



Pavement Evaluation 2019



VIRGINIA
TECH™

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Roanoke, Virginia

The use of Pavement Management Systems (PMS) to manage and process the “big data” sets generated from continuous measurement road condition surveys to develop practical maintenance plans and budgets.

By

Graeme Paterson, BSc C.Eng MICE
Associate Director, W.D.M Limited

Big Data... e.g. vehicle based continuous road condition surveys

Safety
measurements



e.g. Continuous Friction using SCRIM® :

WDM's SCRIM® combines Texture, Skid Resistance, IRI and Alignment measurements nominally every 4 inches and summarized every 33 feet (10m).

Around 5000 pieces of data per mile.

Structural
measurements



e.g. Deflection Measurement (Deflectograph):

WDM's Deflectograph Data is collected and summarized at around 120 inch intervals and collects deflection on both wheeltracks

Around 3000 pieces of data per mile.

Functional,
Safety and
Structural
measurements



Road Assessment Vehicles(RAV): e.g. WDM's SCANNER and TRACS4:
"road speed" measurement of around 40 parameters including Texture, Rutting, Alignment, Profile, Cracking etc. Collected at down to 1 inch intervals summarized at 33 feet (10m intervals):

Around 7000 pieces of data per mile.

PE 2019

Big Data... Typical Road Network

e.g. Scottish Government Major Road Network is 2,200 miles.

Similar length to the National Highway System of a medium size US State (Utah or NJ)

Each year, they survey around:

- 4400 miles SCRIM
- 2200 miles SCANNER
- 800 miles Deflectograph



Approximately 35 million pieces of data per annum.

This data has been collected continuously since 1989 and this is managed within their Asset Management System (around 1 billion pieces of data).

RAV's - New TRACS4 Vehicle

WDM have been working on the development of models making better use of the very detailed 3d profiles from SCANNER and TRACS4 vehicles (around 1.5 million measurements per mile)

