The Institute of Asphalt Technology

BIM and Data Capture During Road Construction

Ruairi Charlesworth – Development Manager

MATtest Southern

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Introduction

MATtest Southern

UKAS-accredited materials test house.

>50 technicians working across the Midlands, Southeast and Southwest of England.

Part of the MATtest Group – operating UK wide.

Highway Data Systems

MATtest's technology and innovation arm.

Achievements include the automated quality assurance (AQA) system, laser survey systems and the infra-red rate of spread app.

BIM and Data Capture

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BIM

- Building Information Modelling or Better Information Management.
- Means different things to different people.
- Is broadly a movement that seeks to digitise and make better use of information about a project and its assets throughout the course of a project's lifecycle.

Data Capture

- Can't have a data model without data!
- BIM models in highways are not taking advantage of opportunities to include important information.
- The quality assurance sector can help drive BIM adoption by digitising work practices, collecting more data and improving the quality of data.

Why Look For Improvement?

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BIM

More information means greater opportunities for better decision making.

Data Capture

There are opportunities for better data capture – we can't achieve better BIM application without collecting better data.

Health & Safety

Fewer people and vehicles on site will lead to reduction in accidents. It will also reduce carbon emissions.

Lower Cost

Cost reduction through electronic quality assurance methods and better informed lifecycle decisions.

Efficiency

Better management of material movements and paving operations will lead to more streamlined operations and shorter project construction times.

Conventional Testing

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Delivery Temperatures

Density Testing

Rolling Temperatures

Conventional Testing

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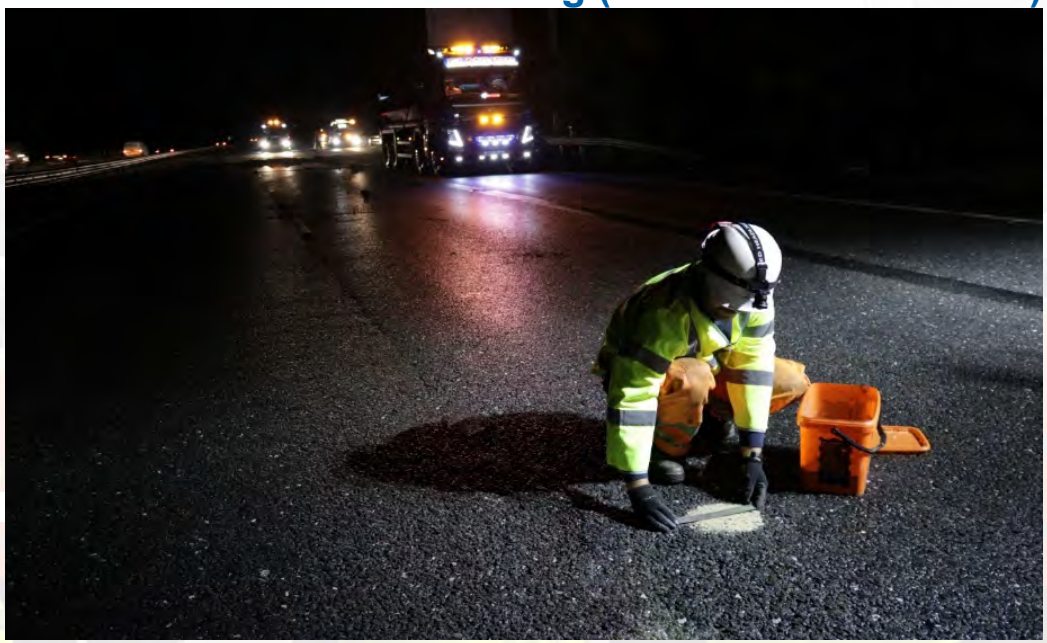
Rolling Straight Edge (Surface Regularity)

Sand Patch Testing (Surface Macrotexture)



Concerns with Conventional Testing

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Health & Safety Concerns – All Tests

- Lone working
- Roller interface
- Site traffic interface
- Hot material interface

Technical Concerns – Sand Patch and Rolling Straight Edge

- Unrepeatability
- Inaccuracy of test procedures
- Difficulty to locate defects
- Representative testing only

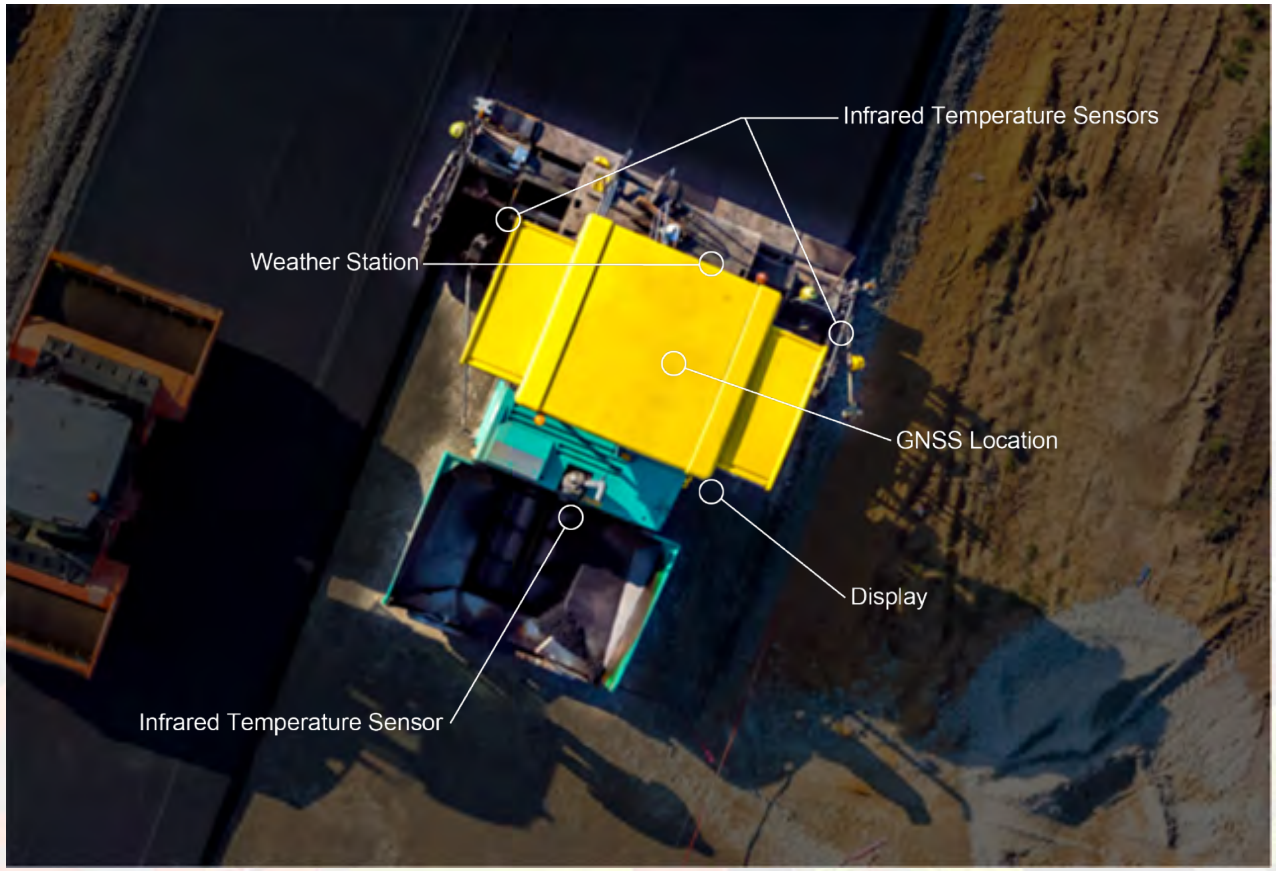
Technical Concerns - Temperatures

- Few measurements per load
- Temps taken from back of lorry – not necessarily representative of the full load
- Rolling temps only taken once per load

