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Highways Agency 2009 National Falling Weight Deflectometer Correlation trials

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Transport Research Laboratory

PUBLISHED PROJECT REPORT PPR 437

Highways Agency 2009 National Falling Weight Deflectometer Correlation trials

by Stuart Brittain (TRL)

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Assessment and Standardisation of Pavement Evaluation and Correlation Techniques

Client: **The Highways Agency, Network Services Directorate**

(Roger Fairclough)

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Contents

Executive summary

The 2009 UK Falling Weight Deflectometer (FWD) correlation trial was held at TRL on the 28th and 29th April 2009. This was the tenth mandatory FWD correlation trial to be held in the UK with the objective being to assess the performance of all FWDs (including Heavy Weight Deflectometers, (HWDs) and Super Heavy Weight Deflectometers (SHWDs)) operating on the Highways Agency (HA) strategic road network. The performance of individual machines was assessed by examining and monitoring the results from the machines operating on specified test sections of the TRL Small Roads System (SRS). Only machines that can demonstrate satisfactory performance in the correlation trial are subsequently approved for use on the HA strategic road network.

A total of seventeen machines took part in the trial, consisting of ten trailer-mounted Dynatest FWDs, one vehicle-mounted Grontmij-CarlBro FWD, five Dynatest trailer-mounted HWDs and one Grontmij-CarlBro SHWD. All of the machines are operated in the UK or Republic of Ireland, except for the vehicle-mounted Grontmij-CarlBro machine which is based in Denmark.

The trials followed a similar format that was used successfully from 2004 through 2008, being split over two days, with machine inspections, corrective actions and practice laps held on the afternoon of the first day, with the correlation trial proper taking place on the second day.

This year continued an initiative introduced in the 2008 trial whereby vehicle inspection check sheets were sent out to the operators ahead of the trial and returned to TRL the week preceding the main trial. This ensured that most of the machines were set up correctly on arrival so that only basic checks were required by TRL staff. This method again proved successful in minimising the delays encountered in previous years as a consequence of machines arriving with incorrect machine or software setups. In addition, operators were asked to provide the current annual calibration certificate for their machine(s) and documentary evidence that satisfactory routine calibration of the machine(s) had been carried out at least 12 weeks prior to the trial.

The key findings from the main test day of the correlation trial are summarised as;

- All seventeen machines met the trial requirements for Field Calibration Factor (FCF) for both average and individual geophone measurements
- Twelve of the seventeen participating machines met the average and individual trial requirements for Standard Deviation of the Deviation Ratio (SDDR) using the full data set of seven geophones for each of the twelve stations over two test laps.
- Three machines met the trial requirements for SDDR following the removal of one geophone measurement from one test station from one test lap.
- One machine met the trial requirements for SDDR following the removal of one geophone measurement from one test station from each of two test laps.
- One machine (K) was unable to meet the trial requirements for both individual and mean geophone SDDR even when one geophone measurement from one test station was removed from each of two test laps.

Sixteen of the seventeen machines that participated in the 2009 correlation trial are therefore considered to be acceptable for use on the HA's strategic road network in the 2009/2010 season.

Machine K is not considered to have met the trial criteria and is therefore not authorised for surveys on the HA's strategic road network until such time as it has successfully met the required criteria in a subsequent re-test.

Abstract

For the last ten years an annual correlation trial for Falling Weight Deflectometers (FWDs) has been held in the UK. The objective of the trial is to assess the performance of all FWDs (including Heavy Weight Deflectometers, (HWDs) and Super Heavy Weight Deflectometers (SHWDs)) operating on the Highways Agency (HA) strategic road network. The performance of individual machines is assessed by examining and monitoring the results from the machines operating on specified test sections of the TRL Small Roads System (SRS). Only machines that can demonstrate satisfactory performance in the correlation trial are subsequently approved for use on the HA strategic road network.

This report describes the conduct and findings of the 2009 correlation trial and presents the details of the machines that are approved for use on the HA strategic road network in 2009/2010.

1 Introduction

Current advice on the use of the Falling Weight Deflectometer (FWD), provided in HD29/08 of the Design Manual for Roads and Bridges (DMRB 7.3.2), requires that all FWDs, including Heavy Weight Deflectometers (HWDs), be tested and approved at an annual correlation trial before being accepted for operating on the Highways Agency's strategic road network. A similar requirement has also been in place for SCRIMs and Deflectographs for many years, and forms part of a system to ensure that consistent, high quality data is obtained from condition surveys of the strategic road network in England. In addition, Defence Estates' Design and Maintenance Guide 27, "A Guide to Airfield Pavement Design and Evaluation" (also known as the "Green Book") requires that an FWDs be approved at an annual correlation trial before it may be permitted to survey on MoD airfields.

The objectives of the 2009 FWD correlation trial remain as they were set out in the report on the 1998 preliminary trial (Gershkoff et al, 1999). In summary these are:

- To ensure that all machines are maintained in good mechanical order by conducting an inspection of each machine at the trial.
- To ensure consistent performance of individual machines and the reproducibility of all machines.
- To monitor and seek improvements in performance over the longer term.
- To keep under review the use of field calibration factors (FCF) to correct measured deflections when working on the HA strategic road network. The FCF indicates how the deflections recorded by each machine relate to the reference deflection basins and forms part of the acceptance criteria for this trial.

The tenth mandatory UK FWD correlation trial was held at TRL on 28th and 29th April 2009 on behalf of the Highways Agency (HA). Seventeen FWDs were included in the trial, of which fifteen were manufactured by Dynatest and two were manufactured by Grontmij-CarlBro.

The trial followed the format that was used successfully in the previous mandatory correlation trials carried out since 1999, details of which were reported by Nell and Langdale (2007).

From the 2007 trial onwards, surveys of vehicle conspicuity inspection have also been carried out, but do not form part of the performance criteria for the trial. The inspection was carried out in addition to the standard calibration and configuration checks on the first day of the trial.

2 Trial Format

2.1 Participants

Seventeen machines took part in the 2009 HA FWD correlation trial, ten FWDs (nine trailer-mounted and one vehicle mounted), six HWDs (all trailer-mounted) and one trailer mounted SHWD. The attending machines were owned by the following organisations (in alphabetical order):

ALC (MoD)	-	2x Dynatest HWD
CET Safehouse	-	1×Dynatest HWD
Grontmij	-	1×Grontmij-CarlBro vehicle-mounted FWD
Jacobs	-	1×Dynatest FWD
Morrison Construction	-	1×Dynatest FWD
PMS (Eire)	-	2×Dynatest FWD, 1×Dynatest HWD
PTS	-	1×Grontmij-CarlBro Super HWD
Scott Wilson	-	2×Dynatest FWD, 2×Dynatest HWD
TRL	-	2×Dynatest FWD
WDM	-	1×Dynatest FWD

Fuller details of the attending machines are provided in Appendix A and photographs of an FWD, an HWD, a SHWD and a vehicle-mounted HWD are given in Appendix B

For convenience, while maintaining confidentiality, the individual machines are referred to by the letters A-Q in this report with each participating organisation being informed of the corresponding letter(s) for their own machine(s). The Highways Agency has been provided with the identification of each machine in a separate document.

2.2 Preparation of vehicles

All operators were asked to prepare their machines for testing under standard conditions prior to their arrival at the trial, as follows:

- Positions of deflection sensors: 0, 300, 600, 900, 1200, 1500 and 1800 mm.
- Standard loading plate, diameter 300mm.
- Load 50kN (fixed height or seek).
- Data storage in standard metric output (R32-20F format).
- Configured for 5 drops at each test site.

Operators were also strongly advised to have the peak smoothing function, if available, activated.

2.3 Inspection of vehicles

2.3.1 Calibration and configuration

On arrival, the machine crews were required to provide information on the manufacturer's calibration and their own dynamic calibrations, the details of which are shown in Appendix A. In addition, a TRL inspector checked each machine's specification

and set-up before testing began to ensure that the machines were as comparable as possible and observed the operation of all machines during testing.

2.3.2 Conspicuity survey

A revised version of Chapter 8 of the Traffic Signs Manual (TSM); "Traffic Measures and Signs for Roadworks and Temporary Situations" was published in 2006. While having no Statutory basis in England, this document provides a Code of Practice for the signage and other related matters to be used in roadworks and also for the activities carried out within them, such as FWD surveys, and is widely adhered-to. However, feedback from FWD operators had revealed that there appeared to be some differences in interpretation of the requirements of the TSM on the part of those commissioning FWD surveys.

As a result of this experience, a review of the revised Chapter 8 was carried out in terms of its apparent applicability to FWD surveys, for which advice was taken from the TRL team responsible for its development. The review sought to summarise the legal, mandatory, recommended and optional requirements set out in Chapter 8 of the TSM for different components of the towing vehicle and the FWD trailer. The requirements were then divided into several areas; namely general requirements, conspicuity of colour, sign and marking on the survey vehicle, and finally requirements of any fitted hazard beacons. Each area was then sub-divided into a number of components. A checklist of items was then developed to form the basis of a survey to be carried out on the first day of the trial in parallel with the standard calibration and configuration checks described above. The survey does not, however, form part of the correlation trial requirements.

