

PUBLISHED PROJECT REPORT PPR787

In-service performance of EME2

F Coyle and C R Jones

Report details

Report prepared for:	Highways England		
Project/customer reference:	Task 328 (4/45/120)-HALC		
Copyright:	© Transport Research Laboratory		
Report date:	June 2016		
Report status/version:	1.0		
Quality approval:			
F Coyle (Project Manager)		I Carswell (Technical Reviewer)	

Disclaimer

This report has been produced by the Transport Research Laboratory under a contract with Highways England. Any views expressed in this report are not necessarily those of Highways England.

The information contained herein is the property of TRL Limited and does not necessarily reflect the views or policies of the customer for whom this report was prepared. Whilst every effort has been made to ensure that the matter presented in this report is relevant, accurate and up-to-date, TRL Limited cannot accept any liability for any error or omission, or reliance on part or all of the content in another context.

Contents amendment record

This report has been amended and issued as follows:

Version	Date	Description	Editor	Technical Reviewer
1.0	5 July 16	First Published Version	FC/CJ	IC

Document last saved on:	11/07/2016 09:43
Document last saved by:	Coyle, Fiona

Contents

1	Introduction	1
2	Methodology	3
2.1	Service Providers experiences with EME2	3
2.2	Selection of EME2 sites for investigation	3
2.2.1	HAPMS Search	3
2.2.2	Review of TRL Reports	5
2.3	Test Methodology	5
2.3.1	Site investigation	5
2.3.2	Laboratory testing	6
3	Results from selected sites	7
3.1	Confirmation of EME2	7
3.1.1	Grading	7
3.1.2	Binder Content	10
3.1.3	Properties of recover binder	11
3.1.4	Voids	12
3.2	Performance of EME2	13
3.2.1	Stiffness	13
3.2.2	Voids	15
3.3	Other UK sites	16
3.3.1	Stiffness	16
3.3.2	Grading and binder content	17
4	Conclusions	21
5	Acknowledgments	23
6	Bibliography	25

Table of Figures

Figure 2-1 Location of EME2 sites with Health and Safety Files.....	4
Figure 3-1 Binder course – A34 site.....	7
Figure 3-2 Binder course – M1 site.....	8
Figure 3-3 Binder course – M4 site.....	8
Figure 3-4 Base layer - A34 site.....	9
Figure 3-5 Base layer – M4 site.....	10
Figure 3-6 Comparison of ITSM results from Wheelpath and Oil lane, samples from the binder course layer	14
Figure 3-7 Comparison of ITSM results from Wheelpath and Oil lane, samples from the base layer.....	15
Figure 3-8 Binder course - M876 site.....	17
Figure 3-9 Binder course - A9 site.....	18

Executive Summary

The inclusion of EME2 in the Highways England (HE) pavement design guidelines in 2006(HD26/06) resulted from the requirement to include an effective and durable high modulus binder and base asphalt material. EME2 was trialled through the collaborative research programme, and was based upon an asphalt material used in France called Enrobé á Module Elevé. EME2 has a relatively high binder content and utilises a stiffer binder than traditional materials such as DBM50/HDM50.

This study was designed to assess the performance of EME2 on the HE network over the longer term. The study was undertaken in two phases. Firstly, the Service Providers were contacted by means of a questionnaire to establish their experiences with EME2 since its introduction in 2006.

Secondly three sites on the HE network were selected for destructive sampling and testing. Samples from both the EME2 binder and base course were taken to establish the properties of the material. In addition to these sites, binder course samples from three further sites were made available for testing.

The conclusions of the study were:

- The results of a questionnaire indicated that although the usage of EME2 on the HE network was still relatively low, the performance of the material that is in use was considered to be satisfactory by the Service Providers.
- Composition and volumetric tests on the EME2 binder and base material sampled from three sites on the HE network confirmed that the material tested was manufactured and compacted to the appropriate standards at the time of construction.
- The Penetration of the recovered binder from the three sites on the HE network ranged between 9-12dmm. The Softening Point of the recovered binder ranged between 74.0-81.6°C. These are similar to the specified values (at the time of construction) of 10 - 20dmm and 63 - 73°C respectively.
- The mean ITSM stiffness of the binder course and base course materials sampled from the oil lane at three sites on the HE network ranged between 7714-9160MPa and 7767-9160MPa respectively. This compares to specified ITSM stiffness (at design) of 7500MPa and demonstrates that these values are appropriate.
- ITSM stiffness data for EME2 binder course at construction was only available at one of the HE sites. The stiffness of material sampled from the oil lane some 9.7 years after construction was similar to the value reported at construction.
- The ITSM stiffness of EME2 binder course sampled from the nearside wheelpath was marginally lower than similar material sampled from the oil lane. However only at one of the sites was the reduction found to be significant. There was no significant difference between the ITSM stiffness of base course material sampled from the nearside wheelpath and the oil lane.
- The mean ITSM stiffness of EME2 binder course material sampled after trafficking from the two sites in Scotland was less than 5000MPa. Composition tests showed the EME2 material on the M876 to be out specification and this may explain the low values of stiffness. The composition of the material in the A9 was largely within specification and therefore the low values of stiffness cannot be explained.

It is recommended that stiffness results at the time of construction, if available, be reviewed to establish the magnitude of the apparent decrease in stiffness.

1 Introduction

The inclusion of EME2 in the Highways England (HE) pavement design guidelines in 2006(HD26/06) resulted from the requirement to include an effective and durable high modulus binder and base asphalt material. EME2 was trialled through the collaborative research programme, and was based upon an asphalt material used in France called Enrobé á Module Elevé. EME2 has a relatively high binder content and utilises a very stiff binder compared to more traditional materials such as DBM50/HDM50. It is compacted at higher temperature and has lower voids than these materials.

The use of EME2, currently allows for a decrease in thickness in flexible pavements of up to 15% in comparison to pavements constructed with DBM50/HDM50 base and binder materials. This reduction in thickness is based on the increased stiffness of the material. For example, EME2 has a design stiffness of 8000MPa in comparison to 4700MPa for DBM50/HDM50. The design stiffness of 8000MPa is that value recorded in a three point bending test (at 20°C and 5Hz), This is equivalent to a stiffness value of 7500 MPa using the Indirect Tensile Test (ITSM) at 20°C, and a frequency of 2.5Hz (Nunn & Smith, 1994).

This project was designed to assess the performance of EME2 on the HE network over the longer term and included both sites that were constructed under 'controlled' conditions and those which were constructed under 'normal' levels of supervision.

The project was based on a combination of desk, field and laboratory based work.

2 Methodology

The study was undertaken in two phases. Firstly the Service Providers were contacted by means of a questionnaire to establish their experiences with EME2 since its introduction in 2006. Secondly a number of sites constructed with EME2 were identified and destructive sampling and testing carried out to establish the properties of the material.

2.1 Service Providers experiences with EME2

The questionnaire was sent to 12 of the Service Providers. Six returned the questionnaire and the results are summarised below in Table 2-1. Their full responses can be found in Appendix A.

Table 2-1 Summary of Service Providers experiences with EME2

Question	Response
What proportion of new designs / works use EME2?	Low level of usage
What are the main reasons for selecting EME2 over other materials?	Reduced pavement thickness. Reduced reflective cracking from lower layers Use it in areas where there is an increase in the risk of rutting such as the HGV lanes on steep hills and climbing lanes
Are you aware of in-service EME2 on your network?	Yes (some lengths that are not recorded on HAPMS)
Are you aware of any issues with EME2, either in-service (e.g. carriageway failures due to EME2) or when being laid (e.g. compaction)?	Since laid – No issues with EME2 While being laid – Time needed to cool, compaction, familiarity of the contractor with the material
Any other comments or observations about EME2.	See Appendix A

In terms second phase of the project, it should be noted that although the usage of EME2 was still relatively low, the performance of the material that had been laid was considered to be satisfactory by all the users.

2.2 Selection of EME2 sites for investigation

Sites that were to be investigated were selected using the combined information gathered from HAPMS and from previous studies undertaken by TRL.

The selection criteria used to select the EME2 sites was set out in the project proposal and comprised:

1. Individual sites needed to be a minimum of 5 years old; and
2. be at least 500m in length.

2.2.1 HAPMS Search

TRL firstly used HAPMS to identify sites where EME2 had been used in major maintenance schemes. A local version of the HAPMS database is downloaded monthly at TRL and the August 2014 version was used in this project.

The 400 HAPMS sections identified were then reduced to 139 (covering 16 roads) by limiting the sections to those constructed prior to September 2009.

To ensure that the final sites selected did in fact contain EME 2, the information from the HAPMS construction database was then further verified using data from another source. This was done by obtaining the health and safety files which, under normal circumstances, should contain a record of the asphalt materials delivered to the site at the time of the works. The health and safety files were obtained by running a further query on the 139 sections found in step 2. This resulted in 43 HAPMS sections over 5 roads across the network being identified. These 43 sections formed 7 individual sites across the network which had health and safety files. Figure 2-1 shows the location of these seven sites (marked in green).

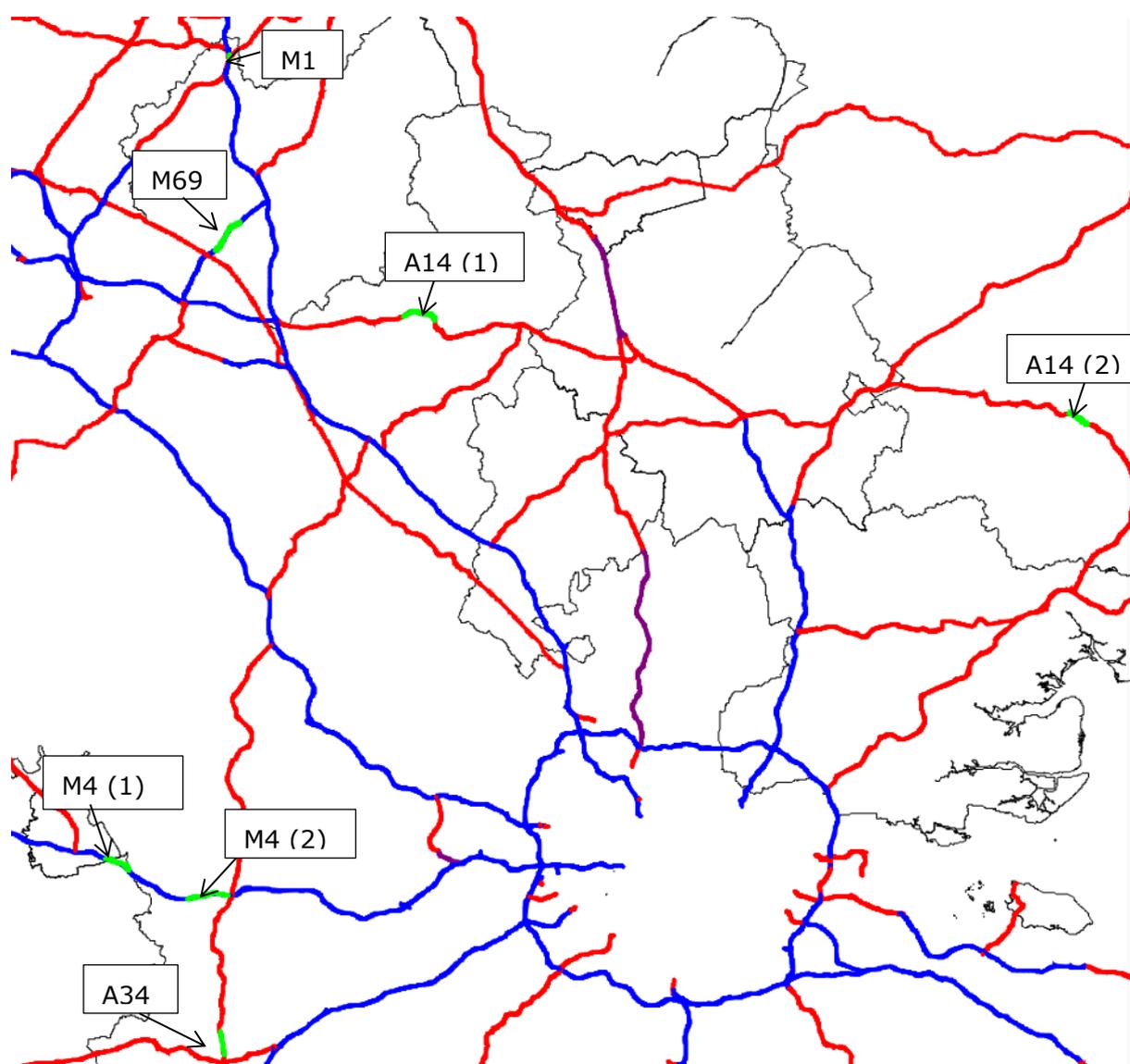


Figure 2-1 Location of EME2 sites with Health and Safety Files

Four of the seven sites were finally ruled out as the health and safety files did not confirm the presence of EME2. Table 2-2 lists the sites that were selected and sampled during the project.

2.2.2 Review of TRL Reports

Sites that had previously been investigated and monitored during the development of EME2 and its initial use on the Strategic Road Network were checked against the criteria for sites for this project. The main sources for these sites were TRL client project reports UPR/IE/149/06 (Nicholls & Perera, 2007), and UPR/IE/149/07 (Nicholls, 2007). These reports confirmed the location of EME2 on the sites on the M1 and A34. Table 2-2 lists the final sites that were selected for destructive sampling.

Table 2-2 Details of the three site that were investigated

Road Name	Date laid	Aggregate size	Layer	Location	Marker Posts	Data Source
M1	Feb-06	0/14mm	Binder	Jn 21 to 20	MP140/9-138/8	HAPMS, TRL Report
A34	Jan-07	0/14mm	Binder	Whitchurch	MP18/4-16/7	HAPMS, TRL Report, H&S File
		0/14mm	Base			
M4	Apr-09	0/10mm	Binder	Baydon	MP116/5 - 112/5	HAPMS, H&S File
		0/14mm	Base			

2.3 Test Methodology

2.3.1 Site investigation

Prior to destructive sampling, a non-destructive FWD survey was completed in both the nearside wheelpath and the oil lane at 20m spacings. The results from the FWD surveys, shown in Appendix B, were used to establish whether the structural strength of selected sites were homogeneous.

After confirmation from the FWD data, 10 pairs of 150mm diameter cores were taken at distance intervals of 70 metres on A43, 100 metres on M1 and 50 meters on M4. One core was taken from the nearside wheelpath and one from the adjacent oil lane. Cores were taken from oil lane as it was hypothesised that these samples would best represent the properties of the material at lay down, compared to those taken in the nearside wheelpath which had been subject to trafficking.

All cores were then logged and these can be seen in Appendix E. Six of the 10 pairs of cores, representative of the whole site, were then selected for testing. These 12 cores were then subject to the suite of testing described in Section 2.3.2.

2.3.2 *Laboratory testing*

The EME2 binder course layer from all three sites was tested and the EME2 base layer from M4 and A34 was also tested. During cutting the cores were trimmed such that their depth did not exceed 70mm and that the final sample did not include any material from adjacent layers.

The following laboratory tests were carried out on all the samples:

- BS EN 12697-6 Bulk density (Sealed samples)
- BS EN 12697-26 Annex C ITSM (Indirect Tensile Stiffness Modulus) at 20°C
- BS EN 12697- 5 Max density (Method A)
- BS EN 12697-8 Void calculation
- BS EN 12697-1&2 Composition (Binder content and grading)

The following laboratory tests were carried out on selected samples from each site:

- BS EN 12697-3 Recovery of bitumen (Rotovap method)
- BS EN 1426 Penetration of bitumen
- BS EN 1427 Softening Point of bitumen (R&B test)

3 Results from selected sites

Section 3.2 shows the laboratory results for the samples from the three sites visited and compare the results to the EME2 specification that was current at the time of construction. The test results confirmed the materials were EME2.

3.1 Confirmation of EME2

The aggregate grading, binder content and binder richness were compared to the specification at the time of construction.

3.1.1 Grading

The aggregate gradings are shown in Figure 3-1 to Figure 3-5.

