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Value and Skills

Wednesday 20 September 2023

Digital's value throughout the highway's lifecycle

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Digital's value throughout the highway's lifecycle

Part 2 – Putting Digital Into Practice | What is done now, what can be done now

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John Sisk & Son

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Digital's value throughout the highway's lifecycle

Putting Digital into Practice

- Traditional vs Modern Workflow
- What's Practical Today, In 2023!
- Common Data Environment | Setting the foundations for Digitalisation
- Unlocking The Potential For Tomorrow

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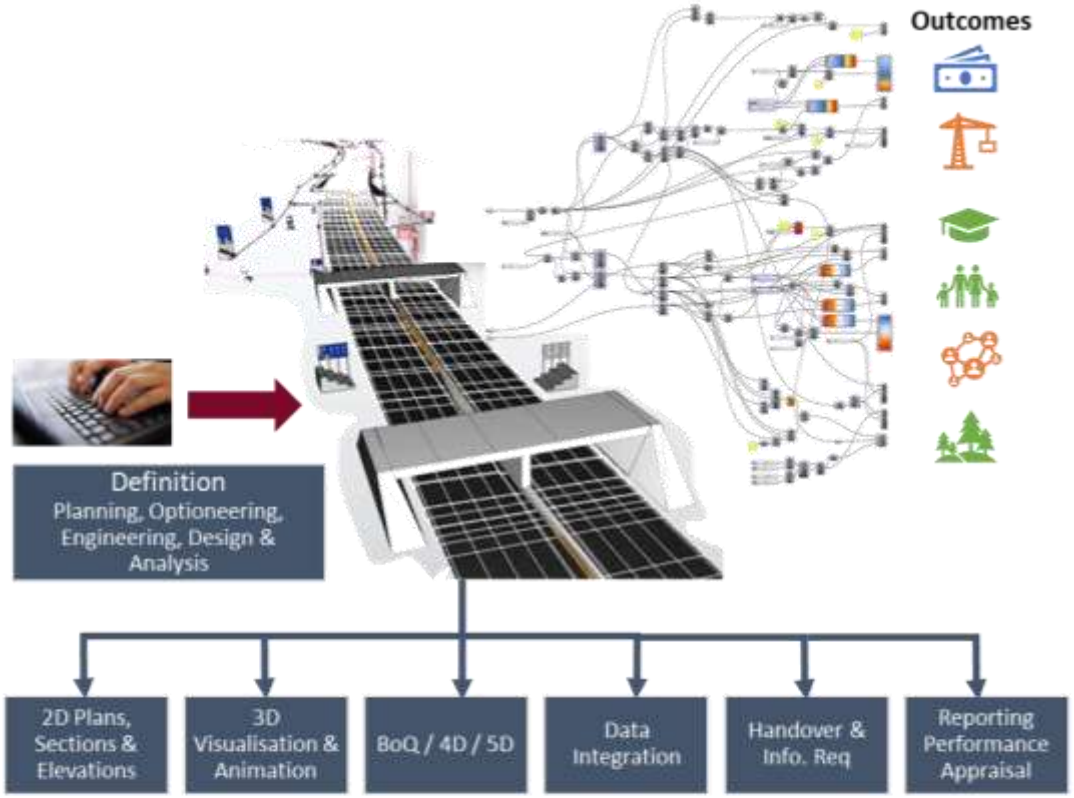
Traditional v Modern Workflow

- All activities, tasks and information are managed separately.
- Exhaustive programming activities and planning.
- Labour intensive and repetitive esp. when managing changes.
- 3D models, Handover & Performance Appraisals are created LAST hence not used to influence decisions or outcomes.



Immediate Benefits Realised using Data-driven Workflow

- Data-driven information (2D, 3D &/or Geospatial) created **FIRST**.
- Leaner programming activities and planning
- Labour efficient and much more productive.
- Supports early collaboration & involvement to influence decisions based on outcomes.
- All information inc. 2D, 3D & 4D models are created as result of data-driven information.
- Allows for downstream integration and advancements in innovation.

