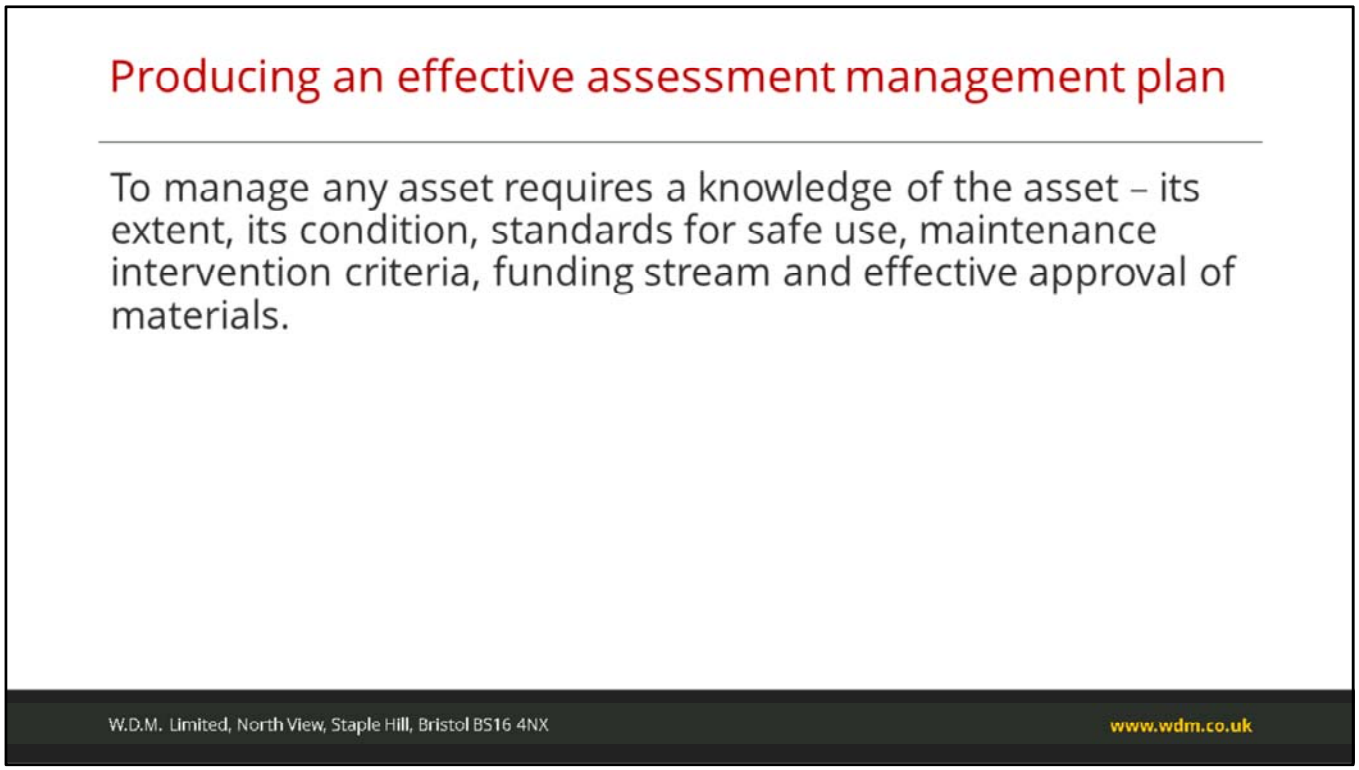
Good after ladies and gentlemen, I trust you have had a good lunch.

In this presentation I will describe the development and use of a vehicle dedicated to the measurement of the infrastructure on both traffic free dedicated cycle paths and on road routes.

Structure of the presentation

1. Why monitoring the condition of cycle ways is important.
2. How WDM became involved.
3. What we designed and how it answers the requirements
4. How we suggest the measurements are reported


Why do we need to manage our cycle ways



To produce an effective asset management plan requires us to manage that asset.

To manage any asset requires a knowledge of the asset – its extent, its condition, standards for safe use, maintenance intervention criteria, funding stream and effective approval of materials.
This requires us to monitor the condition of the cycle route asset.

In addition, Sustrans - Sustainable Transport (British Cycling Organization) states

Maintenance should be considered as part of the route development process long before construction starts. A thoughtful design will mean less maintenance in the future. For example a path surfaced with tarmac will have a long life needing little maintenance other than litter picking and keeping it clear. Whereas a stone dust path will quickly become worn and rutted if left uncared for on a busy route.

To create a safe environment

- people aged 16+ in England (2014/15):

3% cycle five times a week,
9% cycle at least once a week
15% cycle at least once per month

- BUT:

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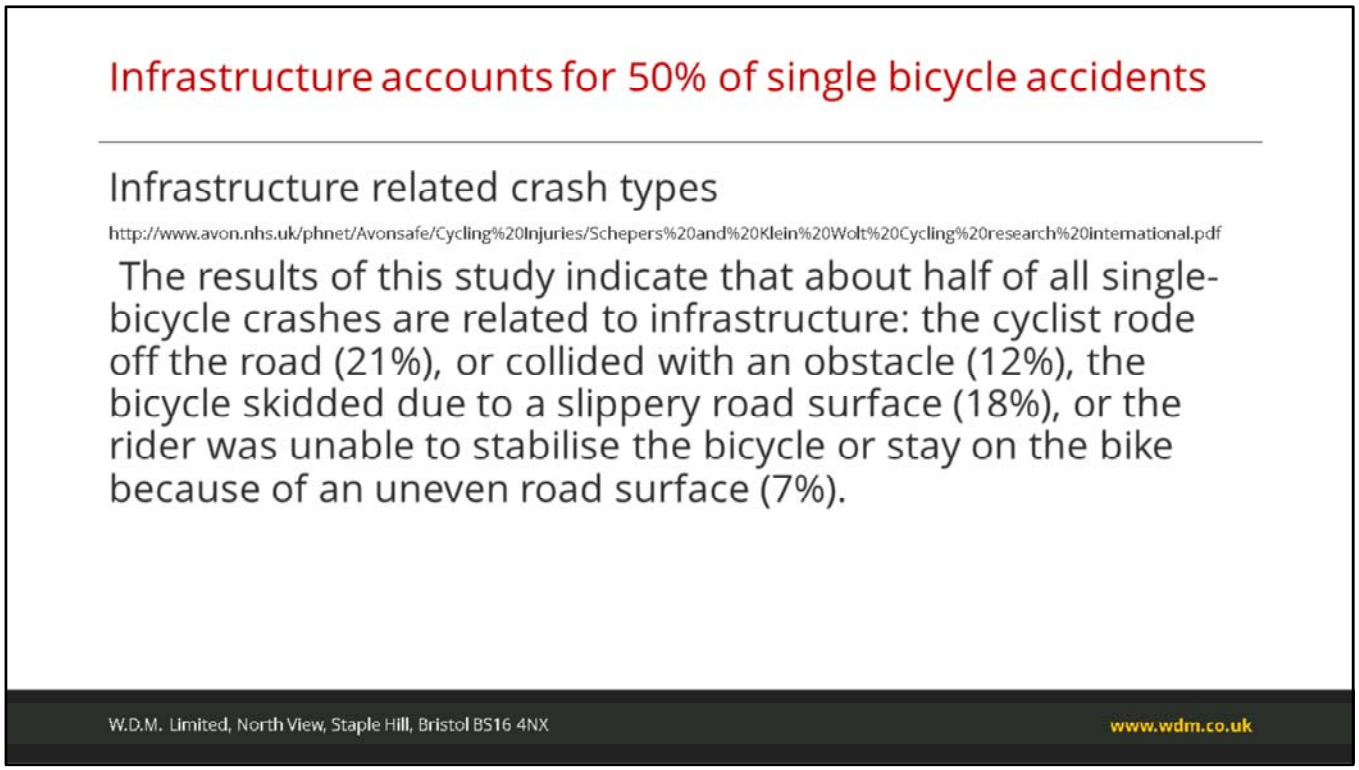
- We need to monitor the condition of our cycle routes to create and maintain a safe environment.

