Network structural surveys in the UK – current status and future European developments

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Acknowledge co-authors;

Peter Langdale
Alex Wright

Also acknowledge support of:

English Highways Agency

European Commission 7th Framework Programme

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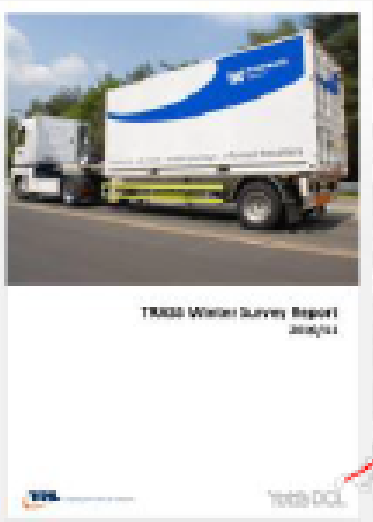
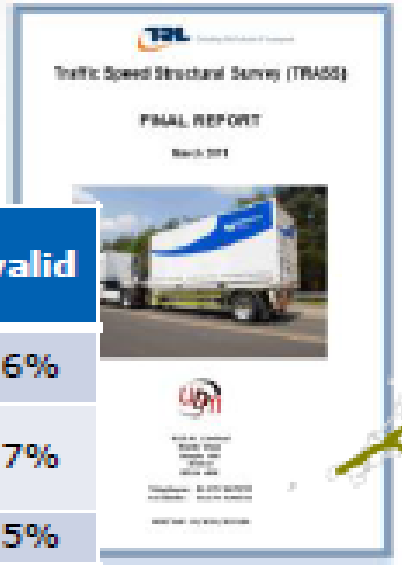
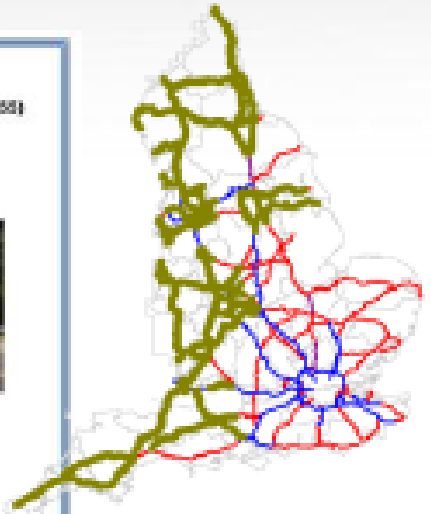
TRASS1

- Network surveys using TSD already undertaken in TRASS1
- Two survey contracts let for a Winter survey and a Summer survey
  - Yotta (winter)
  - WDM (summer)
- Reports are available



Winter coverage



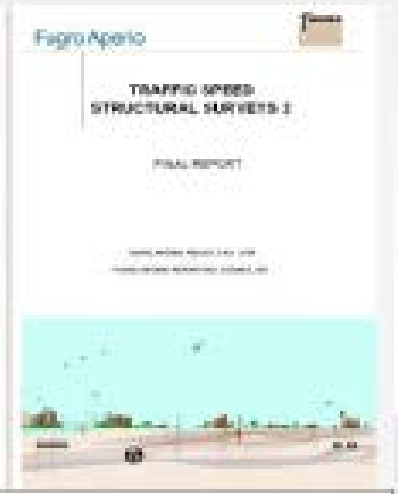


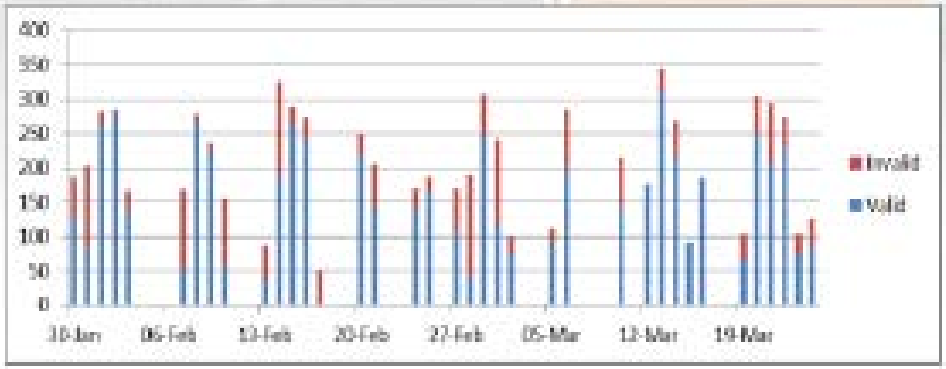
Summer coverage

Survey period	Total surveyed [km]	Total valid [km]	% valid
Summer (WDM)	7057	6211	87.6%
Winter (Yotta)	7838	5775	73.7%
TOTAL	14895	11986	80.5%

