JM1

Roadbridge

BIM for Civil Contractors

Jaime Mulcair, Company BIM Manager

12th April 2021

Who We Are

Roadbridge

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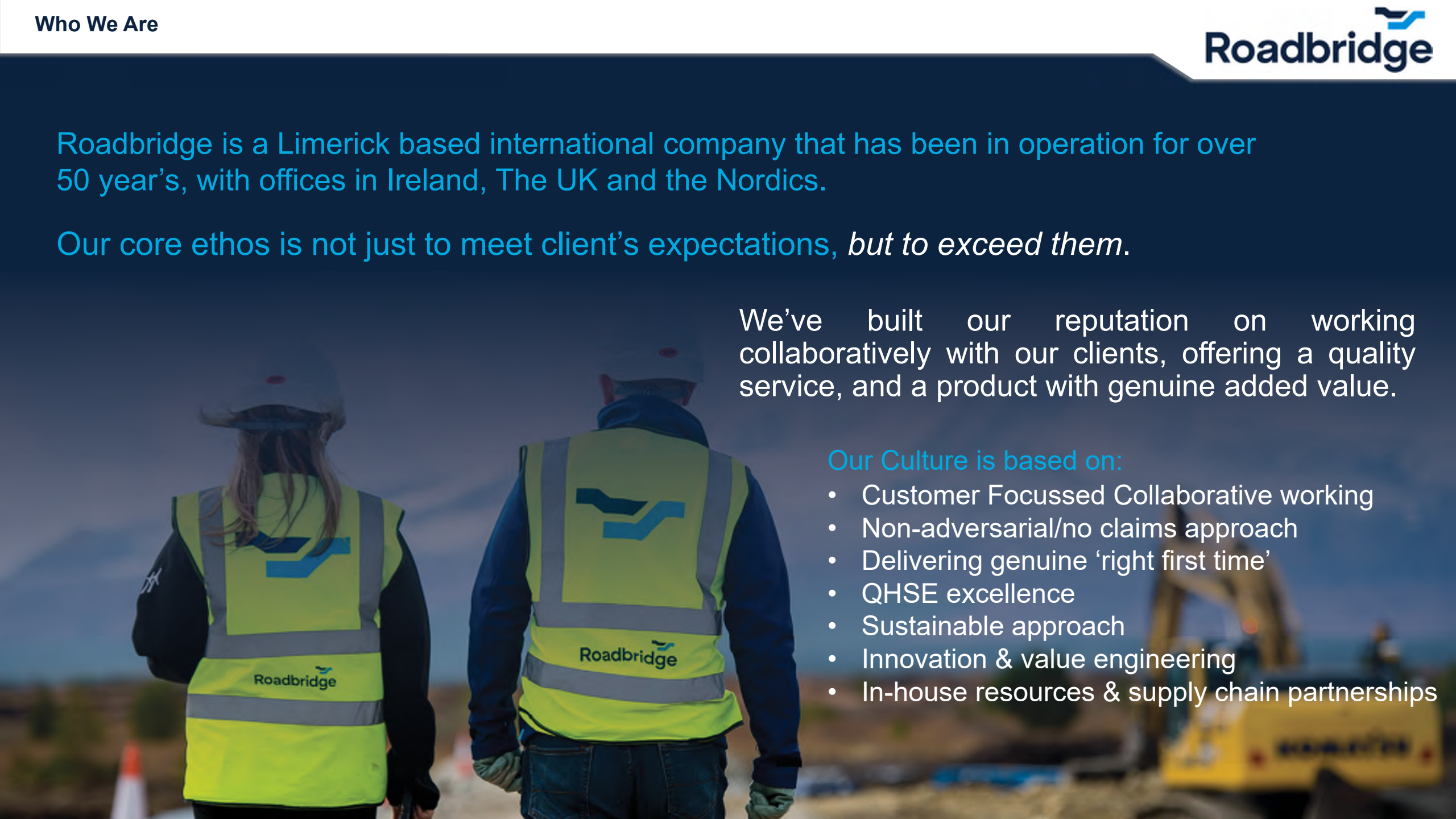
Roadbridge is a Limerick based international company that has been in operation for over 50 year's, with offices in Ireland, The UK and the Nordics.

Our core ethos is not just to meet client's expectations, *but to exceed them*.



We've built our reputation on working collaboratively with our clients, offering a quality service, and a product with genuine added value.

Our Culture is based on:

- Customer Focussed Collaborative working
- Non-adversarial/no claims approach
- Delivering genuine 'right first time'
- QHSE excellence
- Sustainable approach
- Innovation & value engineering
- In-house resources & supply chain partnerships

Our People

"My job in Roadbridge has given me the opportunity to work on very challenging projects which has helped me develop as a professional engineer, but what I most enjoy about Roadbridge is the atmosphere of teamwork and getting the job done"

-Kieran O'Connor, Site Engineer, Center Parcs, Longford

We are founded upon the strength and experience of our 1200 plus people; our leaders, managers, and highly experienced and trained direct labour force.

The Roadbridge approach is to encourage and mentor our personnel to develop excellence in their field and to give them the opportunity for career development

Our aim is to create a great place to work and to provide our personnel with a good work/life balance.

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Our Experience

- Renewable Energy
- Gas Pipelines
- Industrial / Commercial
- Landfills / Tailing Ponds
- Leisure
- Marine
- Roads
- Wastewater