In England in 2014/15, of the population aged 16 and above:
3% cycle five times a week (about 1.3 million people)
9% cycle at least once a week (about 4 million people)
15% cycle at least once per month (about 6.6 million people)

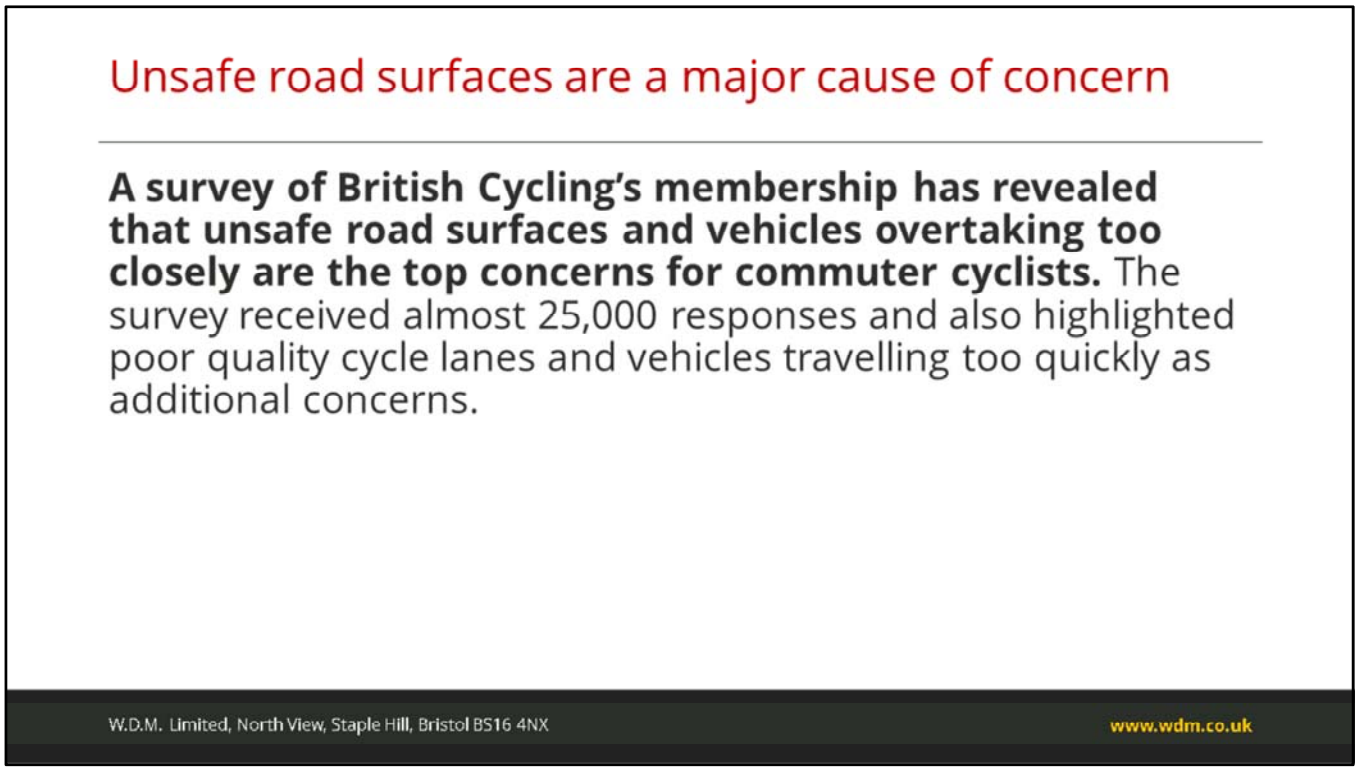
That is good news because we all know the very positive health benefits of cycling, But

While rather like all vehicle numbers, those killed are falling, but killed and seriously injured continue to increase,. This data is for cyclists killed and seriously injured in Great Britain between 2005 and 2015 per billion vehicle miles; while giving a mixed picture the data is following an increasing trend since 2005.



We need to monitor the condition of our cycle routes because infrastructure accounts for 50% of single bicycle accidents.

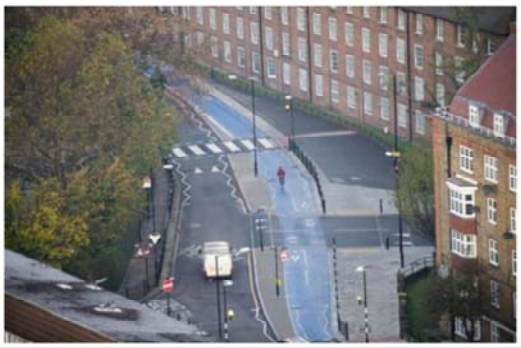
Cycling Research International, Vol 2 (2012), xx – yy www.wocref.org/cri
Single-bicycle crash types and characteristics



We need to monitor the condition of our cycle routes because roads surfaces are a major cause of concern for cyclists.

To help avoid unnecessary risks being introduced

A coroner has called on Transport for London (TfL) to urgently review its cycle superhighways to identify areas of reduced grip, stating 'there is a risk of future deaths' unless action is taken.



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We need to be able to manage our cycle routes to avoid introducing unnecessary risks. Transport for London has an excellent policy to introduce super highways for cycling safely around the city. Someone thought it would be a great idea to paint the roads surface for these route blue to make them clearly visible.; but because their asset management plan clearly did not have an adequate materials testing requirement this may have resulted in an increased risk for cyclists .

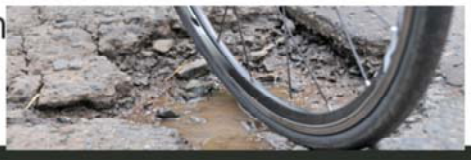
At a pre-inquest review at Westminster coroner's court on February 14, a collision investigator gave evidence that the painted road surface had a skid resistance of 56.3, compared with the conventional road surface score of 77. The superhighway near the pedestrian crossing was differently constituted and had a skid resistance of 89.8.
The coroner, Dr Wilcox said some cyclists had talked about a lack of grip on parts of the superhighway, which runs between Westminster and Wandsworth.
She warned TfL that "there is a risk that future deaths will occur" unless it took action. Listing six areas of concern, she called for "an urgent review of all areas treated with such road surface and replace it with the higher grip surface.
"These concerns are too urgent to wait until the full hearing of the evidence to be addressed." The inquest is due to be held this summer.

To reduce the number of hazards

99 UK cyclists killed or seriously injured by road defects - warning that 2017 could be pothole "tipping point"

Potholes can be more than a nuisance. They can be a danger to cyclists and others. In the UK, there's an average of one road defect for every 110 metres of road.