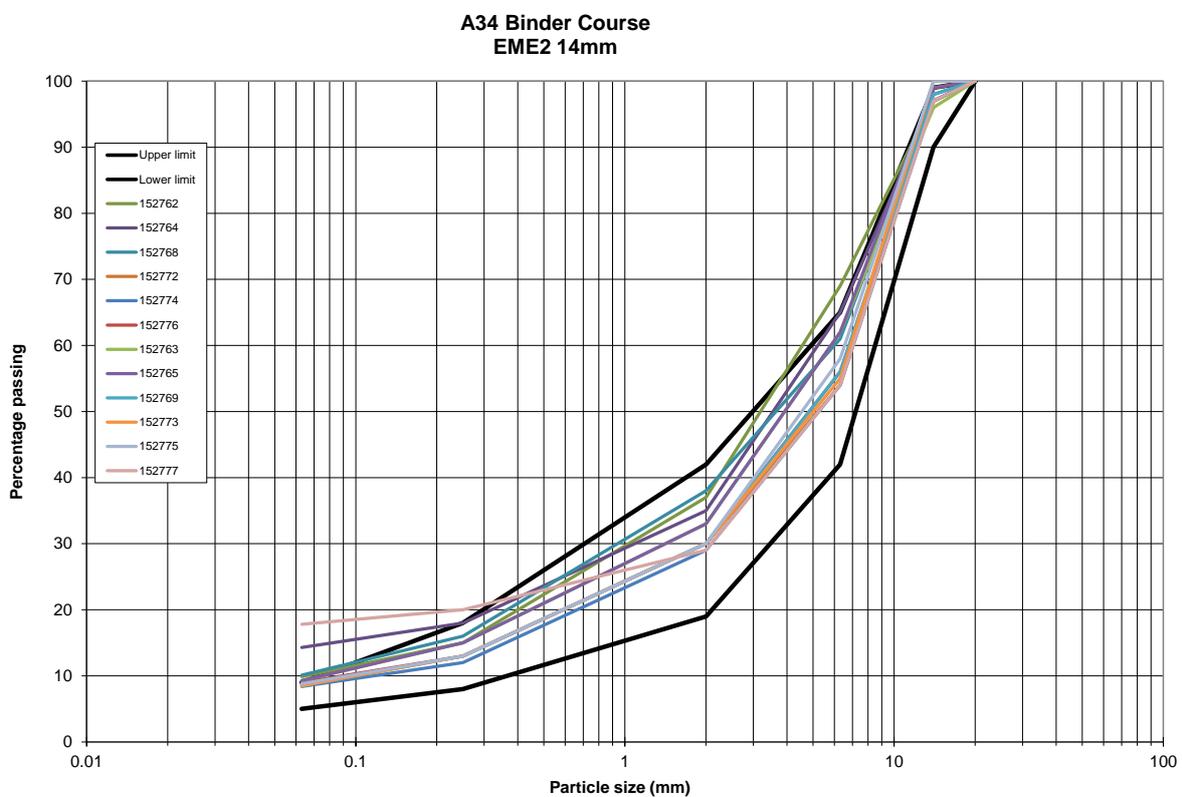


Figure 3-1 Binder course – A34 site

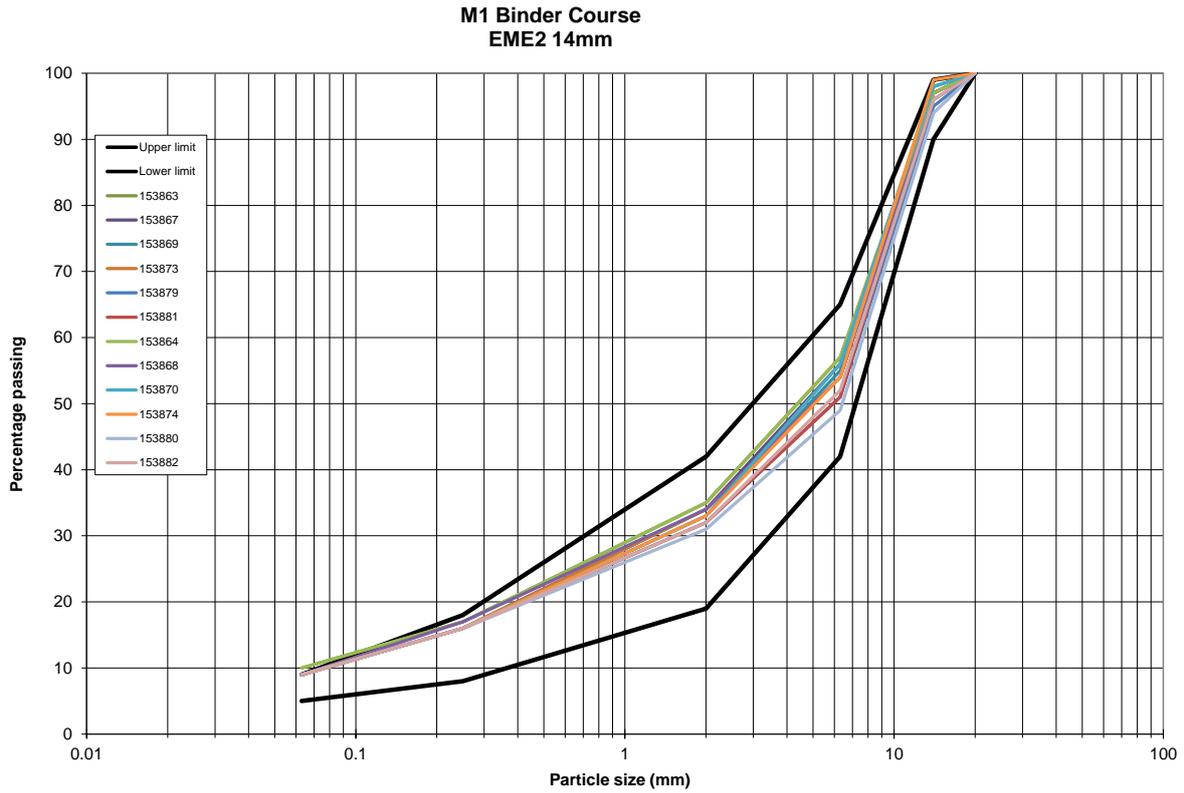


Figure 3-2 Binder course – M1 site

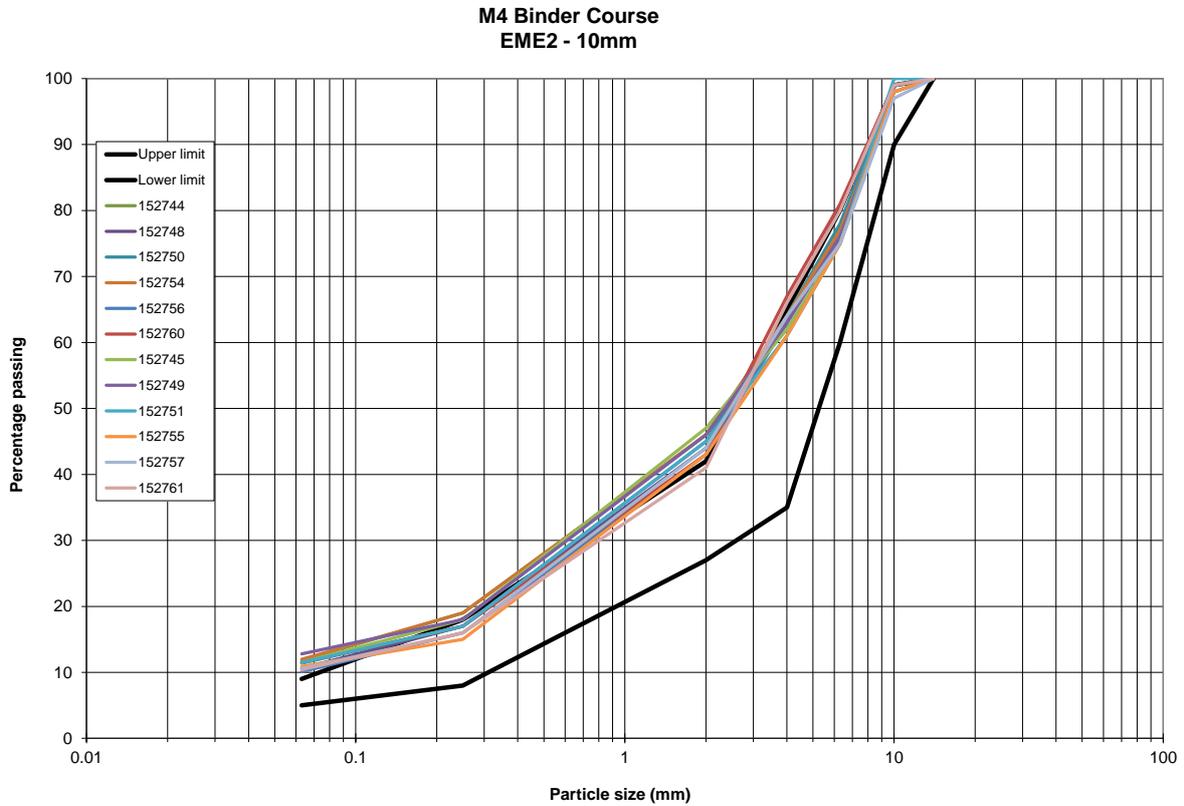


Figure 3-3 Binder course – M4 site

The results show the binder course material to be generally consistent within any one particular site. The grading at the A34 and M1 sites are within the required 14mm EME2 envelope. However, the grading of the binder course material from the M4 is fine when compared to the required envelope for a 10mm EME2.

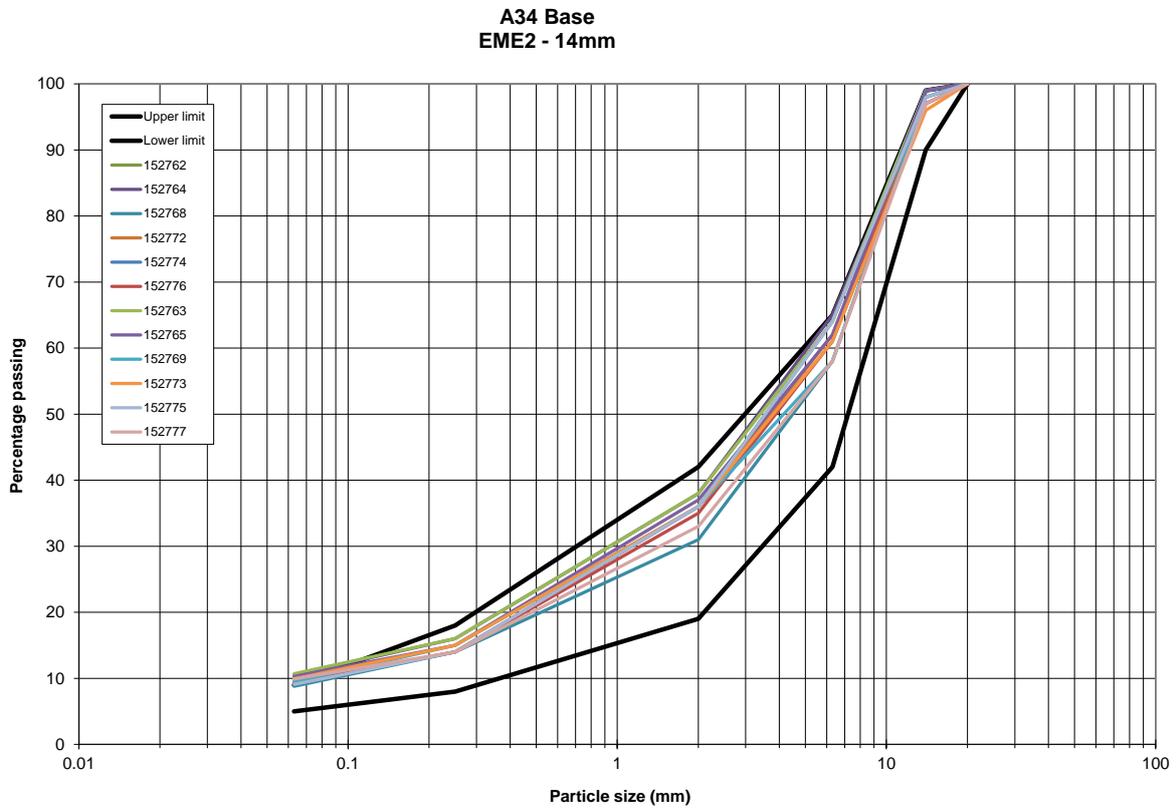


Figure 3-4 Base layer - A34 site

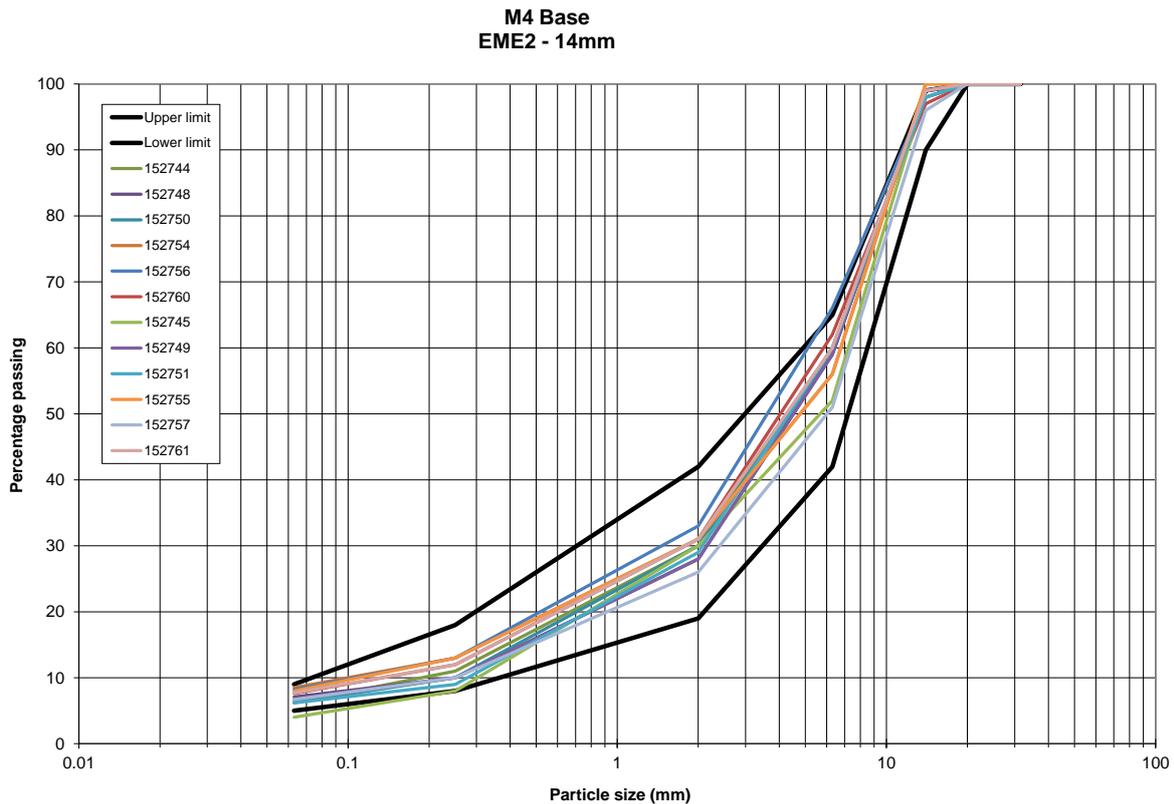


Figure 3-5 Base layer – M4 site

The results show the base material to be generally consistent and the grading at the A34 and M4 sites are within the required 14mm EME2 envelope. (Figure 3-4 and Figure 3-5).

3.1.2 Binder Content

Table 3-1 contains the results from the binder content test carried out on the samples collected from the oil lane. Table 3-1 also contains the results of the binder richness calculations carried out for these samples using the method set out in (Sanders & Nunn, 2005). This method is reproduced in Appendix C

The high bitumen content and resultant low voids in EME2 is beneficial in sealing the pavement and keeping water out.

Table 3-1 Binder content and binder richness

Test	EME2 Layer	Site	Age (years)	No. of samples	Mean	Std Dev	Spec.
Binder Content	Binder	A34	8.4	10*	5.4	0.3	≥5.3
		M1	9.7	12	5.9	0.6	N/A**
		M4	6.1	12	5.3	0.2	≥5.5
	Base	A34	8.4	12	5.3	0.4	≥5.3
		M4	6.1	12	5.9	0.8	≥5.3
Binder Richness	Binder	A34	8.4	10*	3.4	0.2	≥3.4
		M1	9.7	12	3.3	0.2	≥3.4
		M4	6.1	12	3.5	0.5	≥3.4
	Base	A34	8.4	12	3.1	0.3	≥3.4
		M4	6.1	12	4.2	1.0	≥3.4

**Only 10 of the 12 samples from the A34 Binder course were used when calculating mean values of binder content and richness, as 2 of the samples were judged to be outliers base on the grading plots produced (Figure 3-1)*

***The M1 was laid in 2006 and the specification at that time (Sanders & Nunn, 2005) did not specify a minimum value for binder content.*

Green is for values at or above specification, amber 0.2 below of specification, and red is 0.3 or more below specification.

All the available evidence indicated that the binder course at all three sites and the base course at the sites on M4 and A34 were EME2.

3.1.3 Properties of recover binder

In order for there to be sufficient binder for testing two adjacent samples had to be combined prior to recovering the binder. The viscosity of the recovered binder was established through testing its penetration (BS EN 1426) and it’s Softening Point (BS EN 1427).

Table 3-2 contains the results of the binder penetration and soften point tests carried out on the recovered binder from both the wheelpath and oil lane at each of the sites.

Table 3-2 Penetration and Soften Point of recovered binder

Test	EME2 Layer	Site	Age (years)	No of Samples	Mean	Range
Penetration	Binder	A34	8.4	2	9 dmm	8 -9 dmm
		M1	9.7	4	11 dmm	8 - 13 dmm
		M4	6.1	2	12 dmm	9 - 15 dmm
	Base	A34	8.4	2	11 dmm	11 dmm
		M4	6.1	2	11 dmm	10 - 11 dmm
Softening point	Binder	A34	8.4	2	76.8°C	76.0 - 77.6°C
		M1	9.7	4	81.6°C	78.8 – 76.2°C
		M4	6.1	2	74.5°C	72.8 – 76.2°C
	Base	A34	8.4	2	74.0°C	73.0 – 75.0°C
		M4	6.1	2	82.2°C	78.2 – 86.2°C

The results of the penetration and softening point of the recovered binder cannot be compared directly to the original specification as the viscosity of the material will have changed since construction. However it should be noted the results are in keeping with any expected fall in penetration and increase in softening point from the specification at construction values of 10 – 20 dmm and 63 – 73°C for the penetration and softening point respectively.

3.1.4 Voids

The percentage of voids in the mix (V_m) for each of the samples taken from the oil lane was calculated (BS EN 12697-8) using the following equation:

$$\left(\frac{\text{Max Density} - \text{Bulk Density}}{\text{Max Density}} \right) \times 100 = V_m\%$$

Voids were only calculated for the samples taken from the oil lane as these best represent the material at lay down.

Table 3-3 contains the results of the percentage of voids in the mix calculation for the samples from the oil lane.

Table 3-3 Percentage of Voids in the mix (Oil lane only)

EME2 Layer	Site	No. of samples	Mean (%)	Std Dev	Spec.
Binder	A34	6	2.7	0.9	6%
	M1	6	3.3	0.5	6%
	M4	6	2.6	1.5	6%
Base	A34	6	1.8	0.8	6%
	M4	6	2.5	1.7	6%

Green is for values at or above specification

All the sites have less than 6% voids in the mix; therefore the material can be considered as being compacted to the appropriate standard.