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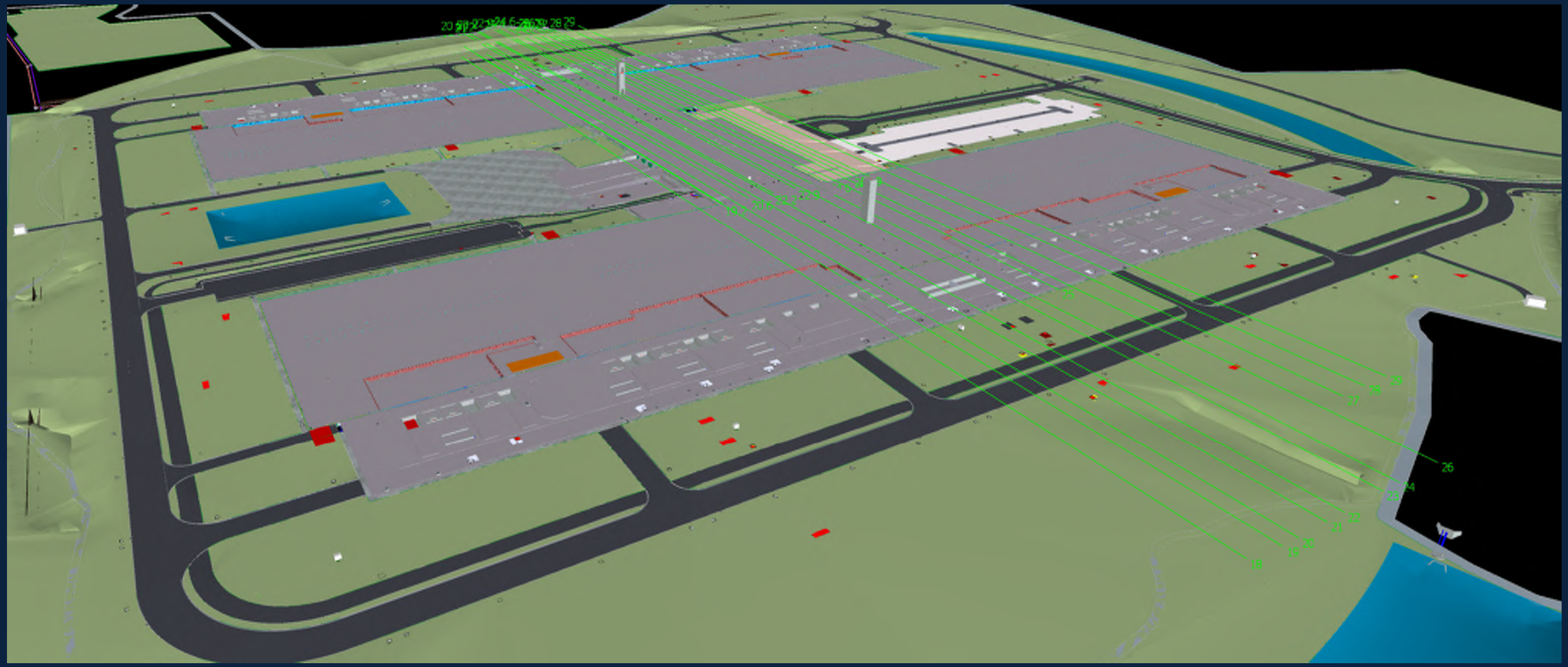
A nice simple design……



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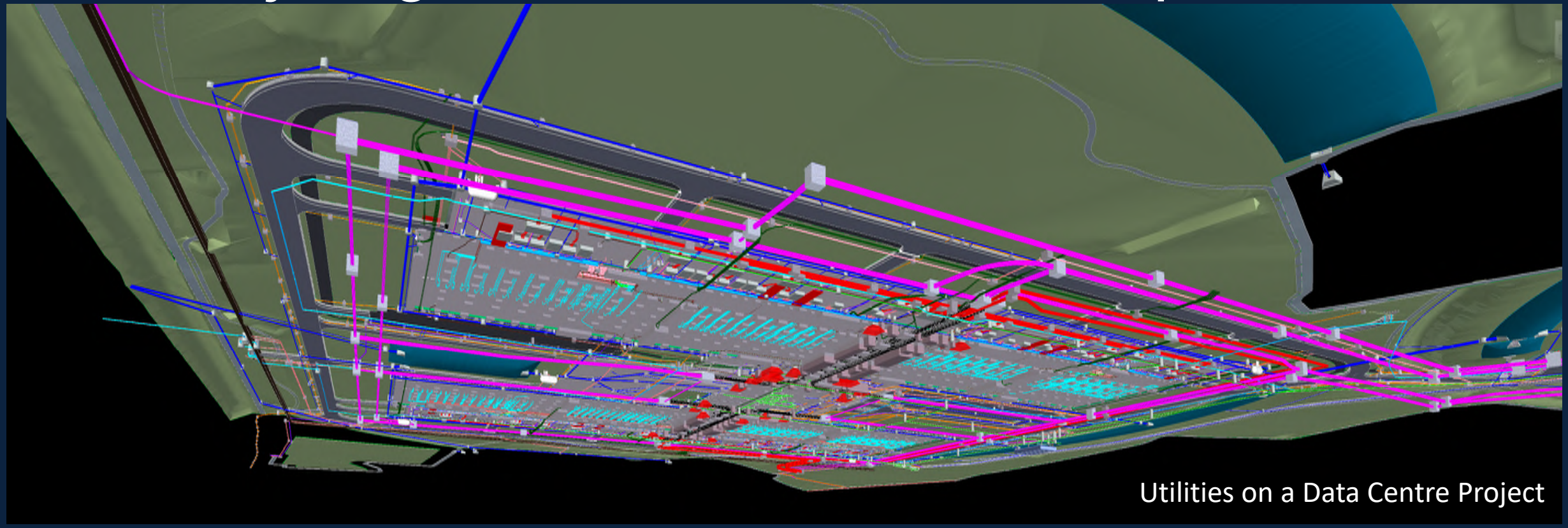
That just got a whole lot more complicated!!



Utilities on a Data Centre Project

This is why BIM is useful to Civil Contractors.

33% of any complex project scheduled time is getting it out of the ground!!

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So Why do Roadbridge need BIM?

Although Civil is seen as having some catching up to do in the BIM world, we work in a highly competitive environment, nationally and internationally where a disproportionate amount of the typical overall project risk is in the civil scope (first in, last out like the Marines!!).

The Four C's

Collaboration

- How? Business Process ISO 19650 / PAS 1192 for last 3 years
- Why? Create efficiency
- Who? Project Team Delivery and end-users
- What? Usable Data
- Check - Pilots to test outputs (SMP's)

Constructability

- Scenario planning with virtual models / digital twins
- Optimisation of design
- No surprises = Less rework
- De-risk projects

Control

- We operate the machines that are used to build the infrastructure, improved control, this brings improved safety & efficiency = value

Continuous Improvement

- Data analytics to minimise waste, reduce cost, reduce energy consumption, maximise efficiency, maximise value, with trend analysis

bsi. BIM Verified Design & Construction Capital/Delivery PAS 1192-2

Roadbridge BIM READY

bsi. BIM Verified Design & Construction Capital/Delivery ISO 19650-1 and -2

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Project Delivery

BIM Project Strategy

- Initial BIM Workshop with Client
- “Begin with the End in Mind” Asset Centric
- Exchange Information Requirement’s (EIR)
- Asset Information Requirements (AIR)

BIM Resources

- Initial BIM Workshop with Project Team
- BIM Assessment across Project Team including Supply Chain (Training)
- BIM Execution Plan
- Responsibility Matrix
- Asset Deliverables

BIM Process

- Set up Common Data Environment (CDE)
- Test and agree Software proposed
- Agree BIM process and workflows
- Develop a sample of a complete package for project delivery