In 2014, the police claimed a "poor or defective" road surface contributed to almost three times more crashes involving cyclists than it did to those involvin



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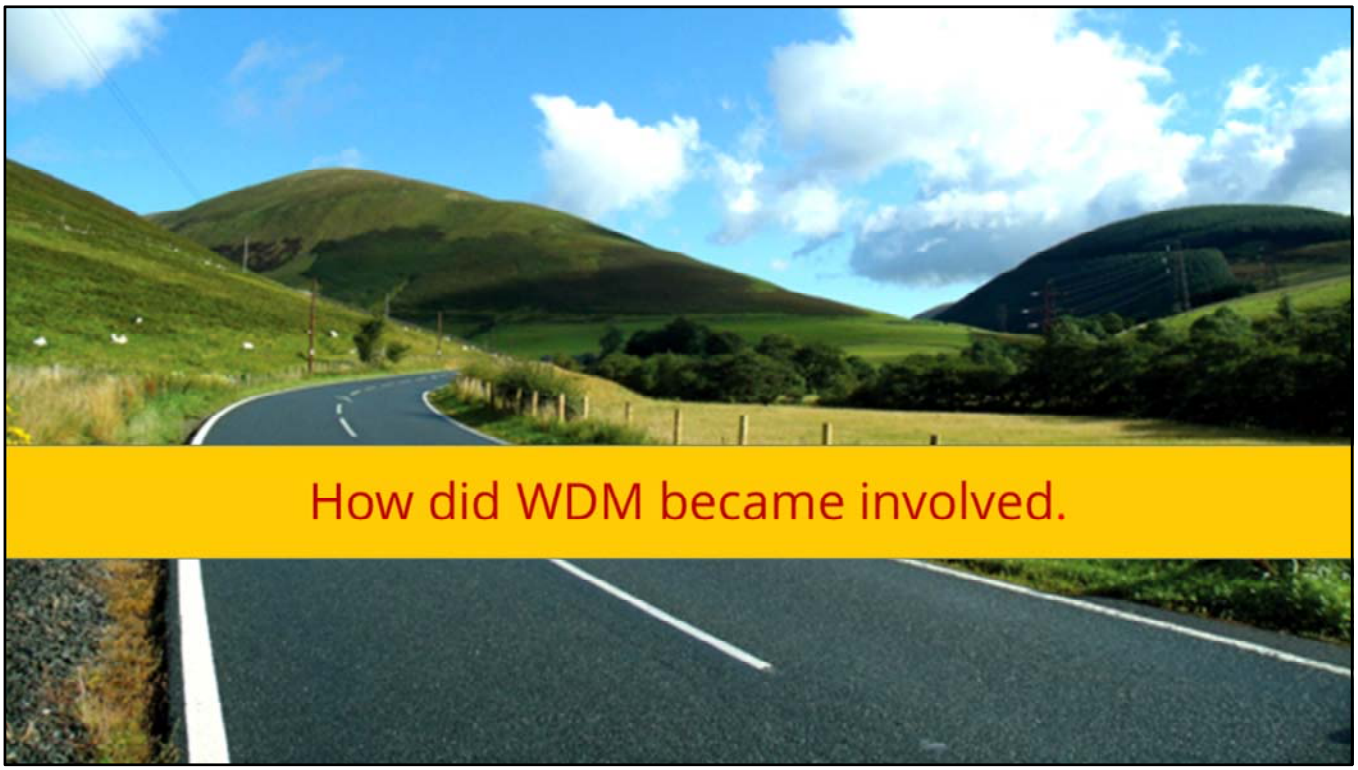
We need to monitor the condition of our cycle routes to reduce the number of hazards.

Cycling UK helps an astonishing 10 per cent of its membership with pothole-related injuries per year, claiming damages against local authorities' stretched budgets, for anything from broken glasses and damaged bikes to fatal collisions.

According to the Government's own statistics, 211 people were killed or seriously injured cycling 2010-2014 because of "poor or defective road surface".

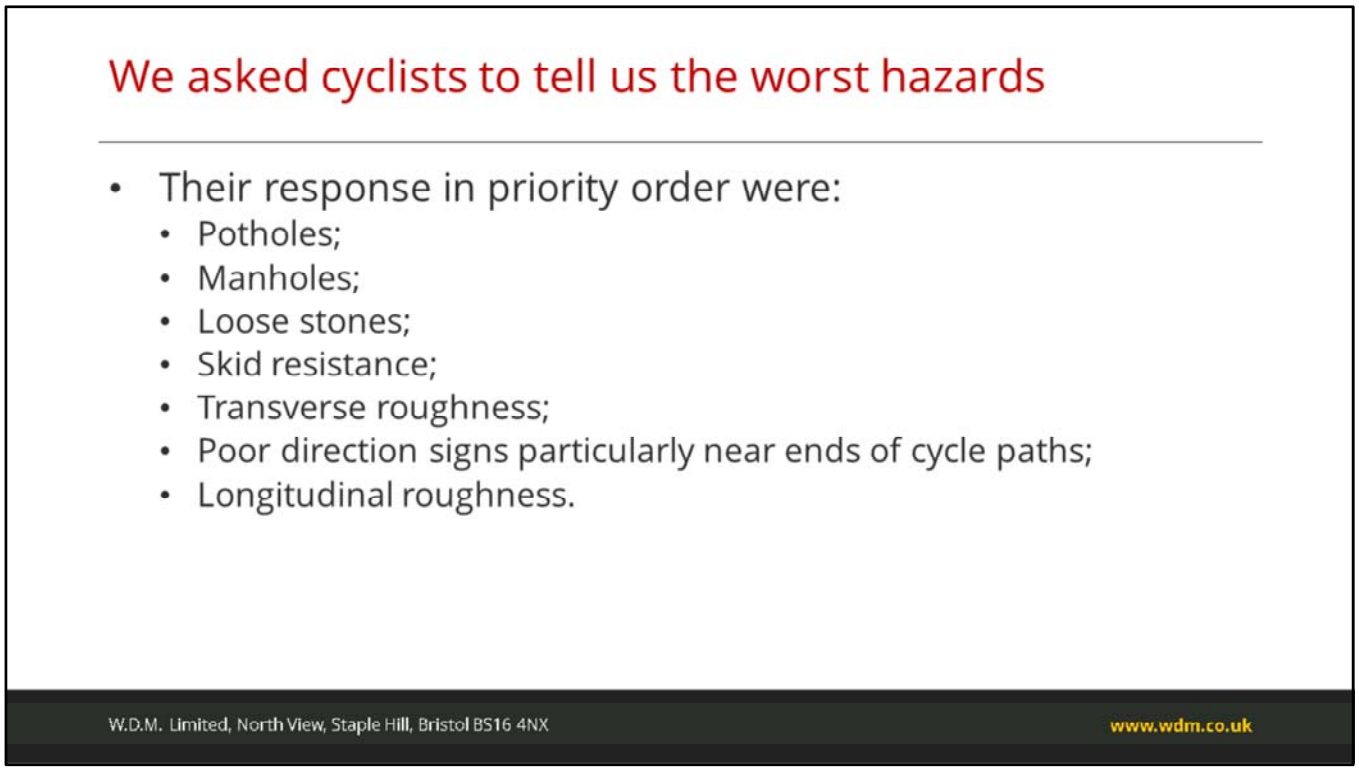
The Local Government Association said earlier this month 2017 could be a tipping point for potholes as councils facing serious budget reductions face growing pothole bills. The LGA's Martin Tett warned local authorities are trapped in a cycle where they are only ever able to patch up deteriorating roads.