TRASS2

- Network surveys with TSD undertaken by Fugro
- Survey Jan 2012 to End Mar 2012
- Data validity
  - Feb surveys: 67%
  - March surveys: 78%
  - Average: 75%
- Report is available





TRASS3 is a 3 year + 1 + 1 contract
Awarded August 2014 to Fugro Aperio – Started September 2014

TRASS3 Objectives

- Operate and Support the TSD to Collect
  - TRASS Raw Condition Data (RCD)
  - Base Condition Data (BCD)
  - Ground Penetrating Radar (GPR) data
- Deliverables:
  - The Surveys
  - Survey Data
  - Quality Assurance records and data
  - Progress reports
- Roles:
  - Highways Agency
  - Auditor (TRL)
  - Technical Advisor (TRL)
  - Survey Consultant

Accreditation

- At commencement
  - To achieve accredited operator status for survey team
    - Training in driving, operating, troubleshooting
  - Can be updated / further staff trained later
- Equipment Examination
  - Assess status and condition of vehicle and systems
  - TA issues report
- Equipment Accreditation
  - Initial, then Monthly re-accreditation
  - TA carries out Equipment Examination
  - Survey data collected on test sites
    - Equipment is operated by consultant
    - Data processed by consultant
    - Auditor assesses data (within 2 days)
  - Auditor Awards Certificate
- Surveys should not be carried out without a valid certificate

QA

- Primary
  - A 10-20km site selected by the consultant that must be surveyed every week (3 repeat runs)
  - Calculate RCD and BCD and assess against requirements.
    - Auditor can provide a tool to carry out the check.
  - These are important for monitoring ongoing consistency of the TSD
- Secondary
  - Sites located on SRN, likely to be covered during the survey
  - A set will be provided at start of the first Task
    - Number will increase with survey progress (provided by the Auditor)
  - Tool provided to extract from the survey and check against the reference
  - Results to be collated and reported weekly
- Daily
  - Undertake surveys on each day to check consistency of equipment
  - There is a process in the Scope but the consultant can propose alternative
- Repeat surveys
  - Contractor to carry out repeat runs on nominated lengths that have already been covered in that Task – max 4 routes per Task (not in Ad hoc)

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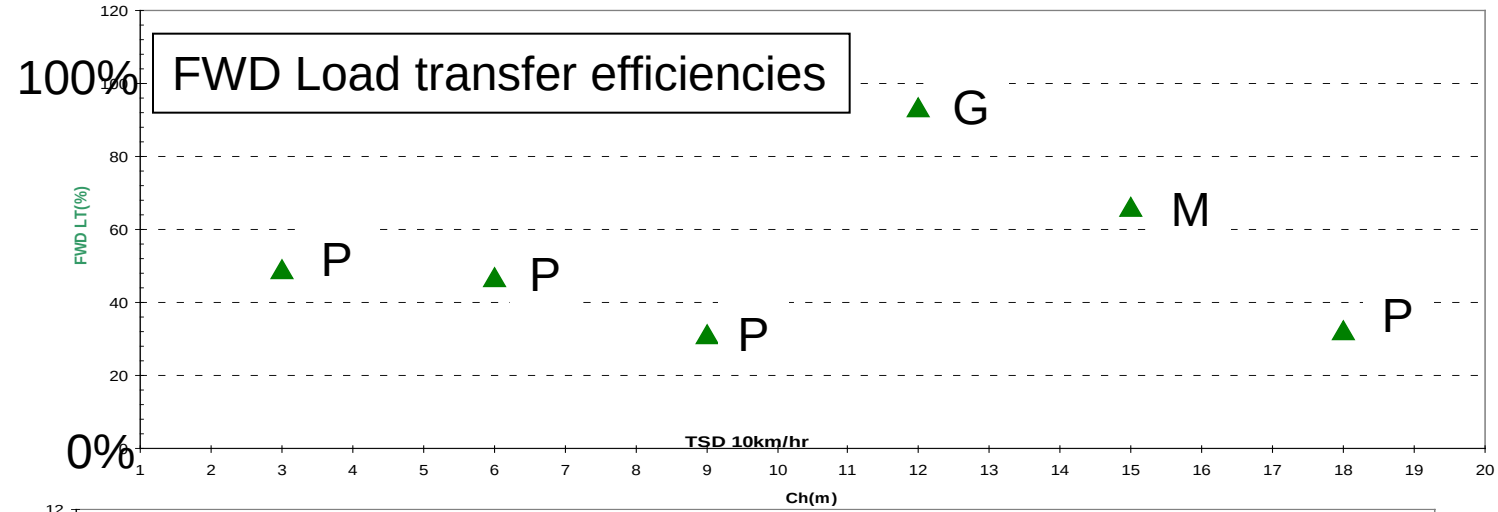
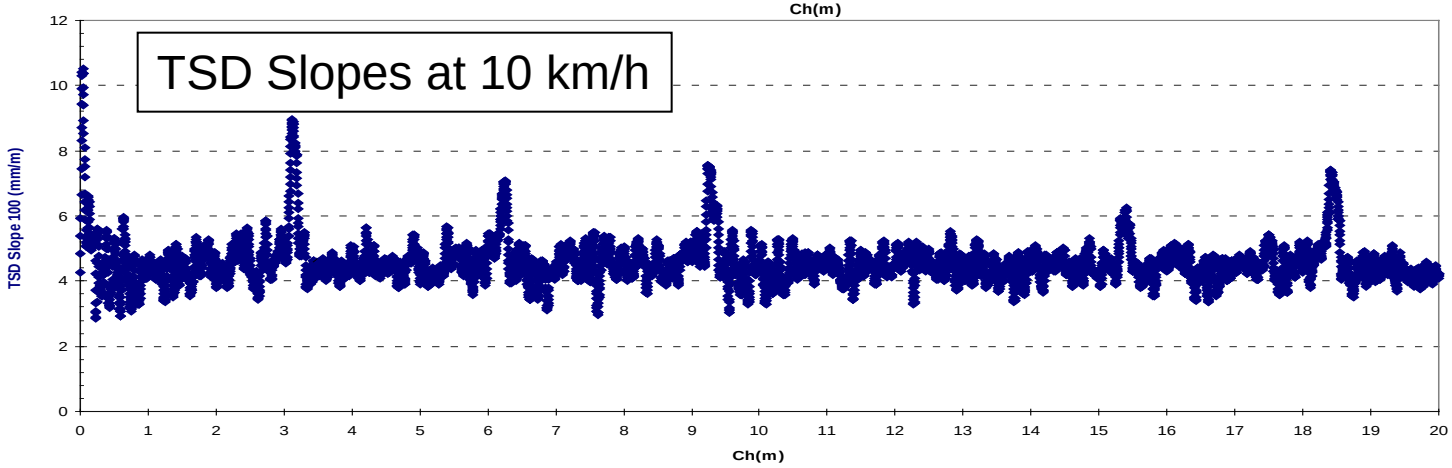
Construction of banked bend of TRL track October 1960