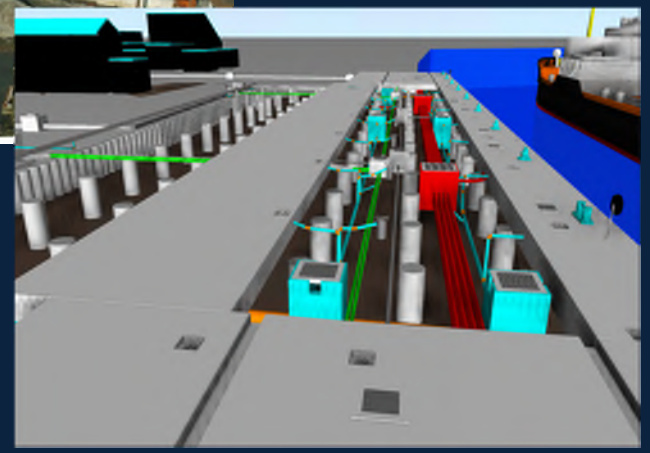
bsi. BIM Verified Design & Construction Capital/Delivery PAS 1192-2

Roadbridge BIM READY

bsi. BIM Verified Design & Construction Capital/Delivery ISO 19650-1 and -2

Dublin Port – Berth 28

Project Name: Design and Construction of Quay Wall Apron Slab Berth 28



- Description of Project
  - 120m Combi Pile Quay wall
  - 90m of contiguous CFA tie back wall inclusive of 25m secant piles (70 number)
  - 120m of cope slab and precast panels
  - Services supported to slab including drainage pipework, water main, communication utilities, gullies, hydro block channels and all chambers and manholes
  - 140 number 1200diam CFA 24m long piles
  - 3,300m2 reinforced concrete slab 0.9m to 1.2m deep
  - 500m2 transition slab 0.9m to 1.2m deep
  - 700m2 ground bearing slab 1.2m deep on MSE foundations.
  - Installation of all ironmongery to F900 loading.

Roadbridge undertook to develop an information rich digital twin of the real asset in Revit, to fully understand the scope, task and process required to fulfil a future clients asset information requirements.

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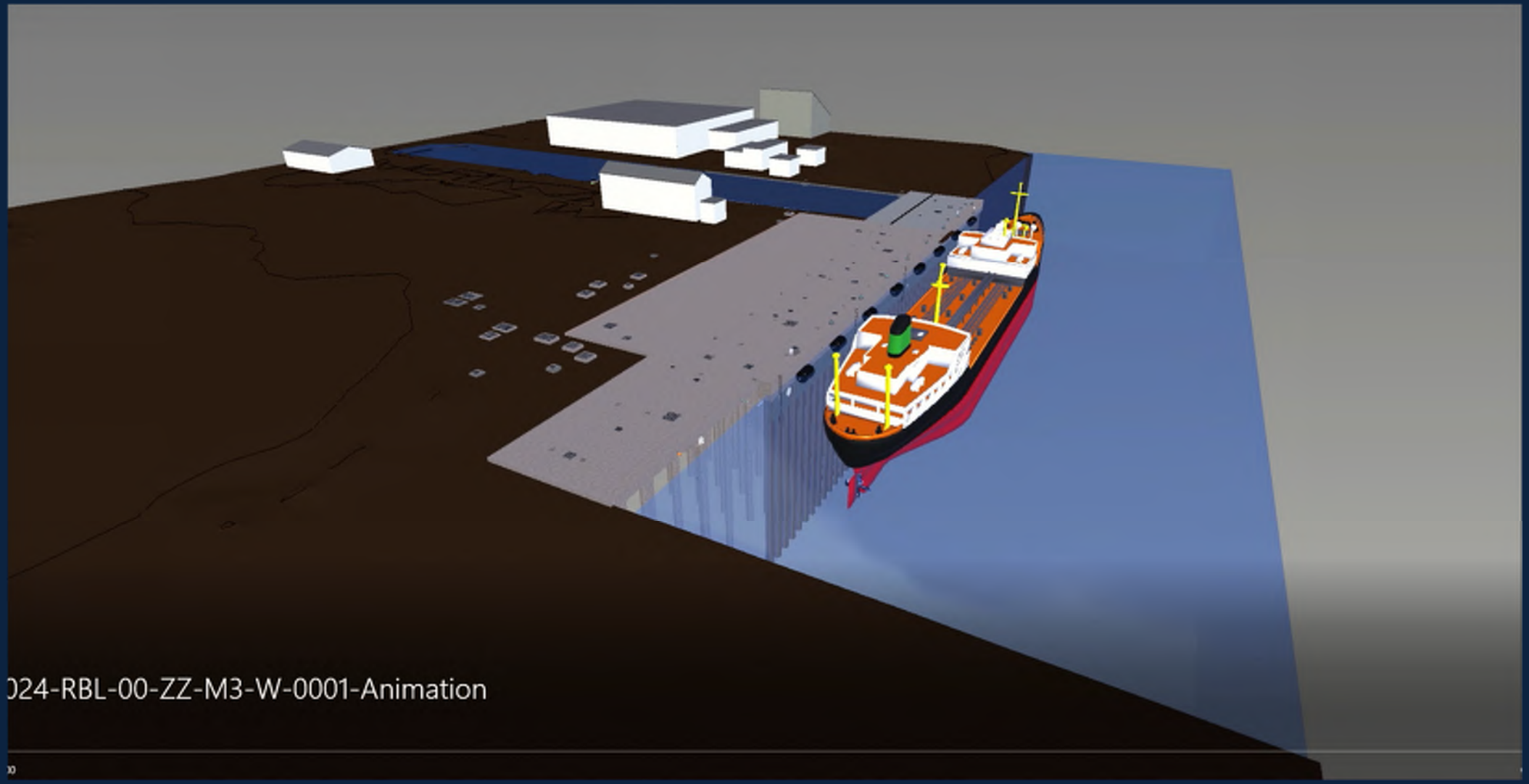
Dublin Port – Berth 28 Navisworks Video