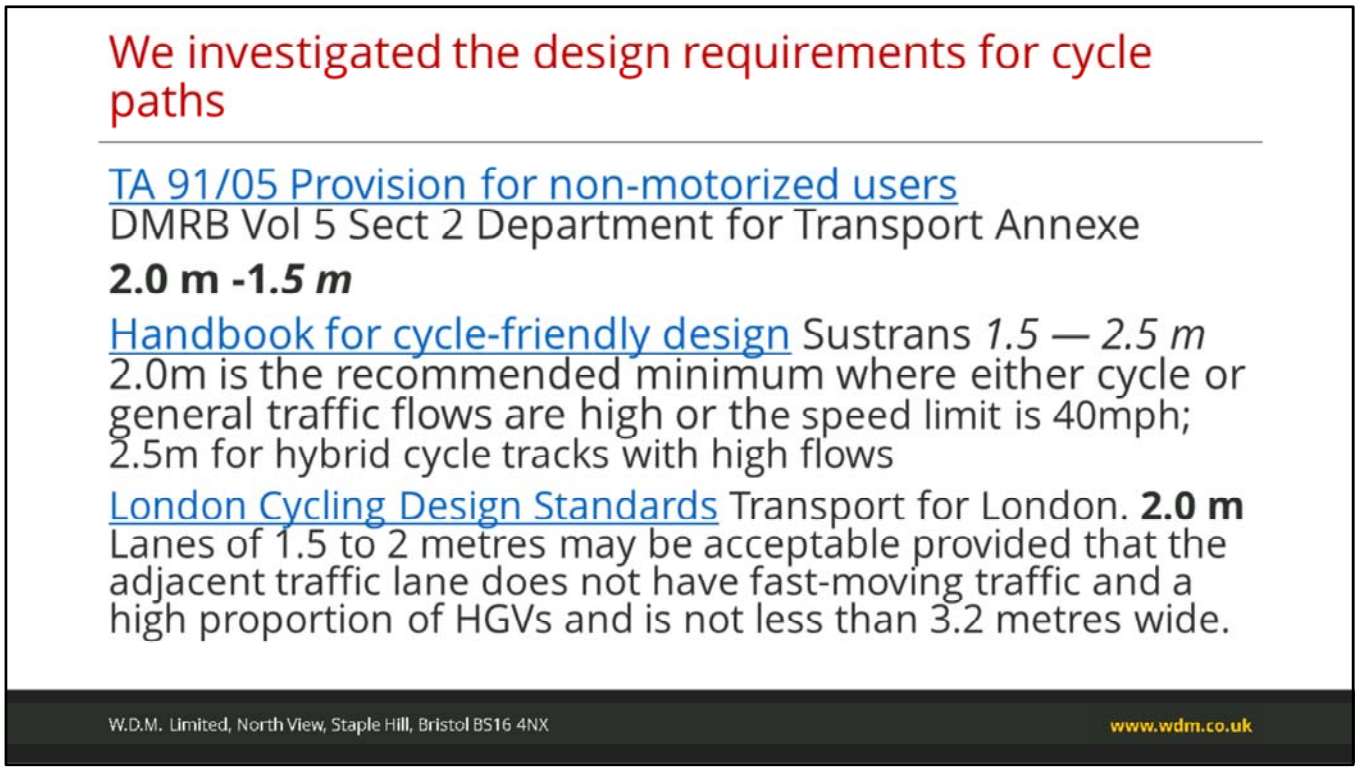
Having established the need to monitor how did WDM become involved.

WDM became involved because it t was a natural progression from the road assessment technology we have perfected over 48 years since the first SCRIM

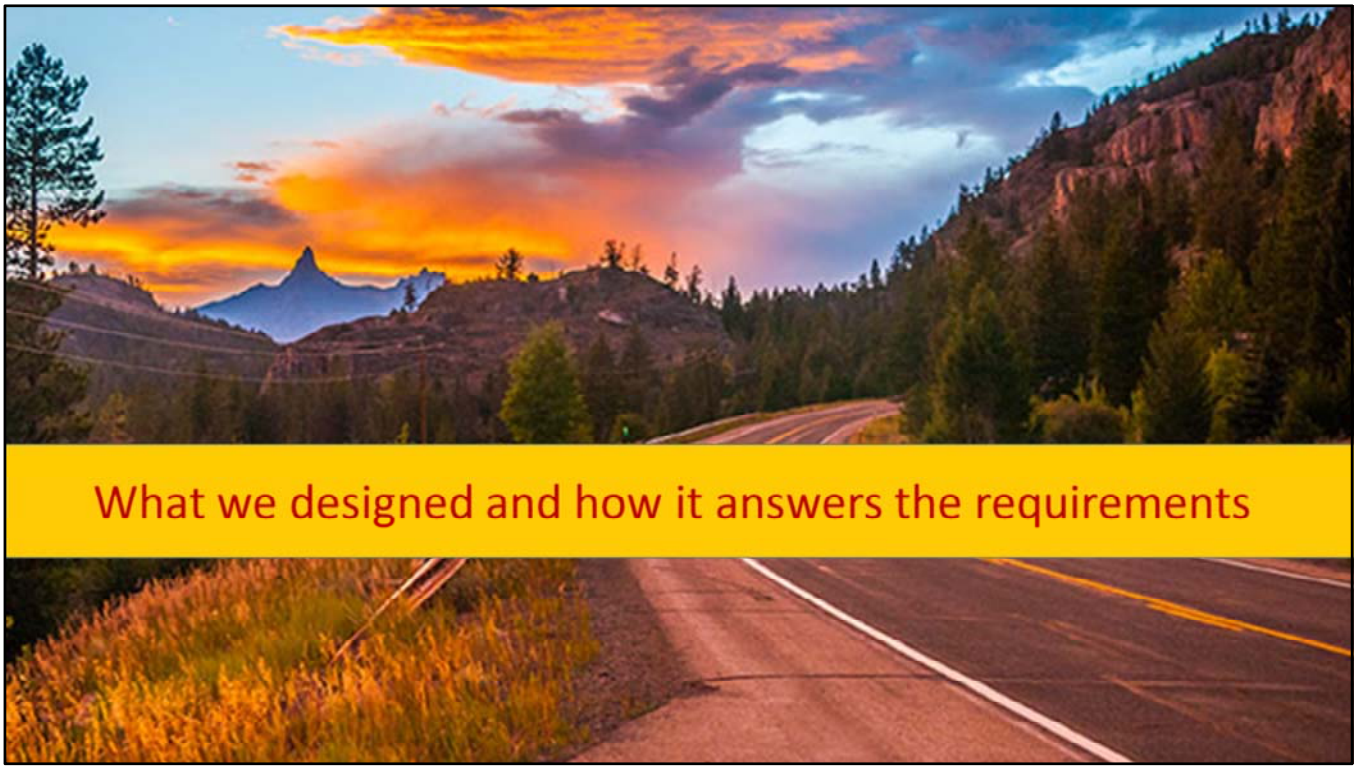
All of the measurements that are incorporated in the cyclopath have been measured as part of our on-road surveys.
What we have attempted, is to use the technology to define the surface of the cycle way by quantifying its shape and roughness. There has been no attempt to define the cycleway criteria to interpret the measurements, as that will form part of a clients asset management plan. For example, some measurements like the location of manholes and the location of potholes is reasonably straightforward, what is less straightforward to define is the size and depth of a pothole, which may be different from those that are use for vehicular traffic.