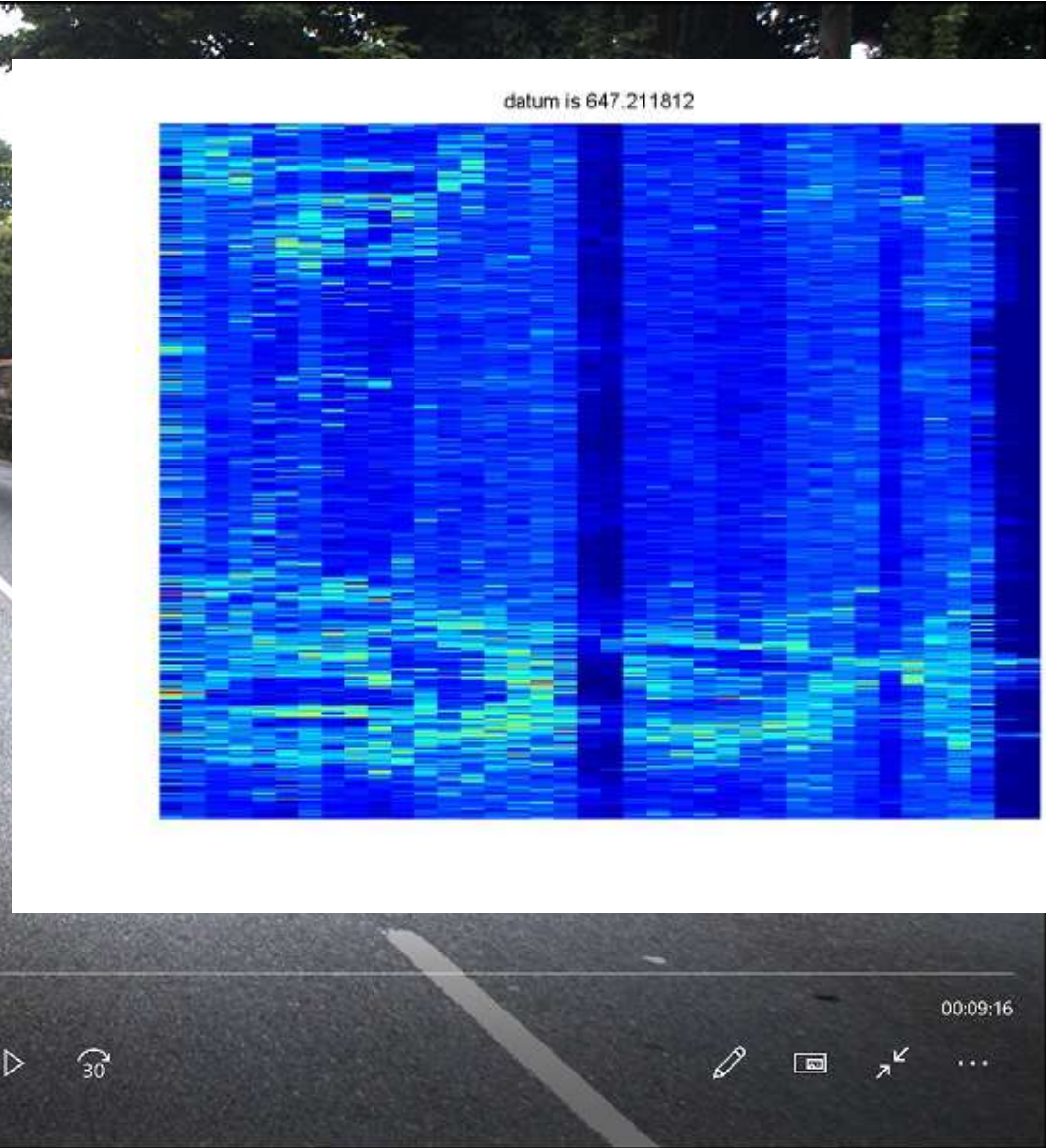
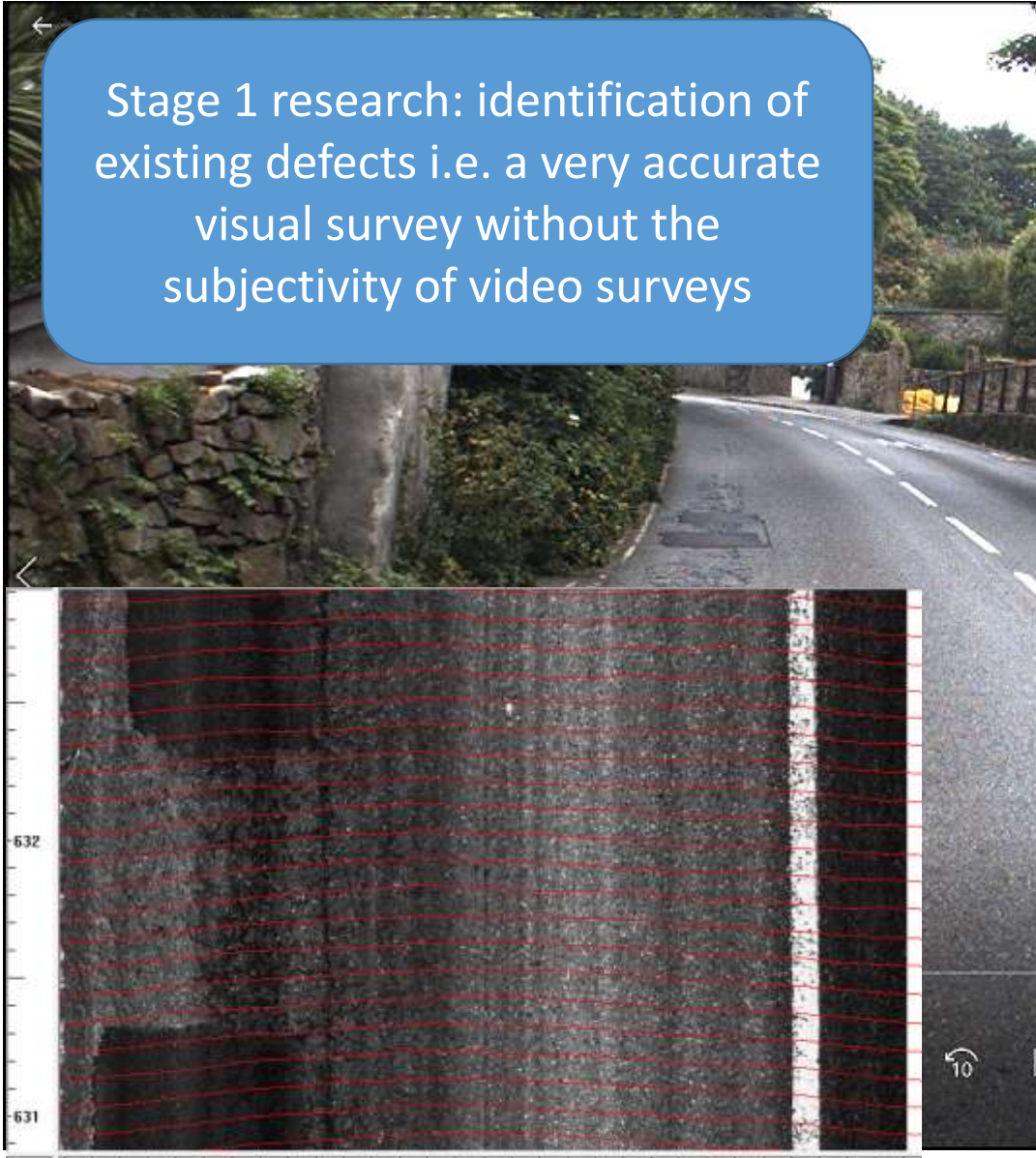


Latest RAV vehicle developed by W.D.M. Limited for Highways England TRACS4 Contract (English Government)

Uses Laser Crack Measurement System (LCMS) 3d Crack detection plus Retro-Reflectivity sensors and greater detail for transverse and longitudinal profile measurements

Fretting/Ravelling Prediction – using SCANNER and TRACS

Stage 1 research: identification of existing defects i.e. a very accurate visual survey without the subjectivity of video surveys