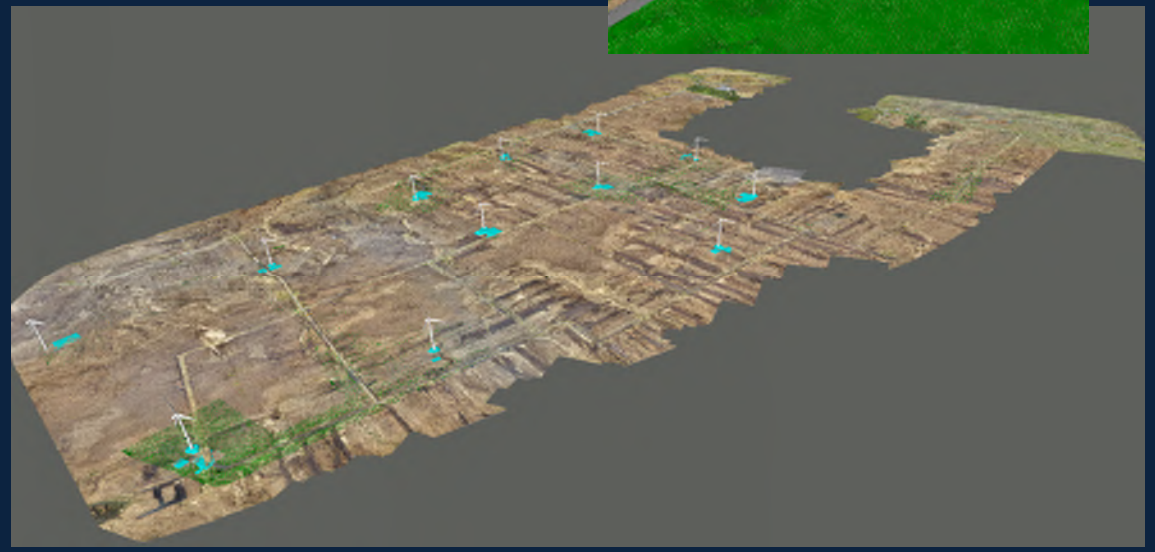


Bunnyconnellan Windfarm

Project Name: Bunnyconnellan Windfarm CBOP

- Description of Project
  - Construction of 12 no. 2.0 MW Enercon turbine bases
  - Construction of 12 no. hardstanding's
  - Construction of 0.9km of underground electrical cabling for grid connection
  - Construction of 6.4km of new access tracks
  - Upgrading of 1.5km of existing access tracks and 1.7km of public roads Pour 5,500m³ of concrete and fix 550 tons of steel.

- Roadbridge in conjunction with MWP, undertook to develop a digital twin of the real asset in C3D, to fully understand the task and process required to fulfil a future clients requirement.



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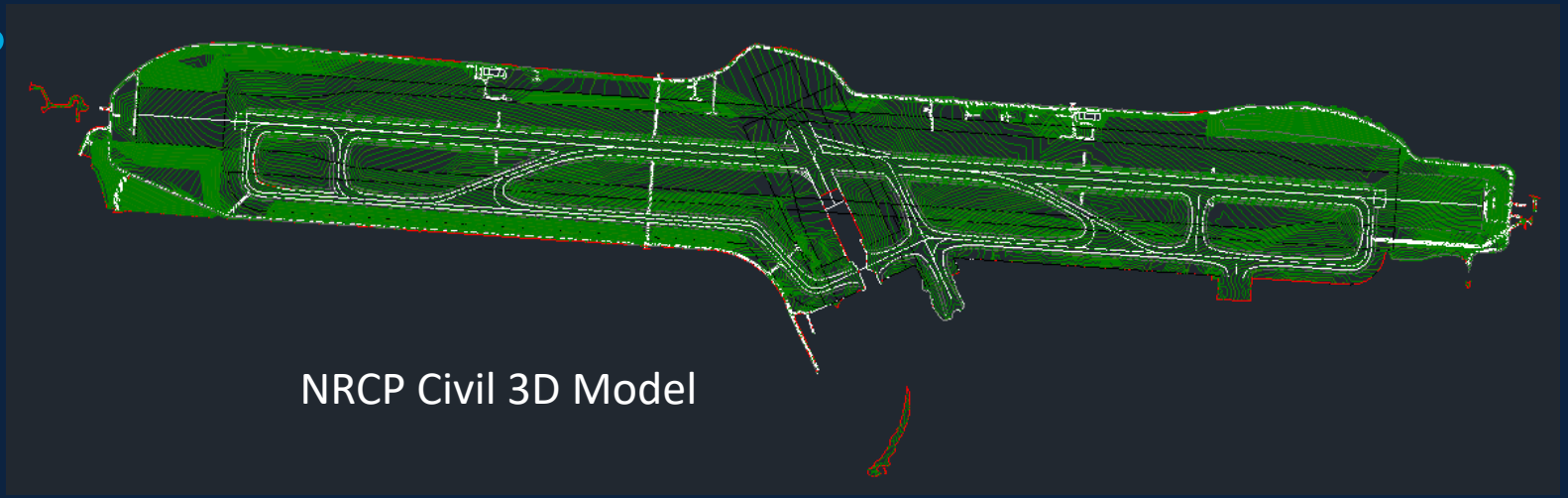
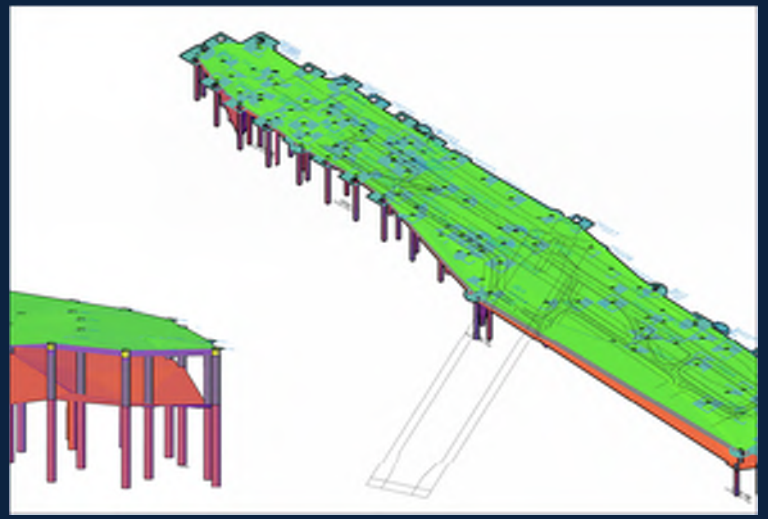
Projects