Sustrans - Sustrans - Sustainable Transport (British Cycling Organization
On-road routes:
• prioritise maintenance of 2m nearest to kerb
• repair loose drain covers and potholes
• clear drainage channels and gullies
• sweep debris
• repair worn markings / coloured surfacing
• accommodate cyclists at roadworks
• include in winter maintenance
Traffic free routes: • repair surface damage • clear drainage channels and culverts • sweep debris • mow verges • cut trees and other vegetation • repair / replace damaged / lost signs • maintain lighting, furniture, structures • use of local volunteers to assist • develop signing and management plan to encourage considerate behaviour on shared paths
repair / replace damaged / lost signs
Not surprisingly our own responses were similar to the wider national surveys but they provided us with more detailed information. There was clearly little difference between dedicated cycleways and on-road routes. We considered skid resistance in some detail and decided this was an area where the location of the route would be important.



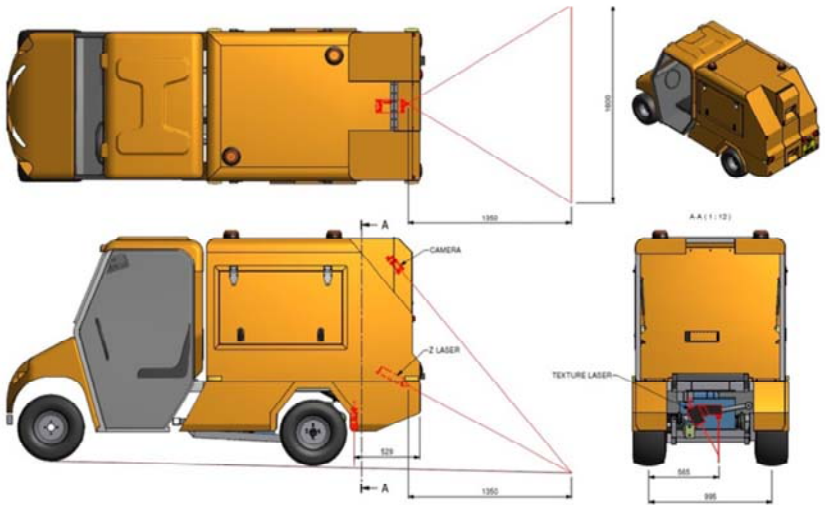
This seems to indicate that any condition monitoring device needs to operate within a 1.5m wide pathway.


What we designed and how it answers the requirements

CYCLOPATH

Size chosen to reflect the narrow nature of cycle ways
This shows comparison with one of our conventional high speed data collection vehicles or Road Assessment Vehicles, RAV's.

Vehicle and measurement dimensions



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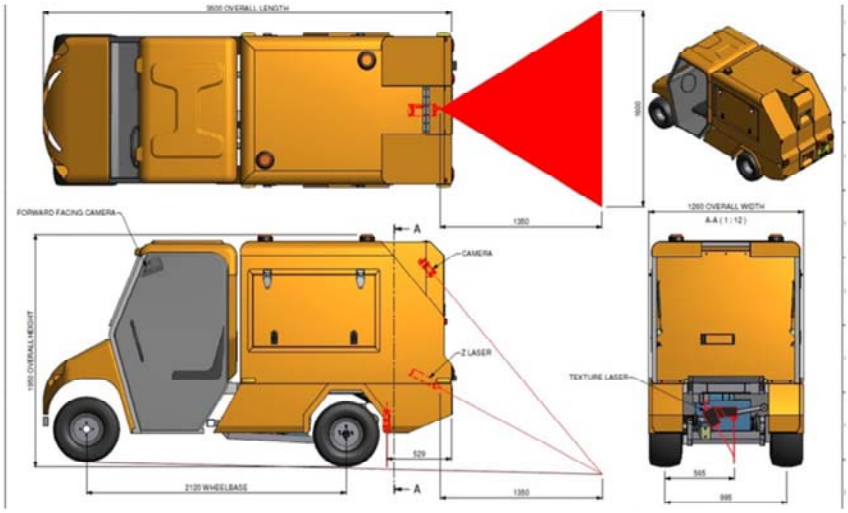
Length 3.5m
Width 1.2m.
Height 1.95m

Vehicle and measurement dimensions



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Measurements where chosen to cover the worst hazards

Forward facing camera capturing an image every 5m of forward travel during a survey.
Images are 1280x768, JPEG compressed, 24bit RGB colour saved as a Windows AVI file.
Longitudinal surface texture and roughness obtained by laser height measurements at 1mm interval.
Continuous GPS location tracking with +-1m accuracy. (Inertial GPS) also providing cross fall, gradient and radius of curvature
Up to 2m wide transverse profile measurement , although 1.6m shown.

Central laser to give longitudinal roughness,(IRI or profile variance) and texture, both SMTD and MPD.
The scanning laser provides frequent transverse profiles which are used to provide RMS texture and also identify the location of manholes and potholes.