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Modern Method of Delivery

Methodology | Parametric
Intent | Data-informed
Outputs | Components, Assemblies, Geospatial & Datasets

DMRB Compliant Ancillaries & Temporary Works Assets

Connectivity with Open & Geospatial Datasets

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Methodology | Parametric
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Ref: Quick Quantities in InfraWorks® 2021
Cadline - https://youtu.be/EsZ9foSXQP0?si=ndx3_b82s9NWgKjp

Early Design, Planning and Conceptualisation

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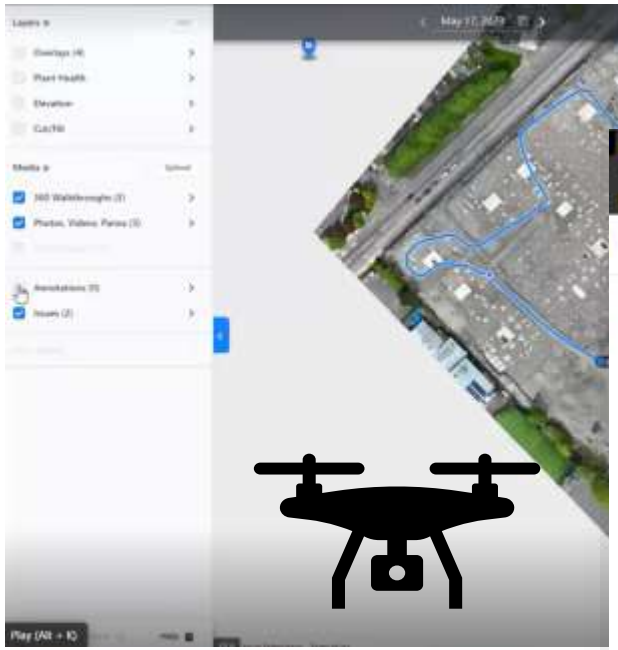
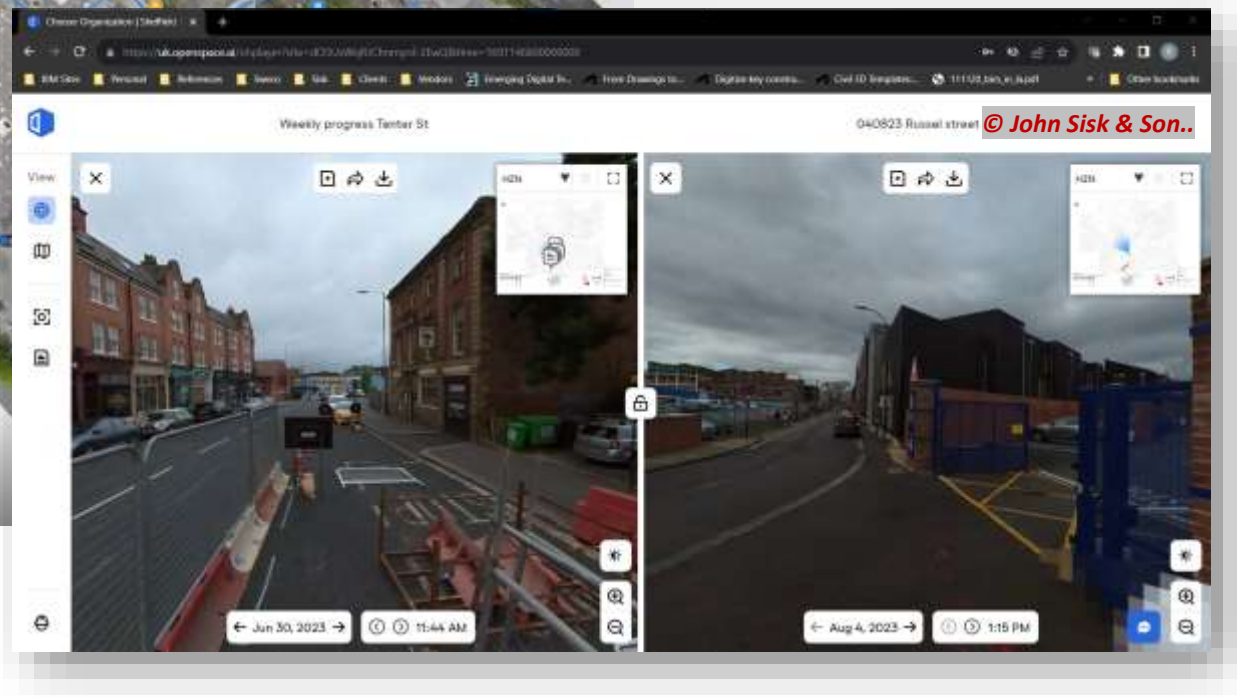
Modern Method of Delivery

Methodology | Parametric
Intent | Data-informed
Outputs | Components, Assemblies, Geospatial & Datasets