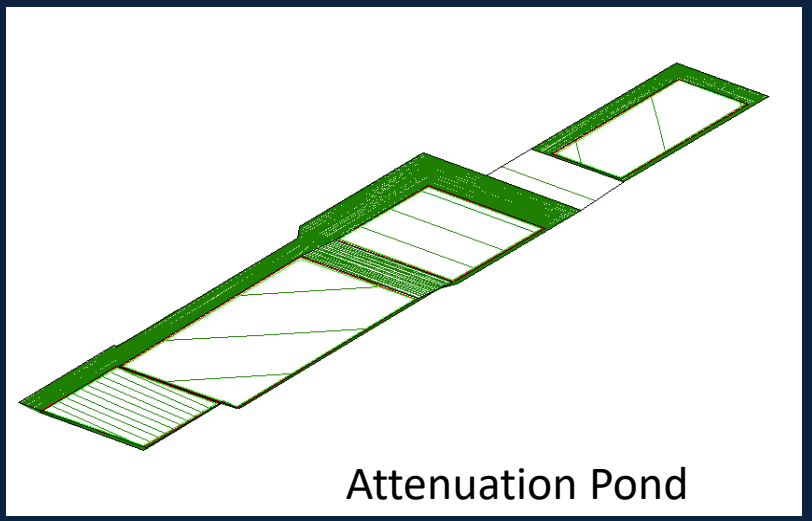
Project Name: Dublin Airport NRCP

- An in-house Civil 3D model for all earthworks and drainage design.
- This model enabled:
  - Mass haul calculation
  - Progress Reports
  - Machine Control Files
  - Sub base preparation
  - QC checks



NRCP Civil 3D Model





Attenuation Pond Model

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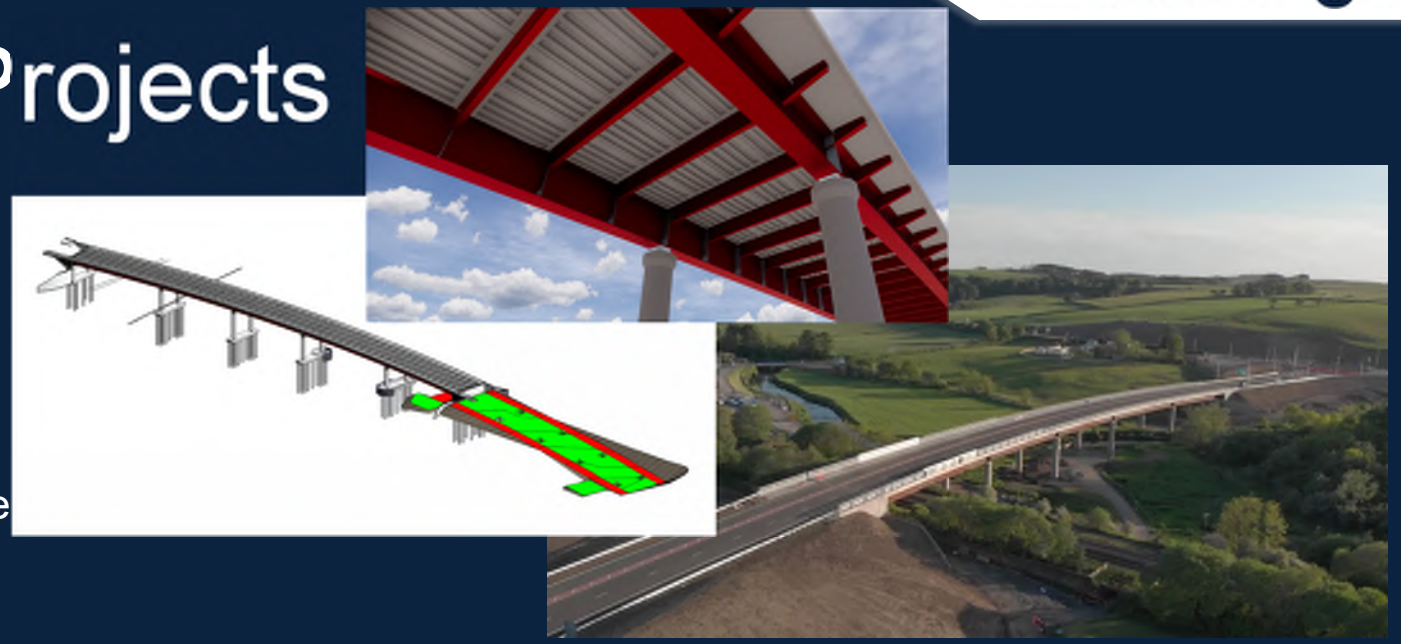
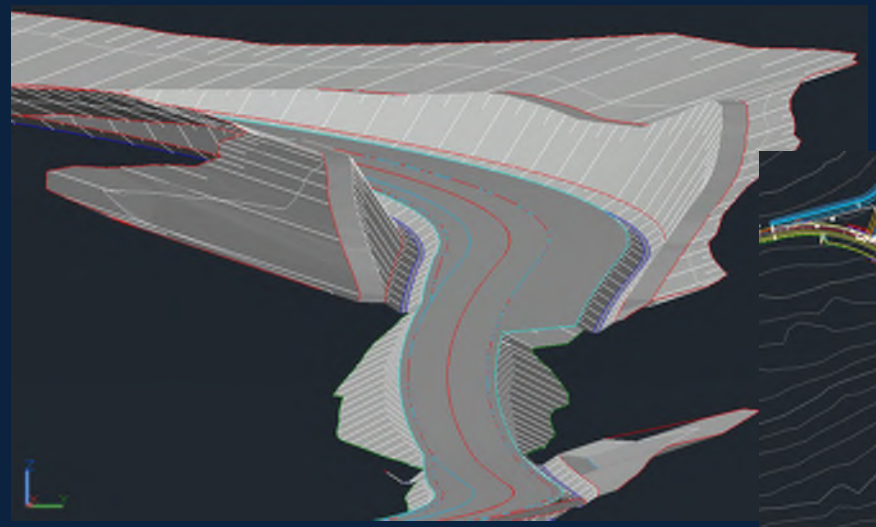
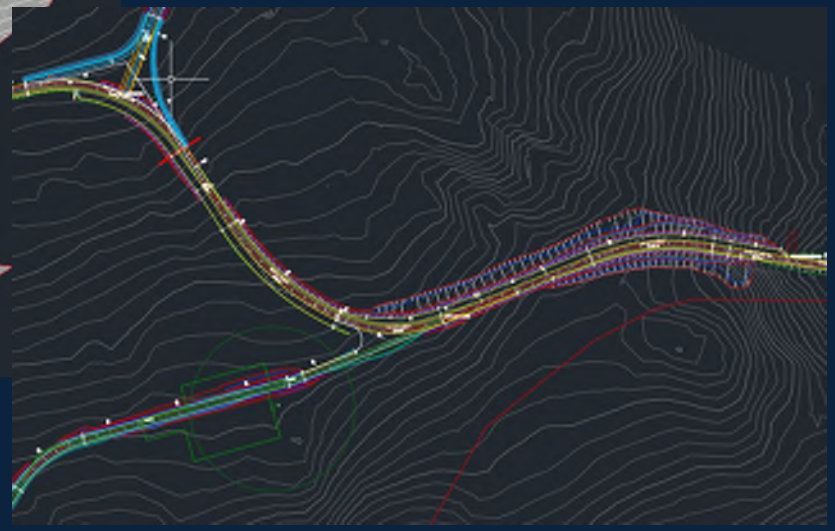
Projects

Project Name: Dalry Bypass

- A Revit model of the 250m Steel Viaduct over the River Garnock and Ayr/Glasgow Railway Line.
- Our sub-contractor Victor Buyck was engaged early to help with the optimisation of the bridge and fortnightly model reviews done.