For skid resistance two solutions

For dedicated routes material testing using the British pendulum

For on-road routes use SCRIM or mini-SCRIM

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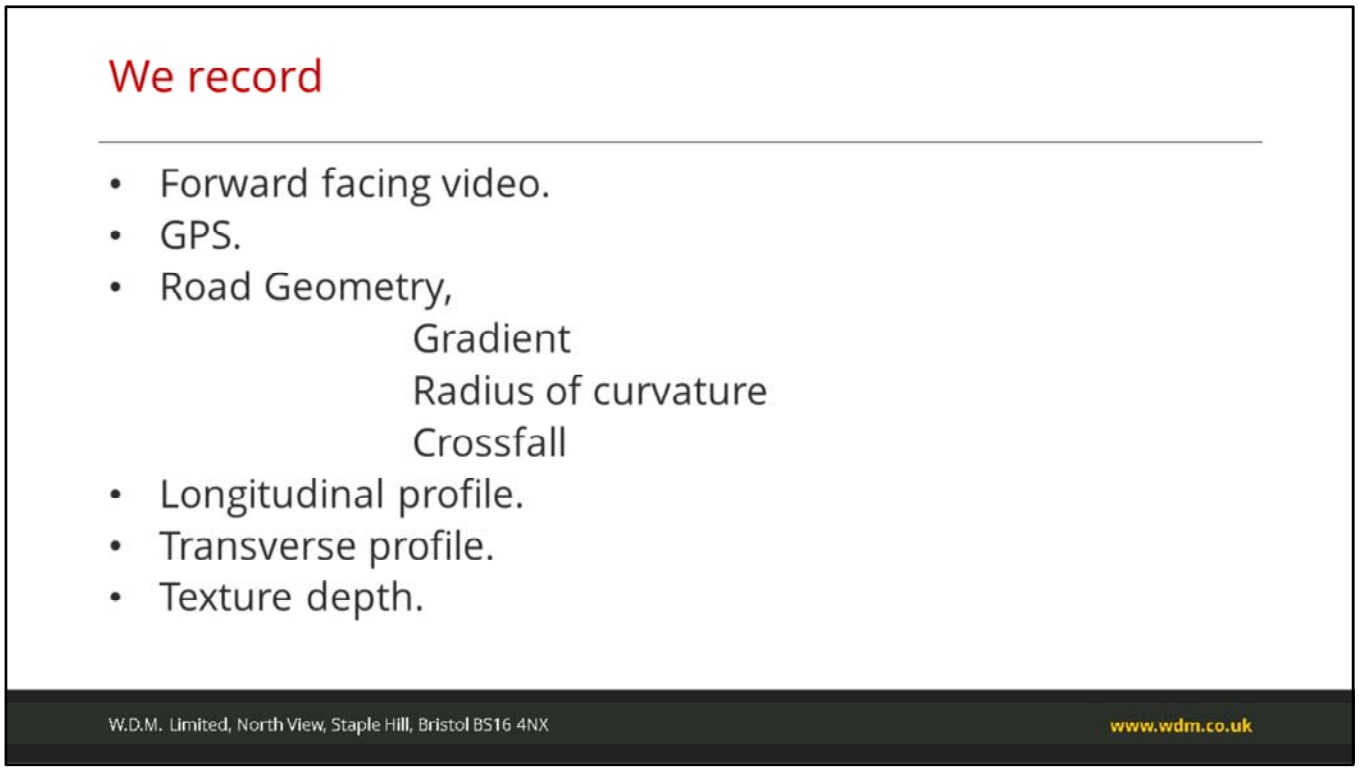
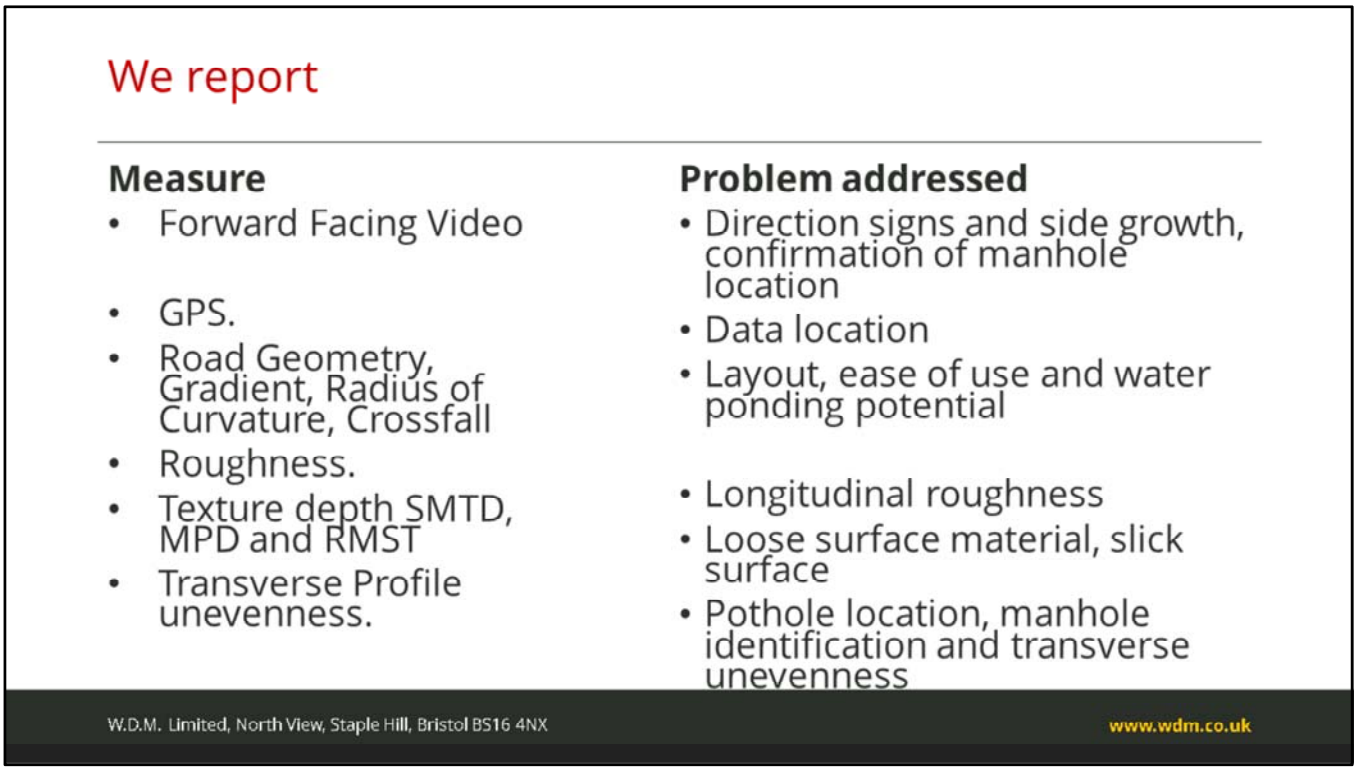
We spent some time considering how best to deal with skid resistance and in the end decided two solutions were required, one for dedicated cycle ways and one for on-road routes.

We reached this conclusion because only on-road routes shared with traffic is the Skid resistance likely to change significantly as polishing takes place under heavy tyre pressures. Monitoring for this situation can best be carried out with a conventional SCRIM or, depending on the situation, for example on more minor housing estate roads, using a mini SCRIM.

On traffic free routes, there is unlikely to be long term changes in skid resistance and so rather than regular monitoring, what is required is a robust approval system for the surface material used. The British pendulum or similar can be used to approve a surface material. This should be combined with periodic monitoring on-site, at only at a small number of locations, during the life of the surfacing.



This summarises the measurements we record and the main emphasis is to define the surface shape and characteristics.



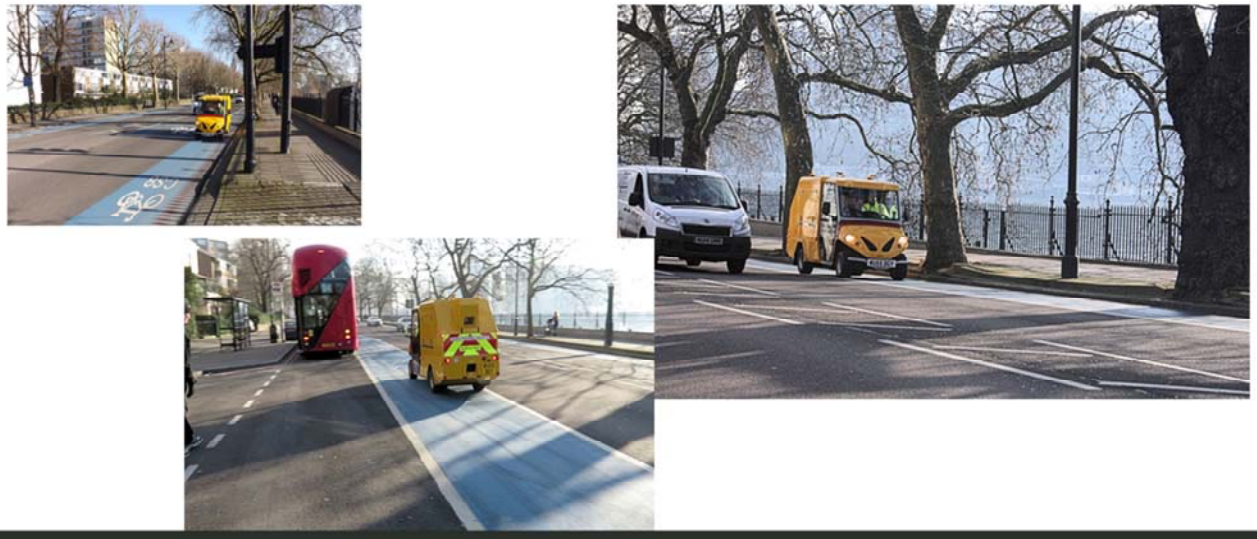
This shows how what re cord addresses the problems cyclist encounter on cycle routes.