2.4 Location of Trial

Four test sections were used for the trial; each with different constructions and associated deflection levels, and located within the TRL small roads system (SRS). Three points in each of these sections (12 test points in total) were clearly marked out using road paint (see Figure 2.1 below) and the whole site was swept clear of debris in the week prior to the trial. Nominal construction details for the test sections can be found in Table C1 in Appendix C. Crews were instructed that the loading plate should be placed completely within the marked box for testing. Throughout testing, road temperatures at 40mm and 100mm depths were each recorded at two separate locations.

Figure 2.1: Test position marked by a painted 'box'

2.5 Test Programme

Appendix D contains the detailed instructions provided to participants regarding the conduct of the trial.

On 28th April (Day 1), after machine inspections had been carried out, each machine made one initial lap of the test course. This preliminary testing is designed to give new operators the chance to familiarise themselves with the course, and to seek to highlight any obvious problems that would otherwise delay progress during the main part of the trials on the following day.

On 29th April (Day 2), after the crew briefing, the first standard lap (of three) commenced at 10:00 a.m. Machines tested points 1 to 12 sequentially, allowing a clear gap of at least one test point between machines.

TRL staff members were made available to assist crews with positioning at test points. Five replicate drops were made at each point, with peak values of load and deflection recorded as well as time histories. Each complete set of 12 test points is referred to as a lap.

The first lap was treated as a warm-up lap, and was then followed by two test laps. After completing each lap, the data was handed over to TRL staff before beginning the next lap, and any anomalies reported by operators were recorded. Real-time data processing enabled summary results of each lap to be available soon after the lap was completed.

3 Inspection of vehicles

3.1 Machine set-up and configuration

The machine check on the first day of the trial ran efficiently due largely to the vehicle inspection checksheets being sent to participants prior to the trial, ensuring that most of the machines arrived correctly set up and configured with only minor checks required by TRL staff. This enabled the participants to complete their test lap within a reasonable time. Unfortunately, it was not possible for the details for three machines to be provided in advance due to the machines not returning to the UK until the week of the trial.

Appendix A itemises the configuration of the various machines, while Table 3.1 and Table 3.2 summarise the findings of the inspection with regards to certain key parameters that either affect operation or are requested in the trial documentation.

Table 3.1: Summary of pre-arrival FWD checks

Checklist item	Number compliant (out of 17)	Notes
Completed check list returned to TRL before trial.	14	Should be received by TRL by 24/04/08
Check list details correspond with condition of equipment at trial	14	Machines should arrive requiring only minor changes
Provide evidence and date of last manufacturer's calibration	11	Should be received in the week before the trial
Provide evidence and date of last dynamic calibration.	11	Should be received in the week before the trial
Provide evidence and date of last tower calibration	14	Should be received in the week before the trial

Table 3.2: Summary of FWD configurations on arrival

Checklist item	Number compliant (out of 17)
Provide evidence and date of last manufacturer's calibration	13
Provide evidence and date of last dynamic calibration.	11
Provide evidence and date of last tower calibration	14
Calibration details correct in field program	14
All seven geophones in correct positions	16
Clock synchronised	16
Correct seating of frame	17
Smoothing checked	17

Following the 2006 Correlation Trial, it had been agreed with the FWD operators that routine dynamic and tower calibration records should be made available for viewing at

the 2007 correlation trial, with a view to making checks mandatory for the 2008 trials. Of the 17 participants at the trial, 13 were able to produce a manufacturer's calibration certificate, 11 could provide details of the latest dynamic calibration and 14 could provide details of the latest tower calibration. This response is comparable to the 2008 trial.

3.2 Conspicuity survey

The survey of machine conspicuity revealed there to be a variable pattern of interpretation and/or implementation of the extant guidance. Table 3.3 provides a description of the items assessed, and their colour coded rating of classification, together with a summary of the findings. For trailer-mounted equipment, the tow vehicle and trailer were assessed separately.

Table 3.3: Summary of findings of conspicuity survey

Item	Tow vehicle (out of 17)	Trailer (out of 16)
Operating company clearly defined?	15	8
Reversing bleeper fitted and operational?	6	5
Vehicle colour conspicuous (silver, white, yellow)?	14	4
High-Visibility markings at rear?	10	10
High-Visibility edges to opening doors?	7	n/a
HIGHWAY or MOTORWAY MAINTENANCE sign?	9	2
Warning Beacon fitted?	15	8
Warning Beacon operational?	15	5*

*Mandatory if beacon fitted

Key:	Mandatory	Recommended	Optional

While it is apparent that, in general, the attendees met the requirements of the great majority of the "mandatory" items, there were also a number of potential shortcomings. This is not, however, unexpected as, given that the correlation trial is held on a closed road site, the participants may not have provided their equipment in the same condition that would be employed on a live carriageway. This is particularly appropriate to the two MoD vehicles, which would not necessarily be expected to be compliant with Chapter 8 of the Traffic Signs Manual.

Each trial participant has been provided with the detailed survey results relating to their individual machines, together with the Chapter 8 review document and item checklist used in the survey.

4 Correlation trial results

4.1 Temperature variation

On day 2, pavement temperatures were recorded at 40 and 100mm depths adjacent to test point 3 (section 1) and test point 5 (section 2). The weather was sunny with temperatures increasing throughout the morning and afternoon, as shown in Figure 4.1.

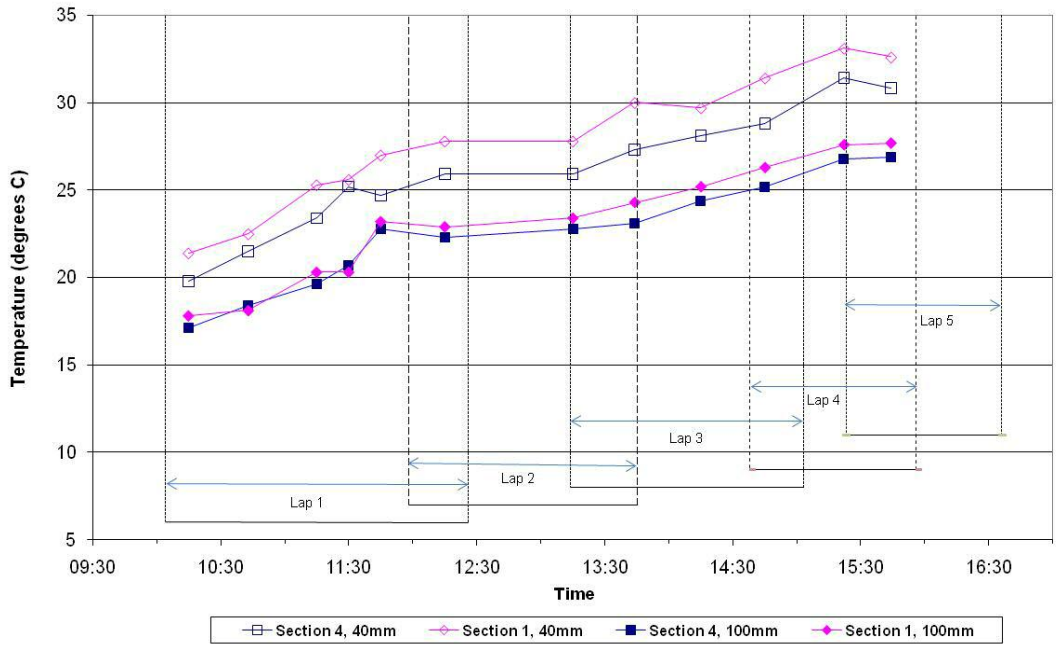

Figure 4.1: Pavement temperatures on test sections during correlation trial

A maximum "asphalt layer" temperature change of 3°C during each test lap is recommended under the CROW procedure (CROW 1998) on which the UK trials are based [CROW is the Dutch information and technology centre for transport and infrastructure]. The aim of the limit is to ensure that, as far as practicable, all machines are subject to the same pavement conditions during any single test lap.

The temperature measurements are given in Table 4.1. It can be seen that while the 3°C limit was exceeded on lap 1, this is a warm-up lap and is not used in the results.

Table 4.1: Pavement temperatures for each lap during correlation trial

Lap	Start of lap			End of lap			Duration (hours:mins)	Temperature difference during lap (°C)	
	Time	Average temp. (°C)		Time	Average temp. (°C)				
		40mm	100mm		40mm	100mm		40mm	100mm
1	10:04	20.1	17.1	12:26	26.9	22.7	02:22	6.8	5.6
2	11:58	26.3	22.8	13:45	29.1	21.7	01:47	2.9	-1.2
3	13:14	28.4	22.6	15:03	31.1	25.8	01:49	2.7	3.2
4	14:38	29.7	26.9	15:56	31.4	27.4	01:18	1.7	0.4
5	15:23	32.2	27.2	16:36	30.4	27.5	01:13	-1.8	0.3

4.2 Acceptance criteria: derivation of FCF and SDDR

As in previous correlation trials, the results have been analysed following the CROW procedure (CROW, 1998). This procedure uses a series of statistical tests to eliminate outlying data in order to define a reference deflection basin for each test point. For each deflection sensor, the ratio of the measured mean deflection to the reference deflection, averaged over all test points is defined as the Field Calibration Factor (FCF). The overall FCF for each machine is calculated by averaging the FCF values for the individual sensors. The FCF therefore indicates, on average, how well the deflections recorded by each machine relate to the reference deflection basins.