Technical Concerns - Compaction

- Small test area
- Only one test per wheel track per 40m required
- Most testing carried out after compaction
- Doesn't take advantage of new technology

Automated Quality Assurance – Paving Operations



- Three temperature sensors
- Continuous testing
- GPS rather than chainage/grid reference
- Volume of data greatly increased

Pave-IR Scanning

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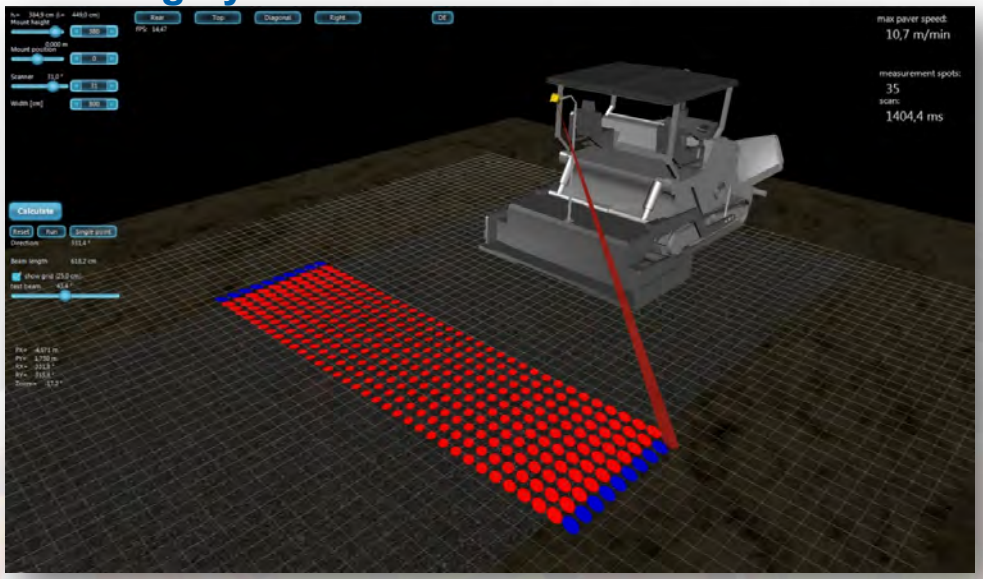
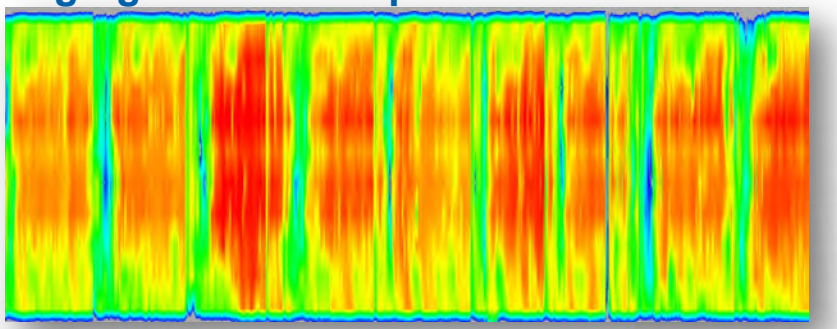
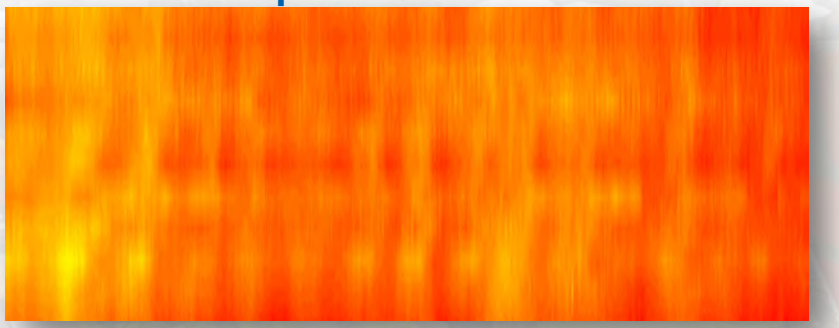
Scanning System



Segregated thermal profile



Good thermal profile



Automated Quality Control – APEX

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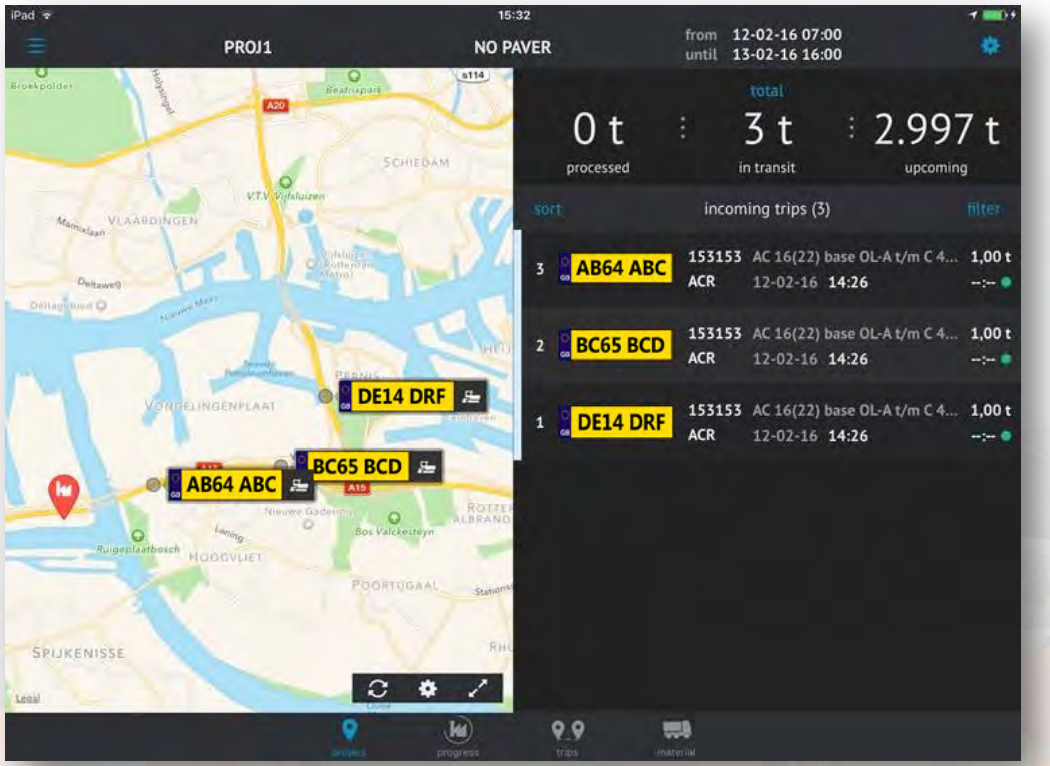
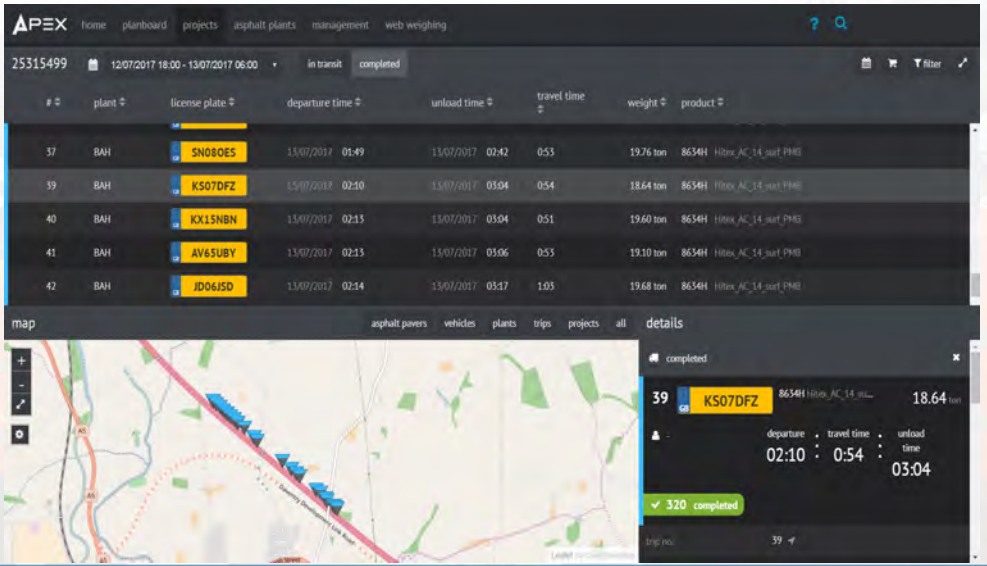