(1) TSD measurements on rigid concrete joints: Preliminary findings 2007

Sample measurements on 20m of rigid pavement at 10km/h





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(3) Further trials in 2013 on continuously reinforced rigid pavement

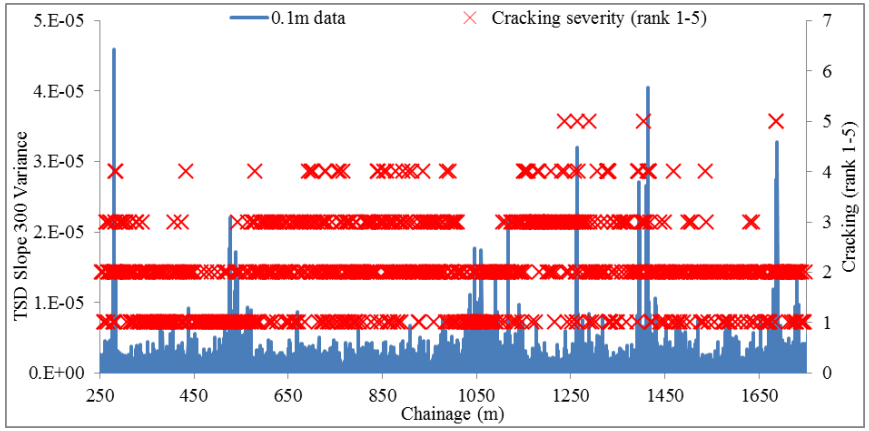
- Visual condition surveys
  - From Videos
- Deflection assessment
  - TSD at range of speeds

- Part of EU 7th Framework programme
- **TRIMM**
- Work Package 4
- Advanced road monitoring

TOMORROW'S ROAD INFRASTRUCTURE MONITORING & MANAGEMENT

Additional task – Application of TSD to rigid roads

- TSD surveys on CRCP construction
- Developed new method of analysis
- Parallel condition surveys from detailed video
- Comparisons promising but further investigation required