The difference between the deflection at each test point and the reference deflection basin, expressed as a fraction of the reference deflection is known as the Deviation Ratio. For each machine, the Standard Deviation of the Deviation Ratio (SDDR) is calculated over all points and gives an indication of the consistency with which it tends to over- or under-read during the lap. Following the preliminary trials in 1998 and 1999 it was proposed that FCF and SDDR should be used as the basis for defining acceptance criteria at future trials, with proposed tolerances as shown in Table 4.2. These criteria have since been adopted and used as the pass criteria for the mandatory trials.

Table 4.2: Pass criteria

Parameter		Maximum	Minimum
FCF	Mean for all sensors	1.05	0.95
	Individual sensor value	1.10	0.90
SDDR	Mean for all sensors	0.05	N/A
	Individual sensor value	0.07	N/A

4.3 Results from test laps

In order to evaluate the performance of each machine two laps are chosen from the test set: these laps are denoted lap i and lap ii. In general, the laps chosen for i and ii are laps 2 and 3 respectively (the data from the warm up lap [lap 1] is always discarded). However, when machines do not perform as expected additional laps may be required.

The FCF and SDDR values derived from each machine's laps are given in Table E1 and the results from laps i and ii (prior to geophone removal) are shown graphically in Figure 4.2 and Figure 4.3. The vertical bars in these figures indicate the range of values from individual sensors and the filled circles/squares indicate the mean value for all seven sensors.

Following completion of test laps 2 and 3, a number of the machines were found to be not performing within the acceptable passing limits in terms of FCF and/or SDDR. These machines had anomalous readings removed or carried out additional laps along with other machines which had performed well, to act as comparisons. The removal of anomalous readings and the undertaking of additional laps is discussed in the following sections.

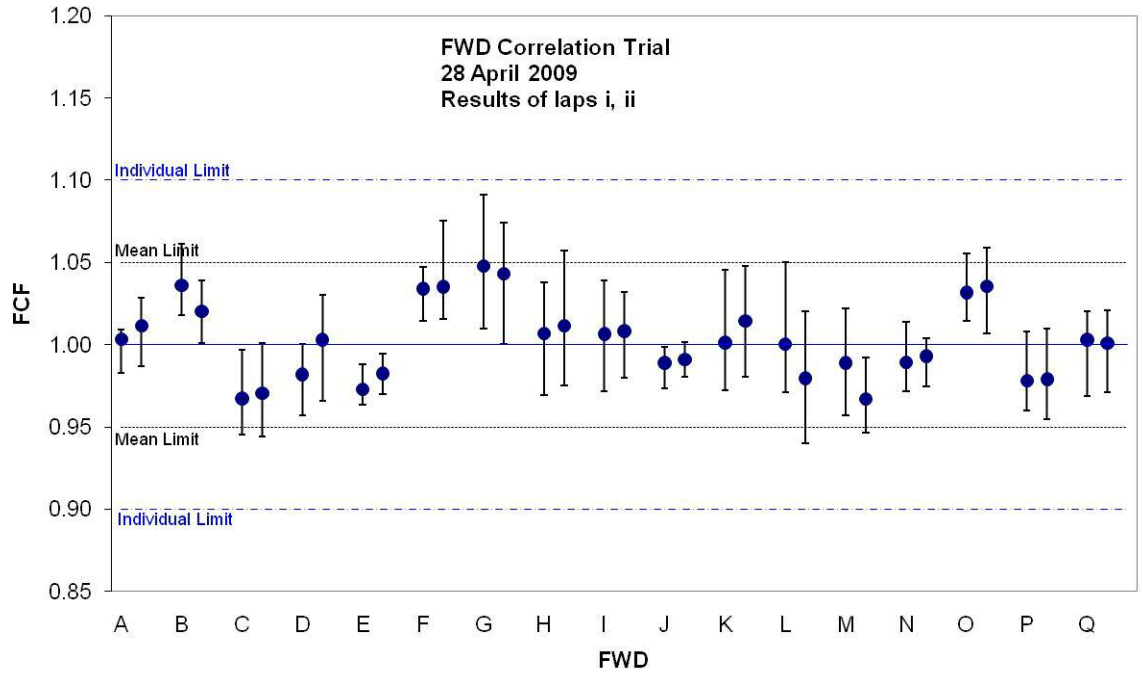

Figure 4.2: Field calibration factors (FCF) for each FWD (for the chosen test laps)

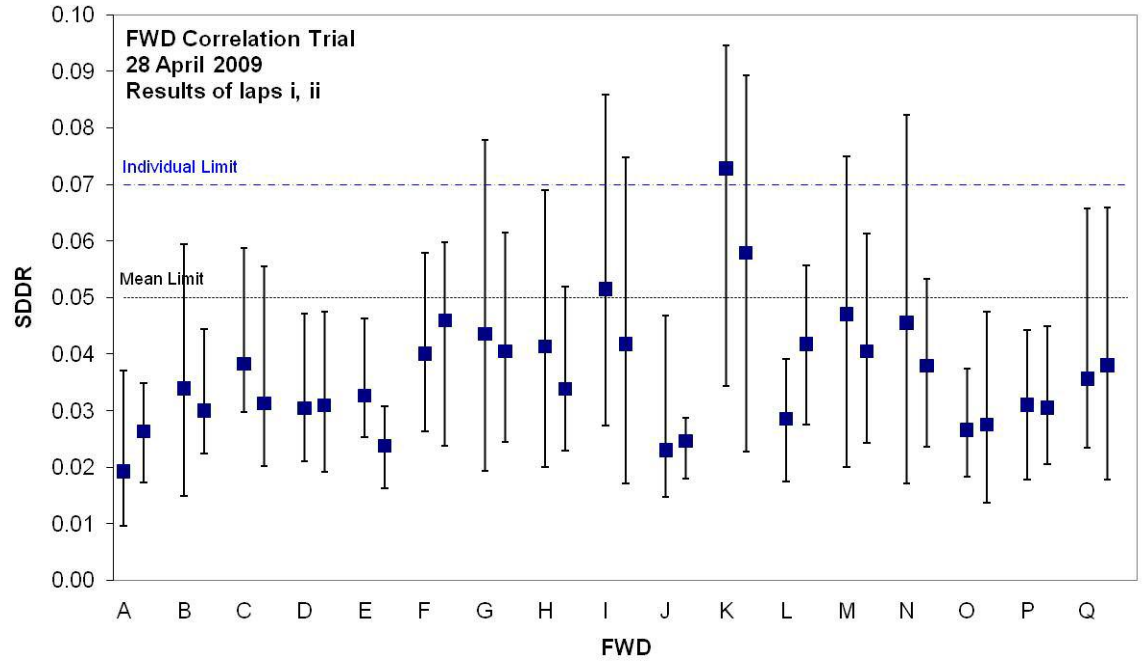

Figure 4.3: Standard deviation of the deviation ratio (SDDR) for each FWD (for the chosen test laps)

4.3.1 Machines D, F and M

During the initial test laps (i.e. laps 2 and 3) it was found that machines D, F and M were not performing within the acceptable passing limits in terms of SDDR. Minor adjustments were carried out to the equipment following these laps and two additional laps were carried out (laps 4 and 5). The machines were then found to be performing within the acceptable passing limits (in the case of machine M, after an anomalous geophone reading was disregarded as discussed in section 4.3.3). The laps used in the analysis for these machines are detailed in Table 4.3.

4.3.2 Machine K

Machine K was unable to take part in laps 2 and 3 owing to an equipment malfunction that required a substitute part from another machine. As a consequence, Machine K took part in laps 4 and 5 and these laps were used in the subsequent analysis as shown in Table 4.3.

Table 4.3: Laps used for machines D, F, K and M

Machine	Lap used as lap i	Lap used as lap ii
D	Lap 4	Lap 5
F	Lap 4	Lap 3
K	Lap 4	Lap 5
M	Lap 5	Lap 3

4.3.3 Removal of anomalous readings (Machines G, I, K, M, N)

Occasionally, a machine will produce isolated anomalous geophone readings which result in SDDR values outside acceptable passing limits. The correlation trial procedure allows for the measurement from a single geophone at one test station to be removed from the analysis of each lap (i.e. one geophone measurement per lap). Five machines (G, I, K, M and N) had either (or both) the mean or maximum individual SDDR values outside the required limits for one or more laps, and therefore had this process applied, as detailed in Table 4.4. With the exception of machine K, this operation resulted in the SDDR values for the machines falling within the acceptable limits. The resulting updated SDDR plot is shown in Figure 4.4 and the results are detailed in Table E2.