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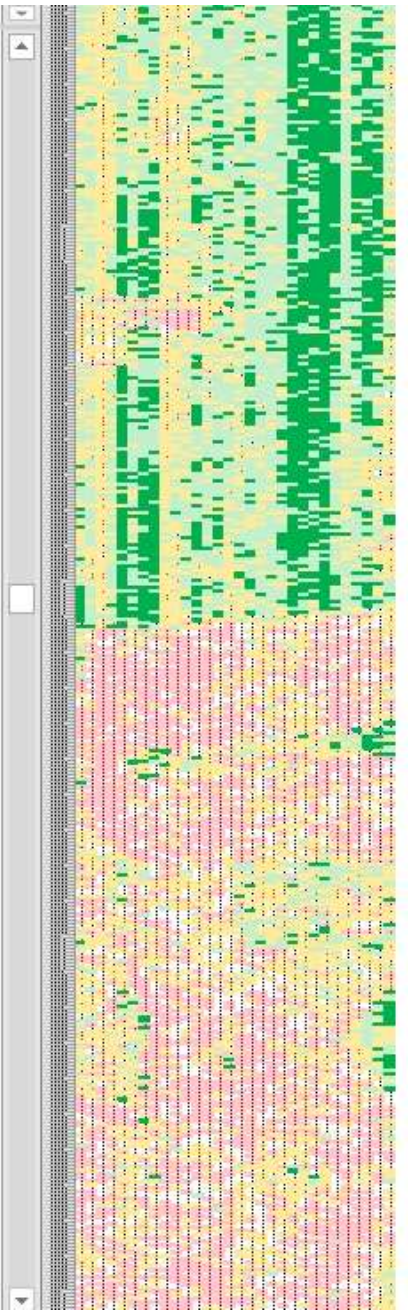
Stage 1 research:
RHS – statistical representation of transverse and longitudinal profile

LHS: summarising profile in a meaningful manner for wheel tracks and whole carriageway

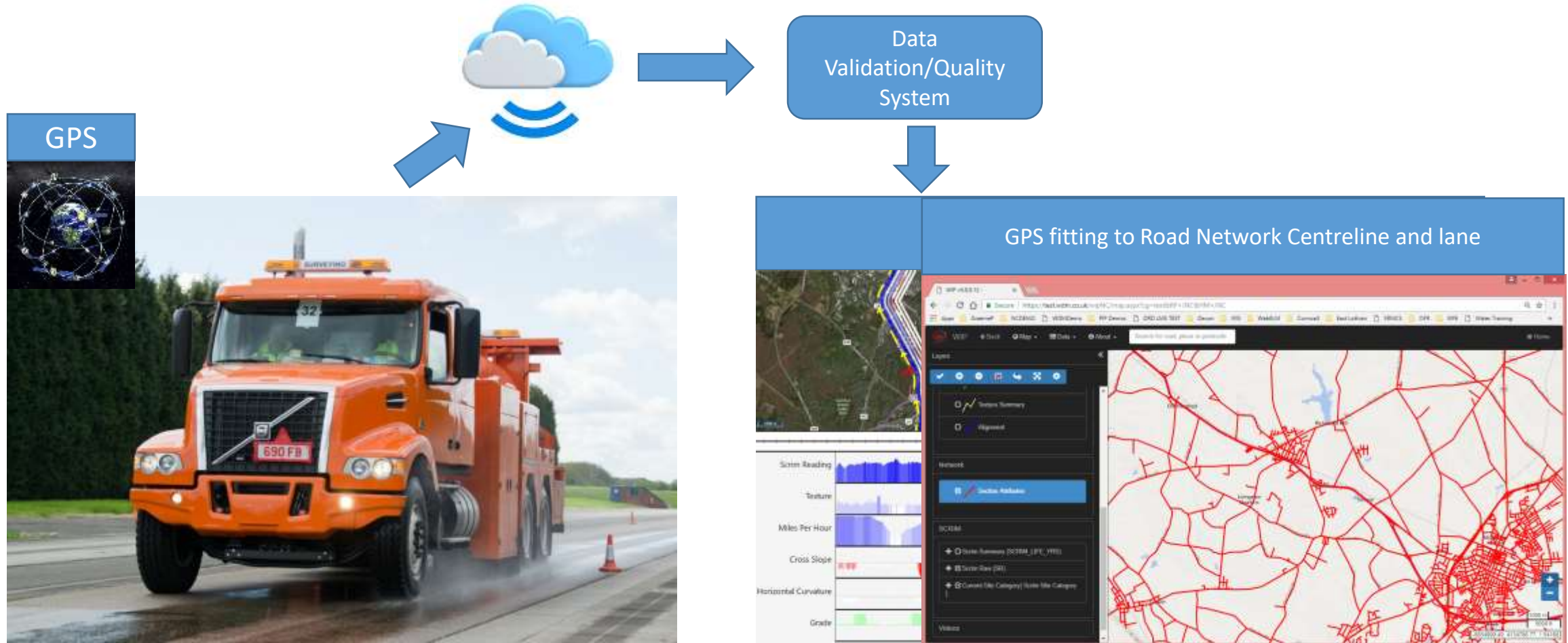


Stage 2: since WDM provide 70% of all RAV surveys in UK

We are currently using surveys from many years to refine prediction models in advance of defects becoming visible