- All material is tracked from plant to site
- Full laying record for every load of material
- GPS/time stamped for accuracy
- No more arguments over waiting time!



Measuring the Rate of Spread of Pre-Coated Chippings Using an Infra-red Camera.

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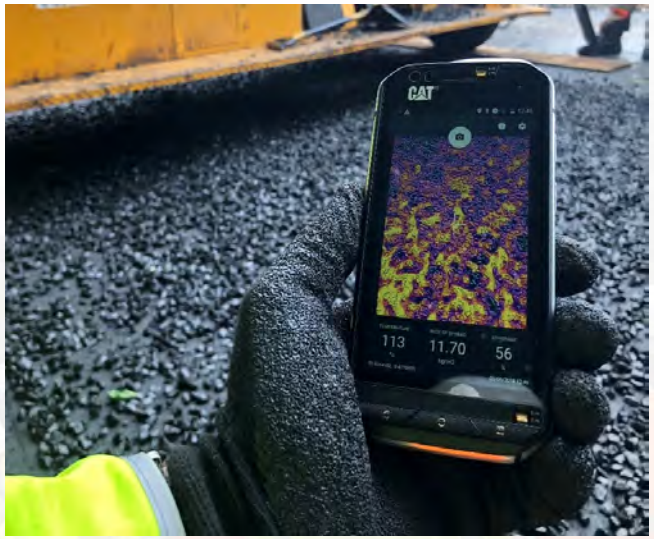
Safety improved by taking operatives away from dangerous site machinery.

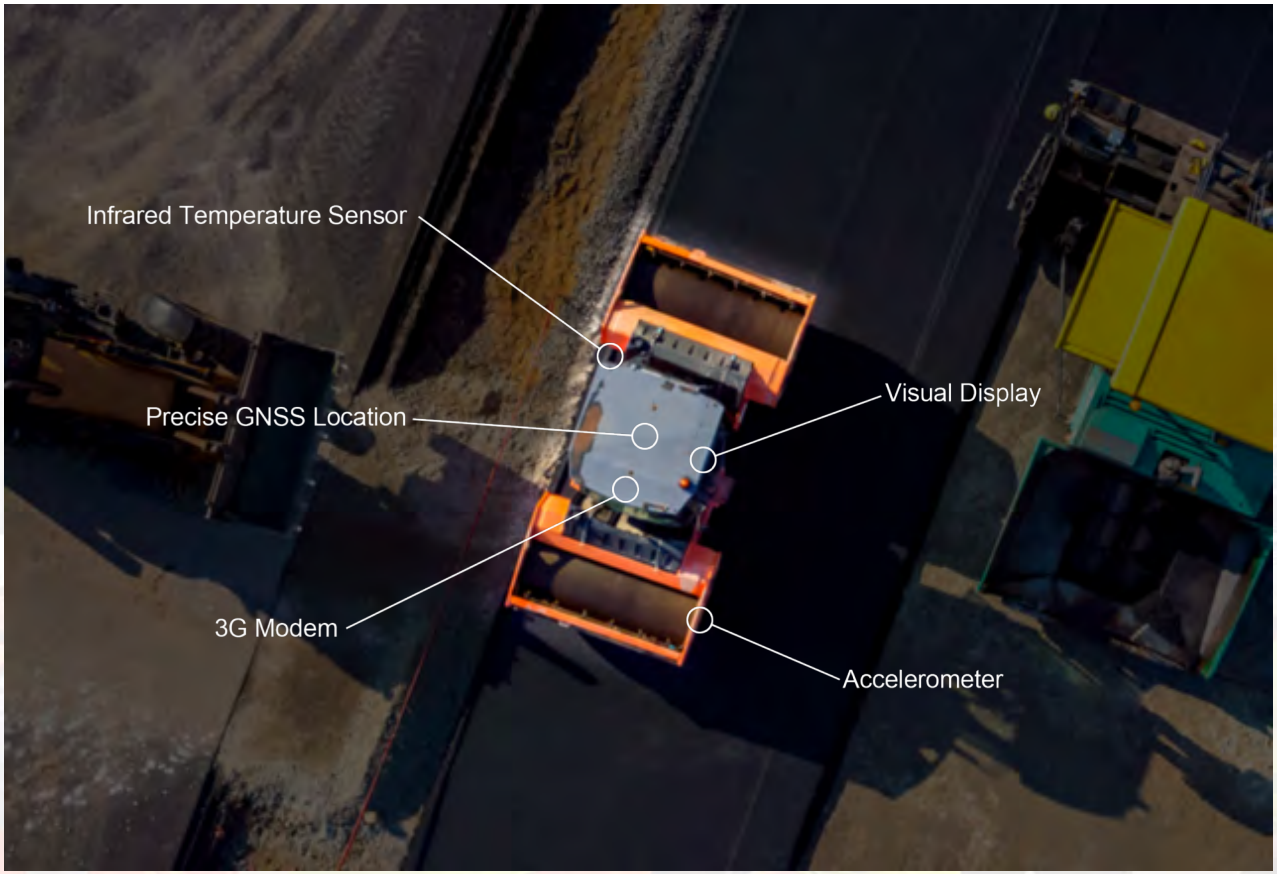
Improves test quality through using better technology.

GPS and time-stamped.

Calculates % coverage as well as kg/m2.