Based on the results of the grading, binder content, binder richness, penetration, softening point and voids given above it is concluded that the material at the three selected sites is EME2 which was laid and compacted to the appropriate standard.

3.2 Performance of EME2

3.2.1 Stiffness

The indirect Tensile Stiffness Modulus (ITSM) was measured for each sample at 20°C, Table 3-4 contains a summary of the mean results obtained. The results for samples taken from the nearside wheelpath and the oil lane are shown in Table 3-4.

Table 3-4 Summary of ITSM Results

EME2 layer	Site	Age (years)	Wheelpath			Oil lane		
			No. of Samples	Mean (MPa)	Std Dev. (MPa)	No. of Samples	Mean (MPa)	Std Dev. (MPa)
Binder	A34	8.4	6	7371	548	6	7831	696
	M1	9.7	6	7268	739	6	8010	973
	M4	6.1	6	7390	963	6	7714	1328
Base	A34	8.4	6	7471	564	6	7767	751
	M4	6.1	6	9154	2050	6	9160	1800

Green is for values at or above 7500MPa, amber is 7499 to 6500MPa, and red is below 6500MPa.

7500MPa is the equivalent ITSM design stiffness value (Nunn & Smith, 1994).

The samples from the oil lane have been largely un-trafficked since construction, whereas those in from the nearside wheelpath in lane 1 have been subjected to the most severe trafficking on the carriageway. Figure 3-6 and Figure 3-7 show the ITSM results from samples taken from the trafficked areas compared to those from un-trafficked areas. It can be seen from Figure 3-6 that the stiffness of the binder course taken from the trafficked areas is lower than that of the samples taken from the un-trafficked areas. However the

student t-test showed that only the stiffness of the samples from the nearside wheelpath of the M1 site were *significantly* lower

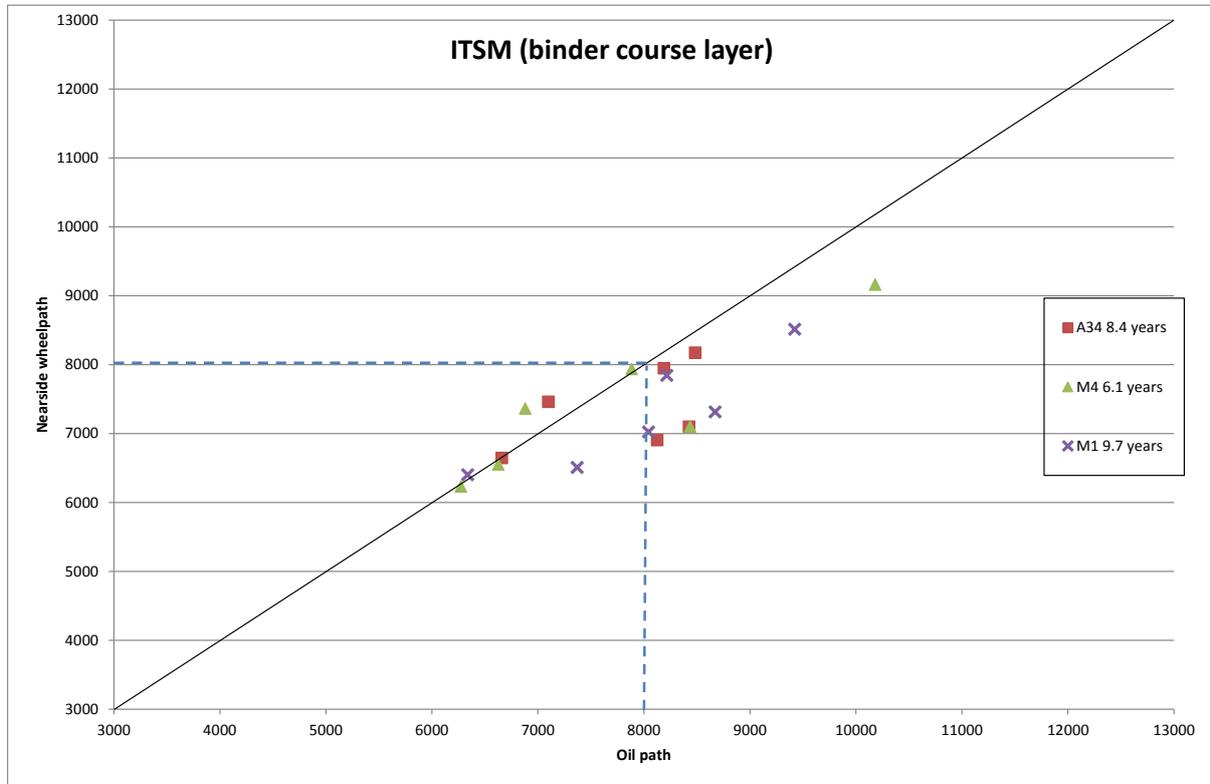


Figure 3-6 Comparison of ITSM results from Wheelpath and Oil lane, samples from the binder course layer

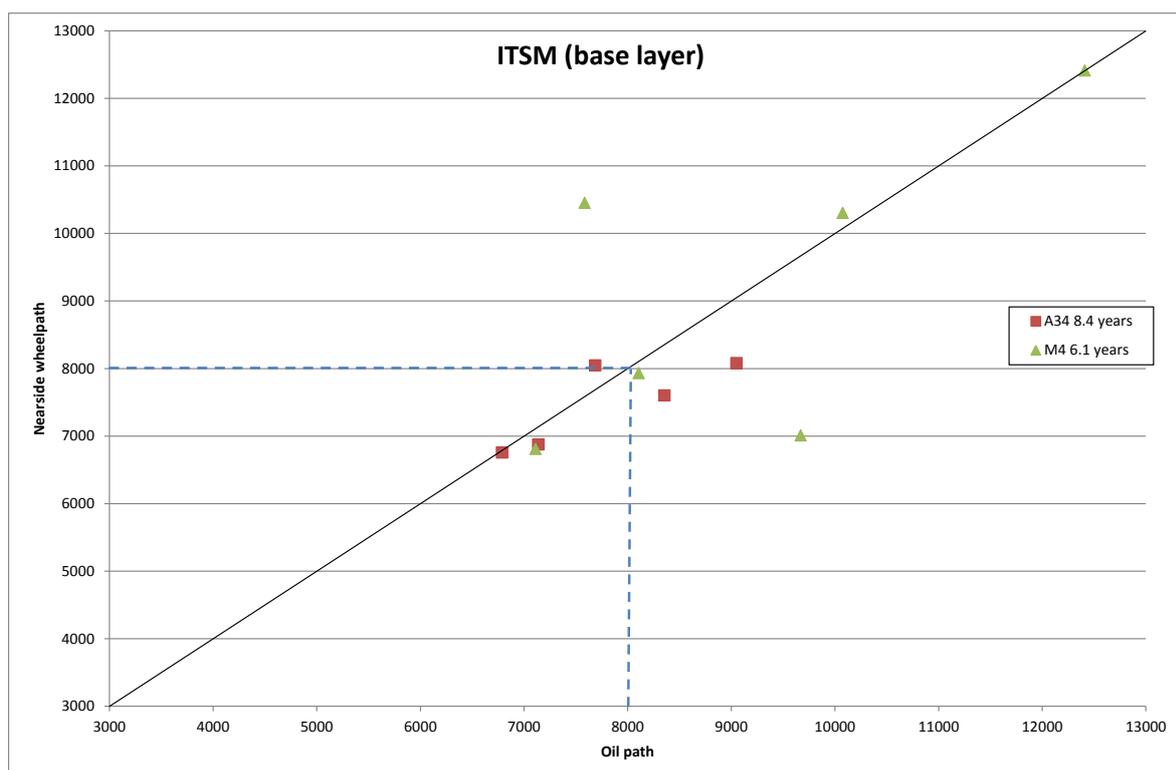


Figure 3-7 Comparison of ITSM results from Wheelpath and Oil lane, samples from the base layer

The only site where stiffness data at time of construction was available was the site on the M1. This site was constructed as part of a trial and samples had been taken for ITSM testing at the time of construction. These results are compared to those samples taken from the oil lane nearly 10 years later in Table 3-5.

Table 3-5 Comparison of ITSM Results for M1 site

Position	Age (years)	No. of samples	Mean (MPa)	Std Dev. (MPa)
Oil lane	9.7	6	8010	973
Various	At construction	19	7550	695

It can be seen there is no significant decrease in stiffness with either time or traffic.

3.2.2 Voids

The percentage of voids in the mix (V_m) for each of the samples taken from the wheelpath was also calculated and are shown in Table 3-6

Table 3-6 Percentage of Voids in the mix (Wheelpath)

EME2 Layer	Site	No. of samples	Mean (%)	Std Dev	Spec.
Binder	A34	6	2.6	0.8	6%
	M1	6	3.4	1.8	6%
	M4	6	2.6	1.6	6%
Base	A34	6	1.8	0.7	6%
	M4	6	3.5	2.3	6%

Green is for values at or above specification

When the results for the voids in the wheelpath (Table 3-6) are compared to the results for the oil path (Table 3-3), there is no significant increase in the values, confirming that there is no secondary compaction of the material by traffic over time.

3.3 Other UK sites

As part of an earlier pavement investigation by TRL in 2012, cores had been taken from the A20 in Dover. The binder course at this site was EME2. Also as part of a separate project for Transport Scotland, EME2 binder course material were sampled from the M876 and A9. These sites were not fully funded under this project and therefore it was not possible to carry out the suite of testing and analysis described in sections 3.1 and 3.2 of this report.

However these three sites were sampled in a similar manner with cores taken in both the wheelpath and the adjacent oil lane. The cores on the A20 Dover were only 3.5 years old when sampled in 2012; they had been kept in cold storage (5°C) since extraction. The M876 site is of the most interest as probably the oldest EME2 site in the UK and utilised a 'standard' 15/25 binder. The material on the A9 was made to a different specification, using a softer 35 penetration grade binder.

3.3.1 Stiffness

The stiffness of the material from the material sampled at these three sites is given in Table 3-7.

The stiffness of the material from the A20 site, after 3.5 years, was above the specified design value of 8000 MPa. However the stiffness of the material from both the M876 and A9 were below 5000 MPa.

Table 3-7 Summary of ITSM Results

EME2 Layer	Site	Age (years)	Wheelpath			Oil lane		
			No. of Samples	Mean (MPa)	Std Dev. (MPa)	No. of Samples	Mean (MPa)	Std Dev. (MPa)
Binder	A20	3.5	9	8783	1665	9	9489	1819
	M876	10.2	6	4477	1049	6	4977	1495
	A9	6.6	6	4460	795	6	4975	787

Green is for values at or above 7500 MPa, amber is 7499 to 6500 MPa, and red is below 6500 MPa.

Grading, binder content, recovered binder properties were carried out on the materials from the M876 and A9 to identify why the stiffness values were lower than expected.

3.3.2 Grading and binder content

Figure 3-8 and Figure 3-9 show the aggregate grading for the samples taken from the M876 and A9 respectively. Table 3-8 contains a summary of the binder test results and Table 3-9 summarises the voids measured in the samples.

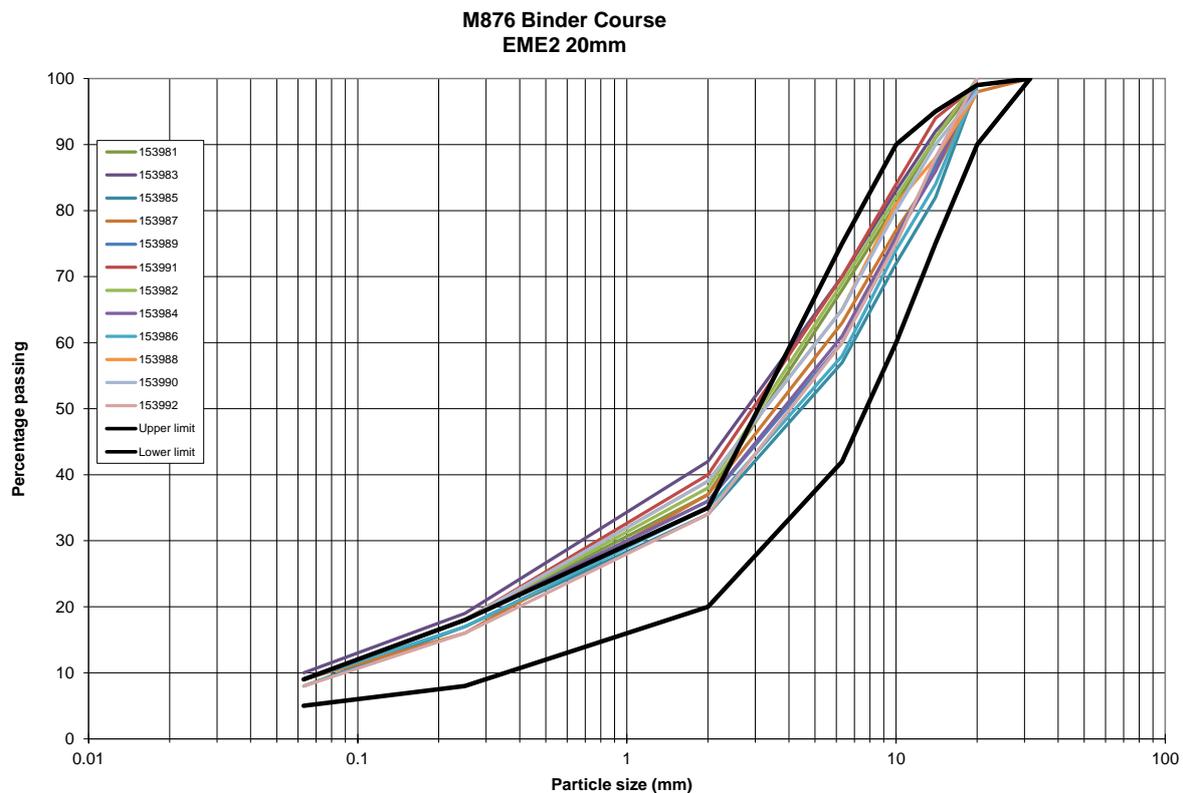


Figure 3-8 Binder course - M876 site

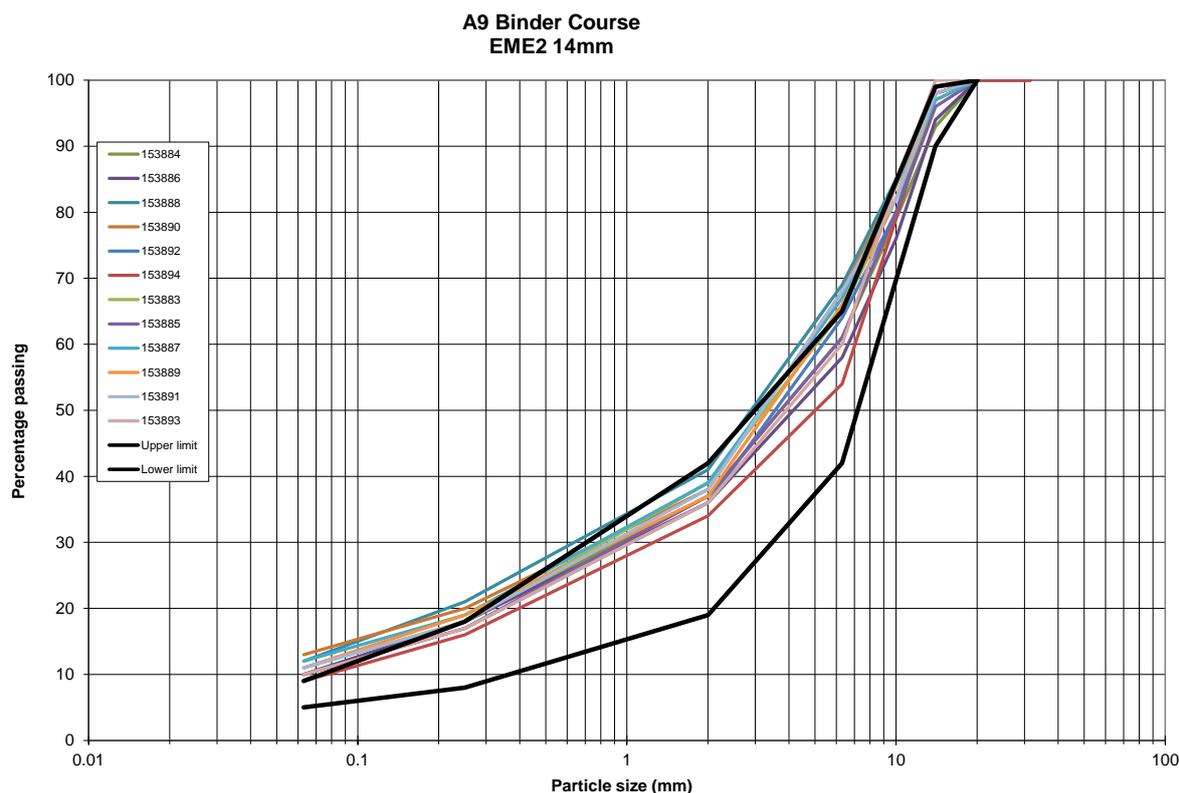


Table 3-8 Binder Content, Richness, Penetration and Soften Point

Test	EME2 Layer	Site	Age	No. of samples	Mean	Std Dev	Spec.
Binder Content	Binder	M876	10.2	6	5.1%	0.2	N/A
		A9	6.6	6	6.1%	0.2	5.3%
Binder Richness	Binder	M876	10.2	6	3.3	0.1	3.4
		A9	6.6	6	3.7	0.2	3.4
Penetration	Binder	M876	10.2	4	10 dmm	1.7	N/A
		A9	6.6	4	11 dmm	1.0	N/A
Softening point	Binder	M876	10.2	4	76.1°C	0.9	N/A
		A9	6.6	4	74.1°C	1.1	N/A

Green is for values at or above specification, amber 0.2 below of specification, and red is 0.3 or more below specification.