Project Name: Windfarm (Private Client)

- Design of road networks in Civil 3D.
- Allows for optimization of Earthworks and micro-siting.
- De-risks the project through virtual design and seeing the potential issues.
- Utilise model files for setting out
- Use Geotech module to model strata.

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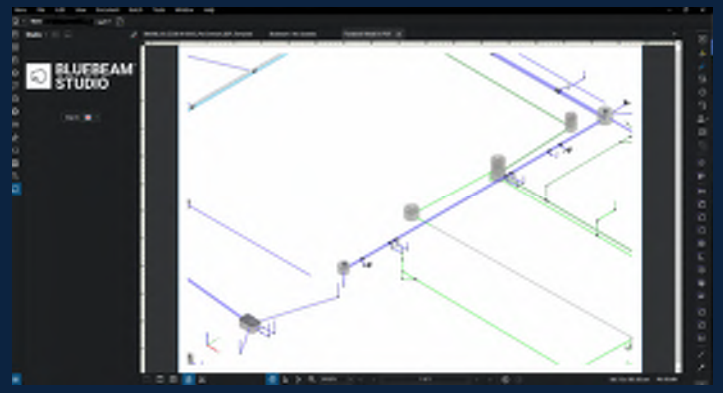
Digital Tools

Digital Tools

- CDE
  - Companywide CDE for BIM Projects
  - Have used the following CDE's on other projects
    - Aconex, BC, Asite, Viewpoint, Sherlayer & BIM 360 Docs
- Bluebeam.
  - Company wide standard Mark ups for review.
  - Studio allows us to collaborate with our team, partners and supply chain in reviewing drawings and documentation.
  - Take-offs.
  - Display 3D models in PDF
- Earthworks estimating software
  - Quantity measurement (Check Vs BoQ)
  - Mass Haul calculations and optimisation
  - PDF Quantity take-off allowing full audit of measure.



BLUEBEAM® REVU® 20 EXTREME

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Digital Tools

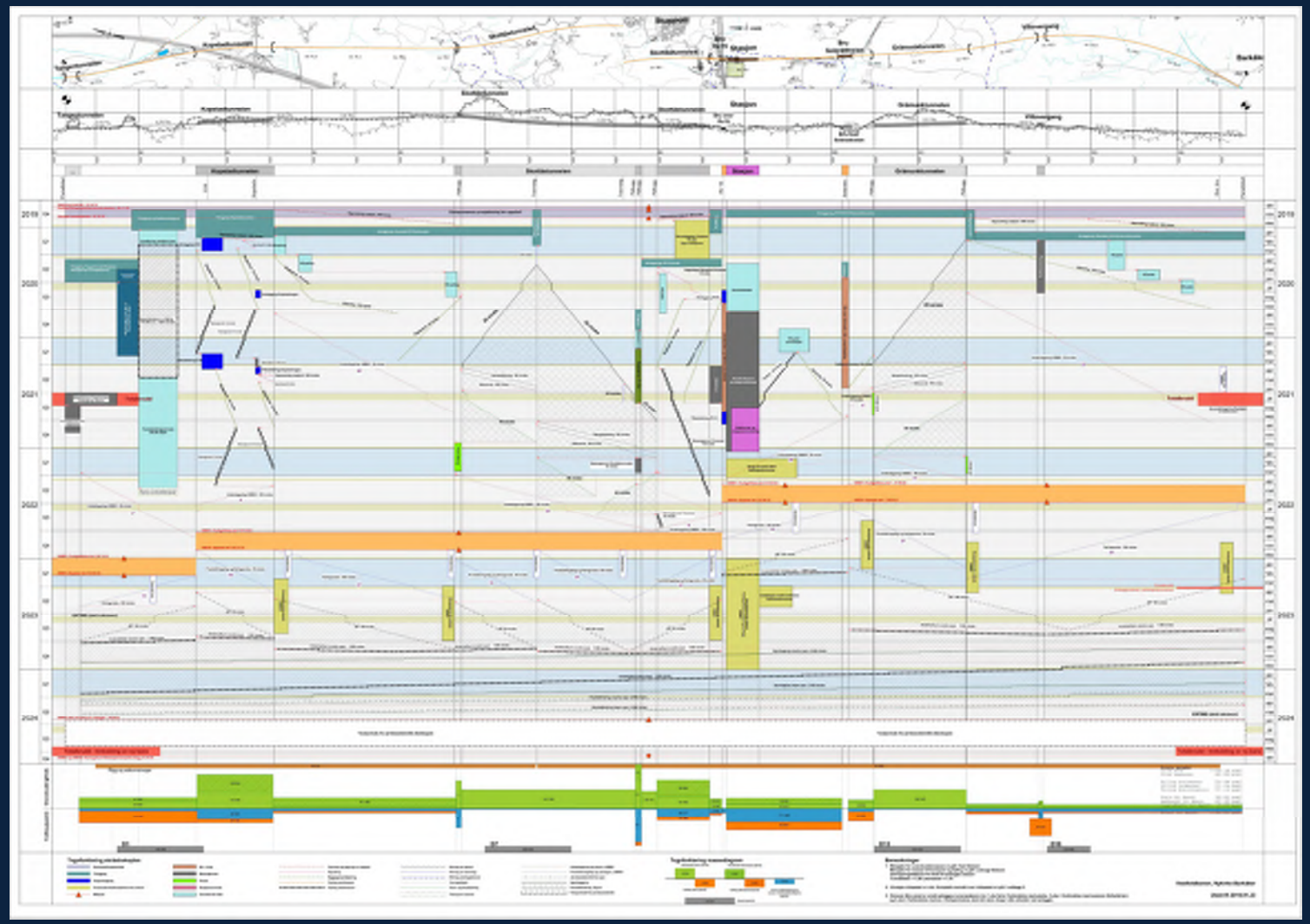
Time Chainage Modelling

- Visual Medium
- Accurate
- Easy to change
- Run different scenarios

Time Chainage Modelling

- Visual Medium
- Makes sense of huge programmes
- Great high level presentations to Boards