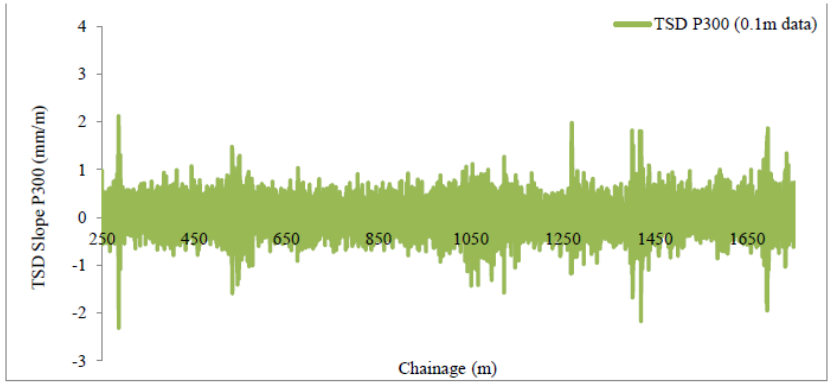


Figure 1.1 – 0.1m TSD Slope data for a 1.5km site

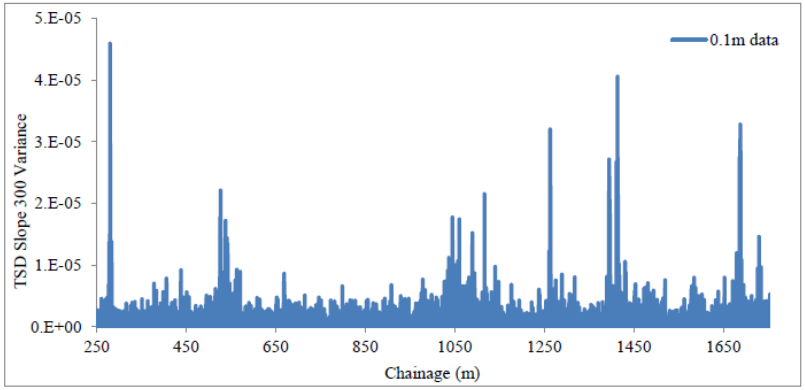


Figure 1.2 – Variance of 0.1m TSD Slope data for a 1.5km site

Variance vs Major defects (wide cracks and failed repairs)