Table 4.4: Anomalous readings removed

Machine	Mean SDDR before	Max SDDR before	Sensor reading removed	Test Station	Test Lap	Mean SDDR after	Max SDDR after
G	0.044	0.078	5	3	ii	0.037	0.052
I	0.052	0.086	7	2	i	0.048	0.061
	0.042	0.075	7	2	ii	0.039	0.062
K	0.073	0.095	6	2	i	0.071	0.095
	0.058	0.089	6	3	ii	0.057	0.081
M	0.047	0.075	6	1	ii	0.045	0.065
N	0.046	0.082	1	10	ii	0.039	0.056

Shaded cells indicate readings outside pass criteria.

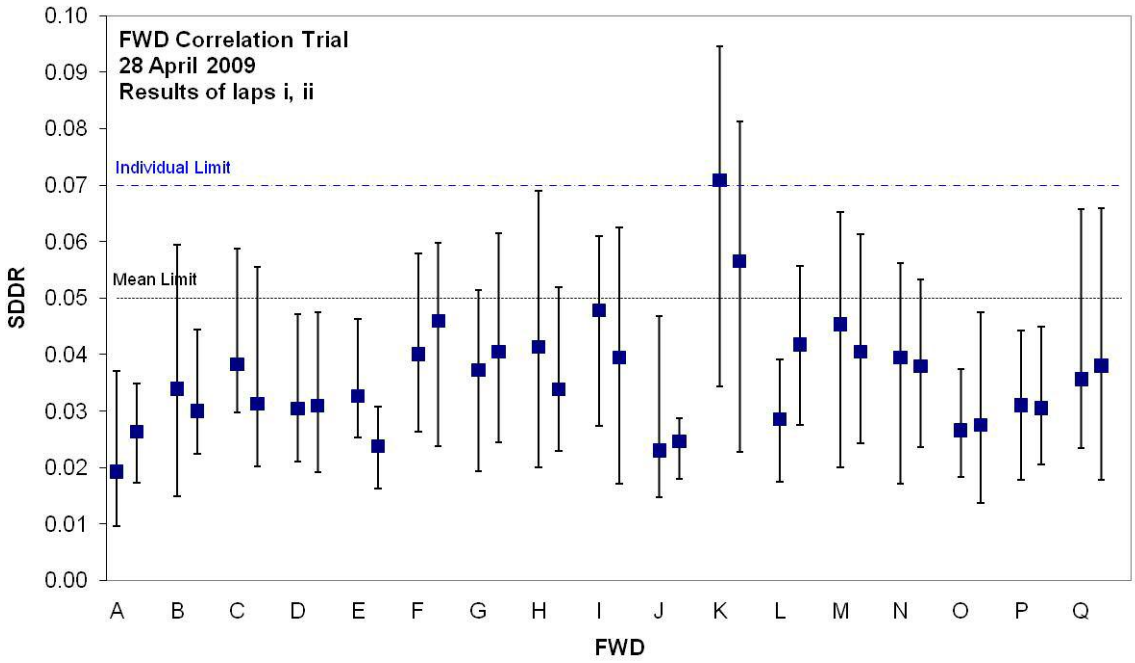

Figure 4.4: Standard deviation of the deviation ratio (SDDR) for each FWD (with selected geophones removed)

4.4 Compliance with acceptance criteria

It can be seen from Figure 4.2 that all seventeen machines passed the trial requirements for Field Calibration Factor (FCF) for both average and individual geophone measurements using the full data set from all seven geophones for each of the twelve stations over the two chosen test laps (i.e. laps i and ii).

Twelve of the seventeen participating machines passed the average and individual trial requirements for Standard Deviation of the Deviation Ratio (SDDR) using the full data set from all seven geophones for each of the twelve stations over two test laps. For two of these machines (D and F), additional test laps were required.

Two machines (G and N) passed the trial requirements for SDDR following the removal of one geophone measurement from one test station from one of two test laps.

One machine (M) passed the trial requirements for SDDR following additional laps and the removal of one geophone measurement from one test station from one of two test laps.

One machine (I) passed the trial requirements for SDDR following the removal of one geophone measurement from one test station from each of two test laps.

One machine (K) was unable to meet the trial requirements for both individual and mean geophone SDDR even when one geophone measurement from one test station was removed from each of two test laps.

The acceptance status of each of the tested machines is outlined in Table F1 in Appendix F.

4.5 Variation of FCF values with time

It is usual practice in the Netherlands to use the annual FCF values for each FWD to correct the deflections recorded in the field by that machine. In the UK this process is not implemented but is kept under review. For the machines included in the 2009 trial, the variation of the mean annual FCF values recorded by the same machine in previous correlation trials is shown in Figure 4.5, Figure 4.6 and Figure 4.7. The machines are displayed in random order, with Greek characters used to represent the results from different machines to maintain confidentiality.

The values shown are: 1999 (mean of laps 1-3), 2000 (mean of laps 2-4), 2001 (mean of laps 2-3), 2002 (mean of laps 2-3), 2003 (mean of laps 2-4), 2004 (mean of laps 2-3), 2005 (mean of laps 2-3), 2006 (mean of laps 2-3), 2007 (mean of laps 2-3), 2008 (mean of laps 2-3) and 2009 (mean of laps 2-3).

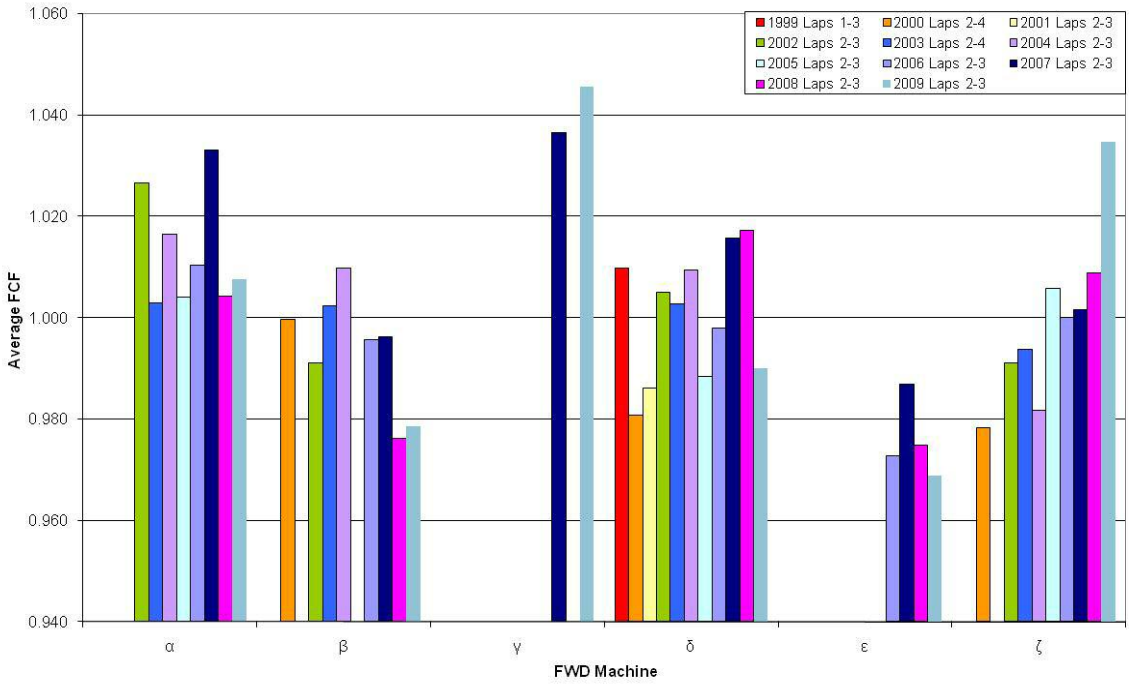

Figure 4.5: Evolution of FCF Values with Time (1)

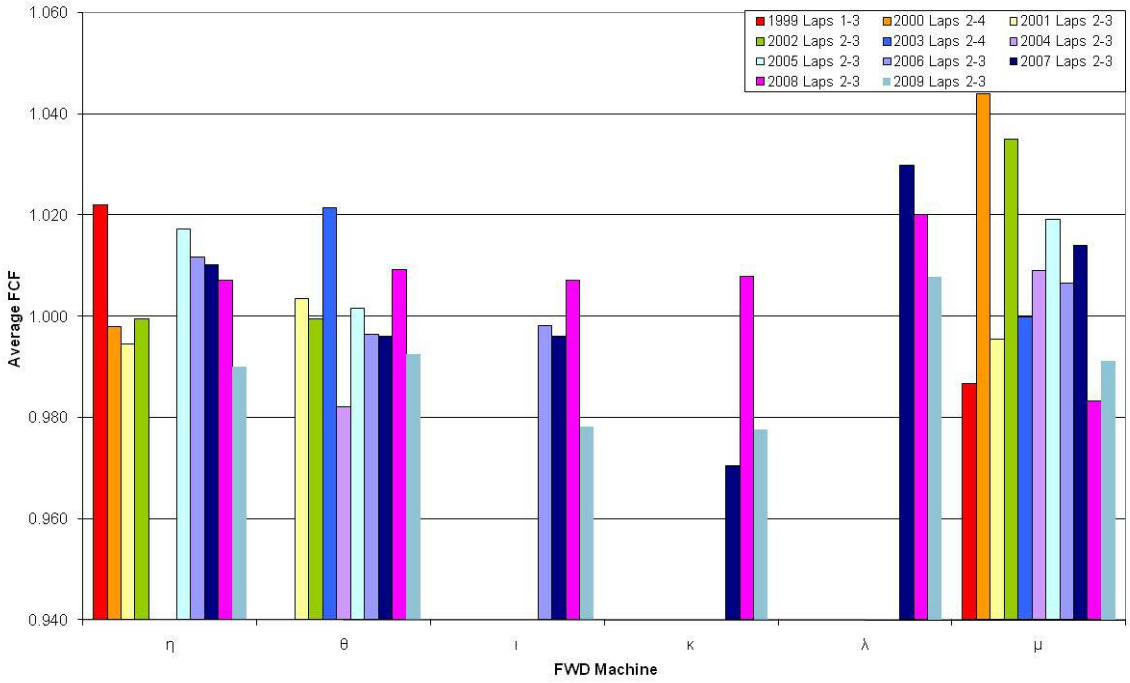

Figure 4.6: Evolution of FCF Values with Time (2)