Automated Quality Control – Roller Operations



- Real-time compaction control information for operatives
- All areas covered rather than representative testing.
- Volume of data greatly increased

Real-time Compaction Control

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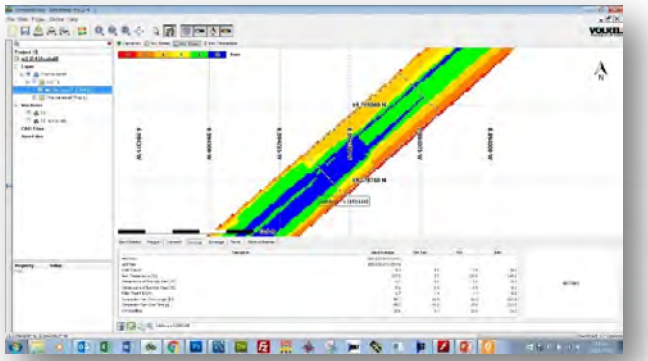
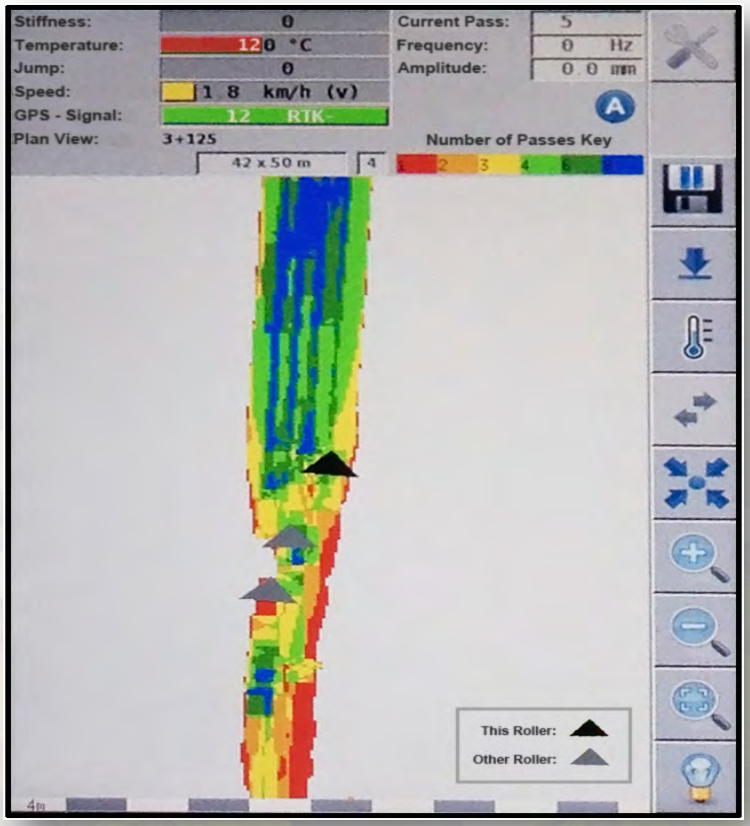
Analysis Software



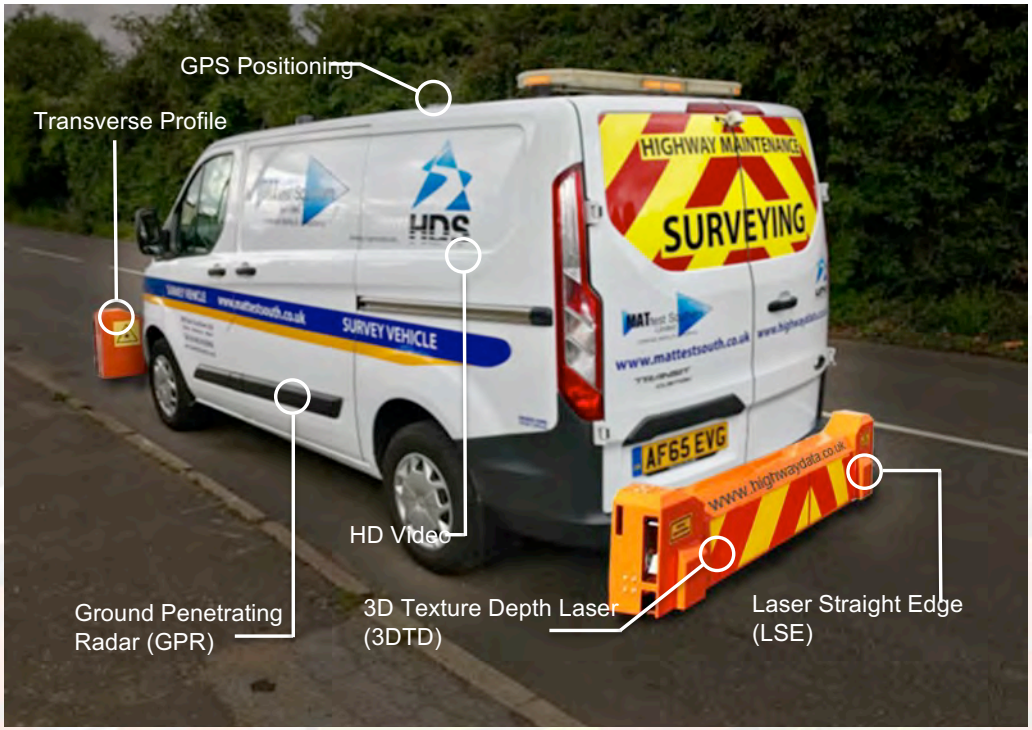
In situ image

Monitor display screenshot



- Rollers are calibrated in the same way that PQIs are currently.
- Cores taken to ensure compliance.
- 100% coverage
- Complete picture of the road

Surveys: Surface Regularity, Macrotexture and More



- Replacing the use of sand patch testing and rolling straight edge.
- GPS and time stamped.
- Texture measurements using calculations from EN 13036-1
- Regularity testing compliant with SHW 702.5
- Remove techs from potentially hazardous test environments.
- Massively larger data sets with better quality information.

Data Flow Process Diagram

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Data Presentation – Halfway House