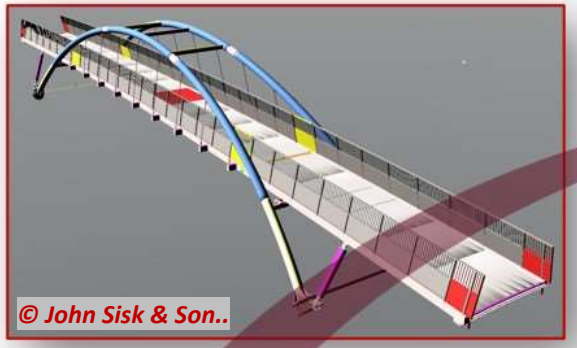


Progress Tracking & Reporting

- Earthworks Mass Haul Analysis
- Hazards Detection
- Deviation & Decomposition Analysis
- Reality Capture / Laser Scanning
- Site Verification
- Scan To BIM
- Aerial Survey and Inspections
- Mixed Reality
- Geospatial Datasets

Modern Methods | Parametric delivery to support off-site fabrication and on-site deviation analysis, bolt positioning and assembly.

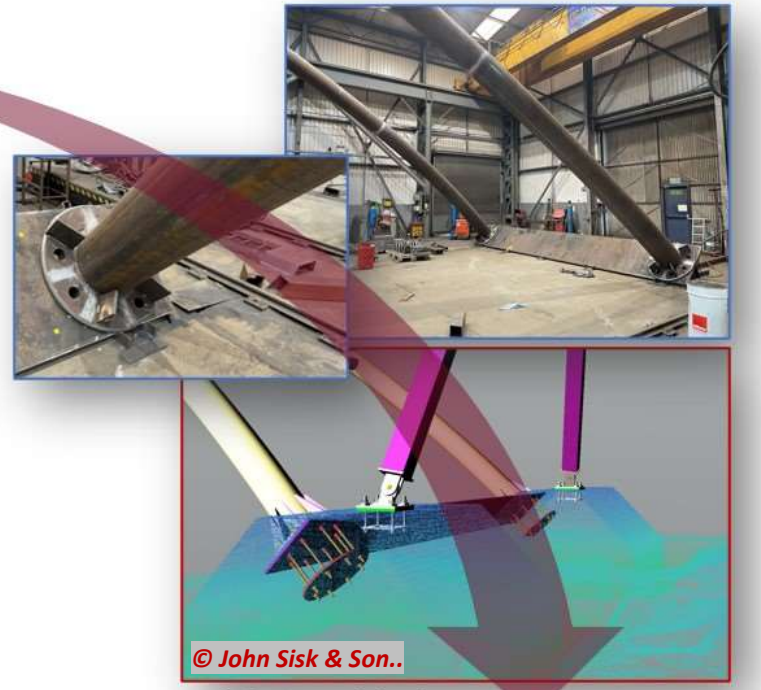
Getting It Right First Time | Highly accurate and geospatially correct 'digital replication' of bridge installation & bolt positioning led to improved planning, communication, collaboration and visualisation.



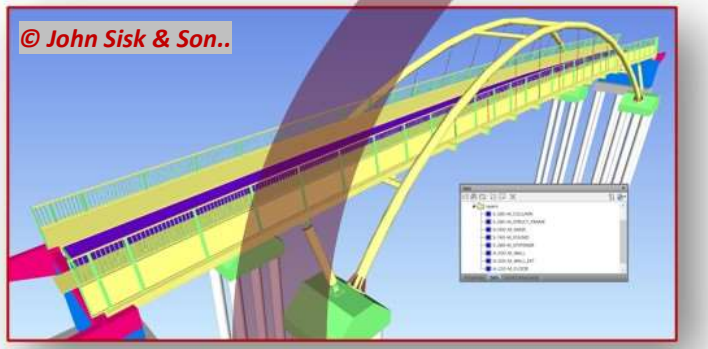
As-built Fabrication
3000+ parametric (fabricated) components

Reality Capture of Casted Supports & Abutments
10GB of 4million+ parametric (classified) point cloud (1 million points/sec)

Off-site Fabrication



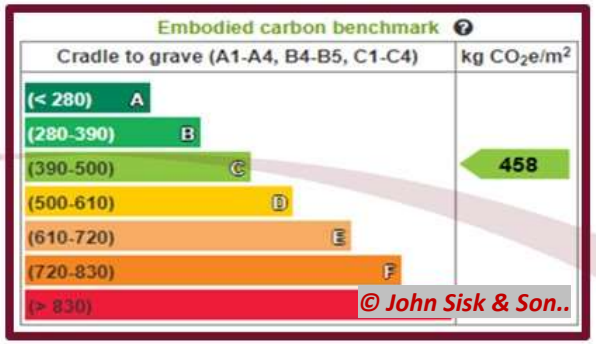
Digital Positioning & Assembly
Highly accurate and geospatial parametric (deviation) analysis



Design Authoring
1300+ parametric (design) components

- **Modern Methods** | Parametric delivery to support assembly-based design, quantity & carbon extraction and machine control.
- **Getting It Right First Time |** Highly accurate and geospatially correct 'digital replication' of pavement assembly led to improved planning, communication, collaboration and visualisation.