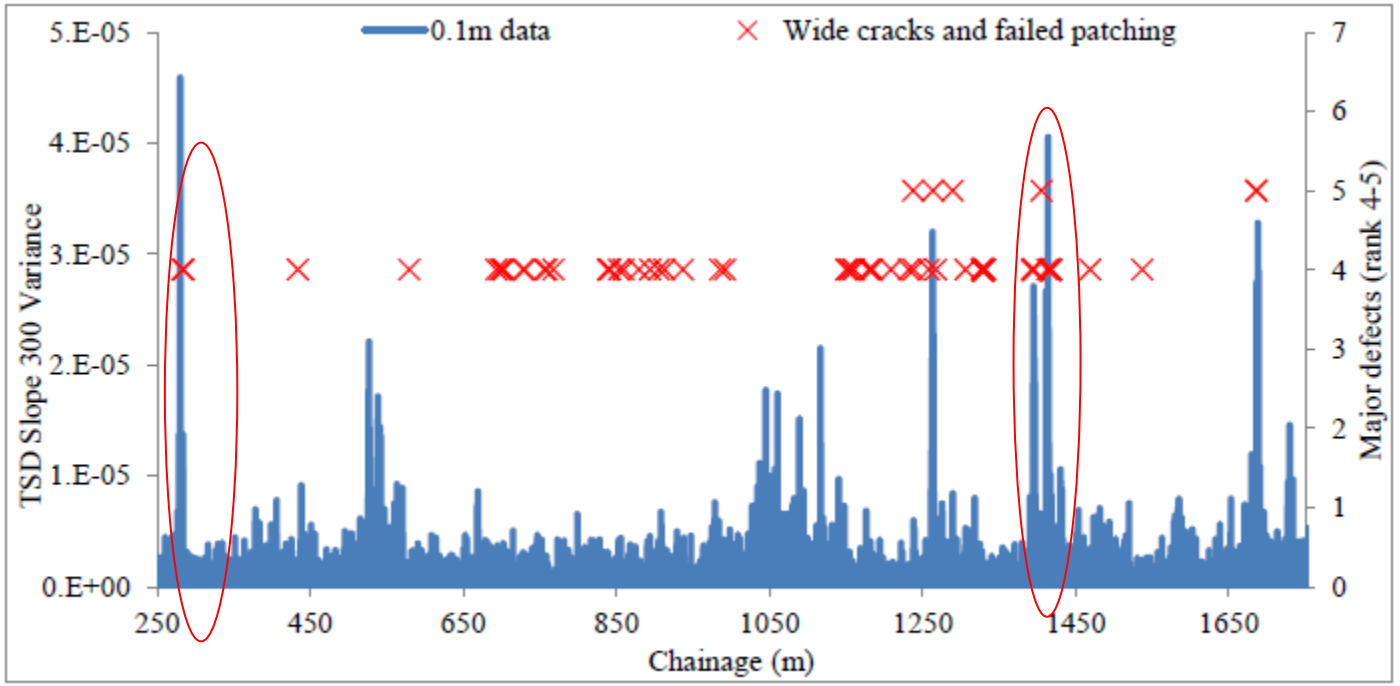
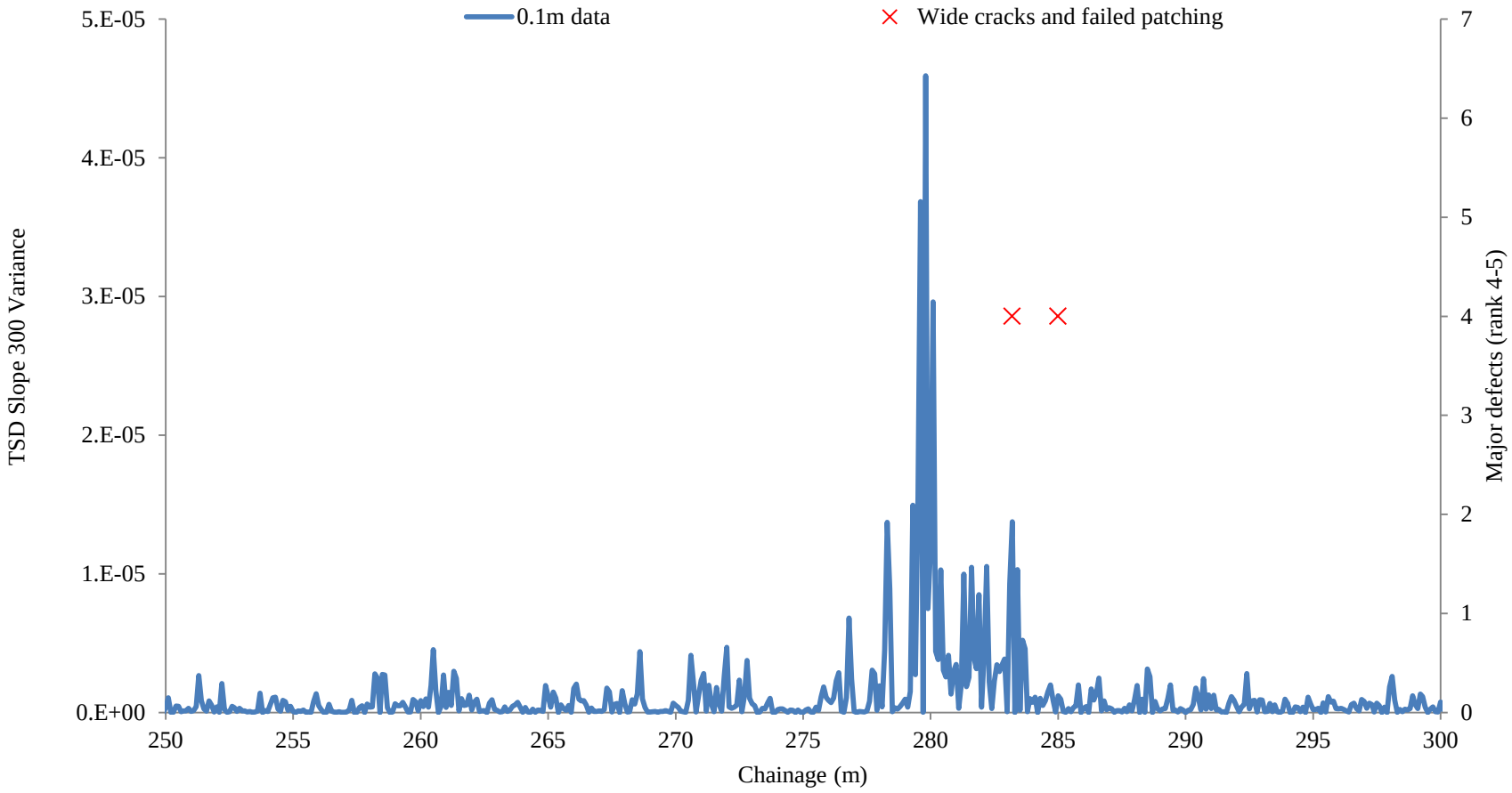
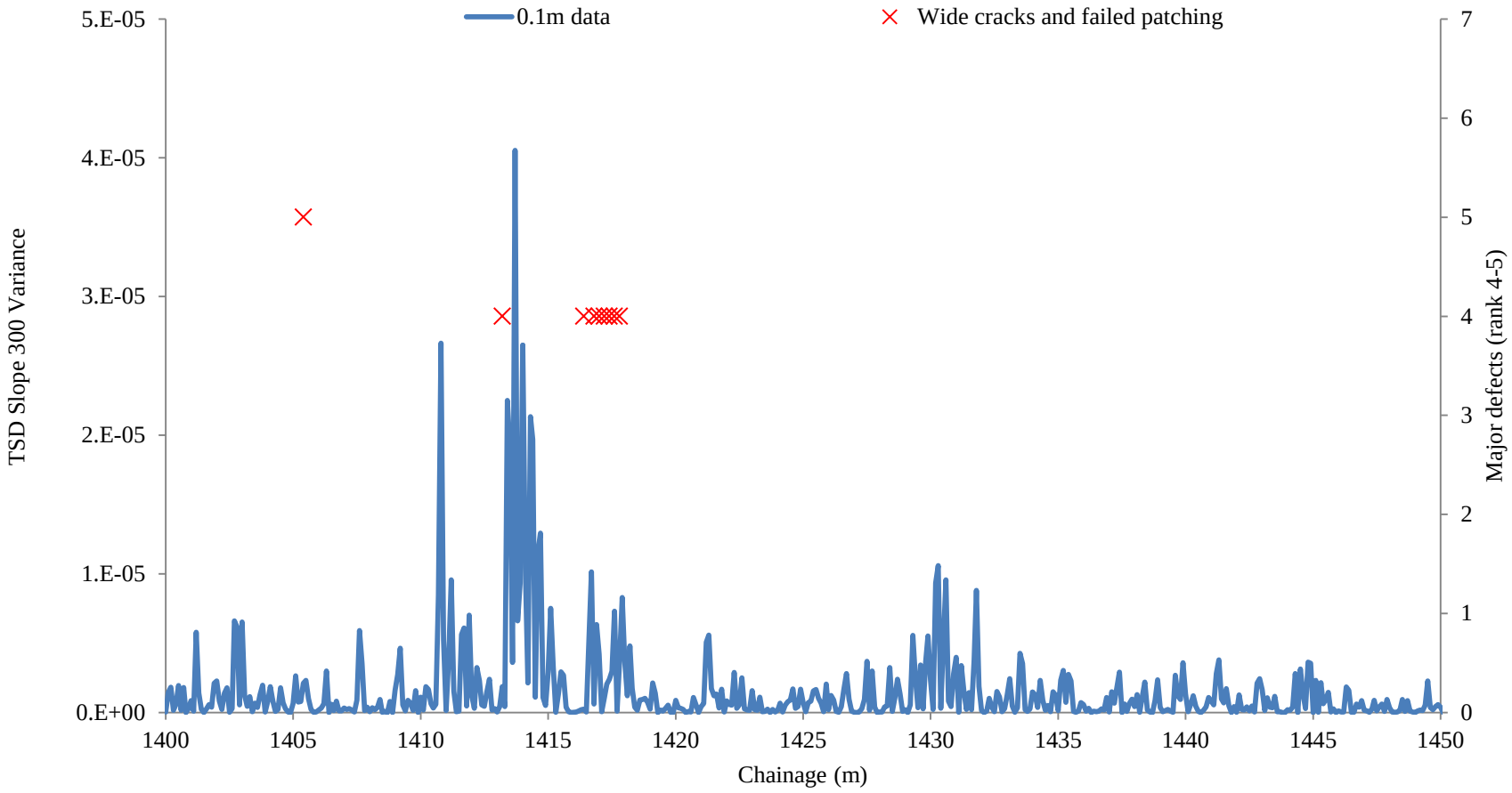