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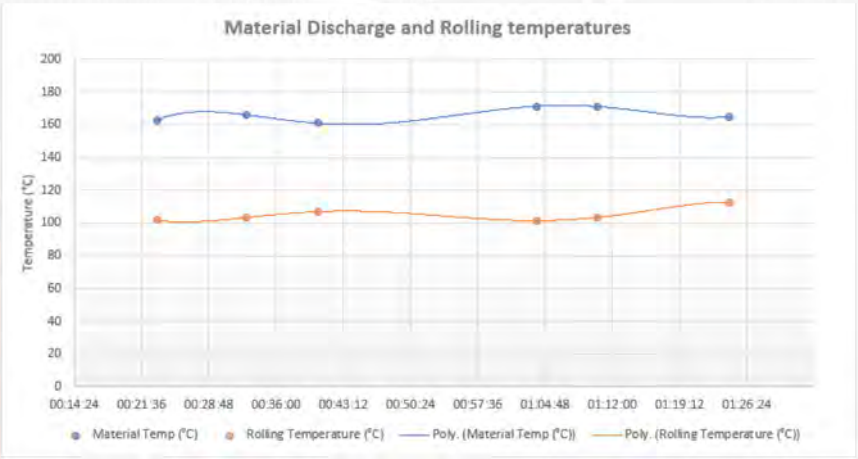
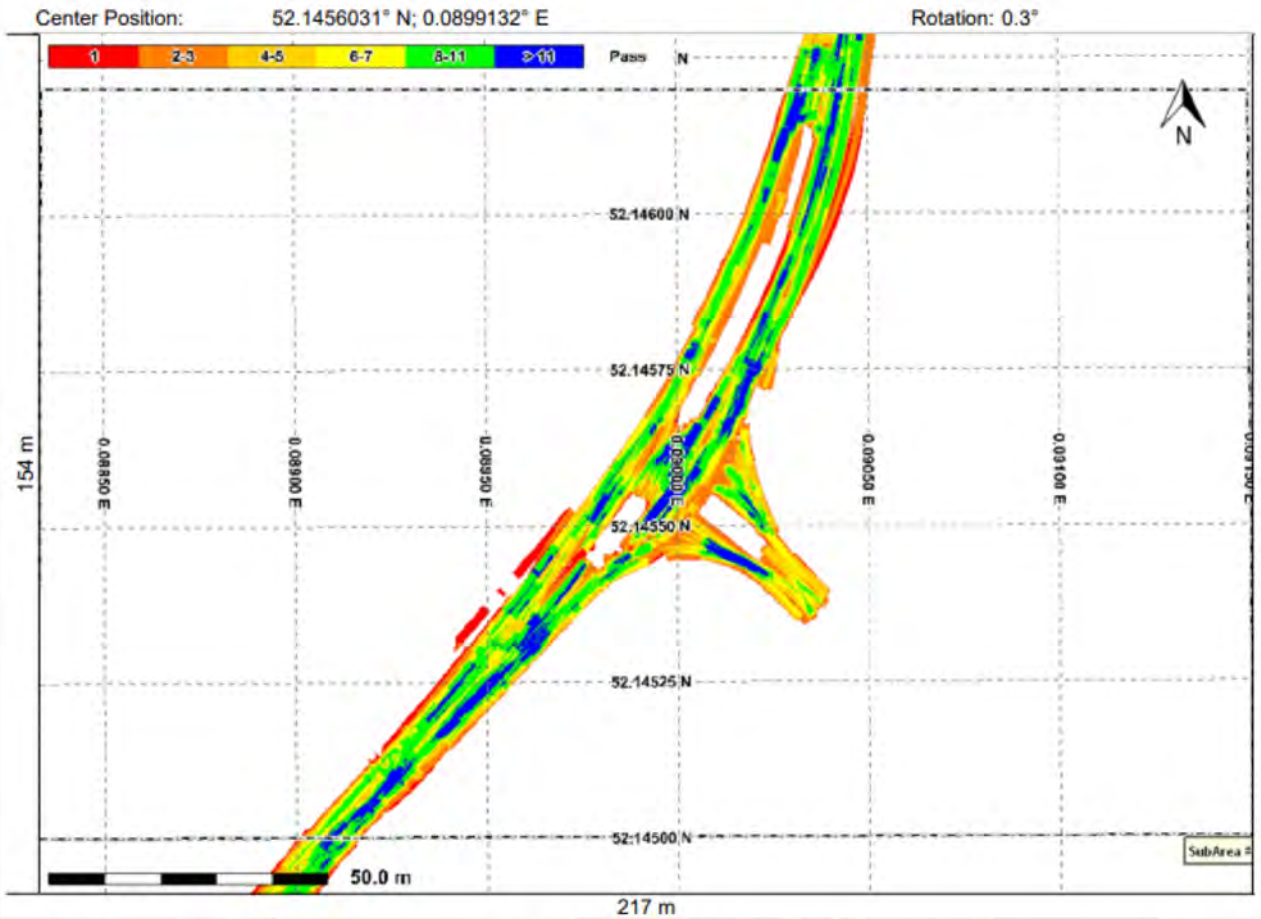
Site	Client	JobNo	Date	Paver ID	Ticket ID	Registration	Plant	Product Code	Material	Tonnage	Load Time
x	x	27875830	2018-04-06	BARTEC01	GBV108-IGN-3	AY66TGO	x	8634H	x	19.8	2018-04-06 23:20:00
x	x	27875830	2018-04-06	BARTEC01	GBV108-IIA-3	KP13MHY	x	8634H	x	19.68	2018-04-06 23:27:00
x	x	27875830	2018-04-06	BARTEC01	GBV108-IEU-3	AB65ASB	x	8634H	x	19.54	2018-04-06 23:26:00
x	x	27875830	2018-04-06	BARTEC01	GBV108-IBH-3	AY18LWR	x	8634H	x	19.98	2018-04-06 23:42:00
x	x	27875830	2018-04-06	BARTEC01	GBV108-IEA-3	KY12LZK	x	8634H	x	19.8	2018-04-06 23:46:00
x	x	27875830	2018-04-07	BARTEC01	GBV108-IQJ-3	KY61JZU	x	8634H	x	20.04	2018-04-07 00:03:00

Time at Paver	Latitude / Easting	Longitude / Northing	Distance (m)	Material Temp (°C)	Rain / Humidity	Air Temperature (°C)	Air Pressure (hPa)	Wind Speed (km/h)	Rolling Temperature (°C)	Roller Passes (Average)	Comments
2018-04-07 00:23:16	52.6562834	-1.8908025	59	163	75	5	989	6	102	6	NA
2018-04-07 00:32:49	52.6562917	-1.8900578	122	166	75	6	989	5	103	11	NA
2018-04-07 00:40:34	52.6562489	-1.8908022	185	161	75	5	989	3	107	4	NA
2018-04-07 01:03:55	52.6562623	-1.8899054	248	171	73	7	989	6	102	10	NA
2018-04-07 01:10:28	52.6562752	-1.8891124	311	171	73	6	989	4	104	13	NA
2018-04-07 01:24:32	52.6563084	-1.8884323	374	165	75	6	989	3	113	13	NA



- Conventional data is presented in a recognisable way
- Data can be plotted on a map
- Takes advantage of improved data capture
- Is still a conventional excel report
- Not integrated with other data