Root Mean Square Texture, RMST

- This measure of texture uses the scanning laser to calculate texture on 20 separate lines;
- It takes measurements spaced at 5mm intervals;
- The measurement are used to give
  - average texture across three strips each 300mm wide every 10m;


How we suggest the measurements are reported

Examples of reporting data from a survey in an urban area



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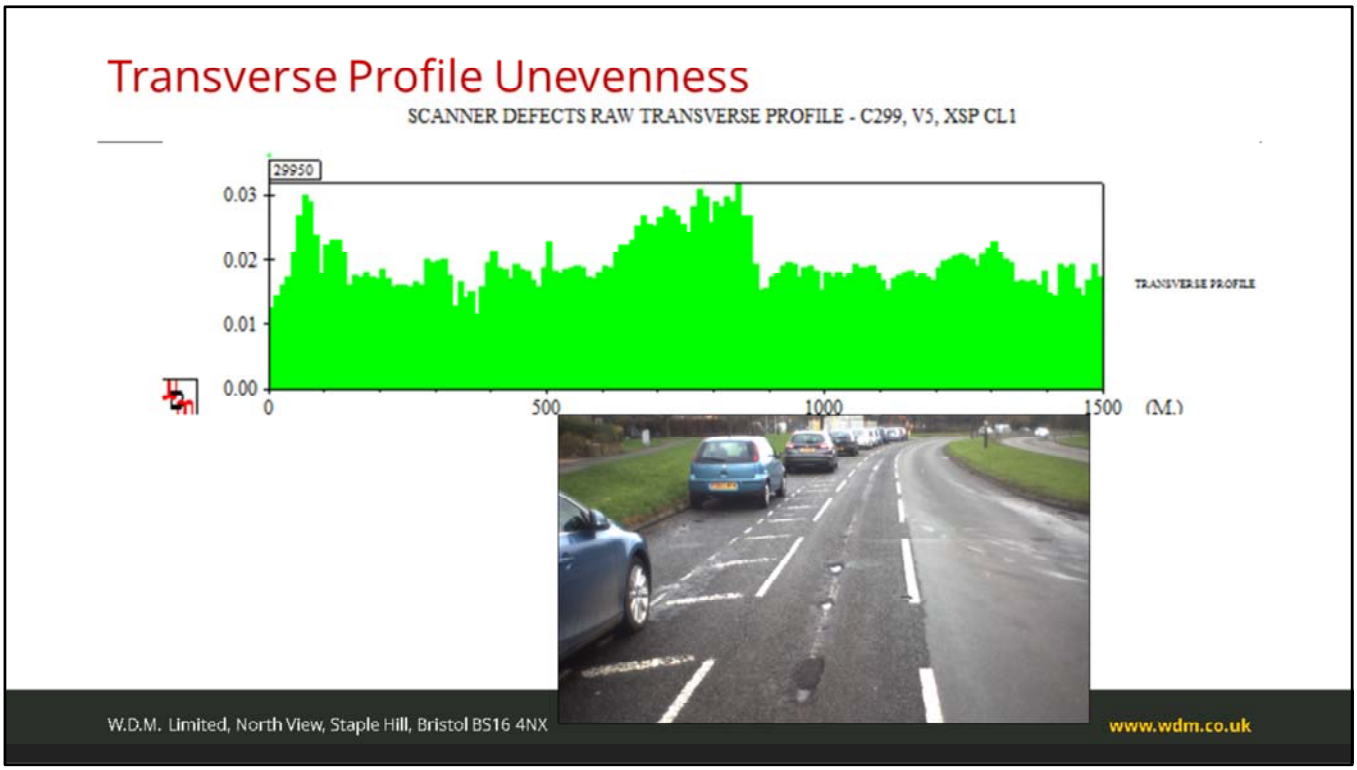
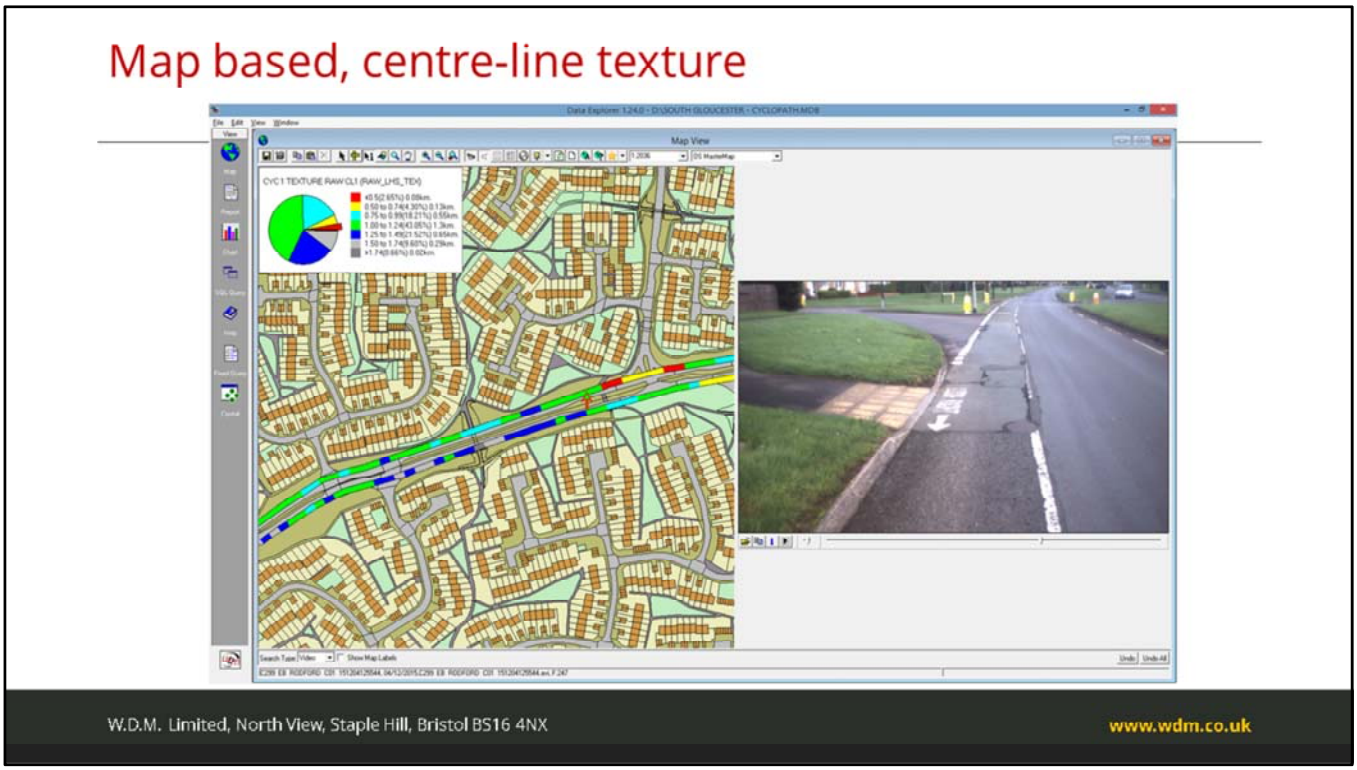
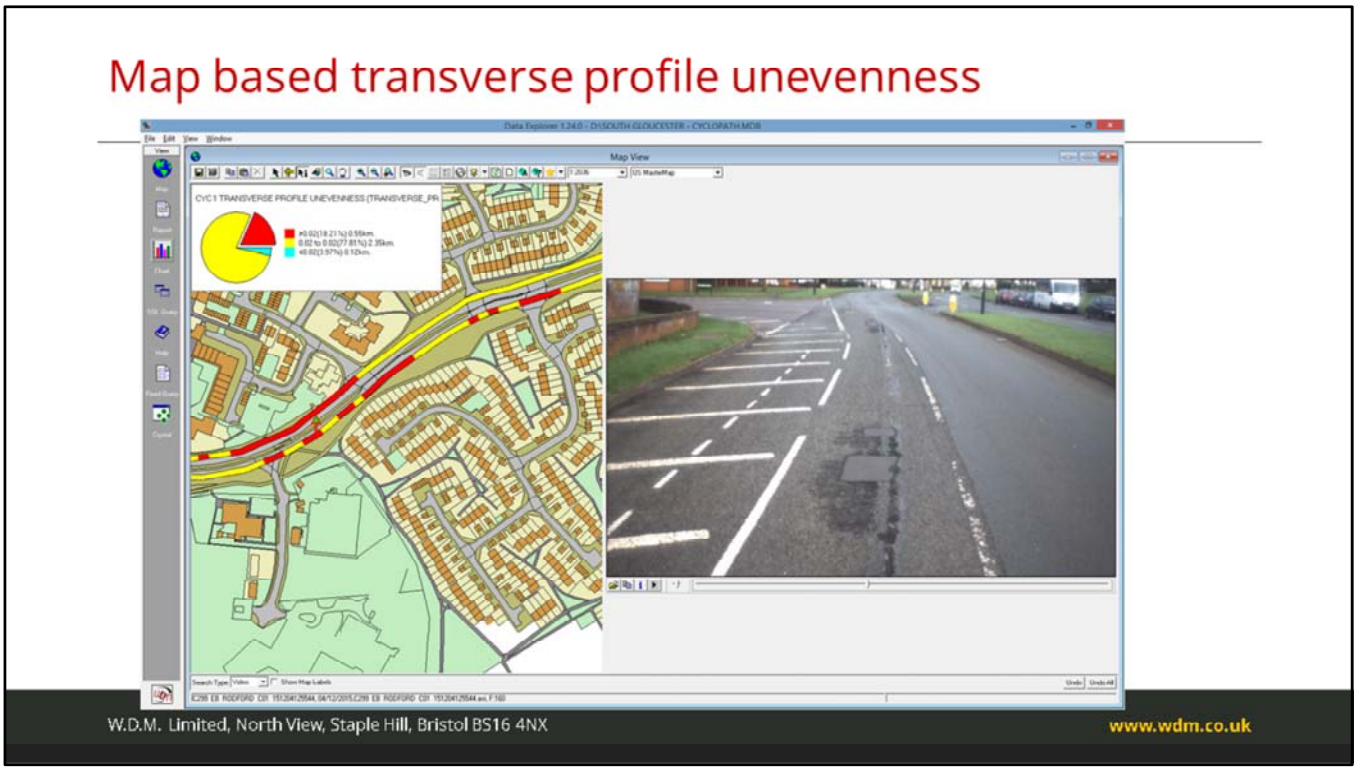
You can see here examples of the Cyclopath operating on cycleways in an urban area



