

Sub-Task 1: Project Report on Premium Asphalt Surfacing System (PASS) Road Trial

Task 1-111 Collaborative Research Project

Highways England, Mineral Products Association and Eurobitume UK

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Executive Summary

The primary objective of this project is “to ensure that asphalt surfacings continue to deliver value for money and to maximise the benefit from innovation”. This project was a collaborative effort between Highways England (HE), Mineral Products Association (MPA) and Eurobitume UK.

The main aim of this project is to develop asphalt surfacing materials with enhanced durability without compromising safety or increasing noise levels. The project successfully advanced the collaborative research project following the demonstration trial for the Premium Asphalt Surfacing System (PASS) installed at Alrewas Quarry access road on 27th June 2016 by conducting a road trial on a section of the Strategic Road Network.

AECOM as part of the collaborative research project led the project delivery team that completed the successful network trial and installation of the PASS on the A46 Hykeham to Carholme (Southbound) which is part of the Area 7 scheme. The trial was conducted on 9th/10th August 2017 (night time installation). The design process for the PASS material is performance based on requirements for controlled in situ air voids aiming to improve the in-service durability of the asphalt material.

The PASS material was successfully installed with observations and feedback from the site team showing that the PASS material was relatively easy to lay and compact. A key point for the trial was the fact that the PASS design was able to meet and exceed the target in-situ macrotexture of 1.0 mm set for the project. The PASS mixtures had mean macrotexture values ranging between 1.2 mm and 1.3 mm with visual inspection showing a ‘dense’ asphalt material. The skid resistance values exceeding 70 were obtained using the skid pendulum test value (PTV) in accordance with EN 13036-4. The resistance to permanent deformation test of the PASS mixtures showed rut depths of less than 5 mm after 10,000 cycles at 60°C in accordance with BS EN 12697-22 (small scale wheel tracker). The visual inspection of the PASS mixtures following the wheel track testing showed that there was little or no rut on the surface of the mixtures. The moisture susceptibility of the PASS mixtures was considered good with Indirect Tensile Strength Ratios (ITSR) of 72% in accordance with BS EN 12697-12.

The Statistical Pass-By (SPB) method was used in assessing the noise properties of the PASS mixtures following the road trial to obtain the Road Surface Influence (RSI). The obtained value for the PASS from this survey was obtained as -5.7 dB(A) which is a quieter surface than a standard Hot Rolled Asphalt (HRA).

This project has successfully arranged the installation of PASS trial sections on the strategic road network. This demonstrates that the PASS can be installed using current practices to achieve the project requirements. Most importantly, the PASS mixtures have shown improved noise characteristics following the SPB tests conducted.

1. Introduction

Following the completion of the previous collaborative research project on the next generation of asphalt surfacings (Highways England Framework - Task 409), Arup AECOM consortium was commissioned by Highways England, Mineral Products Association (MPA) and Eurobitume UK to carry out further trials on the strategic road network under a new project: Task 1-111.

The scope of work and action plan for the project is detailed in Figure 1.