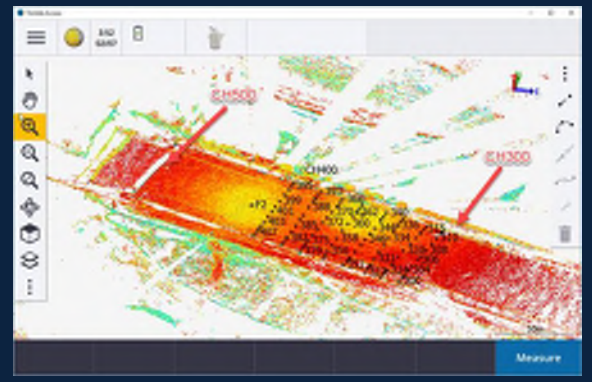
A picture tells a 1000 words ☺

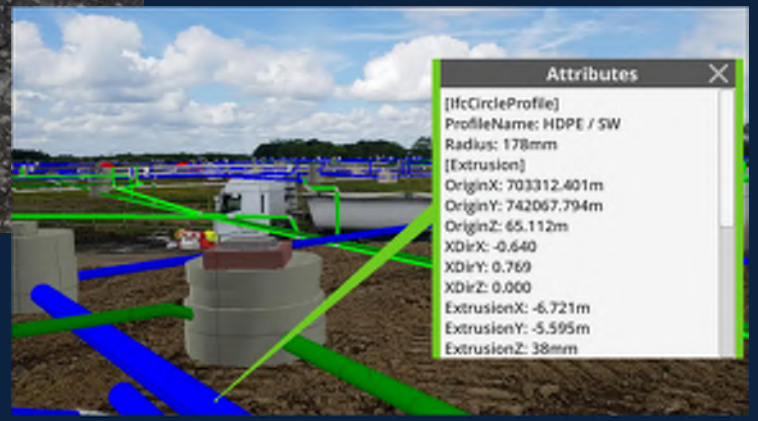


Software & Survey Equipment

Investment in Modern Survey Equipment

- Design Software
  - AutoCAD
  - Civil 3D
  - Revit
  - Trimble Business Centre
- Design Review Software
  - Navisworks
  - BIM 360 Docs
- Controllers
  - Trimble TSC7 Controllers allow setting out from model
  - Ability to handle large model sizes
  - Allow visual interrogation
  - 56 no. rover kits
- Scanners
  - Use Scanners to do high accuracy work
  - Repetitive tasks – survey control
  - Excellent for grid control surveying
  - Allow survey of live roads to be done offline without TM.
  - Allow As-builts to be compared against designs





Machine Control

Investment in Machine Control

- Excavators
  - Automatic real time digging with stroke sensing hydraulic cylinders and IMU sensor.
  - You will no longer worry about over digging.
  - When your bucket hits the target surface, the control function automatically limits and maintains grade with real-time bucket edge positioning.
  - Model the utilities onto the excavator machine control (geo-fencing)
- Dozers & Graders
  - Full 3D machine control whereby design is loaded remotely into machine
  - Using latest design
  - Grade right first time, no re-work
  - Increase productivity
  - 85 no. Machine Control kits
  - Active collision avoidance, whereby, AI will interpret its surroundings and stop the machine if it is going to strike/hit an obstacle/pedestrian.

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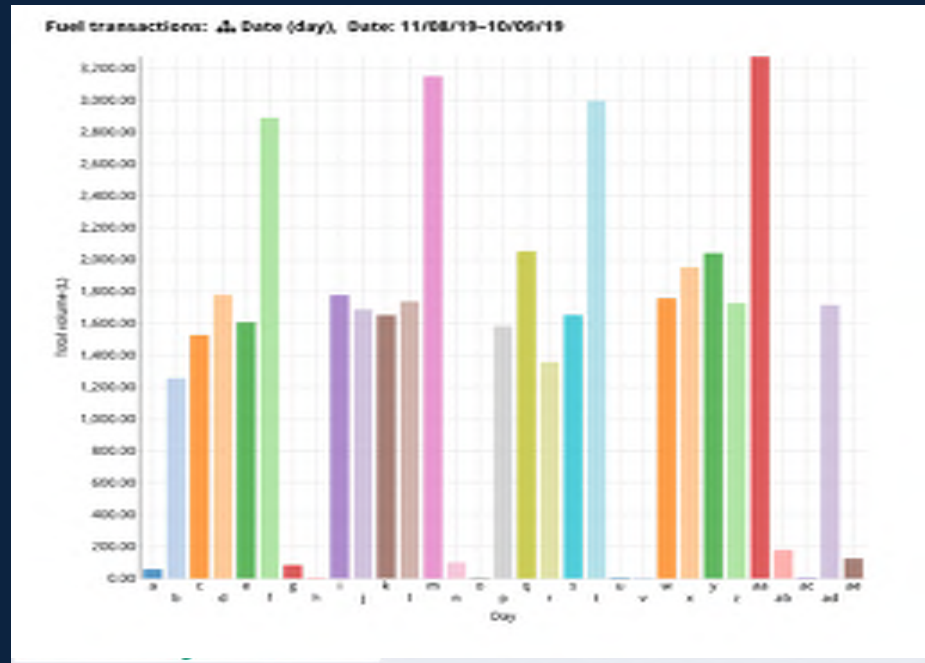
Analytics

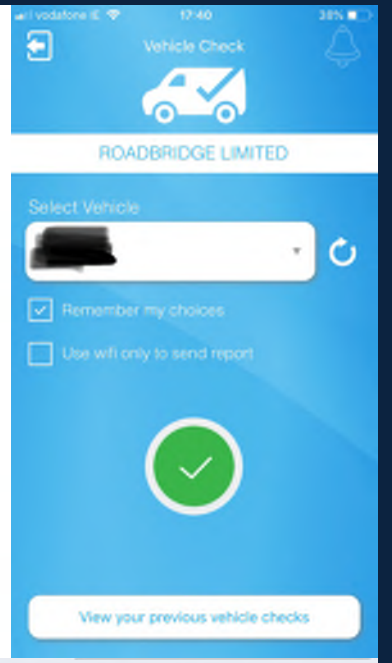
Machine Analytics

- Machine Utilisation (Expected Vs Actual)
- Fuel Usage (machine modes etc)
- Rock breaker hours (affects residuals)
- Location (geo-fence)
- Power modes (vs ground conditions)
- Energy Usage for ISO 50001