Instant Quantity Extraction
30+ parametric (products) definitions for instant quantity extraction



Low Carbon Analysis
4.12^{e7} kg CO_2e (parametric analysis) saved through material replacement and refurbishment

Design Authoring
1200+ parametric (pavement & restraint systems) assemblies

Virtual Progress Management
Global Navigation Satellite System (GNSS) devices to support augmented and mixed reality assessments.

Machine Control
Geodetic strings (parametric alignments) for geo-positioning of Dozer & Excavators lane extent limits; and Cement Bound Granular Mixture (CBGM)/Blacktop laying

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4D Planning

- Provides greater certainty and understanding.
- Provides confidence & security in the programme.
- De-risks the programme and methodology.
- Powerful, information driven visuals that drives collaboration and facilitates conversations.
- Helps keep the team informed, checks for programme, permanent and temporary works.

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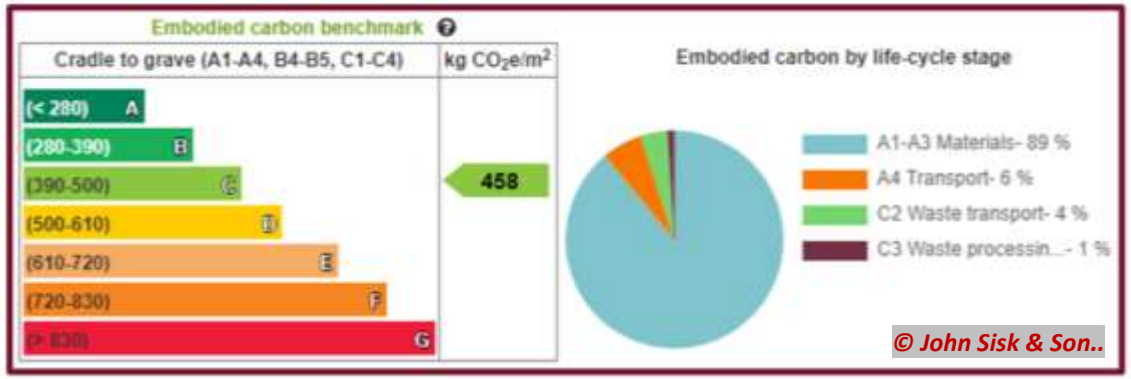
Carbon & Cost Correlation

- Rapid development of TQO and BoQ from datasets and 2D information.
- Linked to the cost plan and design information.
- Increase certainty in change order management and procurement process
- Standardising the method of measurements and standards.
- Being able to track and review the carbon and cost correlation.

Low Carbon Case Study | A12 J25 to J26



Existing concrete recycled to be used in the cement bound granular material)

- **Cost effective CBGM |** faster Cement bound granular material to build a heavy duty and durable pavement.
- **Reduction of wagons and trips |** existing concrete is being planed rather than broken to maximise the quantity of material on a wagon.
- **Lessened Crushing |** planned approach led to less crushing/screening; & production of a certifiable product with majority of the work already completed by the planner.
- **Recycled CBGM |** for the pavement as well as Type 1 and capping for the foundation layers.
- **4.12^{e7} kg CO2e |** saved through material replacement and refurbishment

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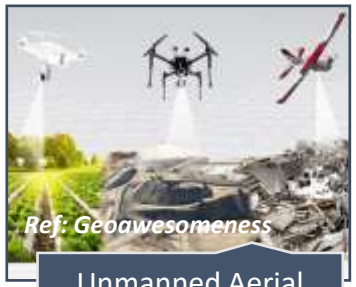
As-Built Asset Inventory