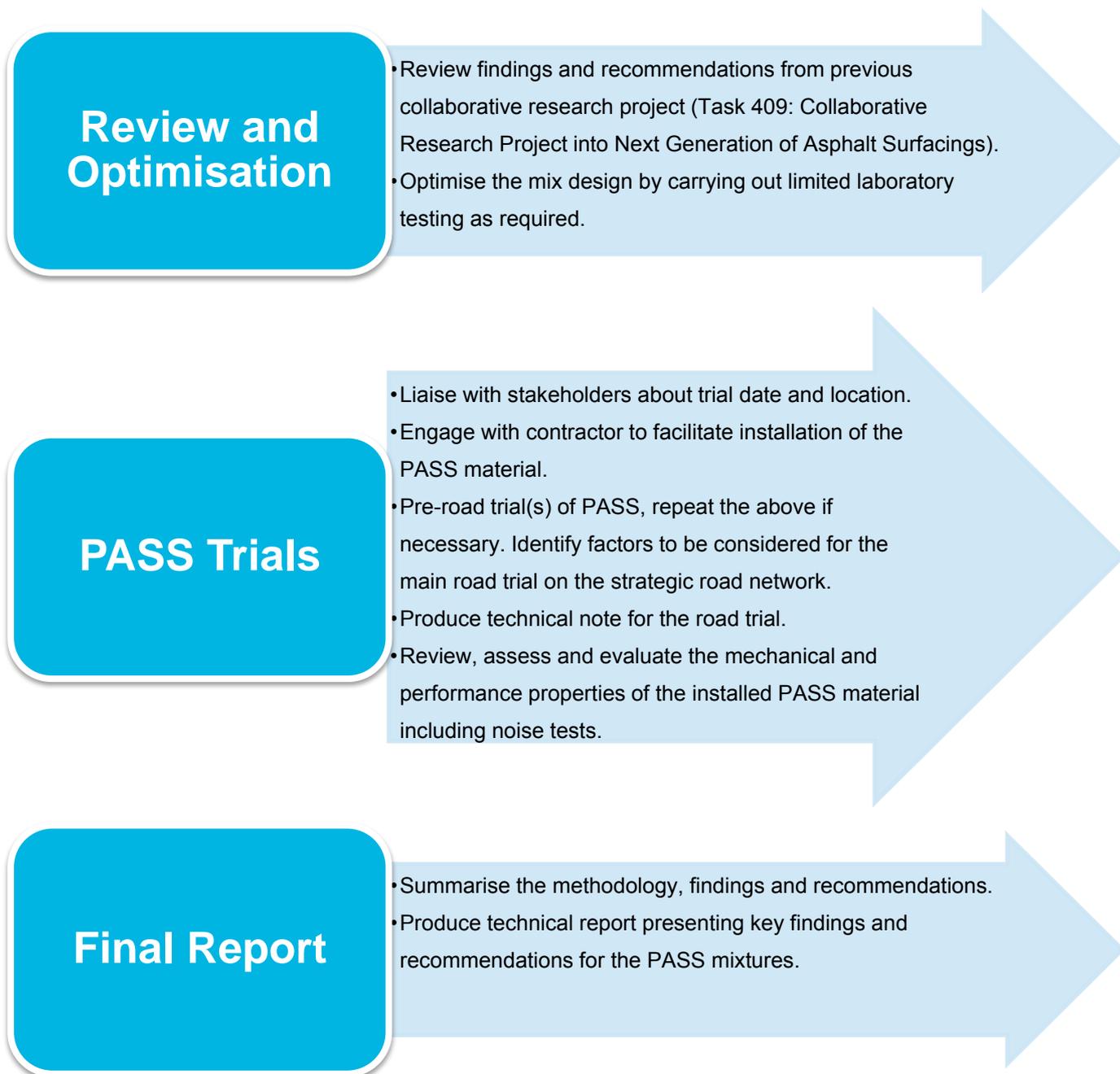


Figure 1: Task 1-111 Scope of Works and Action Plan

Appendix A presents the action plan and timeline followed for the project.

2. Review and Optimisation of the PASS

2.1 Review Findings and Recommendation from Previous Collaborative Research

The key findings and recommendations following the installation of the PASS at the Alrewas Quarry access road trial during the previous collaborative research (Task 409) are summarised below:

1. Samples obtained from the demonstration trial showed that the PASS material was dense, well compacted with a high coarse aggregate content and had good interlocking properties. The cross-section of the PASS is shown below in Figure 2 as the upper layer of this core.