Figure 2.1 – Variance of 0.1m TSD Slope data Vs. Major defect locations

First 50m sample of TSD variance (250 to 300m)



Second 50m sample of TSD variance (1400 to 1450m)



Summary

- Standard methods of concrete pavement assessment are slow, expensive and require disruptive lane closures.
- Traffic speed images suitable for use in detailed visual survey
- TSD technology has matured to a stage where it is being used for routine network surveys of L1 of the UK HA strategic road network
  - But only reports on flexible pavements
  - Concrete (and overlaid concrete) not a priority for HA
- TSD shows response to joints in thin concrete pavement that appears to correlate with LTE from FWD
- Feasibility of using TSD to assess condition of thick in-service concrete pavements not yet established but early results are promising.

Monitoring Structural Condition

Background

To perform traffic speed deflection assessment of pavements in urban areas on minor roads.

Problem

The Traffic Speed Deflectometer (TSD) is based on a large HGV and there is a requirement for a smaller scale vehicle to enable navigation of urban areas. Current technology, the Deflectograph (DFG) is slow 2.5km/hr and the Falling Weight Deflectometer (FWD) is a static device that require traffic managment, often causing user delays and added traffic emmisions.

Method

The first phase will compare surveys conducted by DFG with TSD surveys at normal 10tonne and 5 tonne loadings. The second phase will also investigate integration with coreless GPR and downward facing cameras and the applicabilility to assessing concrete pavements.

Advantages

Routine surveys and better prediction models to greater empower pavement managament authorities.