Fleet Analytics

- Fleet Diesel Usage and allocations
- Repairs costs
- Fitters time
- Whole life costings data
- GPS Tracking
  - Heavy braking
  - Speeding
  - Driving style
- Ties into our ISO50001 Energy Reduction Plan



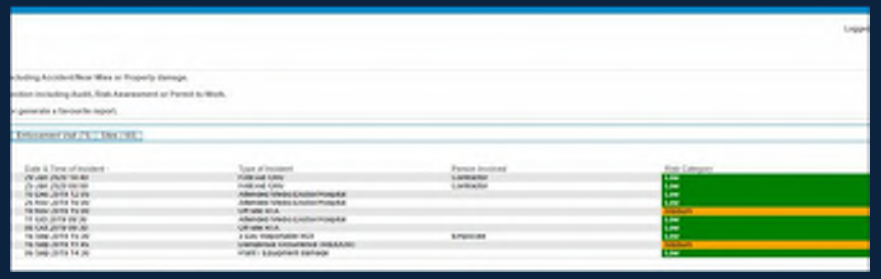


Group / asset	TOTAL WORKING TIME (H:M:S)	Period cost (£)	Fuel used (Gallons)	CO2 (KG)	TRAVEL HRS (H:M:S)	Distance (MI)	Stopped time (H:M:S)	Stop count	Idle Time (H:M:S)	Non utilised days
CP17RFN (Asset)	285:04:57	265.15	47.81	597.94	50:22:10	1802.94	453:35:37	154	03:11:11	9
CP17VNV (Asset)	296:01:36	434.02	78.26	1036.51	97:45:54	2856.38	198:15:42	307	13:16:15	5
CP17VUG (Asset)	167:29:18	208.26	37.55	617.47	80:59:28	1730.59	86:29:50	161	23:01:30	13
CP66GHJ (Asset)	218:02:11	336.94	60.75	796.70	83:15:41	2649.84	134:46:30	144	09:10:56	9
CP66GHN (Asset)	234:40:18	182.93	32.98	451.48	50:51:45	1284.78	183:48:33	182	07:38:19	7
CP66GHU (Asset)	54:11:16	32.76	5.91	95.63	12:35:36	284.10	95:56:07	31	03:25:15	24
Grand Total :	1255:29:36	1460.06	263.26	3595.73	375:50:34	10568.61	1152:52:19	979	59:43:26	67

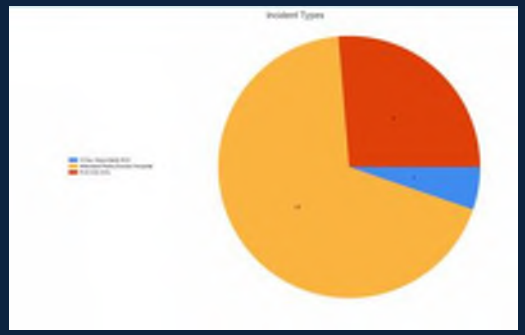
From date 01/05/2019 To date 31/05/2019
Groups Vehicles

HSEQ Analytics

HSEQ Analytics



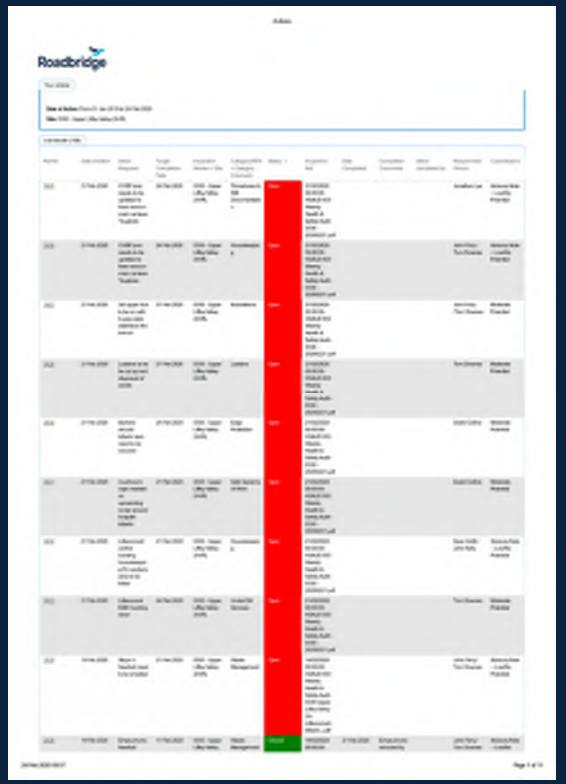
- Real time statistics
- Track leading indicators (Near misses etc)
- Senior Management Dashboards
- Trend analysis



“Knowledge is power. Information is liberating” Kofi Annan

- *Using the right data, to get the right result*

“The Navy thought it had discovered where its planes were suffering the most damage. Instead, it had discovered where its planes could take damage without being destroyed. It wasn’t looking at the whole sample set”



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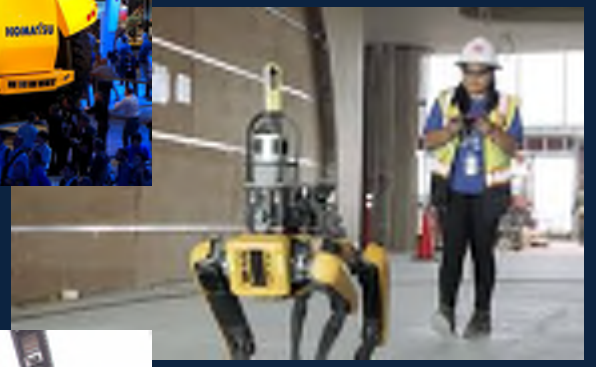
In a not too distant future on a site far, far away….

Automation

- Volvo & Komatsu trialling AI assisted cameras to reduce “struck by” accidents involving machinery
- Highways England did a trial on autonomous ADT’s on the A14 for 1 month.
- Robots checking our work (Boston Dynamics robot dog with Trimble Scanning)
- Trimble Hololens 2 –is primed for use in applications like reviewing design models, viewing complex instructions, or collaborating with experts back in the office while on-site

- Times are changing…….and BIM is laying the groundwork for our industry in the future.



Conclusion

- BIM is a tool that increases our efficiency, lowers our risk profile and promotes collaboration but it does not build anything.

- We want to improve on the four “C’s” every day
    - Collaboration
    - Control
    - Constructability
    - Continuous Improvement

- Roadbridge plan to be at the forefront of the digitization of Civil Engineering.