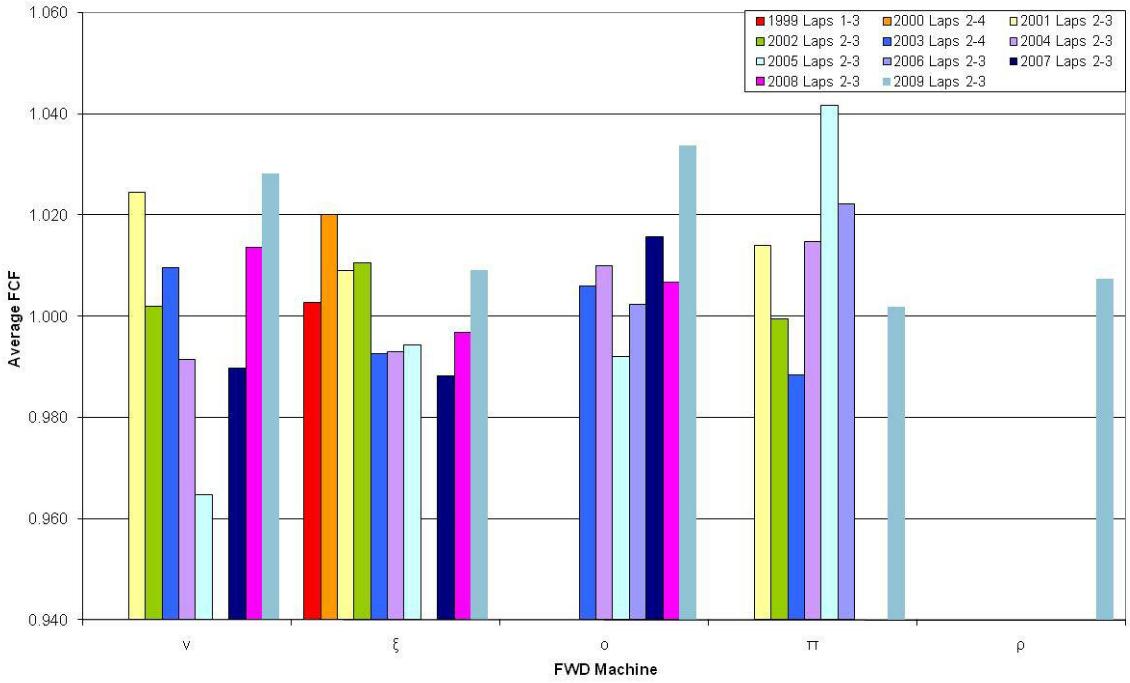

Figure 4.7: Evolution of FCF Values with Time (3)

Although all the mean FCF values are within the acceptable range, there is a considerable year-to-year variation for many of the machines. The grouping of the FCF and SDDR values is, however, comparable to those produced in previous years' trials. Following the 2000 correlation trial it was recommended that the FCF parameter should not be applied to field data, although it remains an indicator of machines' current performance during the annual trials. The latest results continue to confirm this advice; however it is recommended that the trends continue to be monitored.

5 Summary of trial findings

The 2009 UK FWD correlation trial was held at TRL on the 28th and 29th April 2009. Seventeen machines took part in the trial. All machines completed a minimum of two test laps of the twelve test stations on the main test day. The key findings of the trial are as follows:

- Twelve of the seventeen participating machines met the average and individual trial requirements for Standard Deviation of the Deviation Ratio (SDDR) using the full data set from all seven geophones for each of the twelve stations over two test laps. For two of these machines, D and F, additional test laps were required.
- Three machines (G, M and N) met the trial requirements for SDDR following the removal of one geophone measurement from one test station from one of two test laps.
- One machine (I) met the trial requirements for SDDR following the removal of one geophone measurement from one test station from each of two test laps.
- One machine (K) was unable to meet the trial requirements for both individual and mean geophone SDDR even when one geophone measurement from one test station was removed from each of two test laps.

Sixteen of the seventeen machines that participated in the 2009 correlation trial are therefore considered to be acceptable for use on the Highways Agency strategic road network in the 2009/2010 season.

Machine K is not considered to have met the trial criteria and is therefore not authorised for surveys on the HA strategic road network until it has successfully met the required criteria in any subsequent re-test.

The acceptance status of each of the tested machines is outlined in Table F1 in Appendix F, together with contact details for the appropriate operating company.

6 Acknowledgements

The work described in this report was carried out in the Infrastructure division of the Transport Research Laboratory. The author is grateful to Peter Langdale who carried out the technical review and auditing of this report, and to Dave Ankerson, Derek Meachen, Adam Cook, Brian Ferne, Patrick Werro and Kevin Green for their assistance with the trials.

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Appendix A Machine details table

A 1: Machine details

Owner	Make, model and serial number	Trailer or vehicle mounted?	Operator	Number of weights per side	Number of buffers per side	Fixed drop or seek?	Date of last manufacturer's calibration	Date of last dynamic calibration	Date of last tower calibration	Plate diameter and type	Tow vehicle
ALC (MoD)	Dynatest 8082 HWD SN 069	Trailer	Adrian Small	0	4	Seek	01/04/2009	-	01/04/2009	Solid	Details not provided
ALC (MoD)	Dynatest 8082 HWD SN 070	Trailer	Adrian Small	0	4	Seek	01/04/2009	-	01/04/2009	Solid	Details not provided
CET Safehouse	Dynatest FWD 8002 SN 203	Trailer	Thom Myers	6	3	Fixed	01/02/2009	-	01/02/2009	300mm 2-way segmented	Kia Sorento NG08 YVP
Grontmij	Grontmij-CarlBro HWD PRI2509 SN 8566	Vehicle	Rene Clemen	5	3	-	27/04/2009	27/04/2009	27/04/2009	300mm 4-way split	VW Transporter SM93 603
Jacobs	Dynatest FWD 8002 SN 271	Trailer	James Nash	6	4	Fixed	01/03/2009	01/03/2009	11/02/2009	300mm solid	Nissan Pathfinder SH06 0ZS
Morrison	Dynatest FWD 8002 SN 187	Trailer	Sandy Will / James Nash	12	6	Seek	01/04/2009	-	-	300mm solid	Nissan Terrano SD56 CHG
PMS Ltd.	Dynatest 8082 HWD SN 018	Trailer	Paschal Whyte	-	4	Seek	-	25/02/2009	24/02/2009	300mm solid	Mercedes Sprinter 07-G1442
PMS Ltd.	Dynatest 8002 FWD SN 136	Trailer	Cyril Dillon	5	2	Seek	30/03/2009	21/04/2009	21/04/2009	300mm 2-way segmented	Mitsubishi L200 09-G881
PMS Ltd.	Dynatest 8002 FWD SN 173	Trailer	Aiden Mulry	5	2	Seek	09/03/2009	21/04/2009	21/04/2009	300mm solid	Nissan Primaster 08-G-1566
PTS	Grontmij-CarlBro SHWD PRI2100 SN 0704- 201	Trailer	Matthew Ganner	5	4	-	07/11/2008	03/01/2009	-	300mm 2- way segmented	Ford Ranger Pickup PX57 WLB
Scott Wilson	Dynatest FWD 8002 SN 028	Trailer	Richard White	6	3	Seek	23/04/2009	06/04/2009	17/02/2009	300mm 2- way segmented	Nissan Shogun FP03 ODR
Scott Wilson	Dynatest HWD 8082 SN 029	Trailer	Jonathan Eastwood	2	-	Seek	22/04/2008	06/04/2009	30/11/2008	300mm solid	Nissan Shogun FP53 RZT
Scott Wilson	Dynatest HWD 8082 SN 050	Trailer	Jamie Denton (was Richard White)	2	-	Seek	27/04/2009	19/02/2009	18/03/2009	300mm 2- way segmented	Shogun LWB FM54 ULJ
Scott Wilson	Dynatest FWD 8002 SN 192	Trailer	Tom Jervis	6	3	Seek	17/04/2009	06/04/2009	06/02/2009	300mm 2- way segmented	Freelander FM06 SJO
TRL	Dynatest FWD 8002 SN 162	Trailer	Kevin Green	7	3	Seek	17/04/2009	27/08/2008	22/04/2009	300mm 2- way segmented	LDV Maxus AE05 7JZ
TRL	Dynatest FWD 8002 SN 224	Trailer	Kevin Green	6	3	Seek	-	11/04/2009	12/04/2009	300mm 2- way segmented	Jeep Cherokee X585 VUF
WDM	Dynatest FWD 8002 SN 102	Trailer	James Mitchell	4	2	Fixed	15/04/2009	-	01/04/2009	300mm solid	Ford Transit J959 EOU