Table 3-9 Percentage of Voids in the mix (oil lane only)

Layer	Site	No. of samples	Mean (%)	Std Dev	Spec.
Binder	M876	9	5.3	2.2	6%
	A9	6	2.2	1.6	6%

Green is for values at or above specification

The results of samples from the M876 show the aggregate grading to be finer and the binder richness to be lower than the EME2 specification. The voids at lay down are also towards the top end of specified maximum, when compared with the EME2 material sampled from other HE sites. It is therefore concluded that mix composition is the probable cause of the low stiffness values recorded.

The results of samples from the A9 show the aggregate grading to be fine, particularly on the 75 microns sieve. However the binder richness and void content are acceptable. Therefore the reason why the stiffness values are less than 5000MPa after 6.6 years cannot clearly be identified. It is suggested that stiffness results at the time of construction, if available, be reviewed to establish the magnitude of the apparent decrease in stiffness.

4 Conclusions

- The results of a questionnaire indicated that although the usage of EME2 on the HE network was still relatively low, the performance of the material that is in use was considered to be satisfactory by the Service Providers.
- Composition and volumetric tests on the EME2 binder and base material sampled from three sites on the HE network confirmed that the material tested was manufactured and compacted to the appropriate standards at the time of construction.
- The Penetration of the recovered binder from the three sites on the HE network ranged between 9-12dmm. The Softening Point of the recovered binder ranged between 74.0-81.6°C. These are similar to the specified values (at the time of construction) of 10 – 20dmm and 63 – 73°C respectively.
- The mean ITSM stiffness of the binder course and base course materials sampled from the oil lane at three sites on the HE network ranged between 7714-9160MPa and 7767-9160MPa respectively. This compares to specified ITSM stiffness (at design) of 7500MPa.
- ITSM stiffness data for EME2 binder course at construction was only available at one of the HE sites. The stiffness of material sampled from the oil lane some 9.7 years after construction was similar to the value reported at construction.
- The ITSM stiffness of EME2 binder course sampled from the nearside wheelpath was marginally lower than similar material sampled from the oil lane. However only at one of the sites was the reduction found to be significant. There was no significant difference between the ITSM stiffness of base course material sampled from the nearside wheelpath and the oil lane.
- The mean ITSM stiffness of EME2 binder course material sampled after trafficking from the two sites in Scotland was less than 5000MPa. Composition tests showed the EME2 material on the M876 to be out of specification and this may explain the low values of stiffness. The composition of the material in the A9 was largely within specification and therefore the low values of stiffness cannot be explained. It is recommended that stiffness results at the time of construction, if available, be reviewed to establish the magnitude of the apparent decrease in stiffness.

5 Acknowledgments

The work described in this report was carried out in the Infrastructure Division of the Transport Research Laboratory. The cooperation of both Michael Roberts (Area 3 KIER) and Krzysztof Hunik (Area 7 Aone[†]) during the site investigation is gratefully acknowledged.

David Staddon, Darrel Holt, Alan Richardson, Jonathan Tamblyn, Don Whitely, Kevin Clague, Umesh Parajuli, James Bowman and Phil Reynolds are gratefully thanked for their responses to the service provider questionnaire.

The assistance of Kevin Green, John Thraves, James Weeks, John Prime and Dan Anderson during the field work and laboratory testing, and Ian Carswell who carried out the Technical Review of this report, is gratefully acknowledged.

6 Bibliography

- MCHW. (2008). *Volume 1 Specification for Highway Works Series 0900*. Highway England: Manual of Contract Documents for Highway Works.
- Nicholls, J. C. (2007). *Review of EME2 laid on A34 south of Whitchurch*. Crowthorne: TRL Limited (UPR/IE/149/07).
- Nicholls, J. C., & Perera, R. (2007). *Superior Asphalts in High Performance Roads: Inception Report*. Crowthorne: TRL Limited (UPR/IE/147/06).
- Nunn, M. E., & Smith, T. (1994). *Evaluation of enrobé à module élevé (EME): A french high modulus roadbase material*. Crowthorne: TRL Limited PR66.
- Sanders, P. J., & Nunn, M. (2005). *The application of Enrobé à Module Élevé in flexible pavements*. Crowthorne: TRL Limited (TRL636).

Appendix A Responses from Services Providers

A.1 Area 1

I am aware of its benefits and why it may be a better solution in some situations, however, due to increased costs we would only tend to consider it if we had a weak pavement and site constraints limited using other base/binder materials to achieve required strength.

A.2 Area 2

What proportion of new designs / works use EME2?

Very few, we tend to use HDM in Area 2.

What are the main reasons for selecting EME2 over other materials?

We use it in areas where there is an increase in the risk of rutting such as the HGV lanes on steep hills and climbing lanes

Are you aware of in-service EME2 on your network?

Yes we have some on the A40 constructed in 2008, and also on Tickenham Hill M5 although this is not shown in HAPMS.

Are you aware of any issues with EME2, either in-service (e.g. carriageway failures due to EME2) or when being laid (e.g. compaction)?

We are not aware of any issues after laying, however we have used this material on a previous contract in Gloucestershire on the A40 Golden Valley, the material was chosen to allow the design to be as lean as possible, and the ability to lay EME 2 in thinner layers than HDM and gain the same design criteria was an advantage as it meant less material was planed out, less material laid, this helped in reducing the scheme duration and overall scheme costs.

Observations of the laying of the material was only that it does take much longer to cool prior to laying surface course, this could be an issue if laying in warmer weather where there was a requirement to open the lane to traffic the next morning.

Any other comments or observations about EME2.

We had a debate recently which hopefully your research may answer as to whether the increased stiffness and density of the EME would lead to an increase in cracking, or whether the increased binder content of the material would counter the cracking?

The main advantages we have found were mainly on local authority contracts where we had a legacy of tar bound materials, the reduced depth of the EME ensured we could reduce or mitigate the inclusion into the tar bound materials.

It was also useful in reducing the duration of schemes where critical time scales were required.

We didn't have issues in laying other than the temperature as mentioned above

The material was laid on the A40 8 years ago, there are no visible defects on the area the material was laid.

TRL comment: This provider has reported that using EME2 reduces the duration of a scheme but also that EME2 takes longer to cool which can delay the laying of the surface course, ambient temperatures and weather conditions should be considered when planning works with EME2.

A.3 Area 4

We do not have many schemes where EME2 was used in Area 4. It is not meaning that we do not want to use. There are various reasons behind.

Majority of our schemes are renewal and 99% involve inlay (majority surface course and very few localised deeper up to 135mm) with like to like material. Sub-contractor/supplier do not prefer using it for small length due to cost reason. In the past we had specified EME2 in VM stage for some schemes but later during site delivery/construction it was changed to DBM50 or HDM50 for some reasons.

Still we have few schemes where EME2 was used. A20 Dover (I think was 2008/9 delivered scheme) which you already knew that TRL investigated the scheme for surface course failure (I think in 2010/11) and you also knew the conclusion from the investigation. In this scheme EME2 in binder course still working fine.

We have one more scheme (A259 Winchealsea to Icklesham) where 110mm EME2 used below 35mm SC in 2012/13 and there is no issue so far other than thin joint cracks on surface course which I have noticed in a video.

A.4 Area 6 & 8

What proportion of new designs / works use EME2?

Not sure on this statistic, presumably you will be able to review the number of pavement schemes coming through design that have EME2 designated for binder to give a percentage?

What are the main reasons for selecting EME2 over other materials?

Stiffer material for supporting upper layers whilst still performing as a flexible pavement. Strengthening.

Are you aware of in-service EME2 on your network?

HAPMS should record the number of sites with EME2 in the construction layers. Trevor Oliver could run a report to look for the material.

Are you aware of any issues with EME2, either in-service (e.g. carriageway failures due to EME2) or when being laid (e.g. compaction)?

No sorry cannot answer that one.

Any other comments or observations about EME2.

It is generally expensive and as the binder is special order and purchased in bulk amounts the Asphalt companies generally like to have decent volumes to lay to make it viable for them. Specifying it in small amounts is not that practical.

What proportion of new designs / works use EME2?

<10% for me

What are the main reasons for selecting EME2 over other materials?

EME2 is stiffer and provides improved performance in the right circumstances. It can also be laid as a single base/binder course up to a certain depth and can so reduce construction duration and thereby possibly avoid the need for running on a planed surface.

Are you aware of in-service EME2 on your network?

No, it was originally specified at VM stage for 540002 A14 - A1307 WB Resurface but the specification was changed following advice from the construction and project management teams. They said it wasn't sufficiently flexible for use on a clay embankment where some settlement or heave could be expected.

Are you aware of any issues with EME2, either in-service (e.g. carriageway failures due to EME2) or when being laid (e.g. compaction)?

No, but it has a very stiff 10/20 or 15/25 binder grades so I presume it would have to be laid quickly in optimum conditions before the material temperature dropped to much. It might be difficult to achieve good compaction in awkward areas such as roundabouts and irregular shaped and tapered areas of carriageway.

Any other comments or observations about EME2.

No, except it seems to be suggested as an option far more than it is actually used.

A.5 Area 10**What proportion of new designs / works use EME2?**

Within the MAC/ASC areas I have worked on there has been limited use. The majority of work we do is maintenance rather than new build and tends to be surfacing inlays as we have a well-built long life network. Where we go deeper or construct new alignments we tend to stick with CL929 materials, partly for ease of supply and installation, partly because designers don't know any better in our office.

What are the main reasons for selecting EME2 over other materials?

If we can use it we will do as we have a price on our commercial schedule of rates for it, someone of questionable technical knowledge decided to zero rate CL929 binder course. The

main use on our network in recent years has been over the lower base layers of an HMB15 pavement to provide additional structural capacity.

Are you aware of in-service EME2 on your network?

Yes.

Are you aware of any issues with EME2, either in-service (e.g. carriageway failures due to EME2) or when being laid (e.g. compaction)?

No failures. I believe there were difficulties with compaction and achieving levels on a large scheme and there was some talk of shrinkage cracks around the longitudinal joints although this is unproven.

Any other comments or observations about EME2.

Without careful planning we struggle to get it to site as the asphalt producers need a good lead in time and confirmation of the working window to free up bitumen tanks and ensure mixture designs are up to date for the plants they are supplying from. They also need to ensure they have reasonable on site testing capacity available.

A.6 AREA 13

What proportion of new designs / works use EME2?

None or almost none. Our work involves the repair and maintenance of existing roads and we are only occasionally doing full depth reconstruction and even then in only short length. We cannot justify the higher classification of foundation required either on cost or curing time.

What are the main reasons for selecting EME2 over other materials?

Reduced pavement thickness. Reduced reflective cracking from lower layers.

Are you aware of in-service EME2 on your network?

We have one length of 2.45km of two lane carriageway where we laid an EME2 binder course in 2008. The problem here was reduced structural strength and longitudinal reflective cracking from lower layers. We overlaid the pavement with 60mm of EME2 and 40mm of TSCS. So far the reflective cracking has not reappeared and the pavement shows no signs of structural distress.

Are you aware of any issues with EME2, either in-service (e.g. carriageway failures due to EME2) or when being laid (e.g. compaction)?

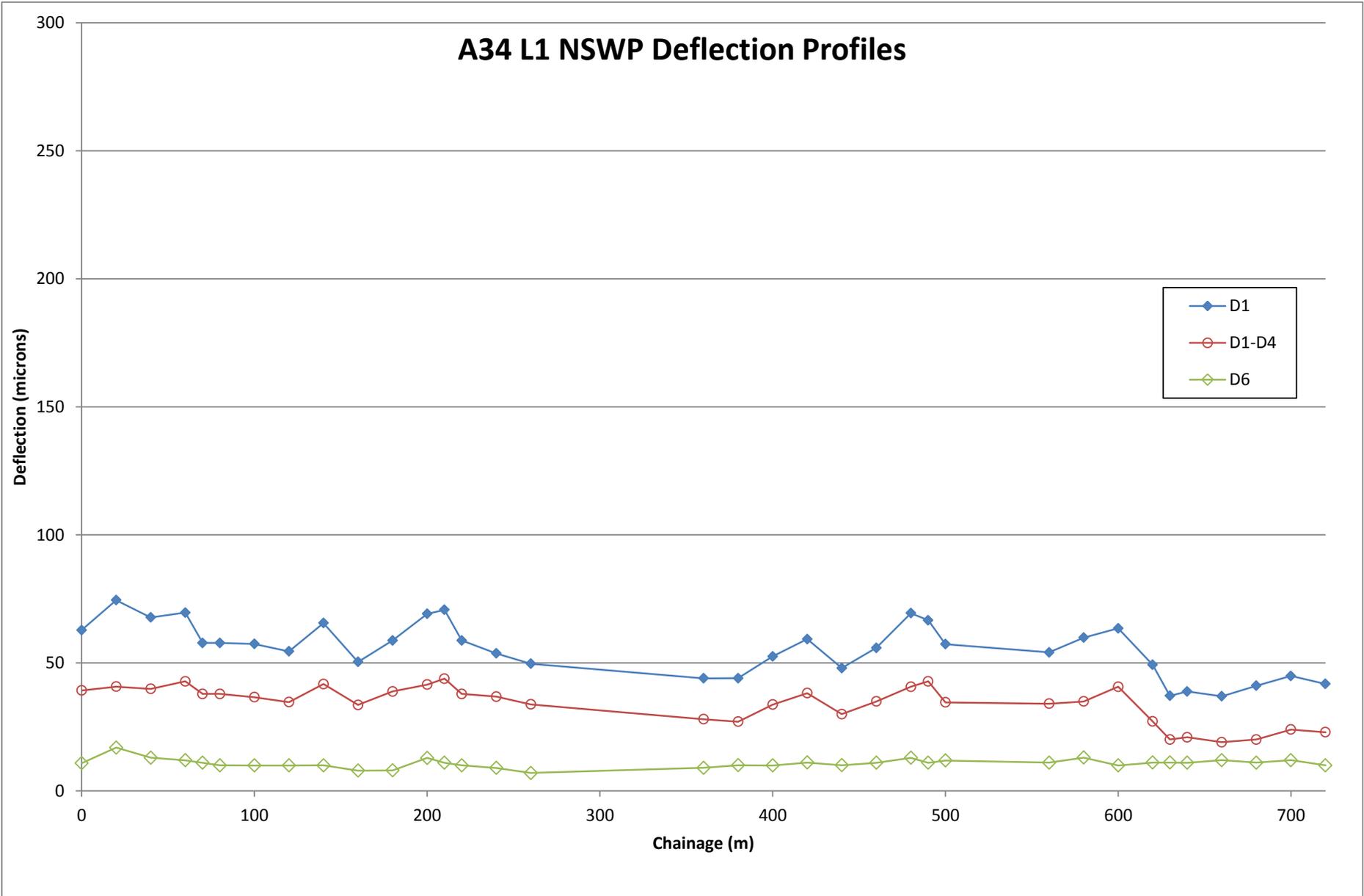
When we laid this material there were some locations where the EME2 did not meet the specified compaction requirements. The material looked as if it should have been very easy

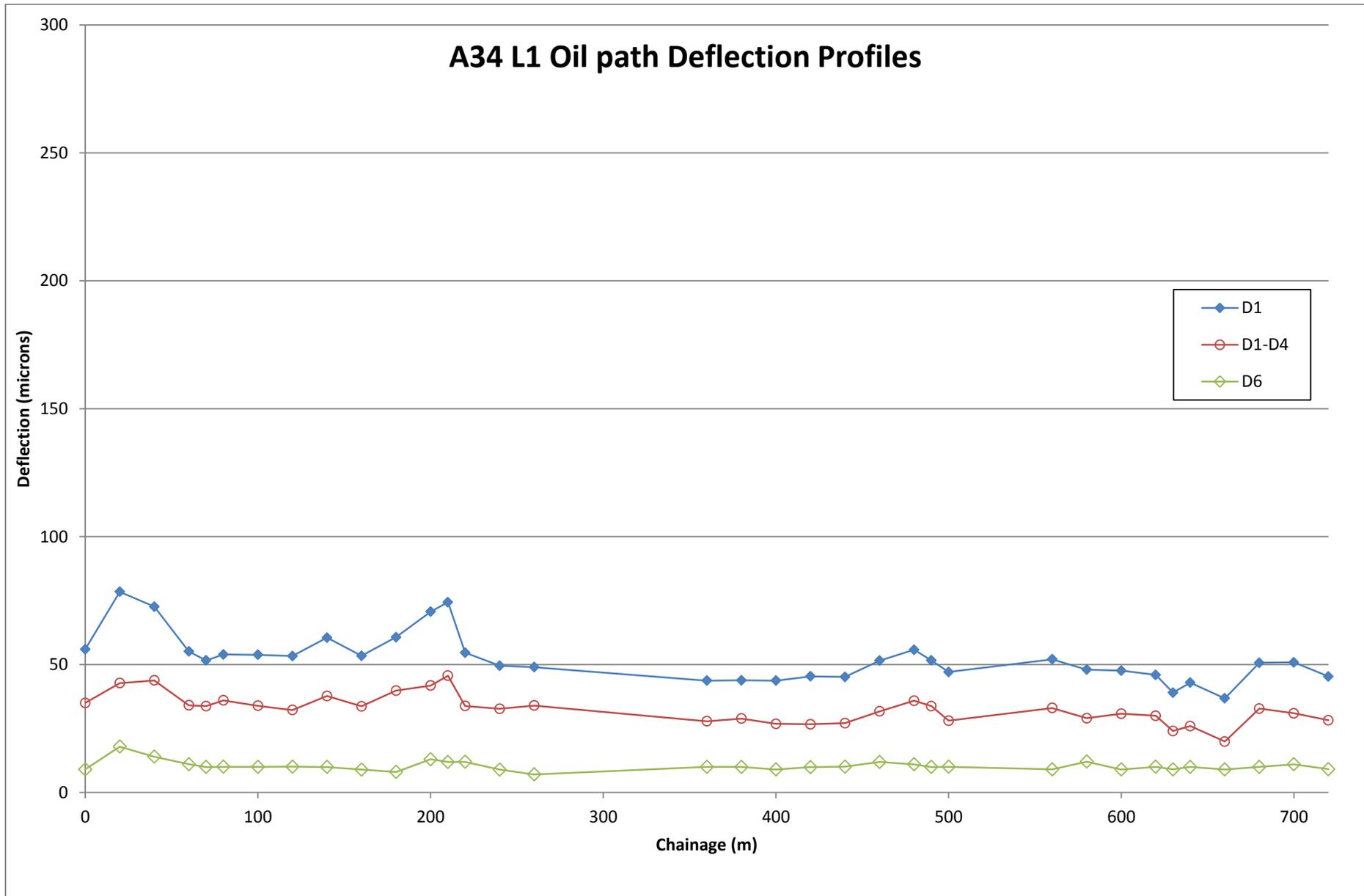
to compact but clearly was not so. We did repeat testing and it was found that only in one location did the compaction not meet the specification. This was removed and replaced. We have had no problems with the in-service performance of the material.