Reduced user delays and emmisions

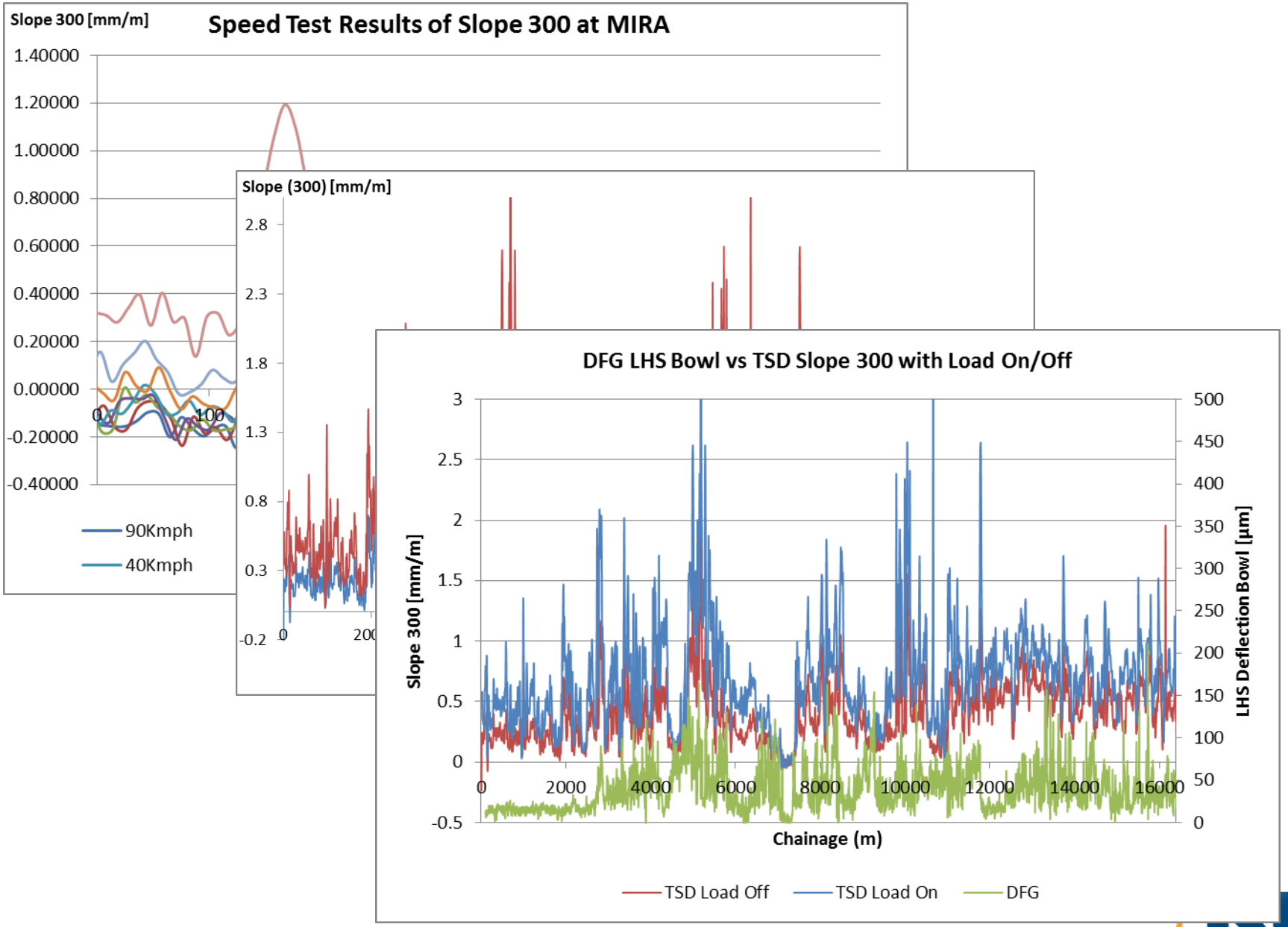
Limitations

The project will be a proof of concept, construction of a new vehicle is beyond the scope of the project.

Sub-tasks 4.4.1-4.4.4

Develop, carry out and analyse practical TSD tests on local roads

- Local road network selected
- TSD surveys carried out on 160+km Oct. 2013
- Deflectographs surveys carried out Oct. &Nov.2013
- TSD data in question due to component failure.
- Repeat TSD surveys carried out in 2014.
- Compared surveys to ascertain ability of lower loading to categorise structural condition.


Slope 300 [mm/m]
Speed Test Results of Slope 300 at MIRA
1.40000
1.20000
1.00000
0.80000
0.60000
0.40000
0.20000
0.00000
-0.20000
-0.40000
0
100
90Kmph
40Kmph
Slope (300) [mm/m]
2.8
2.3
1.8
1.3
0.8
0.3
-0.2
0
200
DFG LHS Bowl vs TSD Slope 300 with Load On/Off
Slope 300 [mm/m]
3
2.5
2
1.5
1
0.5
0
-0.5
0
2000
4000
6000
8000
10000
12000
14000
16000
Chainage (m)
LHS Deflection Bowl [µm]
500
450
400
350
300
250
200
150
100
50
0
TSD Load Off
TSD Load On
DFG

TSD = Traffic Speed Deflectometer

TRIMM Sub-task 4.4.5

It is possible to make a TSD for local roads.