Appendix B Example photographs

Figure B1: Dynatest FWD

Figure B2: Dynatest HWD

Figure B3: Grontmij-CarlBro SHWD

Figure B4: Grontmij-CarlBro vehicle-mounted HWD

Appendix C Construction details for SRS trial site

Table C1: Construction details for SRS deflection site

Deflection section	Test points	Nominal construction details (thickness [mm] and material type)					Results from cores (thickness [mm] and material type)			
		Surface course	Binder course	Base	Total asphalt thickness [mm]	Sub-base	Surface course	Binder course	Base	Total asphalt thickness [mm]
1	1-3	-	-	-	-	-	5 SD	50 DBM	95 DBM (broken)	55
2	4-6	40 HRA	60 HRA	75 dense tar macadam	175	150 type 2 granular	33	66	84	183
3	7-9	40 HRA	60 HRA	300 wet-mix macadam	100	150 type 2 granular	39	78	Not measured	117
4	10-12	40 HRA	60 HRA	300 lean concrete	100	150 type 2 granular	39	39	339 LC	98

Notes
For sections 2-4 mean result is based on two cores taken from each section in 1992.
For section 1, one core was taken in December 2003.
HRA = Hot Rolled Asphalt, SD = Surface Dressing, DBM = Dense Bitumen Macadam, CBM = Cement Bound Material, LC = Lean Concrete

Appendix D Detailed trial instructions

The main trials will consist of three test laps of a defined test circuit on the Small Road System (SRS) at TRL. Diagrams of the test site are shown in Figure D1 and Figure D2. Each lap of the site will consist of 12 separate test points. These are located between the vehicle wheelpaths and will be marked using road tape with 450mm open squares. Test measurements should take place with the FWD loading plate (300mm diameter) within the 450mm open square.

The site has four different test sections each with different deflection levels. There are three test points in each section, each. The test points are to be numbered 1 to 12 and they will be identified by a sign at the side of the road.

Each machine will commence each lap on spot 1 working sequentially through to spot 12. At each test point, each machine will perform 5 drops with the peak load and peak deflections recorded at each point. Time histories should also be recorded. During testing, a gap of at least one spot will be maintained between machines to avoid any cross-interference between the different FWDs.

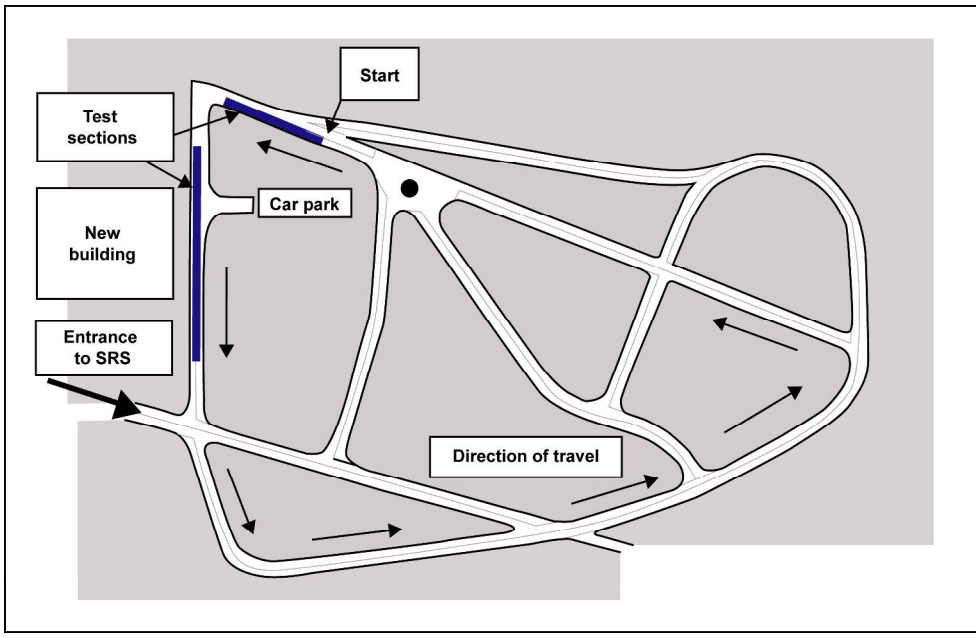

Figure D1: Overview of the test sites on the SRS

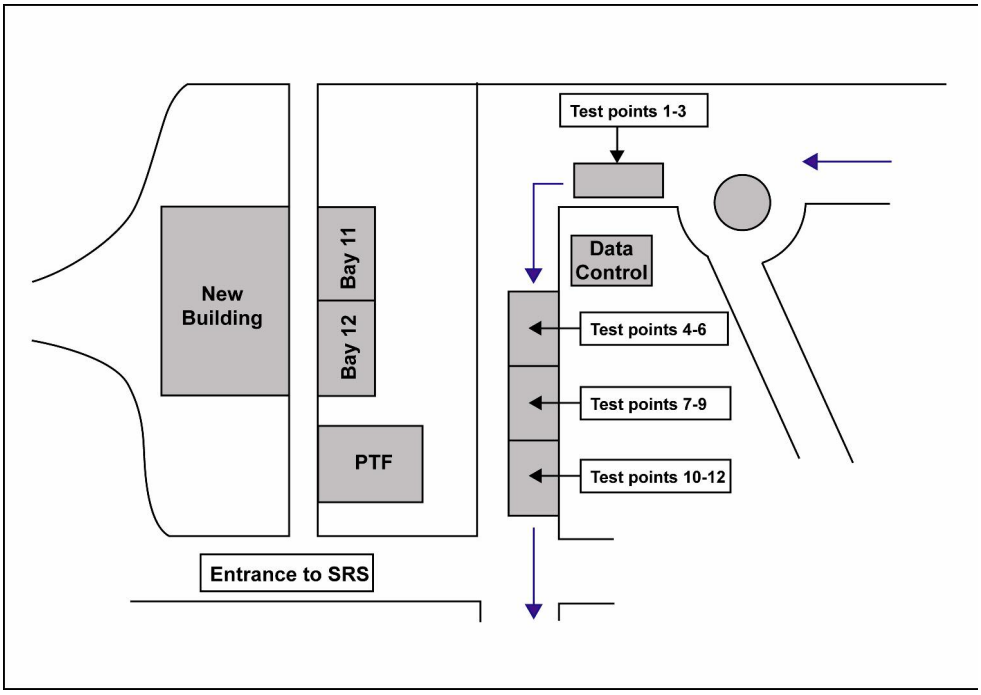

Figure D2: Detailed diagram of the test site

KEY POINTS:

- All testing to be performed at nominally 50kN (seek mode OR fixed height).
- Warm up machine prior to first test point.
- Full time histories should be recorded. Operators should ensure that they have access to a suitably-sized storage medium.
- Five drops to be recorded at each test point/station.
- Attention must be paid to the CODING of the data as detailed below.
- It is recommended that, where available, the smoothing option should be activated.
- Excessive repeats should be avoided.
- The data is to be handed in to TRL staff in the data control unit immediately at the end of each lap.
- Please contact a TRL staff member if you have any problems or questions.
- Coding to be used for test runs
    - Each machine will have a number M i.e. the number of your machine.
    - Each lap will have a number L (L = 1 to 3).
    - Each test point/station has a letter S (S = 1 to 12).
    - Results from each lap will be saved as a separate data file as follows: M_L_2008.ext where ext is the standard extension used by the FWD software (e.g. .f20).
    - For example, for machine 2, lap 3 will be saved as: 2_3_2008.f20
- Within each file, each station tested will be labelled 1 to 12 using the numeric or chainage setting facility of the FWD software.

