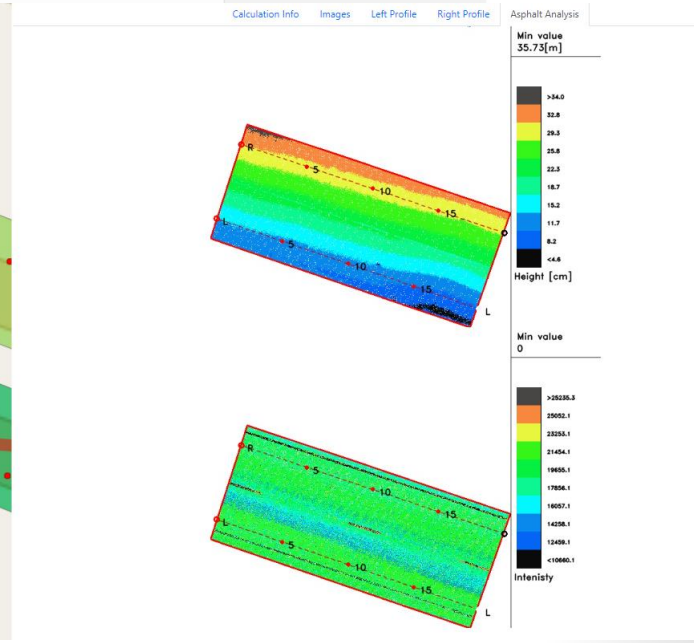
Big Data provides

- Improved digital asset management data
- Improved efficiencies
- Improved Health and Safety
- Analysis and Pro-active maintenance
- Deterioration modelling
- Cost estimation and Risk Allocation
- Improved data accessibility and quality

What's happening now?

- Increase awareness and adoption across the framework
- Further evaluation and development of the E2ED workflow – especially design
- Working with AECOM to develop 'gold standard AI' for design including attribute data
- Undertaking a new national lidar survey of schemes
- Finalisation and implementation of digital handover specification (EIR) into the portal
- Working with DRF at Cambridge University to create an 'exemplar' digital twin
- Further enrich the Digital Twin, HD imagery, GPR, Thermal, Noise, Carbon, Drone footage
- Review, implement, and measure other identified efficiencies especially H&S
- Trials of the process on Asphalt





Thank You

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Questions?