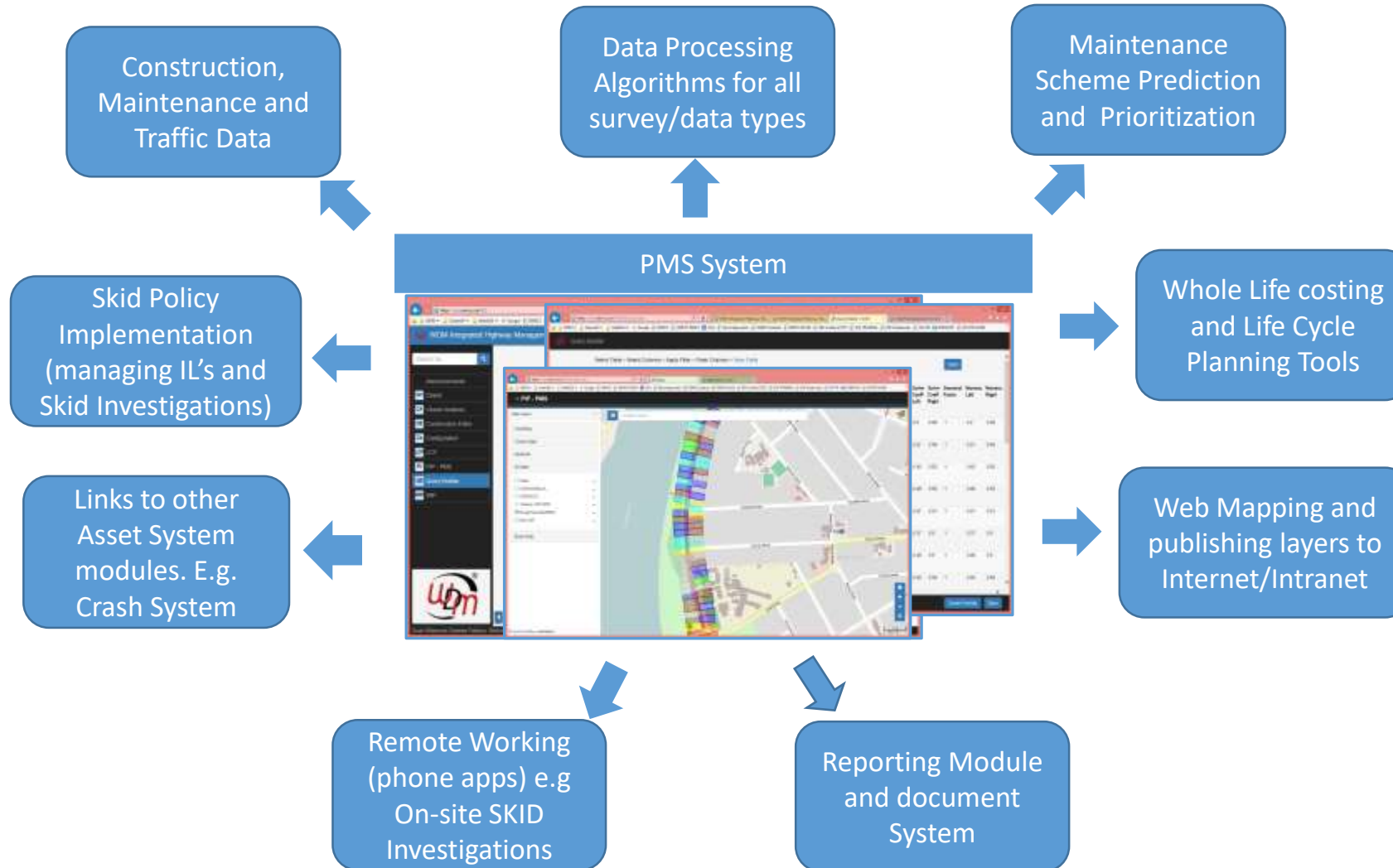


Survey data needs to quickly be available in your PMS



Pavement Management System (PMS)...

Key functions required to facilitate managing these “Big Data” sets



Integrated Mapping/GIS tools...

Easy access to all datasets both summary and detailed



PMS – construction/maintenance database...

This allows you to maintain a history of all treatments, material specifications, contractors, aggregate source etc. Useful for monitoring performance of treatments etc.

PMS also needs management systems for Traffic statistics and Maintenance Policy.