Data Presentation – Halfway House



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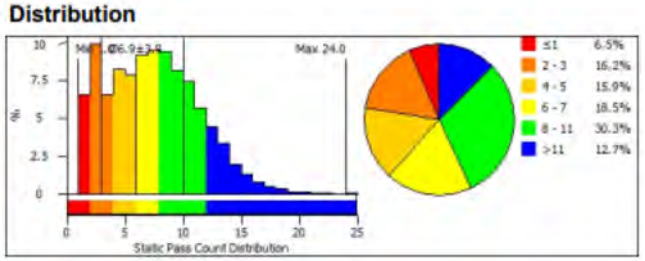
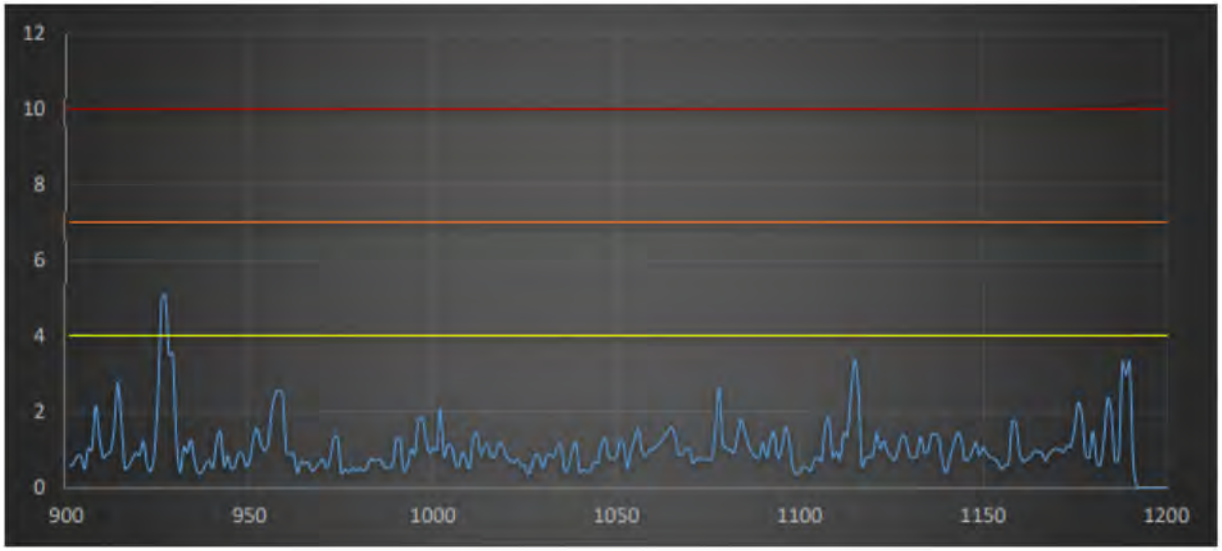


- Visualisation of roller data
- Huge increase in data
- Not especially usable
- Isn't integrated with other data sets

Data Presentation – Halfway House

Eastbound Lane 1 **900 - 1200 metres** (Total survey length = 1192 metres)



Eastbound Lane 1		
PASS		
> 4mm	> 7mm	> 10mm
1	0	0

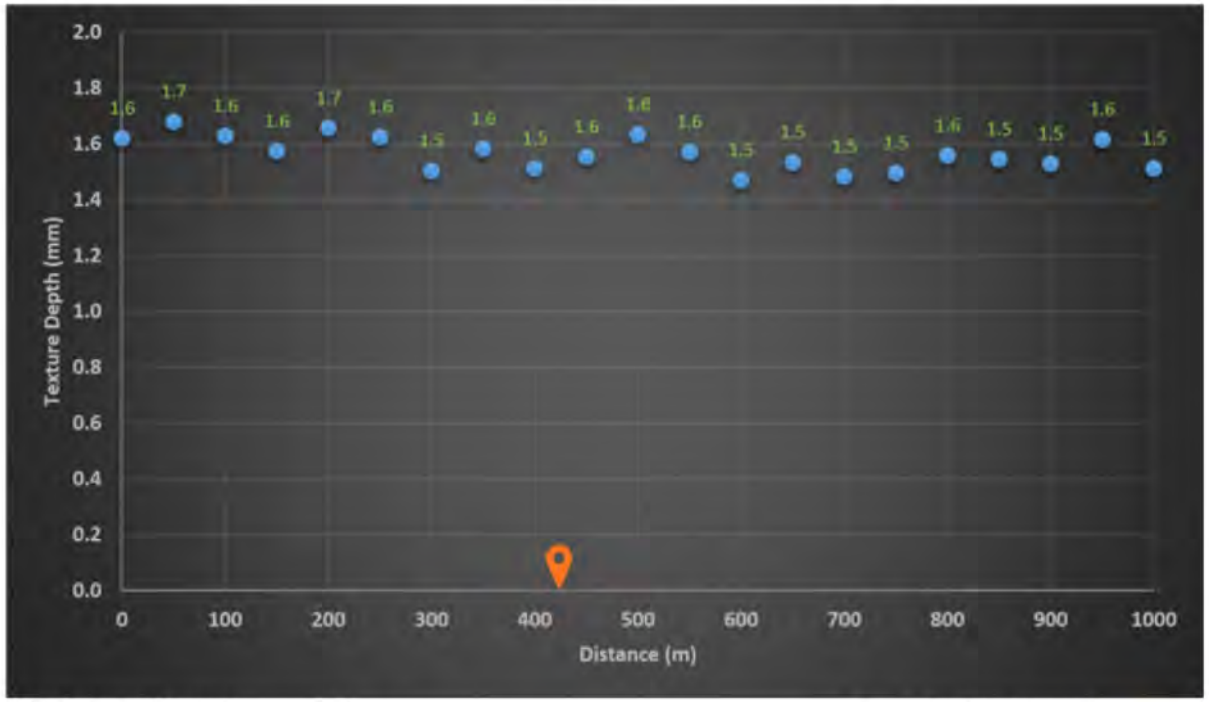
*Please refer to table 7/2 in the appendix for surface Regularity requirements.

- Laser straight edge retains same investigation levels.
- Results for the entire length of the road.
- Gives a better idea of rideability
- Other calculations such as International Roughness Index (IRI) can be calculated

Data Presentation – Halfway House

Test Results

Northbound Lane 1 **0 - 1000 metres** (Total survey length = 3700 metres)



1000 metre Average: **1.6**

*Please refer to table 9/3 in the appendix for Texture depth requirements.

Event Marker Legend:

Old material patch

- **Laser texture meter gives results directly comparable to sand patch testing.**
- **Apart from with especially high textured materials.**
- **Sand/glass disappears into the matrix.**