Orthomosaic

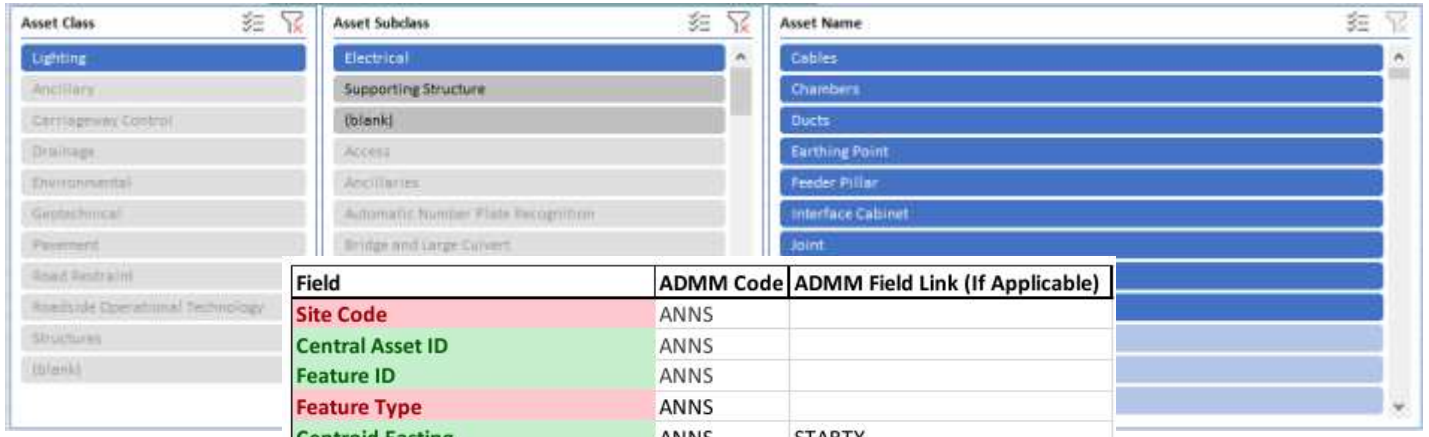
Point Cloud

2D/3D & Geospatial Datasets



Unmanned Aerial Vehicle Survey

Driven Survey



Field	ADMM Code	ADMM Field Link (If Applicable)
Site Code	ANNS	
Central Asset ID	ANNS	
Feature ID	ANNS	
Feature Type	ANNS	
Centroid Easting	ANNS	STARTX
Centroid Northing	ANNS	STARTY
Feature location	ANNS	AST_LOCTXT
Feature notes	ANNS	ASST_INFO
BLANK	ANNS	
Type (ANNS)	ANNS	TYPE
Material	ANNS	MATERIAL
Owner	ANNS	OWNER
Current Maintenance Contract	ANNS	
Currently Maintained By	ANNS	
Surface Material (MLCR)	ANNS	
Accessibility	ANNS	ACCSBILITY
Maintenance Contractor	ANNS	
Maintenance Responsibility	ANNS	MAIN_REP
M&R: Asset Validation	ANNS	
XSP Code	ANNS	XSP
Source ID	ANNS	OSOURCE_ID
Departure - DAS ID	ANNS	
System ID	ANNS	
Length	ANNS	LENGTH_M
Number of	ANNS	
Width	ANNS	WIDTH_M
Date of Construction	ANNS	
Defect Liability Period	ANNS	

Ref: Asset Data Management Manual (ADMM), Data Dictionary, National Highways

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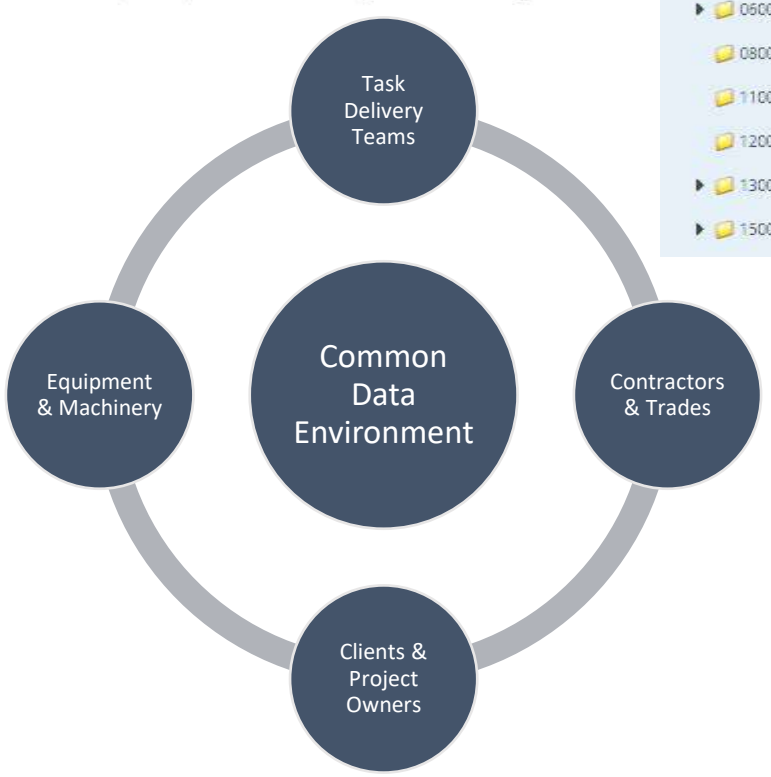