Construction Edit 1.7.37 - D7YXPL1 JSQ2005 - webseris

File

CL1 View at '31/March/2007' 100% Include Works Record on Add Layer

Road Name: A68

Start Metres: 0
End Metres: 47
Psv: 0
Aav: 0
Thickness: 40
Treatment Type: INLAY
Material Type: Stone Mastic Asphalt
Material Source: Maintenance scheme data form
Material Specification: RMC Viatex
Binder Type: Bituminous
Aggregate Size: 12
Aggregate Type: Crushed rock
Texture Type: Dense
Layer Date: 14/September/2005

Sections

- 13001/05 - NATIONAL BOUNDARY TO JCT. A6088 HAWICK (D1S4H4)
- 13003/05 - A6088 HAWICK TO JUNCTION LETHEM (D1S6H4)
- 13003/29 - LETHEM TO JUNCTION C31 FALSIDE (D1S4H4)
- 13003/61 - C31 FALSIDE TO JUNCTION C35 CHESTERS (D1S6H4)
- 13003/87 - C35 CHESTERS TO JCT B6357 BONCHESTER BR. (D1S6H4)
- 13005/05 - B6357 BONCHESTER BRIDGE TO INCHBONNY BR. (D1S6H4)
- 13009/05 - INCHBONNY BRIDGE TO JUNCTION PLEASANTS (D1S6H4)
- 13009/37 - JUNCTION PLEASANTS TO JUNCTION WATERSIDE ROAD (D1S4H4)
- 13009/68 - WATERSIDE ROAD TO STATION BRIDGE (D1S4H4)
- 13011/05 - STATION BRIDGE TO JUNCTION A698 KELSO (D1S5H4)
- 13013/05 - A698 KELSO TO JUNCTION A698 HAWICK (D1S6H4)
- 13015/05 - A698 HAWICK TO JUNCTION B6400 ANCRUM (D1S6H4)**
- 13015/13 - B6400 ANCRUM TO JUNCTION C66 SANDYSTONES (D1S6H4)
- 13015/29 - C66 SANDYSTONES TO JCT. C52 LONGNEWTON (D1S6H4)
- 13015/78 - C52 LONGNEWTON TO JUNCTION A699 SELKIRK (D1S4H4)
- 13019/05 - A699 SELKIRK TO JCT B6404 ST.BOSWELLS (D1S4H4)
- 13019/10 - B6404 ST.BOS. TO ST OF ISLAND (B6398) (D1S4H4)

depth (mm.)

Treatment Type

- NONE
- ANTI SKID
- INLAY
- OVERLAY
- RECONSTRUCTION
- RETEXTURE
- STRUCTURAL INLAY
- SURFACE TREATMENT
- THIN OVERLAY
- MICROSURFACING
- NEW CONSTRUCTION
- PATCHING

Update Layer Add New Layer Remove Layer Colour By (Currently Treatment Type) Set XSP (Currently CL1)

Layers

- NETWORK
- SCANNER RAW v1 inc 2018
- SRMCS RCI at 31st March 2018
- SRMCS RCI at 31st March 2019
- HISTORICAL RCI LAYERS
- DATAVIEW LAYERS
- VIDEOS
- MAINTENANCE
 - Maintenance 2015/16
 - SURFACE DRESSING**
 - RESURFACING
 - Maintenance 2014/15
 - Maintenance 2013/14
 - Maintenance All Years (LAYER DATE)

PMS Processing...merges all datasets together to produce useful outputs.

The screenshot displays a web-based GIS application interface. At the top, the browser address bar shows the URL `apps1.wdm.co.uk/WipScotland/?RP=/Scotland&cg=South%20West`. Below the browser, there is a search bar with the text "Search for road, place or postcode". The main map area shows a residential area with a road highlighted in red and green. A popup window titled "Sw Predicted Micro Schemes" is overlaid on the map, displaying the following data:

Field	Value
Str Life Yrs	-4
Fun Life Yrs	32
Saf Life Yrs	-4
Treatment Area	120
Treatment Type	OVERLAY
Treatment Depth	95
Treatment Cost	3094

On the right side of the interface, there is a "Layers" panel. It includes an "Automap" section with three icons (checked, a person, and a gear). Below that is a "SW Summary Condition Data" section with a list of data items, each with a checkbox:

- SW CRACKING SUMMARY
- SW CRACKING SURVEY DATE
- SW Deflectograph Summary
- SW Deflectograph Survey Date
- SW PROFILE Summary
- SW PROFILE Survey Date
- SW RUT Summary
- SW RUT Survey Date
- SW SCRIM Summary
- SW SCRIM Survey Date
- SW TEXTURE Summary
- SW TEXTURE Survey Date
- SW PREDICTED MICRO SCHEMES