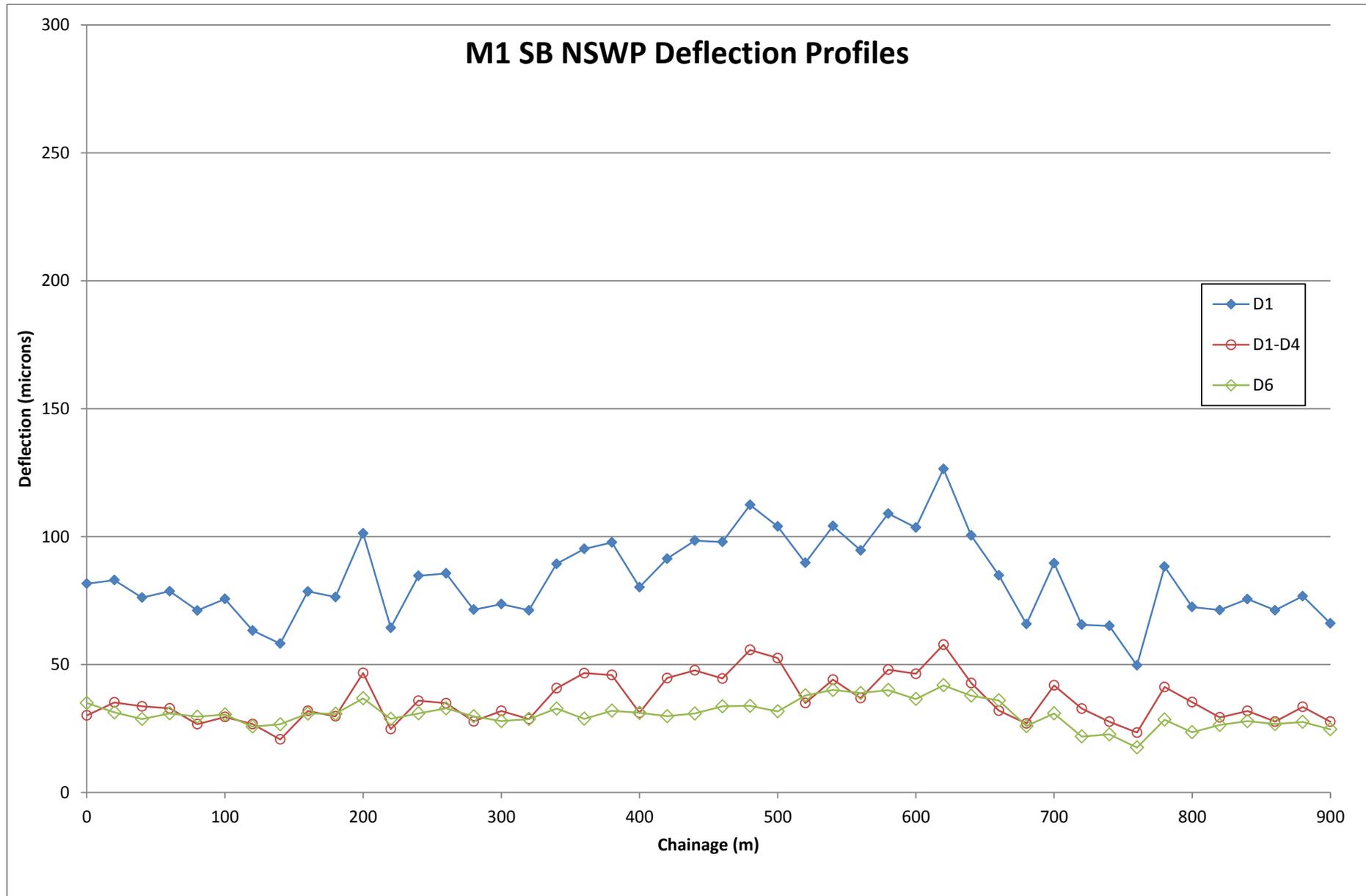
Any other comments or observations about EME2.

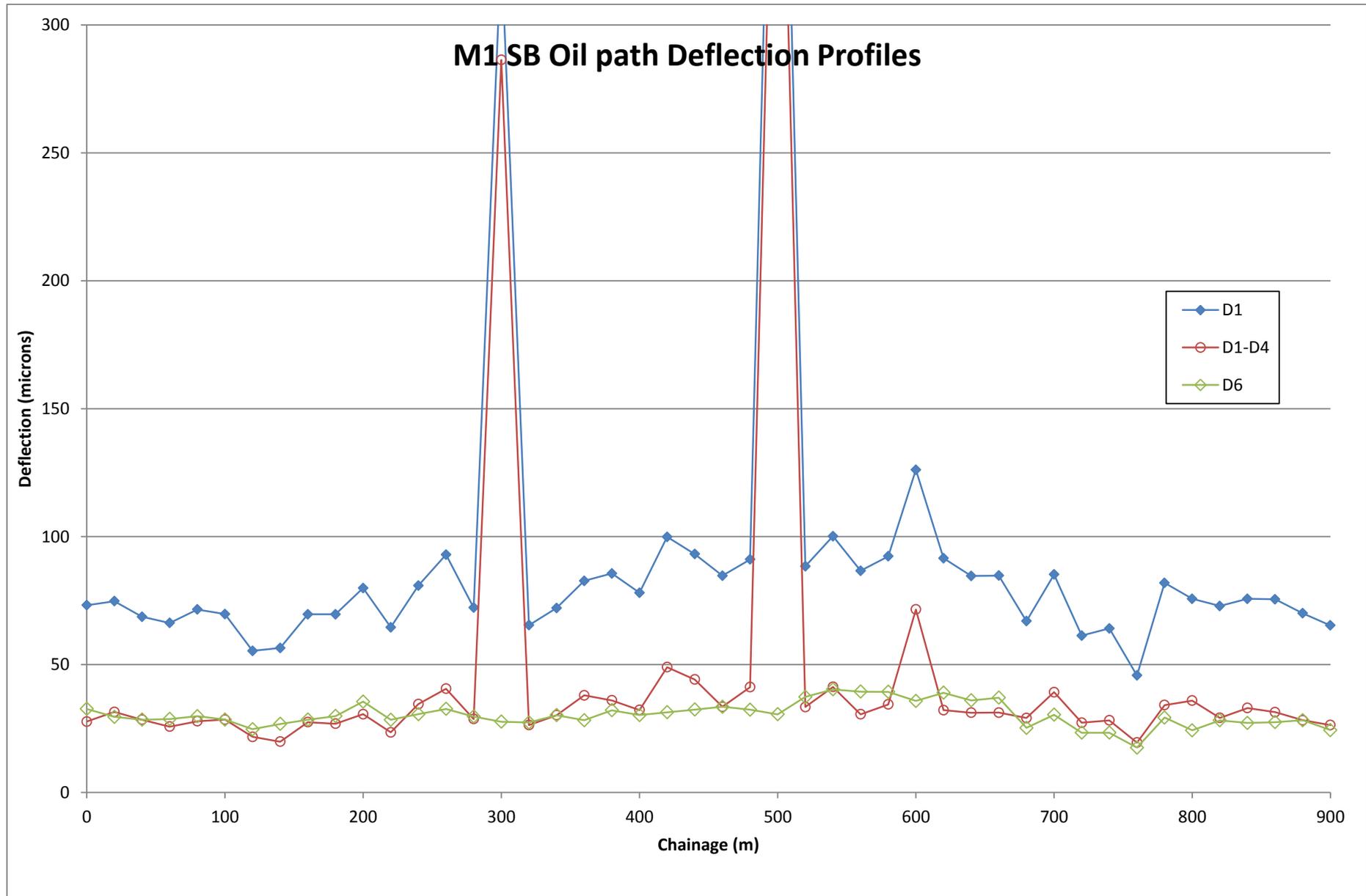
It became clear quite early in the contract that the contractor had not laid this material before although he appeared to handle it well with no problems. Later when test results were received we found that the testing contractor had clearly not read the specification as the format of the results did not follow that specified in SHW. All the results were returned for recalculation/formatting which caused a long delay before we found that compaction in some areas did not comply. By this time surfacing had been laid over the EME2 so repeat testing damaged this and some had to be replaced. From our experience there is clearly a lack of familiarity with the material possibly due to its use being relatively rare.

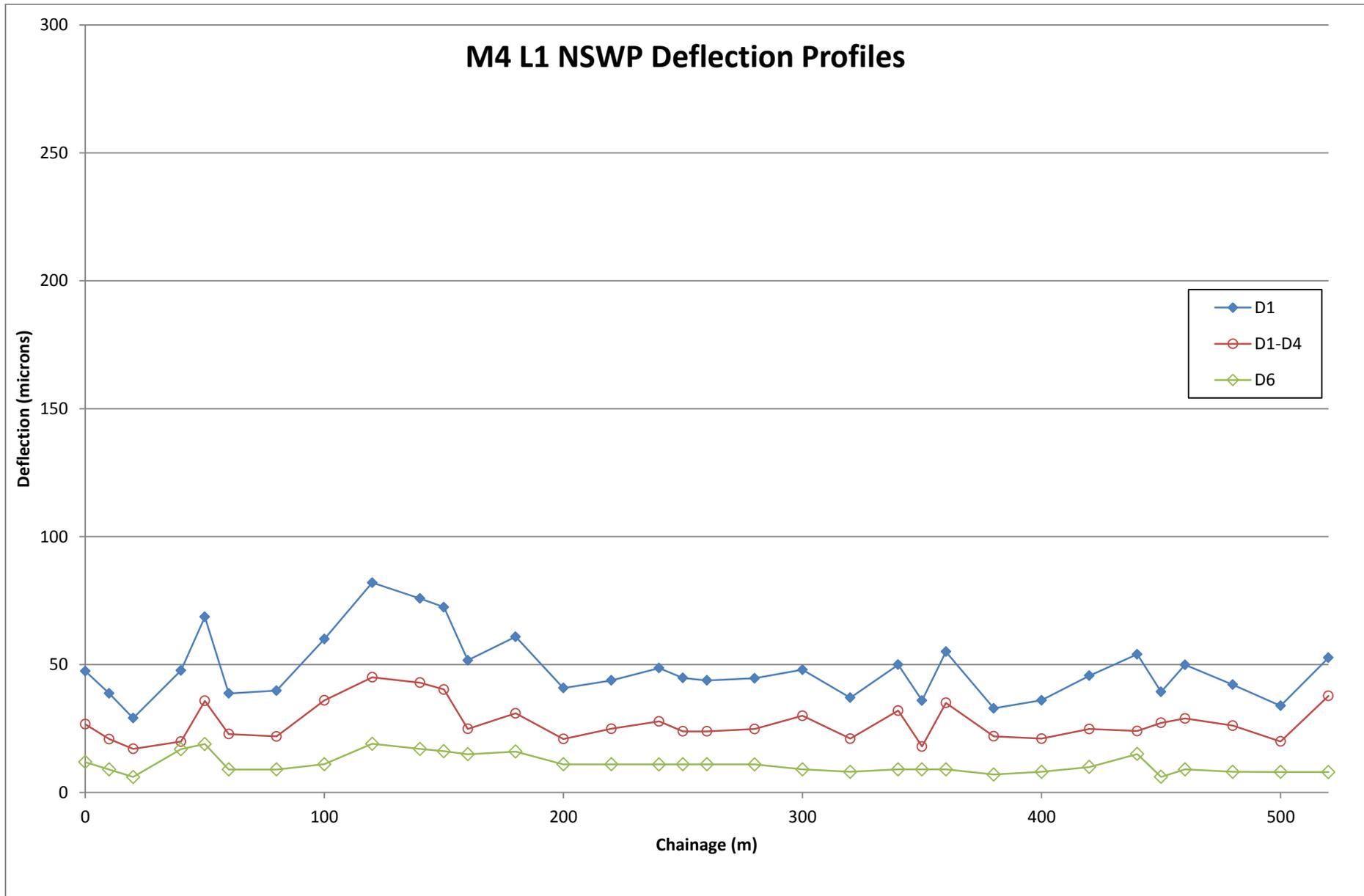
Appendix B Falling Weight Deflectometer

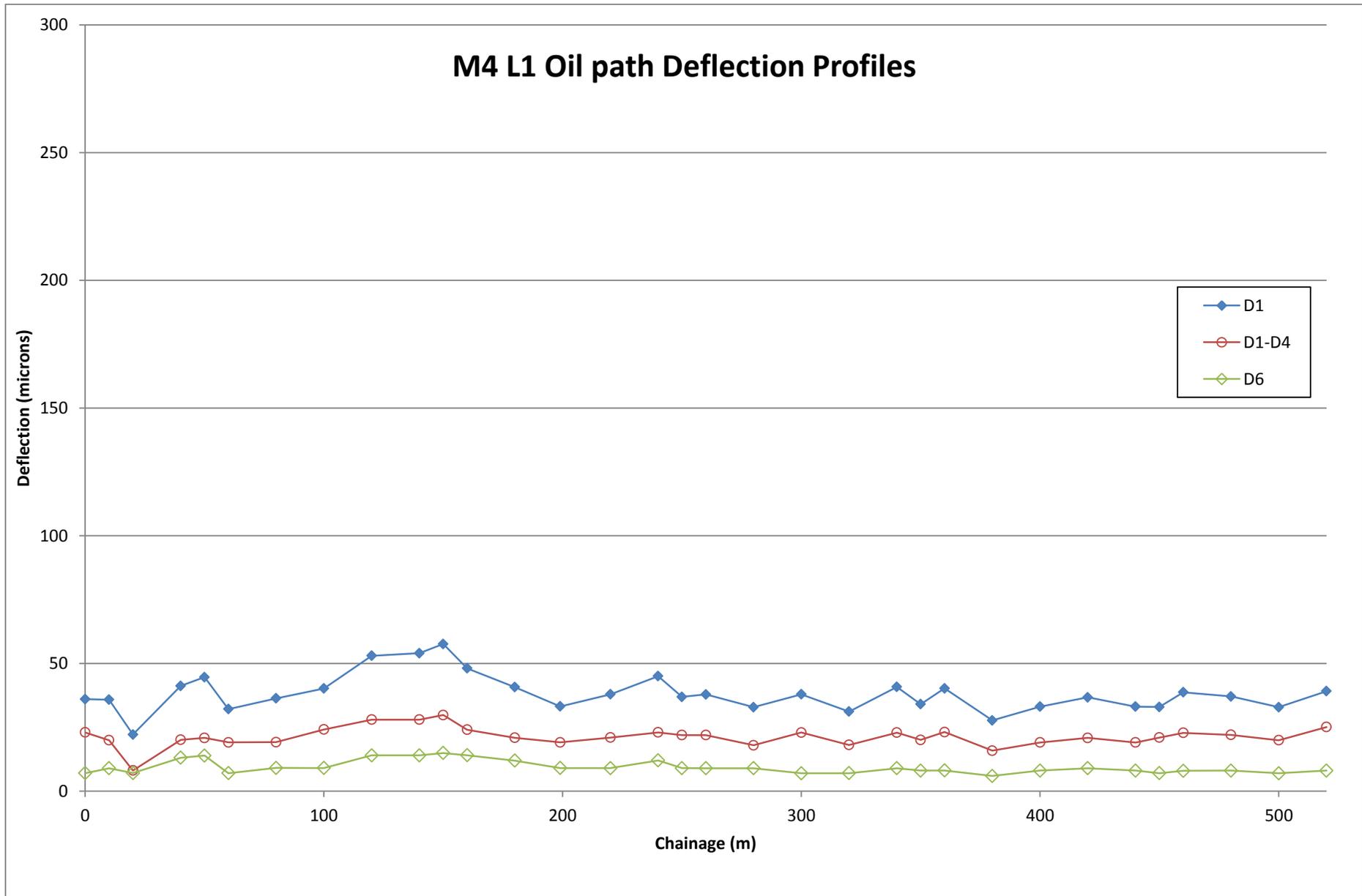












Appendix C Binder Richness

$$K = \frac{((100B_m)/(100 - B_m))}{a \sqrt[5]{\Sigma}}$$

K is the binder richness modulus.

B_m is the binder content (as measured during testing).

$a = 2.65 / r$.

r is the density of aggregate $r = \frac{100 - B_m}{\frac{100}{\rho_G} - \frac{B_m}{\rho_B}}$.

ρ_G is the max density of the sample (as measure during testing).

ρ_B is the density of Bitumen and was taken to be 1.03.