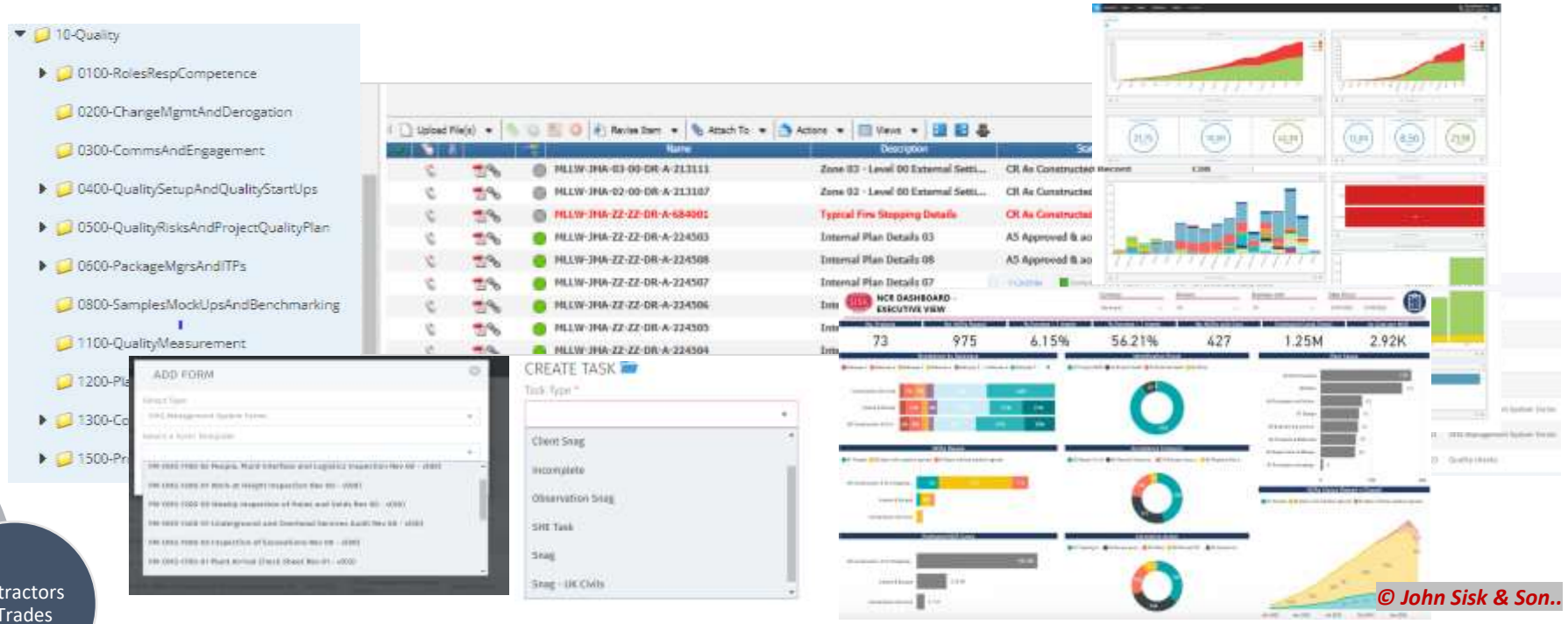

- Collaborative environment for all information, issues & inspections.
- Facilitates storage for all departments and consistency across all projects & tasks.
- Workflow functionality for review and approvals.
- Can be extended to support aspects such as snagging, procurement & tendering and tagging procedures.
- Retention and handover of information.
- Facilitates digital inspections across functions e.g. OHS, Quality & Ops.