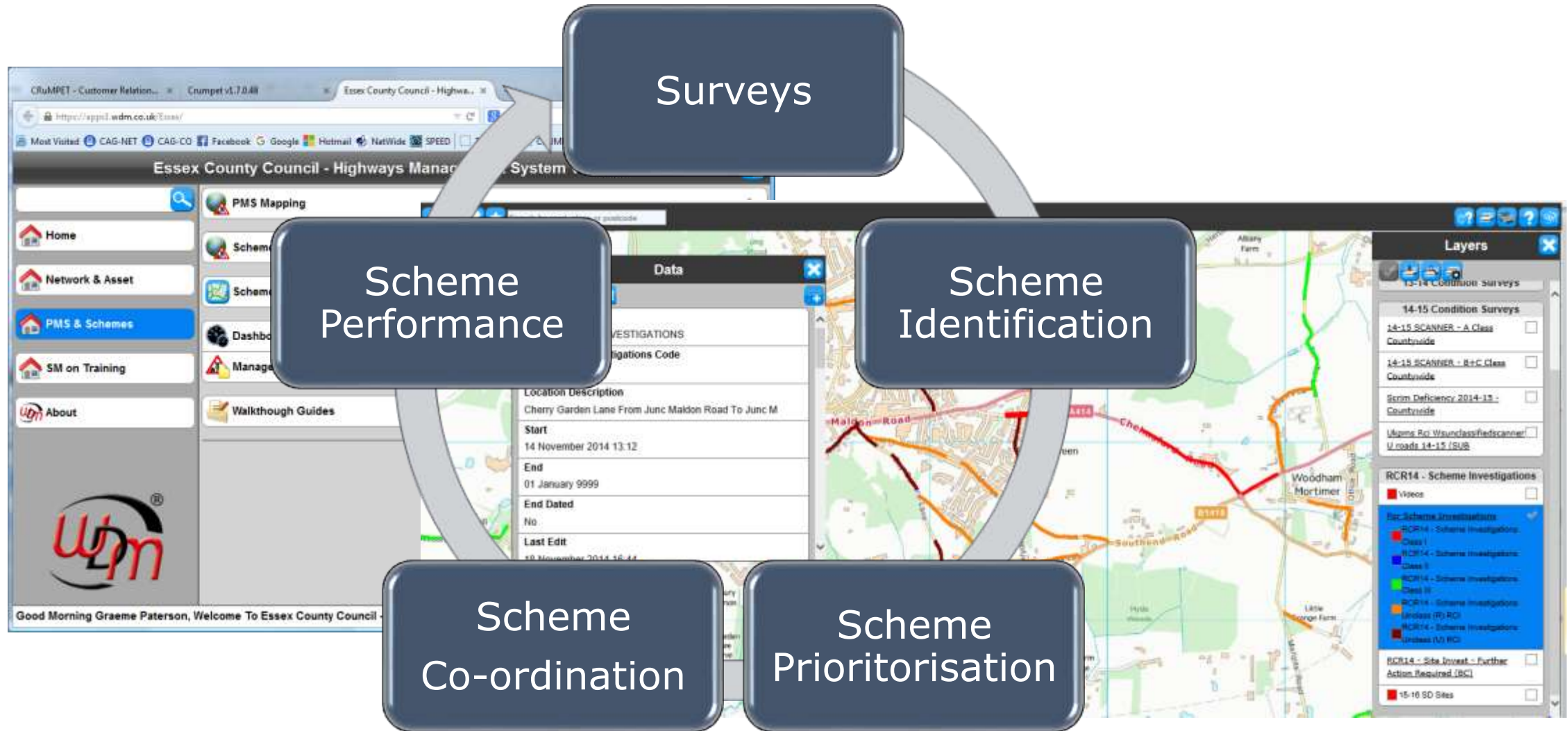
At the bottom of the "Layers" panel, there is a legend for the "SW PREDICTED MICRO SCHEMES" layer:

- Overlay (Red)
- Inlay (Yellow)
- Surface Treatment (Green)
- Reconstruction (Cyan)
- None (Grey)

The bottom left corner of the map shows a scale bar (20 m / 100 ft) and coordinates: `296441.42, 577107.37, 1:1250 - (Map License No: 100046668)`.

PMS Processing...Maintenance Scheme Management

... from inception to completion



PMS Processing - Whole Life Costing and Life Cycle Planning models based on “real” proposed maintenance Schemes and programs

This both calculates costs to meet the desired Maintenance Policy but also allows testing of various actual budgets to gauge their effect on network condition.

- Announcements
- CH Charts
- CA Cluster Analysis
- CE Construction Editor
- Co Configuration
- LCP LCP**
- FP - FMS
- QB Query Builder
- WIP WIP



Proposed maintenance cost

Defectograph CI Scanner RCI SCRMI CI

Year	Required	Proposed 1	Proposed 2	Proposed 3	Proposed 4	Proposed 5
2015	€117,485	100000	€0	€0	€0	€0
2016	€8,830	€100,000	€0	€0	€0	€0
2017	€27,845	€100,000	€0	€0	€0	€0
2018	€34,965	€100,000	€0	€0	€0	€0
2019	€77,070	€100,000	€0	€0	€0	€0





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Continuous Friction Measurement and PMS

Continuous Friction measurement...e.g. WDM US SCRIM®...