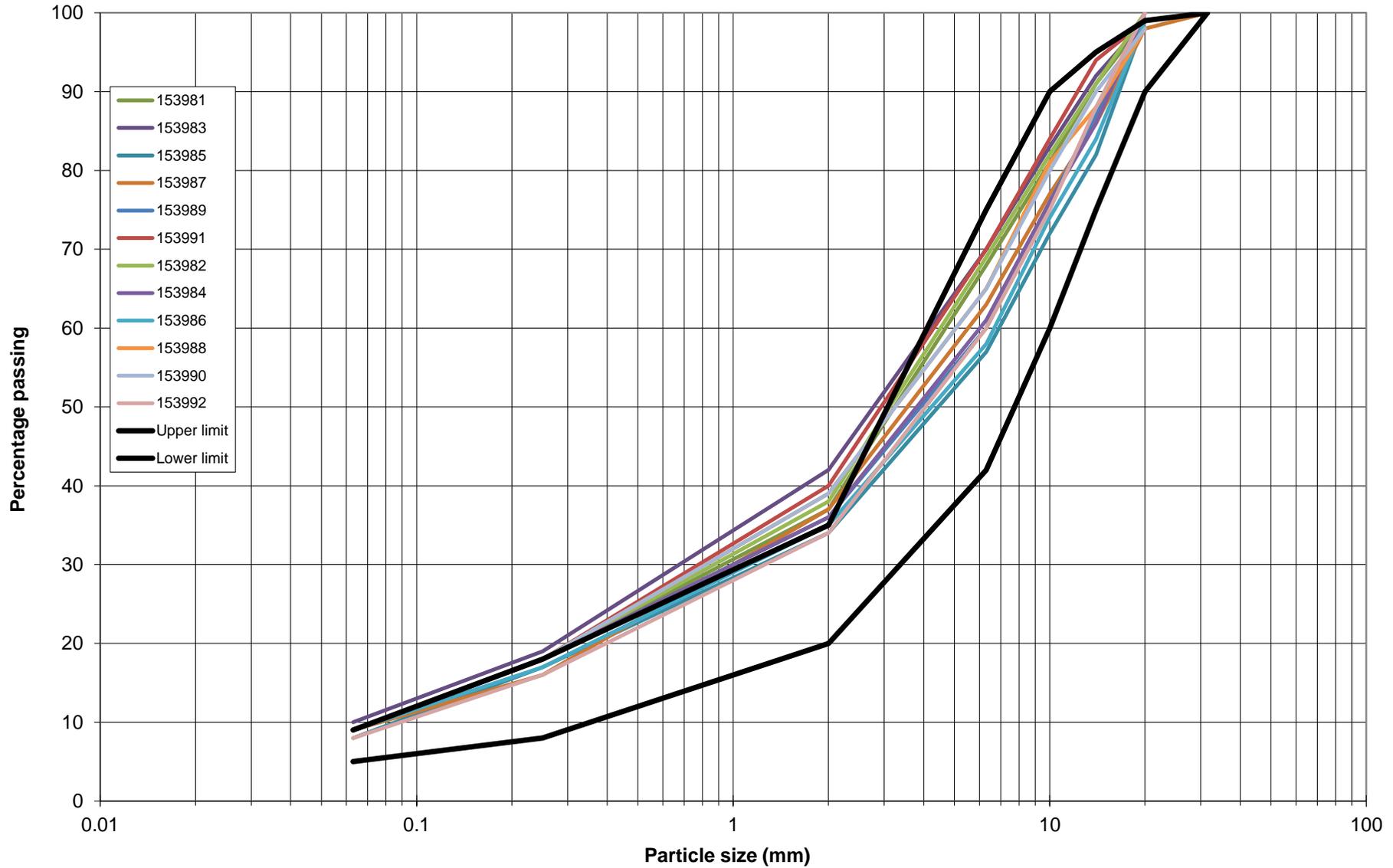
Σ is the specific surface area of the aggregate, $\Sigma = 0.25G + 2.3S + 12s + 135f$.

Where G is the proportion by mass of aggregate over 6.3mm, S between 6.3mm and 0.315mm, s between 0.315mm and 0.080mm and f is smaller than 0.080mm.

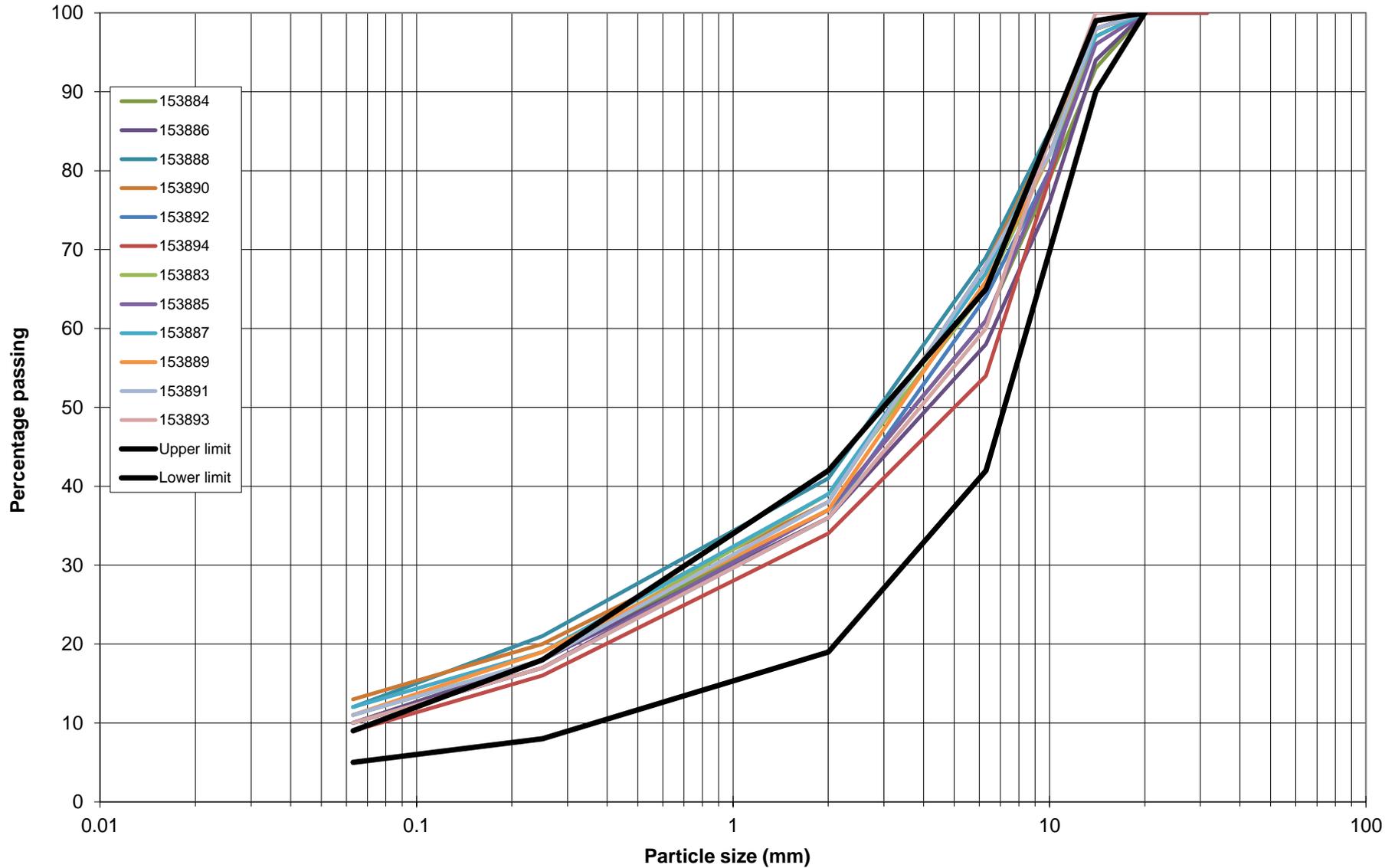
The binder richness modulus should be greater than 3.4 (Sanders & Nunn, 2005).

Appendix D Aggregate Grading (Other UK sites)

M876 Binder Course EME2 20mm



A9 Binder Course EME2 14mm



Appendix E Core logs

E.1.1 A34 Cores

CORE LOG	1A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	33	33	TS	14	GS	Sound	Intact	Yes	-	
	2	33	89	56	EME2	14	LST	Sound	Intact	No	-	
	3	89	200	111	EME2	14	LST	Sound	Intact	No	-	
	4	200	289	89	EME2	14	LST	Sound	-	No	-	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: Granular		Remarks: Intact,					
Time of coring:					Hole depth: 290mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150		
								Core Ref:		1A		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152762 1			
			Project:		EME2		Project Code:		11113136			
	Location: MP17/4 +0		Direction: SB		FWD ch: 0		Coring Date:		02/06/2015			
	Section: (A34)		Lane: 1		Offset: m		NSWP		Logged by:		KG & JT	
	Section Chainage: m		Grid Ref X: 446206		Grid Ref Y: 145739		Checked by:		FC			

CORE LOG	1B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	33	33	TS	14	GS	Sound	Intact	Yes	-	
	2	33	93	60	EME2	14	LST	Sound	Intact	Yes/Low	-	
	3	93	201	108	EME2	14	LST	Sound	Intact	No	-	
	4	201	315	114	EME2	14	LST	Sound	-	No	-	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: Granular		Remarks: Intact,					
Time of coring:					Hole depth: 310mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150		
								Core Ref:		1B		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152763 1			
			Project:		EME2		Project Code:		11113136			
	Location: MP17/4 +0		Direction: SB		FWD ch: 0		Coring Date:		02/06/2015			
	Section: (A34)		Lane: 1		Offset: m		Oil Lane		Logged by:		KG & JT	
	Section Chainage: m		Grid Ref X: 446206		Grid Ref Y: 145739		Checked by:		FC			

CORE LOG		2A		Layers				Aggregate		General Remarks			PAK test
No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE			
1	0	32	32	TS	14	GS	Sound	Intact	Yes	-			
2	32	92	60	EME2	14	LST	Sound	Intact	No	-			
3	92	197	105	EME2	14	LST	Sound	Intact	No	-			
4	197	275	78	EME2	14	LST	Sound	-	No	-			
5													
6													
7													
8													
9													
10													
Cored at: Sound				Subbase type: Granular			Remarks: Intact,						
Time of coring:				Hole depth: 310mm									
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base									Core Dia (mm)		150		
									Core Ref:		2A		
Client:				Highways England			TRL LMS Ref:		152764		1		
Project:				EME2			Project Code:		11113136				
Location: MP17/4 +70				Direction: SB		FWD ch: 70		Coring Date:		02/06/2015			
Section: (A34)				Lane: 1	Offset: m		NSWP	Logged by:		KG & JT			
Section Chainage: m				Grid Ref X: 446221		Grid Ref Y: 145669		Checked by:		FC			

CORE LOG		2B		Layers				Aggregate		General Remarks			PAK test
No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE			
1	0	35	35	TS	14	GS	Sound	Intact	Yes	-			
2	35	95	60	EME2	14	LST	Sound	Intact	No	-			
3	95	201	106	EME2	14	LST	Sound	Intact	No	-			
4	201	285	84	EME2	14	LST	Sound	-	Yes/Low	-			
5													
6													
7													
8													
9													
10													
Cored at: Sound				Subbase type: Granular			Remarks: Intact,						
Time of coring:				Hole depth: 288mm									
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base									Core Dia (mm)		150		
									Core Ref:		2B		
Client:				Highways England			TRL LMS Ref:		152765		1		
Project:				EME2			Project Code:		11113136				
Location: MP17/4 +70				Direction: SB		FWD ch: 70		Coring Date:		02/06/2015			
Section: (A34)				Lane: 1	Offset: m		Oil Lane	Logged by:		KG & JT			
Section Chainage: m				Grid Ref X: 446221		Grid Ref Y: 145669		Checked by:		FC			

CORE LOG	3A	Layers				Aggregate		General Remarks			PAK test
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)
	1	0			TS	14	GS	Sound	Intact	Yes	-
	2				EME2	14	LST	Sound	Intact	No	-
	3				EME2	14	LST	Sound	Intact	No	-
	4				EME2	14	LST	Sound	-	No	-
	5										
	6										
	7										
	8										
	9										
	10										
Cored at: Sound					Subbase type: Granular		Remarks: Intact,				
Time of coring:					Hole depth: 290mm						
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150	
								Core Ref:		3A	
 TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA	Top of core		Client:		Highways England		TRL LMS Ref:		152766	1	
			Project:		EME2		Project Code:		11113136		
	Location: MP17/4 +140		Direction: SB		FWD ch: 140		Coring Date:		02/06/2015		
	Section: (A34)		Lane: 1	Offset: m		NSWP	Logged by:		KG & JT		
	Section Chainage: m		Grid Ref X: 446236		Grid Ref Y: 145600		Checked by:		FC		

CORE LOG	3B	Layers				Aggregate		General Remarks			PAK test
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)
	1	0	38	38	TS	14	GS	Sound	Intact	Yes	-
	2	38	107	69	EME2	14	LST	Sound	Intact	No	-
	3	107	208	101	EME2	14	LST	Sound	Intact	No	-
	4	208	302	94	EME2	14	LST	Sound	-	No	-
	5										
	6										
	7										
	8										
	9										
	10										
Cored at: Sound					Subbase type: Granular		Remarks: Intact,				
Time of coring:					Hole depth: 305mm						
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150	
								Core Ref:		3B	
 TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA	Top of core		Client:		Highways England		TRL LMS Ref:		152767	1	
			Project:		EME2		Project Code:		11113136		
	Location: MP17/4 +140		Direction: SB		FWD ch: 140		Coring Date:		02/06/2015		
	Section: (A34)		Lane: 1	Offset: m		Oil Lane	Logged by:		KG & JT		
	Section Chainage: m		Grid Ref X: 446236		Grid Ref Y: 145600		Checked by:		FC		

CORE LOG	4A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	34	34	TS	14	GS	Sound	Intact	Yes	-	
	2	34	103	69	EME2	14	LST	Sound	Intact	No	-	
	3	103	193	90	EME2	14	LST	Sound	Intact	No	-	
	4	193	263	70	EME2	14	LST	Sound	-	No	-	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: Granular		Remarks: Intact,					
Time of coring:					Hole depth: 270mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150		
								Core Ref:		4A		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client: Highways England		TRL LMS Ref: 152768		1					
	Project: EME2		Project Code: 11113136									
	Location: MP17/4 +210		Direction: SB		FWD ch: 210		Coring Date: 02/06/2015					
	Section: (A34)		Lane: 1		Offset: m		NSWP		Logged by: KG & JT			
	Section Chainage: m		Grid Ref X: 446251		Grid Ref Y: 145531		Checked by: FC					

CORE LOG	4B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	39	39	TS	14	GS	Sound	Intact	Yes	-	
	2	39	107	68	EME2	14	LST	Sound	Intact	No	-	
	3	107	185	78	EME2	14	LST	Sound	Intact	No	-	
	4	185	267	82	EME2	14	LST	Sound	-	No	-	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: Granular		Remarks: Intact,					
Time of coring:					Hole depth: 275mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150		
								Core Ref:		4B		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client: Highways England		TRL LMS Ref: 152769		1					
	Project: EME2		Project Code: 11113136									
	Location: MP17/4 +210		Direction: SB		FWD ch: 210		Coring Date: 02/06/2015					
	Section: (A34)		Lane: 1		Offset: m		Oil Lane		Logged by: KG & JT			
	Section Chainage: m		Grid Ref X: 446251		Grid Ref Y: 145531		Checked by: FC					

CORE LOG	5A	Layers				Aggregate		General Remarks			PAK test
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)
	1	0	35	35	TS	14	GS	Sound	Intact	Yes	-
	2	35	95	60	EME2	14	LST	Sound	Intact	No	-
	3	95	207	112	EME2	14	LST	Sound	Intact	No	-
	4	207	285	78	EME2	14	LST	Sound	-	No	-
	5										
	6										
	7										
	8										
	9										
	10										
Cored at: Sound					Subbase type: Granular		Remarks: Intact,				
Time of coring:					Hole depth: 285mm						
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150	
								Core Ref:		5A	
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client: Highways England		TRL LMS Ref:		152770 1		
	Project:		EME2		Project Code:		11113136				
	Location: MP17/4 +260		Direction: SB		FWD ch: 260		Coring Date:		02/06/2015		
	Section: (A34)		Lane: 1		Offset: m		NSWP		Logged by: KG & JT		
	Section Chainage: m		Grid Ref X: 446261		Grid Ref Y: 145482		Checked by:		FC		

CORE LOG	5B	Layers				Aggregate		General Remarks			PAK test
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)
	1	0	36	36	TS	14	GS	Sound	Intact	Yes	-
	2	36	94	58	EME2	14	LST	Sound	Intact	Yes	-
	3	94	198	104	EME2	14	LST	Sound	Intact	No	-
	4	198	299	101	EME2	14	LST	Sound	-	No	-
	5										
	6										
	7										
	8										
	9										
	10										
Cored at: Sound					Subbase type: Granular		Remarks: Intact,				
Time of coring:					Hole depth: 300mm						
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150	
								Core Ref:		5B	
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client: Highways England		TRL LMS Ref:		152771 1		
	Project:		EME2		Project Code:		11113136				
	Location: MP17/4 +260		Direction: SB		FWD ch: 260		Coring Date:		02/06/2015		
	Section: (A34)		Lane: 1		Offset: m		Oil Lane		Logged by: KG & JT		
	Section Chainage: m		Grid Ref X: 446261		Grid Ref Y: 145482		Checked by:		FC		