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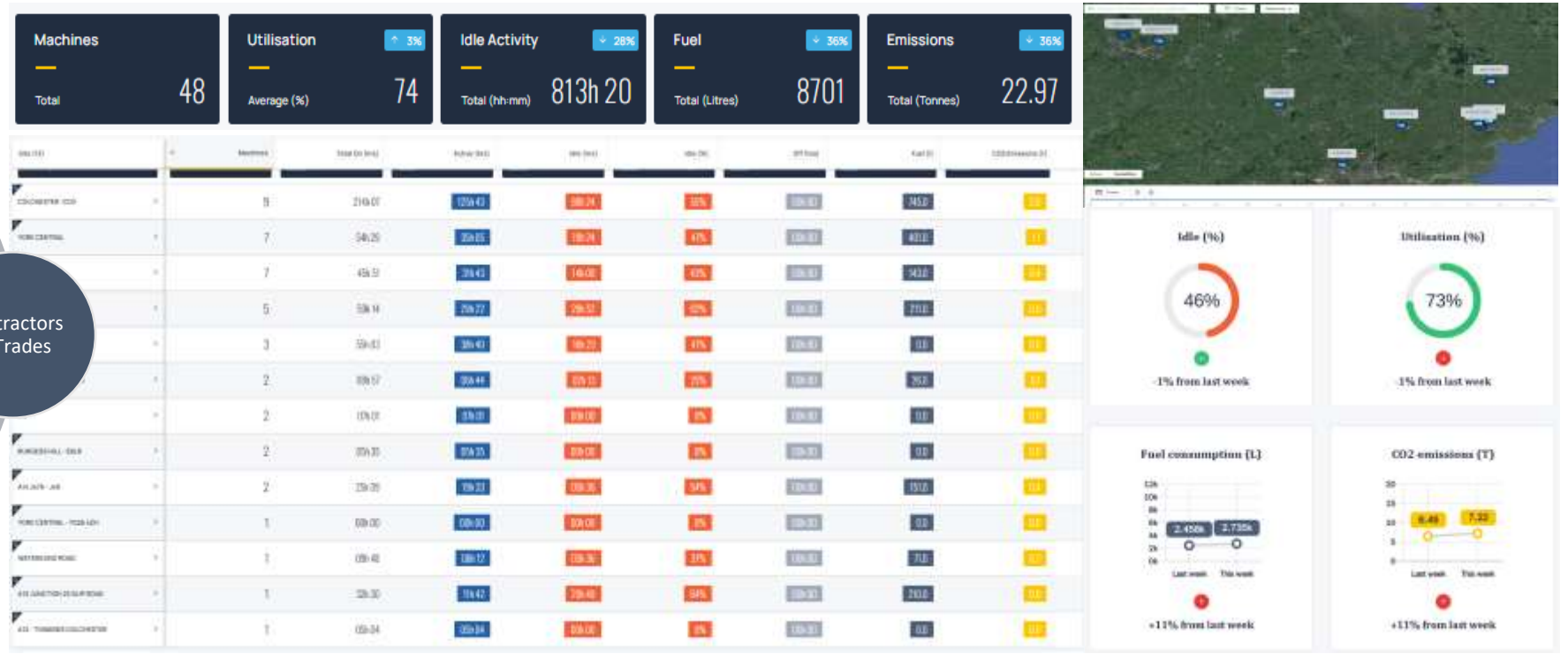
Fleet Management | utilisation, idling time, fuel consumption, emissions, location, and operating hour to maximise productivity.