Appendix E Trial data

Table E1 2009 All trial data (all laps, and no geophones removed)

FWD	Lap	Lap Used	Field Calibration Factor								Standard Deviation of Deviation Ratio (SDDR)							
			D1	D2	D3	D4	D5	D6	D7	mean	D1	D2	D3	D4	D5	D6	D7	mean
A	Lap 2	Y	0.983	1.005	1.005	1.009	1.009	1.006	1.007	1.003	0.037	0.018	0.010	0.011	0.015	0.024	0.020	0.019
	Lap 3	Y	0.987	0.991	1.012	1.029	1.026	1.019	1.017	1.012	0.028	0.035	0.017	0.023	0.029	0.029	0.022	0.026
B	Lap 2	Y	1.018	1.032	1.025	1.037	1.029	1.061	1.051	1.036	0.036	0.027	0.015	0.034	0.023	0.044	0.059	0.034
	Lap 3	Y	1.023	1.020	1.019	1.025	1.014	1.039	1.001	1.020	0.044	0.026	0.022	0.028	0.027	0.031	0.032	0.030
C	Lap 2	Y	0.983	0.997	0.978	0.963	0.952	0.945	0.954	0.967	0.059	0.037	0.035	0.041	0.030	0.037	0.031	0.038
	Lap 3	Y	0.984	1.001	0.989	0.964	0.956	0.944	0.954	0.970	0.055	0.036	0.027	0.025	0.020	0.023	0.032	0.031
D	*Lap 2*	*N*	*0.997*	*0.995*	*0.998*	*1.010*	*0.998*	*0.880*	*0.989*	*0.981*	*0.019*	*0.022*	*0.017*	*0.028*	*0.034*	*0.043*	*0.019*	*0.026*
	Lap 3	*N*	*1.004*	*0.991*	*0.999*	*0.997*	*0.997*	*0.877*	*0.994*	*0.980*	*0.022*	*0.024*	*0.023*	*0.018*	*0.041*	*0.044*	*0.045*	*0.031*
	Lap 4	Y	0.983	1.001	0.986	0.978	0.991	0.978	0.957	0.982	0.021	0.047	0.022	0.028	0.025	0.040	0.030	0.030
	Lap 5	Y	1.005	1.012	1.021	1.031	0.998	0.989	0.966	1.003	0.019	0.048	0.032	0.039	0.024	0.023	0.032	0.031
E	Lap 2	Y	0.972	0.979	0.972	0.966	0.988	0.968	0.963	0.973	0.029	0.046	0.025	0.029	0.037	0.027	0.035	0.033
	Lap 3	Y	0.982	0.995	0.970	0.981	0.987	0.991	0.973	0.983	0.021	0.029	0.026	0.031	0.022	0.023	0.016	0.024
F	*Lap 2*	*N*	*1.004*	*0.998*	*1.044*	*1.040*	*1.058*	*1.054*	*1.086*	*1.041*	*0.018*	*0.069*	*0.040*	*0.077*	*0.072*	*0.047*	*0.073*	*0.057*
	Lap 3	Y	1.015	1.051	1.023	1.021	1.044	1.018	1.075	1.035	0.024	0.046	0.045	0.049	0.060	0.048	0.051	0.046
	Lap 4	Y	1.021	1.046	1.048	1.042	1.015	1.024	1.043	1.034	0.026	0.041	0.045	0.058	0.037	0.033	0.041	0.040
G	Lap 2	Y	1.091	1.074	1.051	1.023	1.010	1.031	1.057	1.048	0.047	0.052	0.019	0.027	0.078	0.038	0.044	0.044
	Lap 3	Y	1.074	1.070	1.065	1.025	1.000	1.017	1.051	1.043	0.049	0.041	0.024	0.034	0.062	0.034	0.040	0.041
H	Lap 2	Y	1.013	1.010	0.999	0.969	0.990	1.038	1.029	1.007	0.022	0.027	0.020	0.045	0.064	0.042	0.069	0.041
	Lap 3	Y	1.020	1.008	0.993	0.975	1.006	1.057	1.020	1.011	0.025	0.033	0.031	0.036	0.023	0.037	0.052	0.034
I	Lap 2	Y	1.039	1.016	1.004	1.006	0.995	1.015	0.972	1.007	0.027	0.041	0.042	0.047	0.061	0.056	0.086	0.052
	Lap 3	Y	1.032	1.019	1.019	1.012	0.996	1.000	0.980	1.008	0.017	0.031	0.024	0.029	0.054	0.062	0.075	0.042
J	Lap 2	Y	0.998	0.985	0.998	0.991	0.993	0.983	0.974	0.989	0.016	0.047	0.016	0.023	0.027	0.018	0.015	0.023
	Lap 3	Y	0.991	0.980	1.002	0.990	0.995	0.998	0.981	0.991	0.029	0.028	0.024	0.026	0.018	0.027	0.020	0.025
K	Lap 4	Y	1.045	1.014	0.998	0.989	0.994	0.972	0.995	1.001	0.034	0.051	0.058	0.091	0.095	0.092	0.089	0.073
	Lap 5	Y	1.048	1.010	1.035	1.020	1.005	0.981	1.002	1.014	0.026	0.023	0.048	0.059	0.081	0.089	0.079	0.058
L	Lap 2	Y	0.987	0.994	0.971	0.976	1.015	1.011	1.050	1.000	0.029	0.027	0.017	0.033	0.026	0.028	0.039	0.029
	Lap 3	Y	0.977	0.968	0.956	0.940	0.995	0.999	1.021	0.980	0.056	0.045	0.048	0.049	0.039	0.028	0.028	0.042
M	*Lap 2*	*N*	*0.929*	*0.969*	*0.953*	*0.989*	*0.975*	*0.900*	*0.977*	*0.956*	*0.250*	*0.047*	*0.089*	*0.036*	*0.038*	*0.527*	*0.058*	*0.149*
	Lap 3	Y	0.964	0.952	0.956	0.980	0.992	0.947	0.979	0.967	0.036	0.059	0.035	0.033	0.024	0.061	0.035	0.040
	Lap 4	*N*	*0.968*	*0.945*	*0.954*	*0.986*	*1.019*	*1.029*	*0.993*	*0.985*	*0.032*	*0.105*	*0.042*	*0.055*	*0.112*	*0.122*	*0.074*	*0.078*
	Lap 5	Y	0.959	0.957	0.978	1.001	1.008	0.999	1.022	0.989	0.046	0.065	0.032	0.037	0.020	0.075	0.053	0.047
N	Lap 2	Y	0.972	0.997	0.990	0.978	0.977	1.014	0.997	0.989	0.082	0.040	0.033	0.056	0.045	0.045	0.017	0.046
	Lap 3	Y	0.988	1.003	0.996	0.974	0.988	0.997	1.004	0.993	0.034	0.032	0.029	0.053	0.048	0.024	0.047	0.038
	Lap 5	*N*	*0.977*	*1.002*	*0.995*	*0.968*	*0.994*	*1.012*	*1.045*	*0.999*	*0.047*	*0.026*	*0.021*	*0.043*	*0.023*	*0.033*	*0.060*	*0.036*
O	Lap 2	Y	1.016	1.014	1.039	1.042	1.035	1.021	1.055	1.032	0.023	0.029	0.018	0.032	0.037	0.019	0.028	0.027
	Lap 3	Y	1.007	1.009	1.052	1.047	1.032	1.043	1.059	1.035	0.035	0.047	0.014	0.035	0.017	0.023	0.021	0.028
	Lap 4	*N*	*1.003*	*1.014*	*1.029*	*1.025*	*1.018*	*1.031*	*1.041*	*1.023*	*0.014*	*0.021*	*0.023*	*0.023*	*0.019*	*0.021*	*0.027*	*0.021*
P	Lap 2	Y	0.969	0.960	0.975	1.008	0.985	0.971	0.979	0.978	0.044	0.025	0.030	0.043	0.018	0.026	0.032	0.031
	Lap 3	Y	0.967	0.955	0.959	1.010	0.993	0.981	0.989	0.979	0.032	0.045	0.028	0.020	0.021	0.037	0.029	0.031
Q	Lap 2	Y	1.021	1.012	1.001	1.014	1.016	0.988	0.969	1.003	0.024	0.035	0.023	0.025	0.038	0.039	0.066	0.036
	Lap 3	Y	1.019	1.008	0.997	1.008	1.021	0.982	0.971	1.001	0.026	0.018	0.021	0.026	0.048	0.061	0.066	0.038

Note: Shading on a cell indicates that the value is outside acceptable limits. Data from laps disregarded in the correlation analysis are shown in italics.

Table E2 2009 Final trial data (analysed laps with selected geophones removed where appropriate)