CORE LOG		6A		Layers				Aggregate		General Remarks			PAK test
No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE			
1	0	39	39	TS	14	GS	Sound	Intact	Yes	-			
2	39	105	66	EME2	14	LST	Sound	Intact	Yes	-			
3	105	190	85	EME2	14	LST	Sound	Intact	No	-			
4	190	316	126	EME2	14	LST	Sound	-	No	-			
5													
6													
7													
8													
9													
10													
Cored at: Sound				Subbase type: Granular			Remarks: Intact,						
Time of coring:				Hole depth: 320mm									
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base									Core Dia (mm)		150		
									Core Ref:		6A		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>		Top of core		Client: Highways England				TRL LMS Ref:		152772		1	
		Project:		EME2				Project Code:		11113136			
		Location: MP17/4 +380		Direction: SB		FWD ch: 380				Coring Date:		02/06/2015	
		Section: (A34)		Lane: 1	Offset: m		NSWP		Logged by:		KG & JT		
		Section Chainage: m		Grid Ref X: 446287		Grid Ref Y: 145364				Checked by:		FC	

CORE LOG		6B		Layers				Aggregate		General Remarks			PAK test
No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE			
1	0	40	40	TS	14	GS	Sound	Intact	Yes	-			
2	40	110	70	EME2	14	LST	Sound	Intact	Yes	-			
3	110	200	90	EME2	14	LST	Sound	Intact	No	-			
4	200	331	131	EME2	14	LST	Sound	-	No	-			
5													
6													
7													
8													
9													
10													
Cored at: Sound				Subbase type: Granular			Remarks: Intact,						
Time of coring:				Hole depth: 335mm									
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base									Core Dia (mm)		150		
									Core Ref:		6B		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>		Top of core		Client: Highways England				TRL LMS Ref:		152773		1	
		Project:		EME2				Project Code:		11113136			
		Location: MP17/4 +380		Direction: SB		FWD ch: 380				Coring Date:		02/06/2015	
		Section: (A34)		Lane: 1	Offset: m		Oil Lane		Logged by:		KG & JT		
		Section Chainage: m		Grid Ref X: 446287		Grid Ref Y: 145364				Checked by:		FC	

CORE LOG		7A		Layers				Aggregate		General Remarks			PAK test
No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE			
1	0	36	36	TS	14	GS	Sound	Intact	Yes	-			
2	36	100	64	EME2	14	LST	Sound	Intact	Yes	-			
3	100	198	98	EME2	14	LST	Sound	Intact	No	-			
4	198	289	91	EME2	14	LST	Sound	-	No	-			
5													
6													
7													
8													
9													
10													
Cored at: Sound				Subbase type: Granular			Remarks: Intact,						
Time of coring:				Hole depth: 280mm									
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base									Core Dia (mm)		150		
									Core Ref:		7A		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client: Highways England			TRL LMS Ref:			152774		1		
	Top of core		Project: EME2			Project Code:			11113136				
	Top of core		Location: MP17/4 +420		Direction: SB		FWD ch: 420		Coring Date: 02/06/2015				
	Top of core		Section: (A34)		Lane: 1		Offset: m		NSWP		Logged by: KG & JT		
	Top of core		Section Chainage: m		Grid Ref X: 446296		Grid Ref Y: 145325		Checked by: FC				

CORE LOG		7B		Layers				Aggregate		General Remarks			PAK test
No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE			
1	0	36	36	TS	14	GS	Sound	Intact	Yes	-			
2	36	101	65	EME2	14	LST	Sound	Intact	Yes	-			
3	101	200	99	EME2	14	LST	Sound	Intact	No	-			
4	200	310	110	EME2	14	LST	Sound	-	No	-			
5													
6													
7													
8													
9													
10													
Cored at: Sound				Subbase type: Granular			Remarks: Intact,						
Time of coring:				Hole depth: 310mm									
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base									Core Dia (mm)		150		
									Core Ref:		7B		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client: Highways England			TRL LMS Ref:			152775		1		
	Top of core		Project: EME2			Project Code:			11113136				
	Top of core		Location: MP17/4 +420		Direction: SB		FWD ch: 420		Coring Date: 02/06/2015				
	Top of core		Section: (A34)		Lane: 1		Offset: m		Oil Lane		Logged by: KG & JT		
	Top of core		Section Chainage: m		Grid Ref X: 446296		Grid Ref Y: 145325		Checked by: FC				

CORE LOG	8A	Layers				Aggregate		General Remarks			PAK test
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)
	1	0	35	35	TS	14	GS	Sound	Intact	Yes	-
	2	35	94	59	EME2	14	LST	Sound	Intact	Yes	-
	3	94	181	87	EME2	14	LST	Sound	Intact	No	-
	4	181	278	97	EME2	14	LST	Sound	-	No	-
	5										
	6										
	7										
	8										
	9										
	10										
Cored at: Sound					Subbase type: Granular		Remarks: Intact,				
Time of coring:					Hole depth: 280mm						
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150	
								Core Ref:		8A	
 TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA	Top of core		Client:		Highways England		TRL LMS Ref:		152776	1	
	Project:		EME2		Project Code:		11113136				
	Location: MP17/4 +490		Direction: SB		FWD ch: 490		Coring Date:		02/06/2015		
	Section: (A34)		Lane: 1	Offset: m		NSWP	Logged by:		KG & JT		
	Section Chainage: m		Grid Ref X: 446310		Grid Ref Y: 145256		Checked by:		FC		

CORE LOG	8B	Layers				Aggregate		General Remarks			PAK test
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)
	1	0	37	37	TS	14	GS	Sound	Intact	Yes	-
	2	37	98	61	EME2	14	LST	Sound	Intact	Yes	-
	3	98	176	78	EME2	14	LST	Sound	Intact	No	-
	4	176	275	99	EME2	14	LST	Sound	-	No	-
	5										
	6										
	7										
	8										
	9										
	10										
Cored at: Sound					Subbase type: Granular		Remarks: Intact,				
Time of coring:					Hole depth: 250mm						
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150	
								Core Ref:		8B	
 TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA	Top of core		Client:		Highways England		TRL LMS Ref:		152777	1	
	Project:		EME2		Project Code:		11113136				
	Location: MP17/4 +490		Direction: SB		FWD ch: 490		Coring Date:		02/06/2015		
	Section: (A34)		Lane: 1	Offset: m		Oil Lane	Logged by:		KG & JT		
	Section Chainage: m		Grid Ref X: 446310		Grid Ref Y: 145256		Checked by:		FC		

CORE LOG	9A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	39	39	TS	14	GS	Sound	Intact	Yes	-	
	2	39	104	65	EME2	14	LST	Sound	Intact	No	-	
	3	104	225	121	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: Granular			Remarks: Debonded from CBM by operator, High voids in bottom 25mm of layer 3				
Time of coring:					Hole depth: 225mm			Core Dia (mm)		150		
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Ref:		9A		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152778 1			
	Project:		EME2		Project Code:		11113136					
	Location: MP17/4 +560		Direction: SB		FWD ch: 560		Coring Date:		02/06/2015			
	Section: (A34)		Lane: 1		Offset: m		NSWP		Logged by:		KG & JT	
	Section Chainage: m		Grid Ref X: 446324		Grid Ref Y: 145188		Checked by:		FC			

CORE LOG	9B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	42	42	TS	14	GS	Sound	Intact	Yes	-	
	2	42	103	61	EME2	14	LST	Sound	Intact	No	-	
	3	103	215	112	EME2	14	LST	Sound	Intact	No	-	
	4	215	325	110	EME2/DBM ?	14	LST	Sound	-	No	-	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: Granular			Remarks: Intact, Not sure if layer 4 is EME2 or DBM, gravel fines are present in the mix				
Time of coring:					Hole depth: 342mm			Core Dia (mm)		150		
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Ref:		9B		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152779 1			
	Project:		EME2		Project Code:		11113136					
	Location: MP17/4 +560		Direction: SB		FWD ch: 560		Coring Date:		02/06/2015			
	Section: (A34)		Lane: 1		Offset: m		Oil Lane		Logged by:		KG & JT	
	Section Chainage: m		Grid Ref X: 446324		Grid Ref Y: 145188		Checked by:		FC			

CORE LOG	10A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	30	30	TS	14	GS	Sound	Intact	Yes	-	
	2	30	95	65	EME2	14	LST	Sound	Intact	No	-	
	3	95	221	126	EME2	14	LST	Sound	Intact	No	-	
	4	221	293	72	EME2/DBM ?	14	LST	Sound	-	No	-	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: CBM		Remarks: Intact, Debonded from CBM by operator. Not sure if layer 4 is EME2 or DBM, gravel fines are present in the mix					
Time of coring:					Hole depth: 300mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		10A			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152780 1			
	Project:		EME2		Project Code:		11113136					
	Location: MP17/4 +630		Direction: SB		FWD ch: 630		Coring Date:		02/06/2015			
	Section: (A34)		Lane: 1		Offset: m		NSWP		Logged by:		KG & JT	
	Section Chainage: m		Grid Ref X: 446338		Grid Ref Y: 145119		Checked by:		FC			

CORE LOG	10B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	30	30	TS	14	GS	Sound	Intact	Yes	-	
	2	30	91	61	EME2	14	LST	Sound	Intact	No	-	
	3	91	220	129	EME2	14	LST	Sound	Intact	No	-	
	4	220	297	77	EME2/DBM ?	14	LST	Sound	Intact	No	-	
	5	297	315	18	HRA	14	LST	Sound	Intact	No	+VE	
	6	315	377	62	HRA	14	LST	Sound	Intact	No	+VE	
	7	377	405	28	HRA	6	LST	Sound	Intact	No	+VE	
	8	405	440	35	Sub-Base	24	LST	-	-	-	-	
	9											
	10											
Cored at: Sound					Subbase type: Granular		Remarks: Intact, Not sure if layer 4 is EME2 or DBM, gravel fines are present in the mix					
Time of coring:					Hole depth: 450mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		10B			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152781 1			
	Project:		EME2		Project Code:		11113136					
	Location: MP17/4 +630		Direction: SB		FWD ch: 630		Coring Date:		02/06/2015			
	Section: (A34)		Lane: 1		Offset: m		Oil Lane		Logged by:		KG & JT	
	Section Chainage: m		Grid Ref X: 446338		Grid Ref Y: 145119		Checked by:		FC			

E.1.2 M1 Cores

CORE LOG	1A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	25	25	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	25	87	62	EME2	14	GNT	Sound	Intact	No	-VE	
	3	87	102	15	HRA	14	GNT	Sound	Intact	No	-VE	
	4	102	218	116	DBM	20	GNT	Sound	-	No	-VE	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 23:10					Hole depth: 220mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base								Core Dia (mm)		150		
								Core Ref:		1A		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Internal		TRL LMS Ref:		153863		1			
	Project:		In service performance of EME2				Project Code:		11113136			
	Location: MP140/0		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1		Offset: 0.88m		NSWP		Logged by:		JW	
	Section Chainage: m		Grid Ref X: 454955		Grid Ref Y: 285843		Checked by:		FC			
	Top of core		Internal		TRL LMS Ref:		153864		1			
Project:		In service performance of EME2				Project Code:		11113136				
Location: MP140/0		Direction: SB		FWD ch:		Coring Date:		04/11/2015				
Section:		Lane: L1		Offset: 1.58m		O/L		Logged by:		JW		
Section Chainage: m		Grid Ref X: 454955		Grid Ref Y: 285843		Checked by:		FC				

CORE LOG	2A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	33	33	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	33	94	61	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	94	121	27	HRA	14	GNT	Sound	Intact	No	-VE	
	4	121	250	129	DBM	32	GNT	Voided at top	-	Yes	-VE	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 23:30					Hole depth: 250mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		2A			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153865	1
	Project:		In service performance of EME2		Project Code:		11113136		Coring Date:		04/11/2015	
	Location: MP		Direction: SB		FWD ch:		Logged by:		JW			
	Section:		Lane: L1		Offset: 0.83m		NSWP		Checked by:		FC	
	Section Chainage: m		Grid Ref X: 454949		Grid Ref Y: 285745							

CORE LOG	2B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	33	33	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	33	102	69	EME2	10	GNT	Sound	Intact	Yes	-VE	
	3	102	126	24	HRA	14	GNT	Sound	Intact	No	-VE	
	4	126	252	126	DBM	32	GNT	Sound	-	No	-VE	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 23:38					Hole depth: 250mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		2B			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153866	1
	Project:		In service performance of EME2		Project Code:		11113136		Coring Date:		04/11/2015	
	Location: MP		Direction: SB		FWD ch:		Logged by:		JW			
	Section:		Lane: L1		Offset: 1.56m		O/L		Checked by:		FC	
	Section Chainage: m		Grid Ref X: 454949		Grid Ref Y: 285745							

CORE LOG	3A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
<p>153867</p>	1	0	25	25	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	25	101	76	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	101	231	130	DBM	24	GNT	Sound	Intact	Yes	-VE	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 23:50					Hole depth: 240mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		3A			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		<p>153867</p>		Client:		Internal		TRL LMS Ref:		153867	1
	Project:		In service performance of EME2				Project Code:		11113136			
	Location: MP		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1	Offset: 1.03m	NSWP	Logged by:		JW				
	Section Chainage: m		Grid Ref X: 454940		Grid Ref Y: 285643		Checked by:		FC			

CORE LOG	3B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
<p>153868</p>	1	0	27	27	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	27	106	79	EME2	10	GNT	Voided at base	Intact	Yes	-VE	
	3	106	237	131	DBM	24	GNT	Sound	-	No	-VE	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 00:00					Hole depth: 250mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		3B			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		<p>153868</p>		Client:		Internal		TRL LMS Ref:		153868	1
	Project:		In service performance of EME2				Project Code:		11113136			
	Location: MP		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1	Offset: 1.98m	O/L	Logged by:		JW				
	Section Chainage: m		Grid Ref X: 454940		Grid Ref Y: 285643		Checked by:		FC			

CORE LOG	4A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
<p>153869</p>	1	0	30	30	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	30	100	70	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	100	221	121	DBM	20	GNT	Sound	-	No	-VE	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 00:20					Hole depth: 220mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		4A			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Internal		TRL LMS Ref:		153869 1			
	<p>153869</p>		Project:		In service performance of EME2		Project Code:		11113136			
	Location: MP		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1		Offset: 1.05m		NSWP		Logged by:		JW	
	Section Chainage: m		Grid Ref X: 454934		Grid Ref Y: 285543		Checked by:		FC			

CORE LOG	4B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
<p>153870</p>	1	0	30	30	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	30	102	72	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	102	221	119	DBM	32	GNT	Sound	-	Yes	-VE	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 00:26					Hole depth: 220mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		4B			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Internal		TRL LMS Ref:		153870 1			
	<p>153870</p>		Project:		In service performance of EME2		Project Code:		11113136			
	Location: MP		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1		Offset: 1.92m		O/L		Logged by:		JW	
	Section Chainage: m		Grid Ref X: 454934		Grid Ref Y: 285543		Checked by:		FC			

CORE LOG	5A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
<p>153871</p>	1	0	25	25	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	25	100	75	EME2	14	GNT	Sound	Intact	No	-VE	
	3	100	199	99	DBM	24	GNT	Sound	Debonded	Yes	-VE	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 00:45					Hole depth: 200mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		5A			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		<p>153871</p>		Client:		Internal		TRL LMS Ref:		153871	1
	Project:		In service performance of EME2		Project Code:		11113136		Coring Date:		04/11/2015	
	Location: MP		Direction: SB		FWD ch:		Logged by:		JW			
	Section:		Lane: L1		Offset: 1.01m		NSWP		Checked by:		FC	
	Section Chainage: m		Grid Ref X: 454929		Grid Ref Y: 285441							

CORE LOG	5B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
<p>153872</p>	1	0	28	28	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	28	101	73	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	101	207	106	DBM	32	GNT	Sound	-	Yes	-VE	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 00:50					Hole depth: 210mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		5B			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		<p>153872</p>		Client:		Internal		TRL LMS Ref:		153872	1
	Project:		In service performance of EME2		Project Code:		11113136		Coring Date:		04/11/2015	
	Location: MP		Direction: SB		FWD ch:		Logged by:		JW			
	Section:		Lane: L1		Offset: 1.84m		O/L		Checked by:		FC	
	Section Chainage: m		Grid Ref X: 454929		Grid Ref Y: 285441							

CORE LOG	6A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	29	29	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	29	92	63	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	92	173	81	DBM	20	GNT	Broken at base	-	Yes	-VE	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core debonded through coring action					
Time of coring: 01:05					Hole depth: 180mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		6A			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153873	1
	Project:		In service performance of EME2				Project Code:		11113136			
	Location: MP		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1	Offset: 0.86m	NSWP		Logged by:		JW			
	Section Chainage: m		Grid Ref X: 454922		Grid Ref Y: 285344		Checked by:		FC			

CORE LOG	6B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	30	30	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	30	95	65	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	95	192	97	DBM	24	GNT	Sound	-	Yes	-VE	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 01:10					Hole depth: 190mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		6B			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153874	1
	Project:		In service performance of EME2				Project Code:		11113136			
	Location: MP		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1	Offset: 1.92m	O/L		Logged by:		JW			
	Section Chainage: m		Grid Ref X: 454922		Grid Ref Y: 285344		Checked by:		FC			

CORE LOG		7A		Layers				Aggregate		General Remarks			PAK test
No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE			
1	0	26	26	TS	10	GNT	Sound	Intact	Yes	-VE			
2	26	96	70	EME2	14	GNT	Sound	Intact	Yes	-VE			
3	96	206	110	DBM	32	GNT	Heavily voided top	Debonded	Yes	-VE			
4	206	368	162	DBM	24	GNT	Sound	-	No	-VE			
5													
6													
7													
8													
9													
10													
Cored at: Sound pavement				Subbase type: Granular			Remarks: Intact, Core snapped off manually						
Time of coring: 01:23				Hole depth: 370mm									
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base									Core Dia (mm)		150		
									Core Ref:		7A		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153875 1		
	Project:		In service performance of EME2		Project Code:		11113136		Coring Date:		04/11/2015		
	Location: MP		Direction: SB		FWD ch:		Logged by:		JW				
	Section:		Lane: L1		Offset: 0.84m		NSWP		Checked by:		FC		
	Section Chainage: m		Grid Ref X: 454919		Grid Ref Y: 285244								