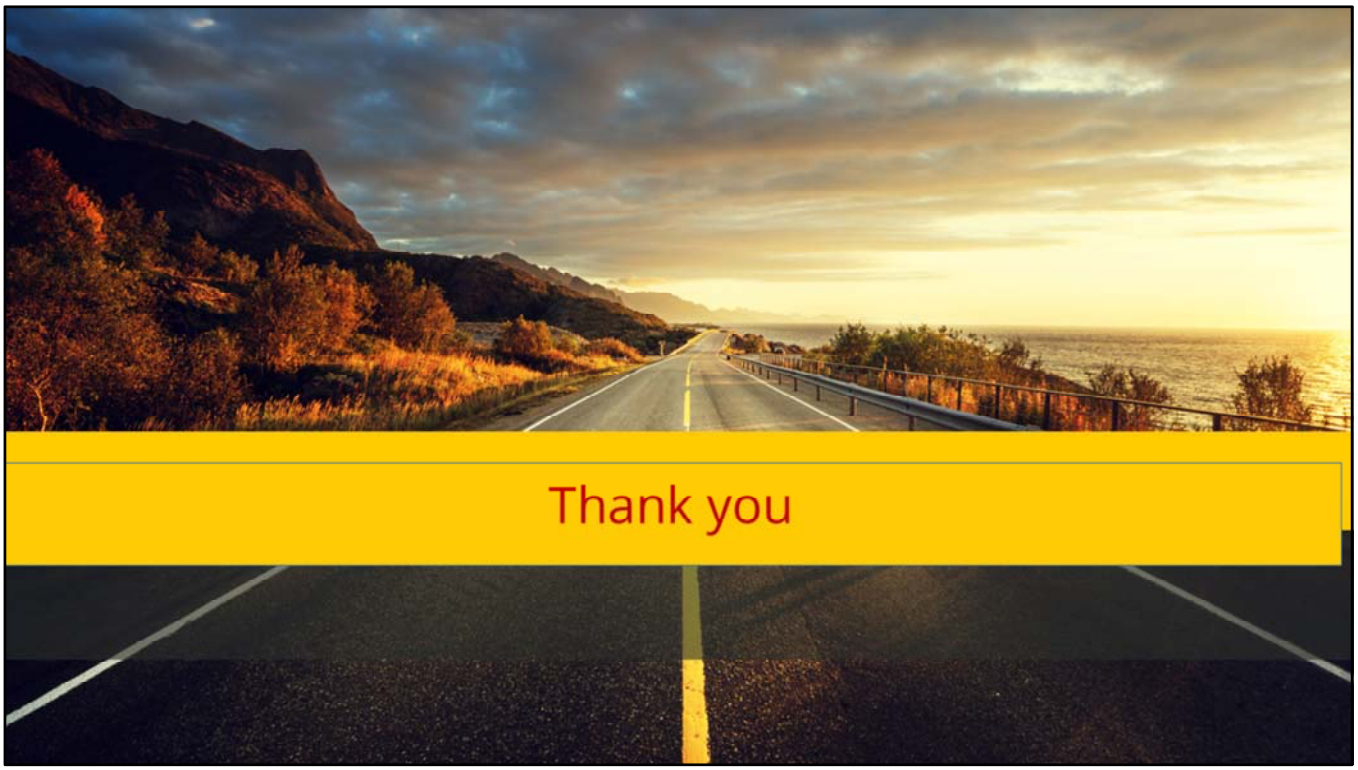
Data can be reported in tabular form and plotted a results over a given length of cycleway. This show the measure of transverse profile over a 1,500 m length with an image associated with the high values near the centre of the length.



Using public available mapping, together with WDM software running on a server gives a client access to the information, and, using client defined criteria, enables the data to be presented against map backgrounds. The video images collected during the survey can be shown and shown linked with the data presentation.
The red arrow on the map shows the point where the image was taken.



Similar to the previous slide but showing transverse profile unevenness


Thank you