Data Presentation – More Exciting Possibilities

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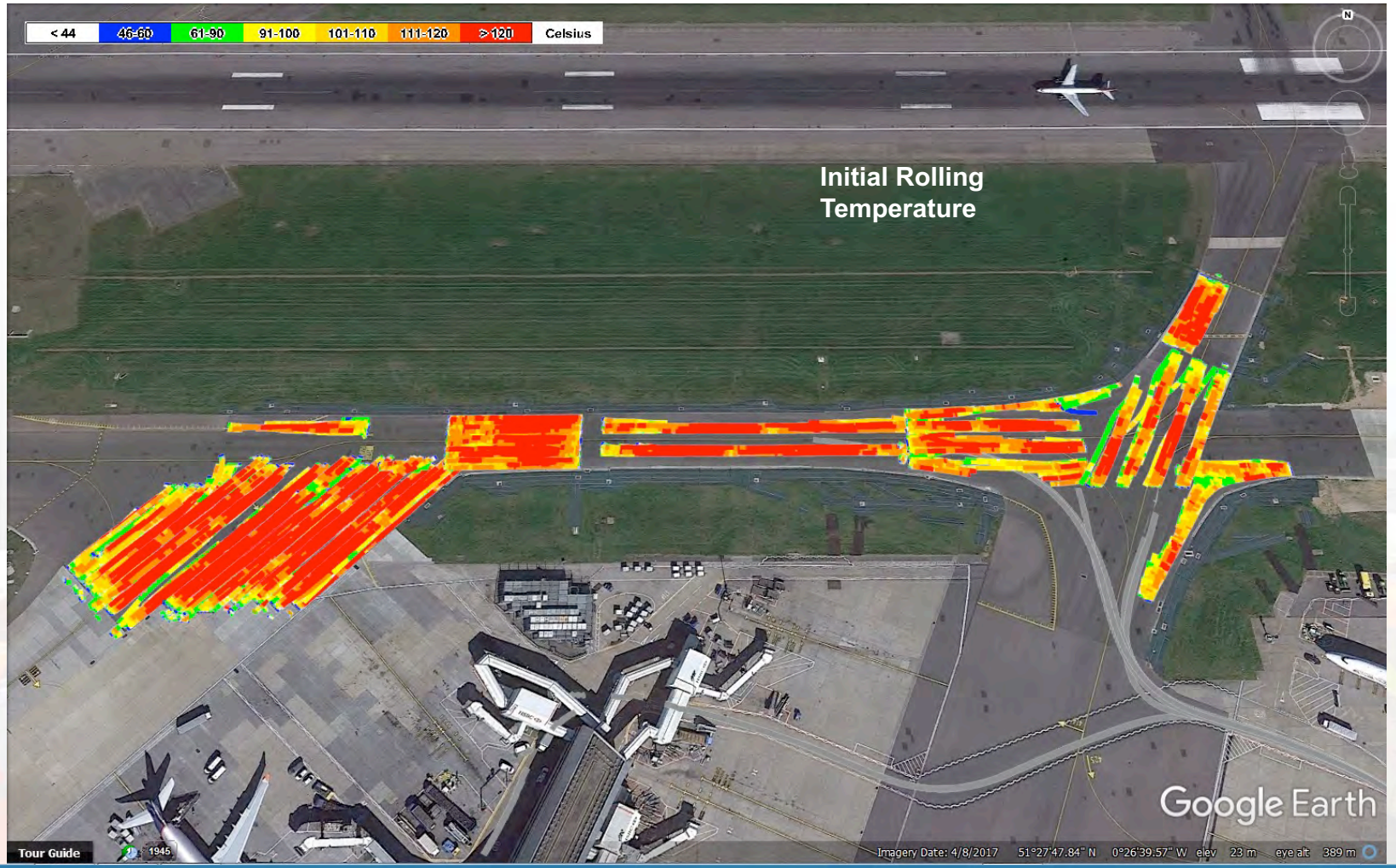
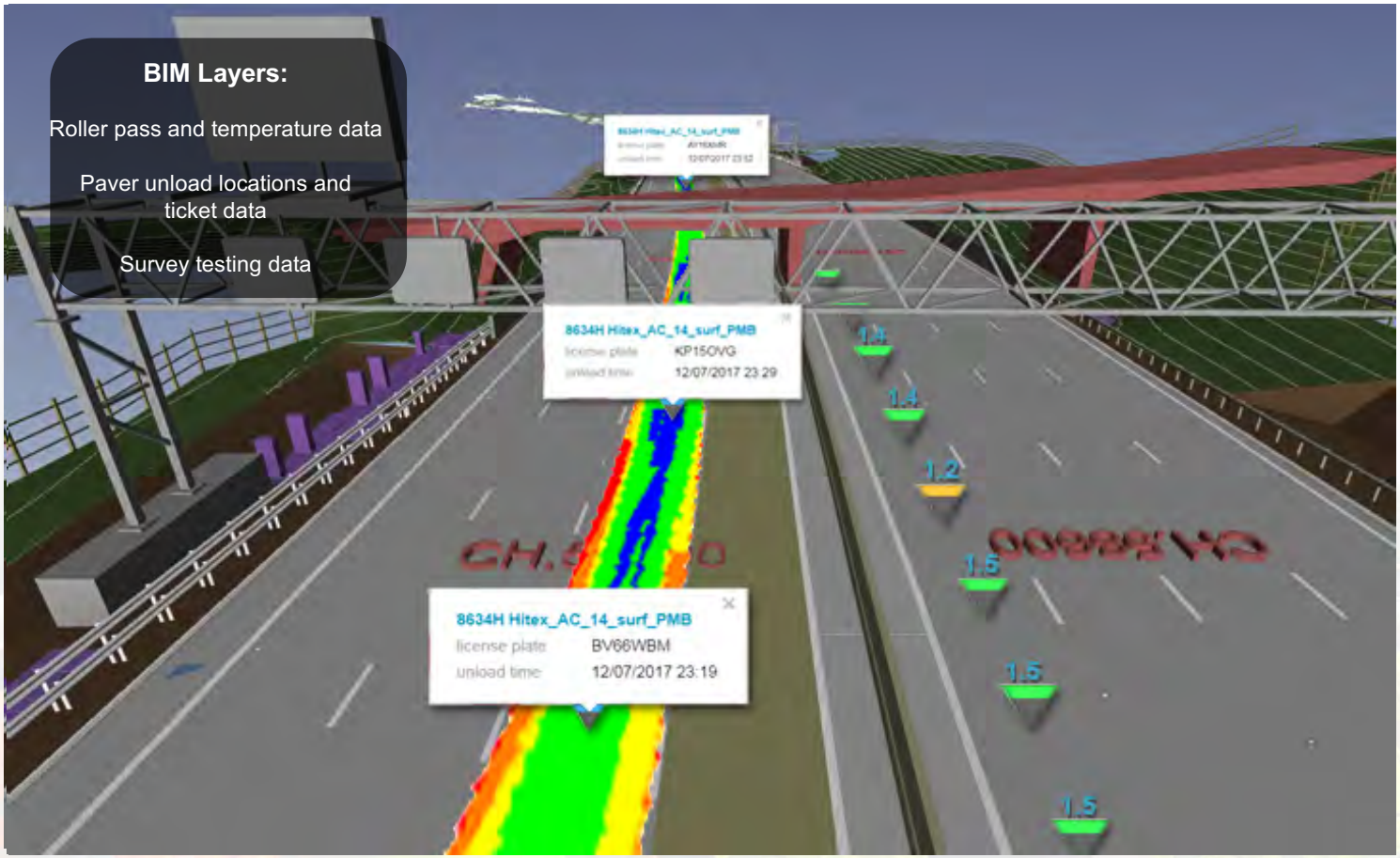


Data Presentation – More Exciting Possibilities



Data is usable and more easily interpretable.

All data sets are represented on the same platform

Huge opportunities through massively increased data availability.

The missing link between QA and asset management?