CORE LOG		7B		Layers				Aggregate		General Remarks			PAK test
No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE			
1	0	31	31	TS	10	GNT	Sound	Intact	Yes	-VE			
2	31	88	57	EME2	14	GNT	Sound	Intact	Yes	-VE			
3	88	100	12	HRA	10	GNT	Sound	Intact	No	-VE			
4	100	214	114	DBM	20	GNT	Sound	-	No	-VE			
5													
6													
7													
8													
9													
10													
Cored at: Sound pavement				Subbase type: Bound material left in hole			Remarks: Intact, Core snapped off manually						
Time of coring: 01:31				Hole depth: 210mm									
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base									Core Dia (mm)		150		
									Core Ref:		7B		
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153876 1		
	Project:		In service performance of EME2		Project Code:		11113136		Coring Date:		04/11/2015		
	Location: MP		Direction: SB		FWD ch:		Logged by:		JW				
	Section:		Lane: L1		Offset: 1.87m		O/L		Checked by:		FC		
	Section Chainage: m		Grid Ref X: 454919		Grid Ref Y: 285244								

CORE LOG	8A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	31	31	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	31	100	69	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	100	138	38	HRA	20	GNT	Sound	Intact	Yes	-VE	
	4	138	238	100	DBM	32	GNT	Sound	-	Yes	-VE	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 01:40					Hole depth: 240mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		8A			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153877	1
	Project:		In service performance of EME2		Project Code:		11113136		Coring Date:		04/11/2015	
	Location: MP		Direction: SB		FWD ch:		Logged by:		JW			
	Section:		Lane: L1		Offset: 0.82m		NSWP		Checked by:		FC	
	Section Chainage: m		Grid Ref X: 454917		Grid Ref Y: 285144							

CORE LOG	8B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	32	32	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	32	91	59	EME2	14	GNT	Sound	Intact	No	-VE	
	3	91	100	9	DBM	14	GNT	Sound	Intact	Yes	-VE	
	4	100	136	36	HRA	14	GNT	Sound	Intact	Yes	-VE	
	5	136	247	111	DBM	32	GNT	Sound	-	No	-VE	
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 01:48					Hole depth: 250mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		8B			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153878	1
	Project:		In service performance of EME2		Project Code:		11113136		Coring Date:		04/11/2015	
	Location: MP		Direction: SB		FWD ch:		Logged by:		JW			
	Section:		Lane: L1		Offset: 1.82m		O/L		Checked by:		FC	
	Section Chainage: m		Grid Ref X: 454917		Grid Ref Y: 285144							

CORE LOG	9A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	30	30	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	30	95	65	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	95	119	24	HRA	20	GNT	Sound	Intact	No	-VE	
	4	119	244	125	DBM	32	GNT	Sound	-	Yes	-VE	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 01:55					Hole depth: 250mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		9A			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153879	1
	Project:		In service performance of EME2		Project Code:		11113136					
	Location: MP		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1		Offset: 0.82m		NSWP		Logged by:		JW	
	Section Chainage: m		Grid Ref X: 454919		Grid Ref Y: 285043		Checked by:		FC			

CORE LOG	9B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	35	35	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	35	98	63	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	98	133	35	HRA	20	GNT	Sound	Intact	No	-VE	
	4	133	262	129	DBM	32	GNT	Sound	-	Yes	-VE	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 02:01					Hole depth: 260mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		9B			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153880	1
	Project:		In service performance of EME2		Project Code:		11113136					
	Location: MP		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1		Offset: 1.94m		O/L		Logged by:		JW	
	Section Chainage: m		Grid Ref X: 454919		Grid Ref Y: 285043		Checked by:		FC			

CORE LOG	10A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	26	26	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	26	92	66	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	92	136	44	HRA	20	GNT	Sound	Intact	No	-VE	
	4	136	253	117	DBM	32	GNT	Sound	-	Yes	-VE	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 02:15					Hole depth: 250mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		10A
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153881	1
	Project:		In service performance of EME2				Project Code:		11113136			
	Location: MP		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1	Offset: 0.93m	NSWP	Logged by:		JW				
	Section Chainage: m		Grid Ref X: 454929		Grid Ref Y: 284944		Checked by:		FC			

CORE LOG	10B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	30	30	TS	10	GNT	Sound	Intact	Yes	-VE	
	2	30	99	69	EME2	14	GNT	Sound	Intact	Yes	-VE	
	3	99	148	49	HRA	20	GNT	Sound	Intact	Yes	-VE	
	4	148	261	113	DBM	32	GNT	Sound	-	Yes	-VE	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound pavement					Subbase type: Bound material left in hole		Remarks: Intact, Core snapped off manually					
Time of coring: 02:20					Hole depth: 260mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		10B
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core				Client:		Internal		TRL LMS Ref:		153882	1
	Project:		In service performance of EME2				Project Code:		11113136			
	Location: MP		Direction: SB		FWD ch:		Coring Date:		04/11/2015			
	Section:		Lane: L1	Offset: 1.9m	O/L	Logged by:		JW				
	Section Chainage: m		Grid Ref X: 454929		Grid Ref Y: 284944		Checked by:		FC			

E.1.3 M4 Cores

CORE LOG	1A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
<p>152742</p>	1	0	37	37	TS	14	GS	Sound	Intact	Yes	-	
	2	37	105	68	DBM	20	LST	Sound	Intact	Yes	-	
	3	105	214	109	DBM	14	LST	Sound	Debonded	Yes	-	
	4	214	414	200	HBM	20	LST	Sound	-	Yes	-	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: Granular		Remarks: Debonded, Full depth core/Flex Comp					
Time of coring: 23:02:00					Hole depth: 410mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		1A			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	<p>Top of core</p> <p>152742</p>	Client:		Highways England			TRL LMS Ref:		152742 1			
		Project:		EME2			Project Code:		11113136			
		Location: MP116/5 + 10		Direction: EB		FWD ch: 10		Coring Date:		15/05/2015		
		Section: (M4)		Lane: 1	Offset: 0.78m		NSWP	Logged by:		Kevin Green		
		Section Chainage: m		Grid Ref X: 425865		Grid Ref Y: 179414		Checked by:		FC		

CORE LOG	1B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
<p>152743</p>	1	0	38	38	TS	14	GS	Sound	Intact	Yes	-	
	2	38	105	67	DBM	20	LST	Sound	Intact	No	-	
	3	105	215	110	DBM	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 23:02:00					Hole depth: 216mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base							Core Dia (mm)		150			
							Core Ref:		1B			
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	<p>Top of core</p> <p>152743</p>	Client:		Highways England			TRL LMS Ref:		152743 1			
		Project:		EME2			Project Code:		11113136			
		Location: MP116/5 + 10		Direction: EB		FWD ch: 10		Coring Date:		15/05/2015		
		Section: (M4)		Lane: 1	Offset: 1.63m		Oil Lane	Logged by:		Kevin Green		
		Section Chainage: m		Grid Ref X: 425865		Grid Ref Y: 179414		Checked by:		FC		

CORE LOG	2A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	48	48	TS	14	GS	Sound	Intact	Yes	-	
	2	48	107	59	EME2	10	LST	Sound	Intact	Yes	-	
	3	107	214	107	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 23:24:00					Hole depth: 214mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		2A
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152744	1		
	Project:		EME2				Project Code:		11113136			
	Location: MP116/5 +50		Direction: EB		FWD ch: 50		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 0.75m		NSWP		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 425868		Grid Ref Y: 179414		Checked by:		FC			

CORE LOG	2B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	49	49	TS	14	GS	Sound	Intact	Yes	-	
	2	49	109	60	EME2	10	LST	Sound	Intact	Yes	-	
	3	109	213	104	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 23:30:00					Hole depth: 245mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		2B
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152745	1		
	Project:		EME2				Project Code:		11113136			
	Location: MP116/5 +50		Direction: EB		FWD ch: 50		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 1.49m		Oil Lane		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 425868		Grid Ref Y: 179414		Checked by:		FC			

CORE LOG	3A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	41	41	TS	14	GS	Sound	Intact	Yes	-	
	2	41	100	59	EME2	10	LST	Sound	Intact	Yes	-	
	3	100	211	111	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 23:45:00					Hole depth: 211mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		3A
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152746	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +100		Direction: EB		FWD ch: 100		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 0.84m		NSWP		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 425912		Grid Ref Y: 179398		Checked by:		FC			

CORE LOG	3B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	42	42	TS	14	GS	Sound	Intact	Yes	-	
	2	42	105	63	EME2	10	LST	Sound	Intact	Yes	-	
	3	105	211	106	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 23:55:00					Hole depth: 210mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		3B
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152747	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +100		Direction: EB		FWD ch: 100		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 1.77m		Oil Lane		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 425912		Grid Ref Y: 179398		Checked by:		FC			

CORE LOG	4A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	39	39	TS	14	GS	Sound	Intact	Yes	-	
	2	39	98	59	EME2	10	LST	Sound	Intact	Yes	-	
	3	98	205	107	EME2	14	LST	Sound	Intact	Yes	-	
	4	205	408	203	DBM	32	LST	Sound	-	Yes	-	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: Granular		Remarks: Intact, Full depth core/ Flex					
Time of coring:					Hole depth: 399mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		4A
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152748	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +150		Direction: EB		FWD ch: 150		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 0.85m		NSWP		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 425960		Grid Ref Y: 179379		Checked by:		FC			

CORE LOG	4B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	44	44	TS	14	GS	Sound	Intact	Yes	-	
	2	44	101	57	EME2	10	LST	Sound	Intact	Yes	-	
	3	101	210	109	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring:					Hole depth: mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		4B
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152749	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +150		Direction: EB		FWD ch: 150		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 1.77m		Oil Lane		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 425960		Grid Ref Y: 179379		Checked by:		FC			

CORE LOG	5A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	39	39	TS	14	GS	Sound	Intact	Yes	-	
	2	39	100	61	EME2	10	LST	Sound	Intact	Yes	-	
	3	100	214	114	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 00:15:00					Hole depth: 215mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		5A
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152750	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +200		Direction: EB		FWD ch: 200		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 1.12m		NSWP		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 426008		Grid Ref Y: 179365		Checked by:		FC			

CORE LOG	5B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	45	45	TS	14	GS	Sound	Intact	Yes	-	
	2	45	103	58	EME2	10	LST	Sound	Intact	Yes	-	
	3	103	209	106	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 00:20:00					Hole depth: 210mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		5B
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152751	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +200		Direction: EB		FWD ch: 200		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 2.25m		Oil Lane		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 426008		Grid Ref Y: 179365		Checked by:		FC			

CORE LOG	6A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	43	43	TS	14	GS	Sound	Intact	Yes	-	
	2	43	101	58	EME2	10	LST	Sound	Intact	No	-	
	3	101	213	112	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring:					Hole depth: 210mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		6A
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152752	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +250		Direction: EB		FWD ch: 250		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 1.14m		NSWP		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 426055		Grid Ref Y: 179344		Checked by:		FC			

CORE LOG	6B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	47	47	TS	14	GS	Sound	Intact	Yes	-	
	2	47	99	52	EME2	10	LST	Sound	Intact	Yes	-	
	3	99	218	119	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring:					Hole depth: 220mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		6B
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152753	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +250		Direction: EB		FWD ch: 250		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 2.14m		Oil Lane		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 426055		Grid Ref Y: 179344		Checked by:		FC			

CORE LOG	7A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	35	35	TS	14	GS	Sound	Intact	Yes	-	
	2	35	98	63	EME2	10	LST	Sound	Intact	No	-	
	3	98	211	113	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 00:45:00					Hole depth: 215mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		7A
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152754	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +300		Direction: EB		FWD ch: 300		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 0.94m		NSWP		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 426101		Grid Ref Y: 179330		Checked by:		FC			

CORE LOG	7B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	35	35	TS	14	GS	Sound	Intact	Yes	-	
	2	35	99	64	EME2	10	LST	Sound	Intact	Yes	-	
	3	99	220	121	EME2	14	LST	Sound	Intact	Yes	-	
	4	220	420	200	DBM	32	LST	Sound	-	Yes	-	
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: Granular		Remarks: Intact, Full depth core/ Flex					
Time of coring: 00:55:00					Hole depth: 410mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		7B
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152755	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +300		Direction: EB		FWD ch: 300		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 0.193m		Oil Lane		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 426101		Grid Ref Y: 179330		Checked by:		FC			

CORE LOG	8A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	42	42	TS	14	GS	Sound	Intact	Yes	-	
	2	42	108	66	EME2	10	LST	Sound	Intact	Yes	-	
	3	108	219	111	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 01:00:00					Hole depth: 220mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		8A
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152756	1		
			Project:		EME2		Project Code:		11113136			
			Location: MP116/5 +350		Direction: EB		FWD ch: 350		Coring Date:		15/05/2015	
			Section: (M4)		Lane: 1		Offset: 1m		NSWP		Logged by:	Kevin Green
			Section Chainage: m		Grid Ref X: 426148		Grid Ref Y: 179309		Checked by:		FC	

CORE LOG	8B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	40	40	TS	14	GS	Sound	Intact	Yes	-	
	2	40	108	68	EME2	10	LST	Sound	Intact	Yes	-	
	3	108	221	113	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 01:10:00					Hole depth: 225mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		8B
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152757	1		
			Project:		EME2		Project Code:		11113136			
			Location: MP116/5 +350		Direction: EB		FWD ch: 350		Coring Date:		15/05/2015	
			Section: (M4)		Lane: 1		Offset: 2.2m		Oil Lane		Logged by:	Kevin Green
			Section Chainage: m		Grid Ref X: 426148		Grid Ref Y: 179309		Checked by:		FC	

CORE LOG	9A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	46	46	TS	14	GS	Sound	Intact	Yes	-	
	2	46	112	66	EME2	10	LST	Sound	Intact	Yes	-	
	3	112	220	108	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 01:20:00					Hole depth: 220mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		9A
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152758	1		
	Top of core		Project:		EME2		Project Code:		11113136			
	Top of core		Location: MP116/5 +400		Direction: EB		FWD ch: 400		Coring Date:		15/05/2015	
	Top of core		Section: (M4)		Lane: 1		Offset: 0.92m		NSWP		Logged by:	Kevin Green
	Top of core		Section Chainage: m		Grid Ref X: 426194		Grid Ref Y: 179290		Checked by:		FC	

CORE LOG	9B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	43	43	TS	14	GS	Sound	Intact	Yes	-	
	2	43	104	61	EME2	10	LST	Sound	Intact	Yes	-	
	3	104	219	115	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 01:30:00					Hole depth: 220mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		9B
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152759	1		
	Top of core		Project:		EME2		Project Code:		11113136			
	Top of core		Location: MP116/5 +400		Direction: EB		FWD ch: 400		Coring Date:		15/05/2015	
	Top of core		Section: (M4)		Lane: 1		Offset: 1.73m		Oil Lane		Logged by:	Kevin Green
	Top of core		Section Chainage: m		Grid Ref X: 426194		Grid Ref Y: 179290		Checked by:		FC	

CORE LOG	10A	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	51	51	TS	14	GS	Sound	Intact	Yes	-	
	2	51	108	57	EME2	10	LST	Sound	Intact	Yes	-	
	3	108	218	110	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 01:40:00					Hole depth: 220mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		10A
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152760	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +450		Direction: EB		FWD ch: 450		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 0.96m		NSWP		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 426240		Grid Ref Y: 179272		Checked by:		FC			

CORE LOG	10B	Layers				Aggregate		General Remarks			PAK test	
		No.	Top (mm)	Btm (mm)	Thickness (mm)	Material type	Max size (mm)	Type	Condition	Bond	Voids (Yes/No)	+VE / -VE
	1	0	45	45	TS	14	GS	Sound	Intact	Yes	-	
	2	45	106	61	EME2	10	LST	Sound	Intact	Yes	-	
	3	106	220	114	EME2	14	LST	Sound	Debonded	Yes	-	
	4											
	5											
	6											
	7											
	8											
	9											
	10											
Cored at: Sound					Subbase type: NA		Remarks: Debonded from CBM by operator, Top layers only					
Time of coring: 01:45:00					Hole depth: 225mm							
Abbreviations: TS=Thin Surfacing; HRA=Hot Rolled Asphalt; DBM=Dense Bituminous Macadam; HBM=Hydraulically Bound Material; GS=Gritstone; GNT=Granite; LST=Limestone; GVL=Gravel; PQC=Pavement Quality Concrete, GSB=Granular Sub-base										Core Dia (mm)		150
										Core Ref:		10B
<p>TRL Limited, Crowthorne House Nine Mile Ride Wokingham. RG40 3GA</p>	Top of core		Client:		Highways England		TRL LMS Ref:		152761	1		
			Project:		EME2		Project Code:		11113136			
	Location: MP116/5 +450		Direction: EB		FWD ch: 450		Coring Date:		15/05/2015			
	Section: (M4)		Lane: 1		Offset: 1.94m		Oil Lane		Logged by:		Kevin Green	
	Section Chainage: m		Grid Ref X: 426240		Grid Ref Y: 179272		Checked by:		FC			

Other titles from this subject area

- PR66** Evaluation of enrobé á modeule élevé (EME): A french high modulus roadbase material. Nunn, M. E., & Smith, T. (1994).
- TRL636** The application of Enrobé á Module Élevé in flexible pavements. Sanders, P. J., & Nunn, M. (2005).
- PPR750** Evaluation of EME2 type mixtures incorporating softer grade binders - Phase I progress. Artamendi, I., & McHale, M. (2015)

TRL

Crowthorne House, Nine Mile Ride,
Wokingham, Berkshire, RG40 3GA,
United Kingdom
T: +44 (0) 1344 773131
F: +44 (0) 1344 770356
E: enquiries@trl.co.uk
W: www.trl.co.uk

ISSN 0968-4093

ISBN 978-1-910377-56-7

PPR787