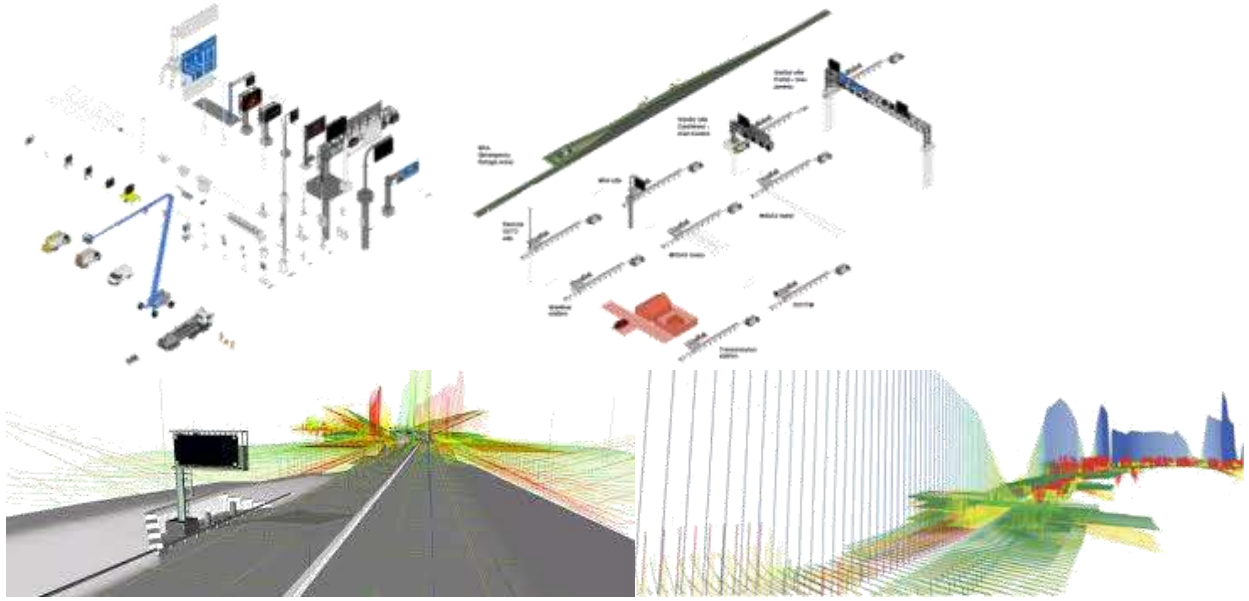


Ref: MachineMax, Flannery

Modern Method of Delivery

Methodology | Generative
Intent | Predictive
Outputs | Corridors & Templates

DMRB compliant Digital Product Catalogue



Design automation on Smart Motorways

Ref: Rapid Engineering Model (REM), Bryden Wood

Machine Control and Pavement analysis

Product optimisation

Ref: A1 Leeming to Barton, Carilion

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Modern Method of Delivery

Methodology | Algorithmic
Intent | Prescriptive
Outputs | Digital representation

Ref: Digital Roads, Connected Autonomous Plant, National Highways

Algorithmic Delivery Case Study | Concrete Roads

© John Sisk & Son..

Ref: Concrete Roads Programme, KOREC, National Highways

Online Asset and Works Management Platform

- **Federated System (Combined Model) |** Geospatial, Online, Secure, Realtime, Flexible, Scalable.
- **Existing Conditions |** mobile mapping, existing asset data, ground penetrating radar (GPR), non-destructive testing (NDT).
- **Surface Analysis & Automated Defect Extraction |** Machine Learning (which is a form of Artificial Intelligence) that learns from the Engineering Analyses process to then automate the detection & extraction of defects on the road surface.
- **Parametric |** Technical & Detail Design developed based on sub-assemblies.
- **Digital As-Builts |** Asset tracking, unmanned aerial vehicle (UAV), tablets feeding data directly into the federated system.
- **Machine Control |** Demolishing or milling the existing pavement, setting out the new concrete pavement layers and the potential of real-time as-built data capture from the machines.

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Digital's value throughout the highway's lifecycle

Table Discussions

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Table Discussions

What are our Barriers?

Change resistance, inertia and costs are the key barriers to digitalisation. *Based on what you have heard where do you think, you can gain value in your team, organisation and or project?*

To assist you, we have listed 4 examples that you may wish to use as a prompt. Please turn over!

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Table Discussions

Digital Competency | People & Culture

Digital transformation requires key functions & roles within each organisation to have a baseline understanding of ISO19650 inc. the commercial contracts and legal liabilities.

Raising the competency of ISO19650 across all teams, functions, roles and across all parties.

Connected CDEs | Information Exchange/Data Drops

Golden Thread | An accurate digital audit trail spanning the entire lifecycle of the asset.

A single CDE where all parties manage information & their functions/tasks can provide access to accurate up-to-date information and accountability for decision-making. However, a single CDE is currently very difficult to employ.

Better integration between CDEs will support the functions required by each party with minimal change to their contractual scope, ease security & liability concerns, and enhance partnership arrangements etc.

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Table Discussions

Standardisation and Digital Innovation

Standardisation can unlock opportunities to improve productivity within a team, project and/or across a framework. However, there's a misconception that this will stifle innovation.

Mandating common data standards will allow teams to embrace modern software and technological solutions; thus, supporting more innovative processes.

Contracts and Works Information

Our current contracts, works information, scope of works and the decision-making processes at each stage gate continues to rely on 2D/traditional deliverables inc. handover into operations.

Adopting the ISO19650 information protocol will allow MHA+ to:

- continue relying on current deliverables & handover requirements (for the stage gate reviews & approvals etc.); and
- be software & technologically agnostic.

This will ensure teams focus on adopting modern workflows that are more efficient and sustainable; rather than focusing on the deliverables.