US SCRIM built for FHWA in 2015 and operated by Virginia Tech. (LHS in background)

Measures SCRIM Coefficient, Texture (MPD), Horizontal Curvature, Grade, Cross Slope and Video

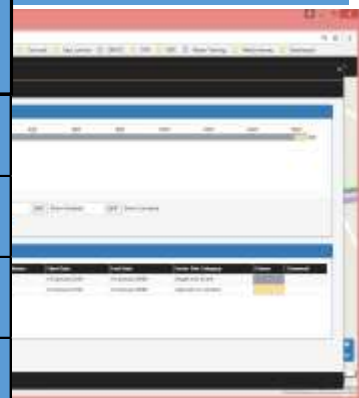
Second SCRIM in US this year operated by WDM - extra functionality over US SCRIM1: Longitudinal profile (IRI)

UK Government Skid Policy Implementation (HD28) using SCRIM (for routine testing)....

PMS is used to manage the processing of Continuous Friction data alongside Crashes, Texture and Friction Demand I.L.'s to determine where treatments need to be undertaken.

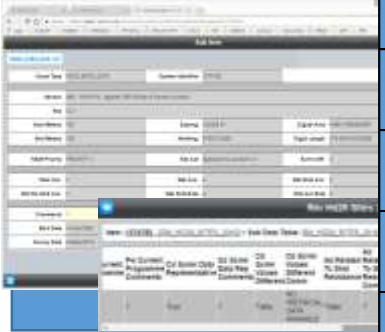
Manage Survey Routes, Survey, Data Fitting, SCRIM vs Crash Ca

Setting Investigatory Levels and of Reviews



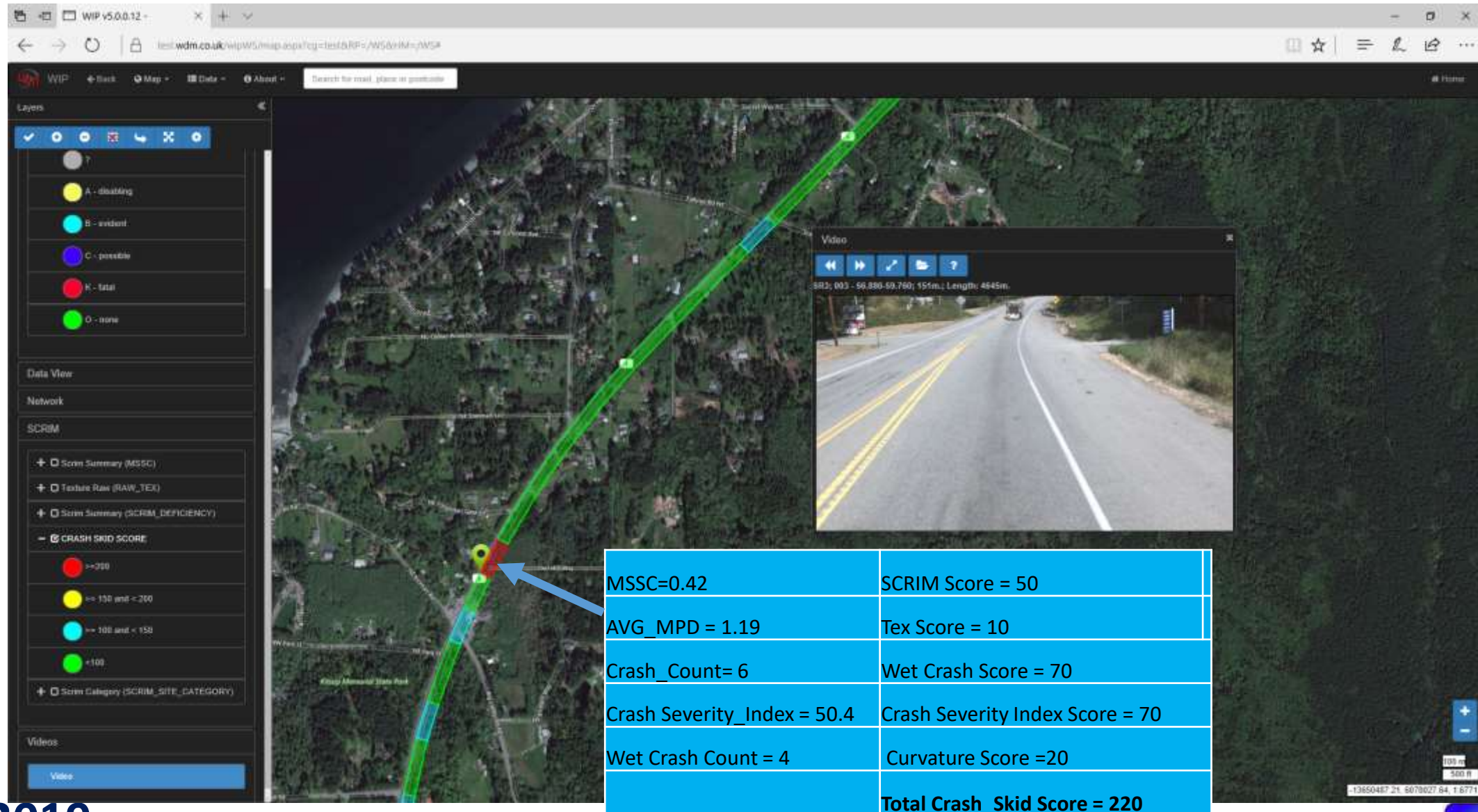
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op for Secondary site (online/offline)