Requirements and specifications must be established before design of such a device

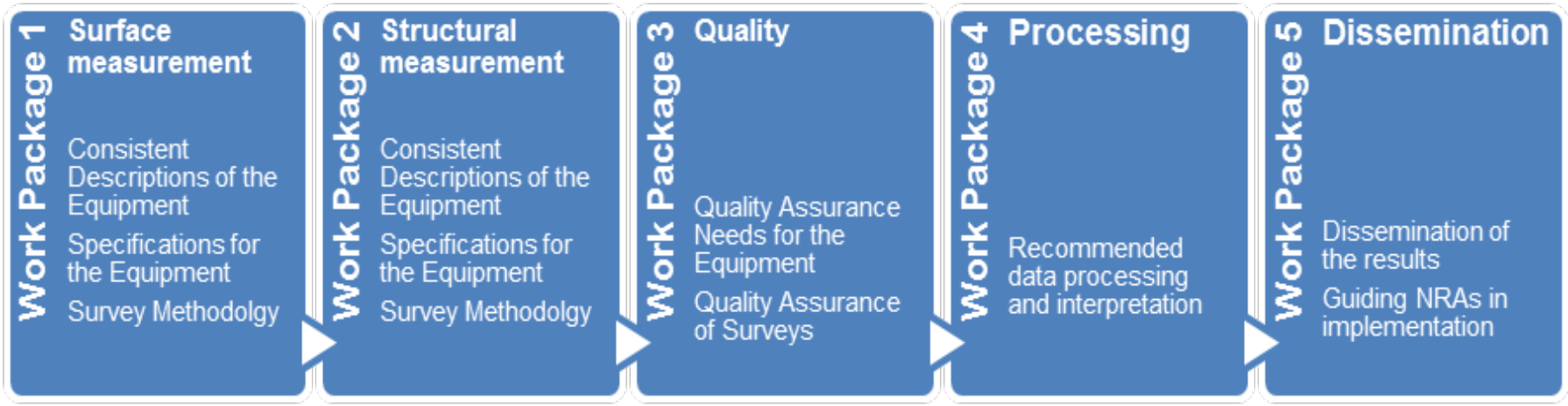
Limitations for a TSD to navigate on local roads:

- Maximum vehicle width
- Maximum vehicle length
- Maximum vehicle height
- Minimum required turning radius

Contents

HI-SPEQ –European project sponsored by CEDR

- **H**i-speed survey **SP**ecifications, **E**xplanation and **Q**uality
- Commissioned under the CEDR Ageing Infrastructure Management Call – High-speed non-destructive Condition Assessment. Managed by Ireland National Roads Authority
- 6 project partners (TRL, AIT, VTI, ZAG, COWI, Fugro). Start date 14th April 2014, Duration: 24 months
- HI-SPEQ will draw on a **Reference Group** of road owners & operators, ***survey equipment builders & users***, Data users, researchers etc.



Objectives of HI-SPEQ project

1. Identify the data that can be collected on road networks to measure surface condition, structural condition and road structure at high speed and the type of equipment that can be used to collect this data.
2. Determine the requirements for, and the capability of, current high speed survey equipment
3. Deliver interactive templates and best practise guidance for describing the equipment used on the network.
4. Investigate how network surveys can be specified to deliver the needs of road Authorities and, using current examples, clarify how such surveys can be commissioned

Objectives of HI-SPEQ project

5. Provide interactive templates for specifying surveys of surface and structural condition on the European road network, accompanied by guidance.
6. Identify the processes that should be applied to ensure that these surveys meet their expected levels of quality,
7. Provide guidance to help Authorities specify suitable QA regimes for their network surveys.
8. Recommend the most effective ways to convert survey data into meaningful condition parameters that can be input to asset management systems.

Contents

Specialist High-speed Deflection Device Groups

- DaRTS (Deflection at Traffic Speed)
  - International Group
  - By invitation only
  - Coordinator – Brian Ferne, TRL, UK
  - Set up by English Highways Agency and TRL in 2012
  - Meetings
    - 2012 – London, England
    - 2013 – Trondheim, Norway
    - 2014 – Blacksburg, USA
  - Specialist sub-groups

- BeCaTS (Bearing Capacity at Traffic Speed)
  - European FEHRL Working Group
  - Leader – Adam Zofka, IBDiM, Poland
  - Set up by FEHRL 2014.

Summary

1. Commercial TSD surveys in England - TRASS
2. Rapid assessment of rigid pavements
3. European projects - TRIMM
4. European projects - HISPEQ
5. Specialist groups – DaRTS and BeCaTS

Thank you

Presented by Brian Ferne

17 September 2014

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