FWD	Lap	Field Calibration Factor								Excluded Geophones and Test Station	Standard Deviation of Deviation Ratio (SDDR)								Excluded Geophones and Test Station
		D1	D2	D3	D4	D5	D6	D7	mean		D1	D2	D3	D4	D5	D6	D7	mean	
A	Lap 2	0.983	1.005	1.005	1.009	1.009	1.006	1.007	1.003		0.037	0.018	0.010	0.011	0.015	0.024	0.020	0.019	
	Lap 3	0.987	0.991	1.012	1.029	1.026	1.019	1.017	1.012		0.028	0.035	0.017	0.023	0.029	0.029	0.022	0.026	
B	Lap 2	1.018	1.032	1.025	1.037	1.029	1.061	1.051	1.036		0.036	0.027	0.015	0.034	0.023	0.044	0.059	0.034	
	Lap 3	1.023	1.020	1.019	1.025	1.014	1.039	1.001	1.020		0.044	0.026	0.022	0.028	0.027	0.031	0.032	0.030	
C	Lap 2	0.983	0.997	0.978	0.963	0.952	0.945	0.954	0.967		0.059	0.037	0.035	0.041	0.030	0.037	0.031	0.038	
	Lap 3	0.984	1.001	0.989	0.964	0.956	0.944	0.954	0.970		0.055	0.036	0.027	0.025	0.020	0.023	0.032	0.031	
D	Lap 4	0.983	1.001	0.986	0.978	0.991	0.978	0.957	0.982		0.021	0.047	0.022	0.028	0.025	0.040	0.030	0.030	
	Lap 5	1.005	1.012	1.021	1.031	0.998	0.989	0.966	1.003		0.019	0.048	0.032	0.039	0.024	0.023	0.032	0.031	
E	Lap 2	0.972	0.979	0.972	0.966	0.988	0.968	0.963	0.973		0.029	0.046	0.025	0.029	0.037	0.027	0.035	0.033	
	Lap 3	0.982	0.995	0.970	0.981	0.987	0.991	0.973	0.983		0.021	0.029	0.026	0.031	0.022	0.023	0.016	0.024	
F	Lap 4	1.021	1.046	1.048	1.042	1.015	1.024	1.043	1.034		0.026	0.041	0.045	0.058	0.037	0.033	0.041	0.040	
	Lap 3	1.015	1.051	1.023	1.021	1.044	1.018	1.075	1.035		0.024	0.046	0.045	0.049	0.060	0.048	0.051	0.046	
G	Lap 2	1.091	1.074	1.051	1.023	1.010	1.031	1.057	1.048		0.047	0.052	0.019	0.027	**0.034**	0.038	0.044	0.037	D5 @ S3
	Lap 3	1.074	1.070	1.065	1.025	1.000	1.017	1.051	1.043		0.049	0.041	0.024	0.034	0.062	0.034	0.040	0.041	
H	Lap 2	1.013	1.010	0.999	0.969	0.990	1.038	1.029	1.007		0.022	0.027	0.020	0.045	0.064	0.042	0.069	0.041	
	Lap 3	1.020	1.008	0.993	0.975	1.006	1.057	1.020	1.011		0.025	0.033	0.031	0.036	0.023	0.037	0.052	0.034	
I	Lap 2	1.039	1.016	1.004	1.006	0.995	1.015	0.972	1.007		0.027	0.041	0.042	0.047	0.061	0.056	**0.060**	0.048	D7 @ S2
	Lap 3	1.032	1.019	1.019	1.012	0.996	1.000	0.980	1.008		0.017	0.031	0.024	0.029	0.054	0.062	**0.059**	0.039	D7 @ S2
J	Lap 2	0.998	0.985	0.998	0.991	0.993	0.983	0.974	0.989		0.016	0.047	0.016	0.023	0.027	0.018	0.015	0.023	
	Lap 3	0.991	0.980	1.002	0.990	0.995	0.998	0.981	0.991		0.029	0.028	0.024	0.026	0.018	0.027	0.020	0.025	
K	Lap 4	1.045	1.014	0.998	0.989	0.994	0.972	0.995	1.001		0.034	0.051	0.058	0.091	0.095	**0.078**	0.089	0.071	D6 @ S2
	Lap 5	1.048	1.010	1.035	1.020	1.005	0.981	1.002	1.014		0.026	0.023	0.048	0.059	0.081	**0.080**	0.079	0.057	D6 @ S3
L	Lap 2	0.987	0.994	0.971	0.976	1.015	1.011	1.050	1.000		0.029	0.027	0.017	0.033	0.026	0.028	0.039	0.029	
	Lap 3	0.977	0.968	0.956	0.940	0.995	0.999	1.021	0.980		0.056	0.045	0.048	0.049	0.039	0.028	0.028	0.042	
M	Lap 5	0.959	0.957	0.978	1.001	1.008	0.999	1.022	0.989		0.046	0.065	0.032	0.037	0.020	**0.063**	0.053	0.045	D6 @ S1
	Lap 3	0.964	0.952	0.956	0.980	0.992	0.947	0.979	0.967		0.036	0.059	0.035	0.033	0.024	0.061	0.035	0.040	
N	Lap 2	0.972	0.997	0.990	0.978	0.977	1.014	0.997	0.989		**0.040**	0.040	0.033	0.056	0.045	0.045	0.017	0.039	D1 @ S10
	Lap 3	0.988	1.003	0.996	0.974	0.988	0.997	1.004	0.993		0.034	0.032	0.029	0.053	0.048	0.024	0.047	0.038	
O	Lap 2	1.016	1.014	1.039	1.042	1.035	1.021	1.055	1.032		0.023	0.029	0.018	0.032	0.037	0.019	0.028	0.027	
	Lap 3	1.007	1.009	1.052	1.047	1.032	1.043	1.059	1.035		0.035	0.047	0.014	0.035	0.017	0.023	0.021	0.028	
P	Lap 2	0.969	0.960	0.975	1.008	0.985	0.971	0.979	0.978		0.044	0.025	0.030	0.043	0.018	0.026	0.032	0.031	
	Lap 3	0.967	0.955	0.959	1.010	0.993	0.981	0.989	0.979		0.032	0.045	0.028	0.020	0.021	0.037	0.029	0.031	
Q	Lap 2	1.021	1.012	1.001	1.014	1.016	0.988	0.969	1.003		0.024	0.035	0.023	0.025	0.038	0.039	0.066	0.036	
	Lap 3	1.019	1.008	0.997	1.008	1.021	0.982	0.971	1.001		0.026	0.018	0.021	0.026	0.048	0.061	0.066	0.038	

Note: Shading on a cell indicates that the value is outside acceptable limits. Measurements in bold indicates that a single geophone reading has been excluded from the result where it was considered to be unrepresentative.

Appendix F 2009 FWD trial – acceptance status

Table F1: 2009 trial results and contact details

TRL Ref. no.	Owning Company	Make, model and serial number	Contact details	Acceptance status
2	WDM	Dynatest FWD 8002 SN 102	Dr. Chris Kennedy, WDM Ltd, Broad Street, Staple Hill, Bristol BS16 5LT	Met required criteria
5	Scott Wilson	Dynatest HWD 8082 SN 050	Mr. John Dobrzycki, Scott Wilson Ltd, 12 Regan Way, Chetwynd Business Park, Chilwell, Nottingham NG9 6RZ	Met required criteria
6	PMS Ltd.	Dynatest 8082 HWD SN 018	Mr. Eoin Greaney, PMS Pavement Management Services Ltd, Raheen Industrial Estate, Athenry, Co. Galway, Ireland	Met required criteria
7	TRL	Dynatest FWD 8002 SN 162	Mr. Kevin Green, TRL Limited, Crowthorne House, Nine Mile Ride, Wokingham, Berkshire RG40 3GA	Met required criteria
8	Scott Wilson	Dynatest FWD 8002 SN 028	As machine 5	Met required criteria
9	PMS Ltd.	Dynatest 8002 FWD SN 136	As machine 6	Met required criteria
10	Scott Wilson	Dynatest FWD 8002 SN 192	As machine 5	Met required criteria
11	Morrison Construction Services	Dynatest FWD 8002 SN 187	Mr Ian Smart, Morrison Construction Services, Grange House, West Main, West Mains Industrial Estate, Grangemouth, FK3 8YE	Met required criteria
13	Scott Wilson	Dynatest HWD 8082 SN 029	As machine 5	Met required criteria
15	CET Safehouse	Dynatest FWD 8002 SN 203	Mr. Thom Myers, CET Safehouse Ltd, Highway House, 6 Lutterworth Road, Wolvey, Nr Hinckley, Leicestershire, LE10 3HW	Met required criteria
17	TRL	Dynatest FWD 8002 SN 224	As machine 7	Met required criteria
26	Grontmij	Grontmij-CarlBro HWD PRI2509 SN 8566	Mr. Klavs Olsen, Manager of International Operations, Grontmij Group, Kolding, Kokbjerg 5, DK-6000 Kolding, Denmark.	Met required criteria
28	Jacobs	Dynatest FWD 8002 SN 271	Mr. Martyn Stonecliffe - Jones, Jacobs, Cardinal Square, 10 Nottingham Road, Derby, DE1 3QT	Met required criteria
30	PMS Ltd.	Dynatest 8002 FWD SN 173	As machine 6	Met required criteria
31	PTS	Grontmij-CarlBro SHWD PRI2100 SN 0704-201	Mr. Tony Sewell, PTS Ltd, Unit 4, Cowling Business Park, Canal Side, Chorley, PR6 0QL	Did not meet required criteria
32	ALC (MoD)	Dynatest HWD 8082 SN 069	Mr Alan Robinson, ALC, ALC Regional office, MoD Stafford, Building 102, 7 site, Beaconside, Stafford, ST18 0AQ	Met required criteria
33	ALC (MoD)	Dynatest HWD 8082 SN 070	As machine 32	Met required criteria

Highways Agency 2009 National Falling Weight Deflectometer Correlation trials

For the last ten years an annual correlation trial for Falling Weight Deflectometers (FWDs) has been held in the UK. The objective of the trial is to assess the performance of all FWDs (including Heavy Weight Deflectometers, (HWDs) and Super Heavy Weight Deflectometers (SHWDs)) operating on the Highways Agency (HA) strategic road network. The performance of individual machines is assessed by examining and monitoring the results from the machines operating on specified test sections of the TRL Small Roads System (SRS). Only machines that can demonstrate satisfactory performance in the correlation trial are subsequently approved for use on the HA strategic road network.

This report describes the conduct and findings of the 2009 correlation trial and presents the details of the machines that are approved for use on the HA strategic road network in 2009/2010.

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