No more PDFs – eventually

Moving beyond BIM level 2

Integration Into Asset Management Systems

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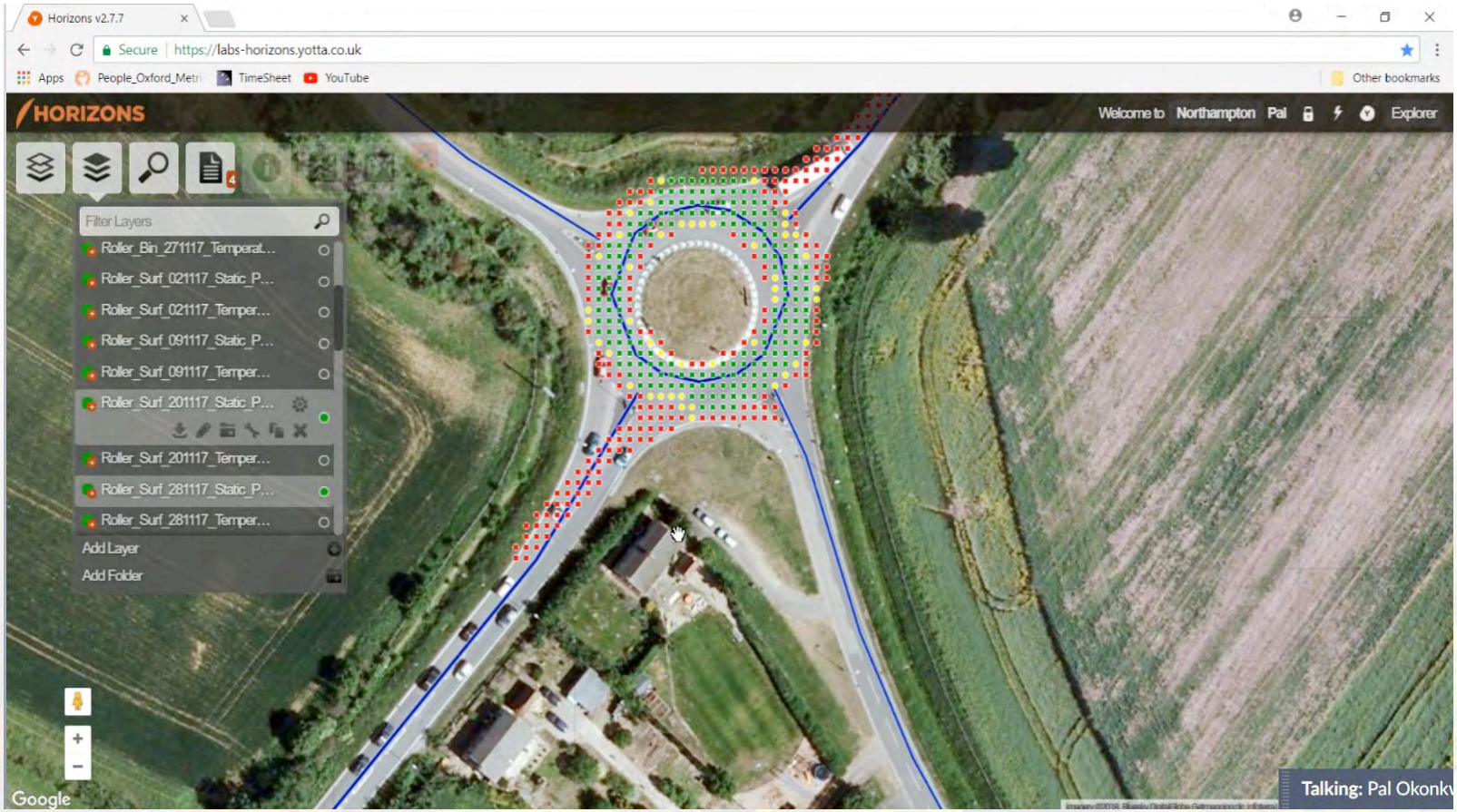


Working with AI and Yotta

Integrated roller data into the Horizons system

Gives far more roller information than conventional testing

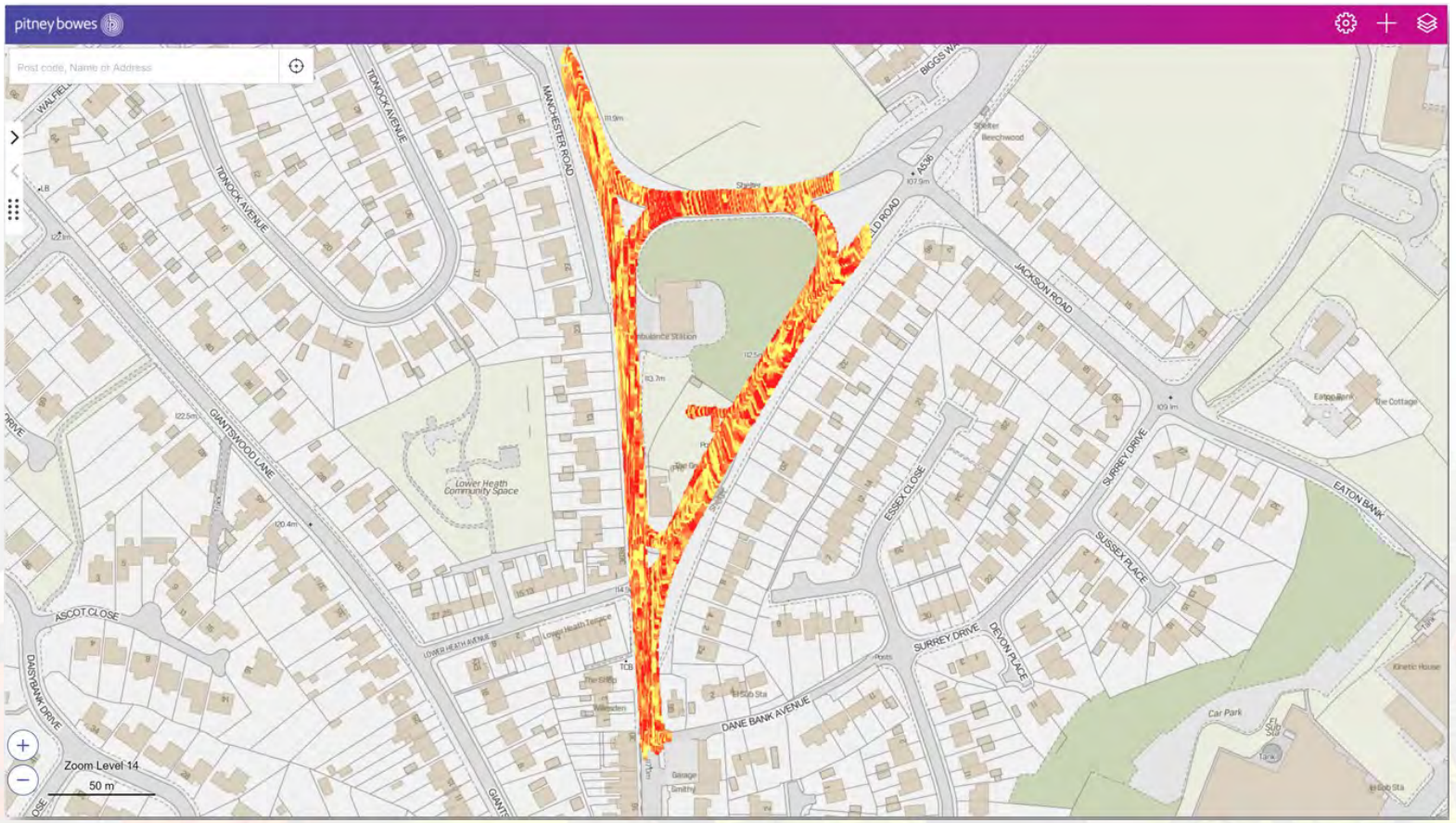
Is far easier to interpret and use

Integration Into Asset Management Systems

However, there is a some extraneous detail.

Specifications and contract documents need to be updated.

Integration Into Asset Management Systems



What level of detail is required?

Data transfer protocol – is there space to do this within current frameworks?

The Future of Quality Assurance

- These methods offer significant opportunities for improvement in the testing and construction of highways in the UK.
- Opportunities to improve health and safety have to be taken.
- Increased quantity and quality of data makes BIM applications possible.
- Standards and industry practice will have to change.

Thank You

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