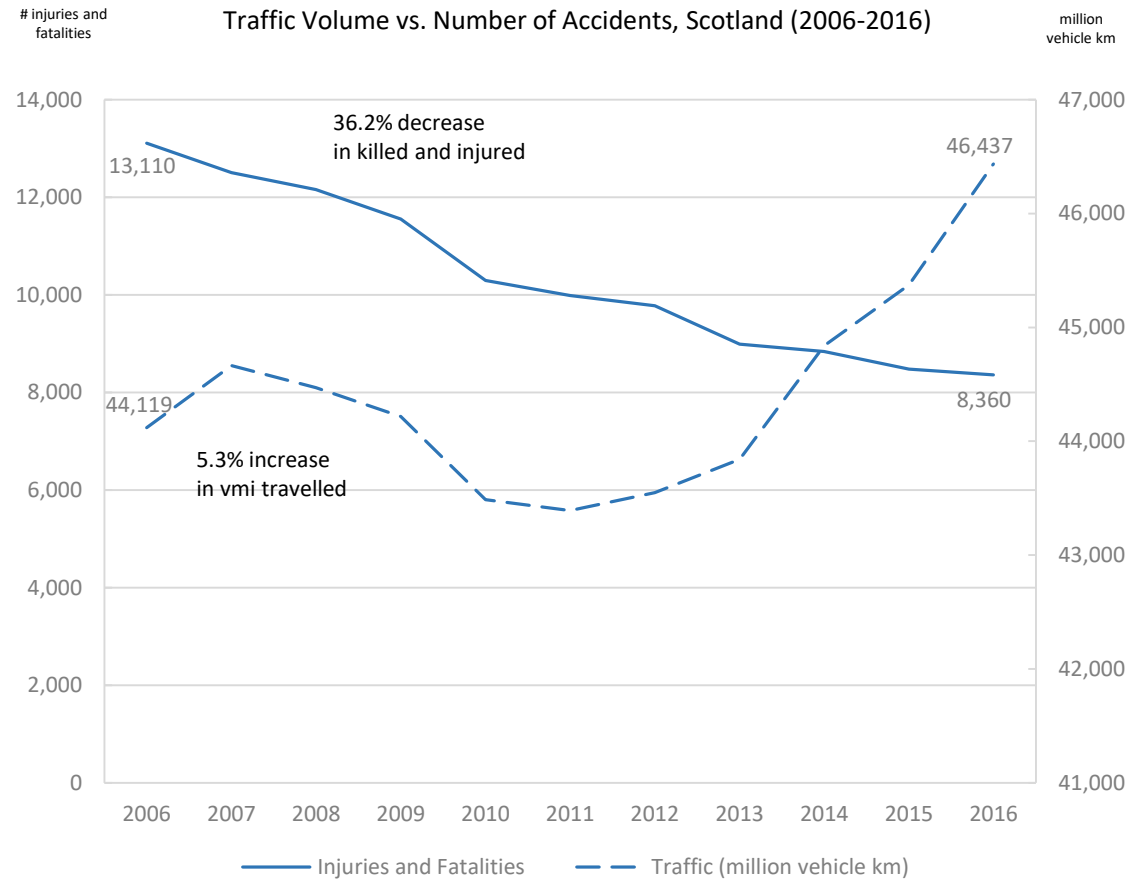


Road classification definitions		Investigatory level (31 or 50 mph)							
		0.30	0.35	0.40	0.45	0.50	0.55	0.60	0.65
A	Interstate highways	Light Blue	Red	Blue	Blue	Blue	Blue	Blue	Blue
B	Divided highways w/o intersections, grade, etc.	Light Blue	Red	Red	Blue	Blue	Blue	Blue	Blue
C	Two lane road w/o intersections, grade, etc.	Blue	Light Blue	Red	Red	Blue	Blue	Blue	Blue
Q	Intersection (& roundabouts)	Blue	Blue	Blue	Red	Red	Red	Blue	Blue
K	Pedestrian crossings and other high risk areas	Blue	Blue	Blue	Blue	Red	Red	Blue	Blue
R	Roundabout	Blue	Blue	Blue	Red	Red	Blue	Blue	Blue
G1	Slope 5-10%, longer than 160 feet	Blue	Blue	Blue	Red	Red	Blue	Blue	Blue
G2	Slope >10% longer than 160 feet	Blue	Blue	Blue	Light Blue	Red	Red	Blue	Blue
S1	Curve radius < 1600 feet - divided roads	Blue	Blue	Blue	Red	Red	Blue	Blue	Blue
S2	Curve radius < 1600 feet - two lane roads	Blue	Blue	Blue	Light Blue	Red	Red	Blue	Blue

Crash Skid Scores (in the absence of Friction Demand categories)



Road deaths have dropped in the UK despite similar increases in traffic and vehicle registrations as the US



Compared with the U.S., Scotland had an identical 5.3% increase in vehicle miles travelled and a 14% increase in number of vehicle registrations, but a 36.2% decline in injuries and fatalities.

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