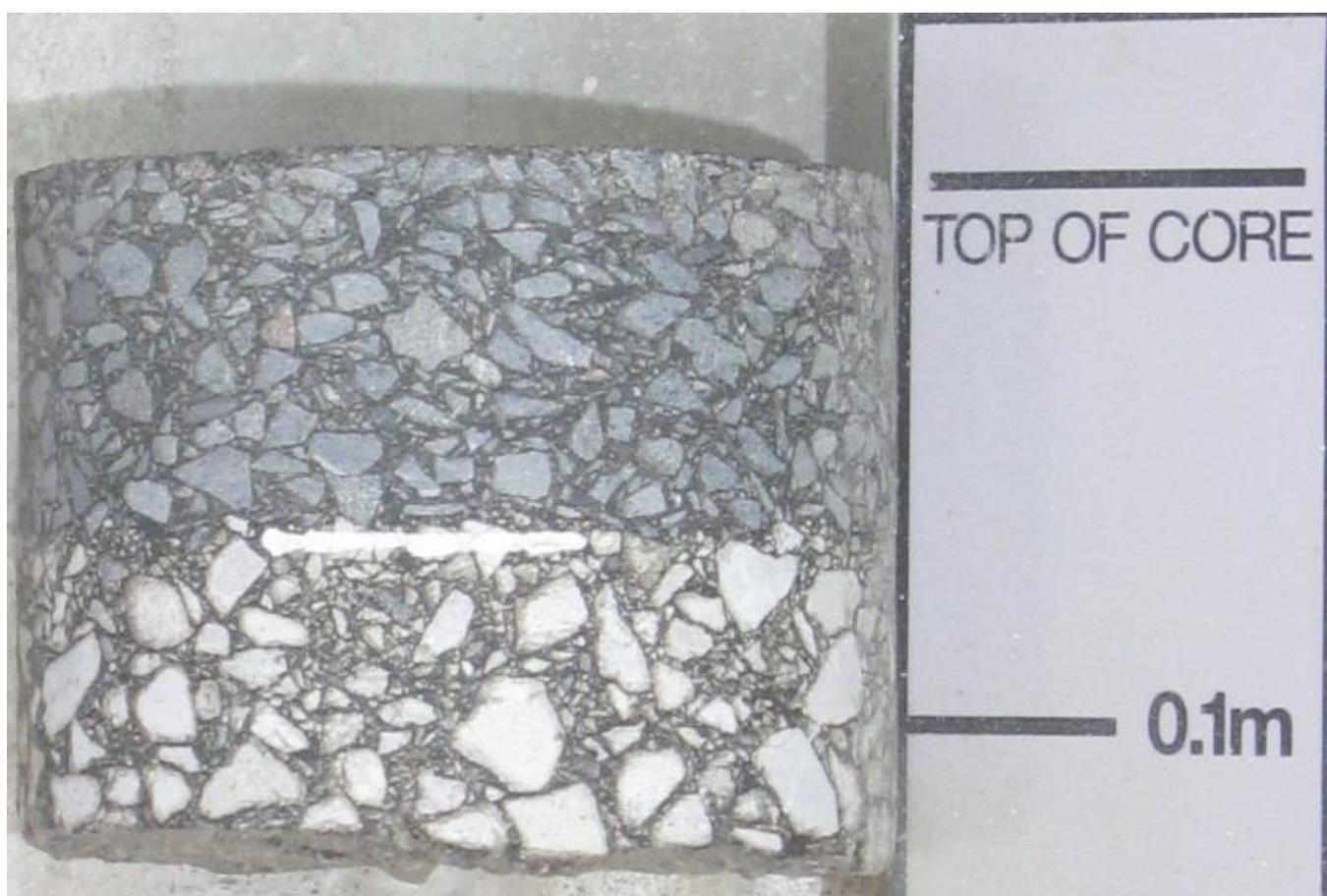


Figure 2: Cross Section of PASS (Alrewas Quarry Trial)

2. The PASS was relatively easy to batch with no problems encountered at the asphalt plants. The laying characteristics were very similar to those of a thin surface course using the same equipment.
3. The obtained air voids were ideal in the 2 – 4% range. The PASS showed superior resistance to deformation with rut depths after 10,000 cycles less than 5 mm when tested in accordance with BS EN 12697-22. The skid resistance value in accordance with BS EN 13036-4 was obtained as 73.

4. Moisture susceptibility of the PASS samples was ascertained in accordance with BS EN 12697-12. The Indirect Tensile Strength Ratio (ITSR) values were obtained as 70%. The inclusion of 1.5% hydrated lime improved the moisture susceptibility of the PASS mixtures.
5. The macrotexture for the PASS in accordance with BS EN 13036-1 was obtained as 0.8 mm. It was recommended following this project that the aggregate gradation for the PASS should be optimised in order to obtain macrotexture values in the region of 1.0 – 1.4 mm.
6. The impedance tube test in accordance with EN ISO 10534-1 was used to measure the sound absorption on 100 mm diameter core samples obtained from the demonstration trial. The test method was unable to adequately differentiate between the different asphalt types. It was recommended that the Statistical Pass-By (SPB) test method in accordance with ISO 11819-1 is conducted for the road trial of the next generation asphalt surfacing materials.

2.2 Optimise PASS Mix Design

In line with the key findings and recommendations as detailed above, the mix design properties of the PASS was optimised to achieve increased macrotexture values. This was attained in the laboratory by amending the aggregate gradation to allow for coarser fractions. This is detailed below in Table 1.

Table 1: Laboratory Optimisation of PASS

Sieve Size (mm)	% Passing		Lower Limit (%)		Upper Limit (%)	
	2016 (Alrewas Trial)	2017 (Laboratory)	2016 (Alrewas Trial)	2017 (Laboratory)	2016 (Alrewas Trial)	2017 (Laboratory)
14	100	100	100	100	100	100
10	94	92	92	90	100	100
6.3	49	45	44	39	56	51
4	42	38	34	32	46	44
2	33	30	27	24	39	36
0.25	15	14	16	10	24	18
0.063	10	7	7	5.5	11	8.5
Binder	5.4%	5.4%				

Figure 3 presents the aggregate gradation making comparisons between the optimised PASS designed in the laboratory in 2007 and the aggregate gradations used in the Alrewas Quarry Trial in 2016. Following this, laboratory mixtures of the PASS asphalt mixtures were produced and select mechanical and performance properties including the volumetrics, workability, macrotexture, moisture susceptibility and wheel tracking tests.



Figure 3: Laboratory Optimisation of PASS

The revised PASS mixture developed in the laboratory in 2017 was produced targeting 3% and 6% air voids incorporating 1.5% hydrated lime. The workability of the asphalt mixtures was monitored and assessed during the laboratory production of the PASS mixtures. This was represented as the resistance of the asphalt mixture during high temperature mixing to the applied torque per unit weight. Figure 4 shows the asphalt mixer used in this study capable of mixing 50 kg of materials. A major advantage of this mixer was that it has temperature controlled mixing chamber and the capability to measure variations in mixing temperature and torque, and real-time data logger linked to a computer.



Figure 4: Asphalt Mixer

The findings following the workability assessment for the PASS is shown below in Figure 5 depicting comparable workability between PASS mixtures designed and produced in the laboratory in 2016 and 2017.

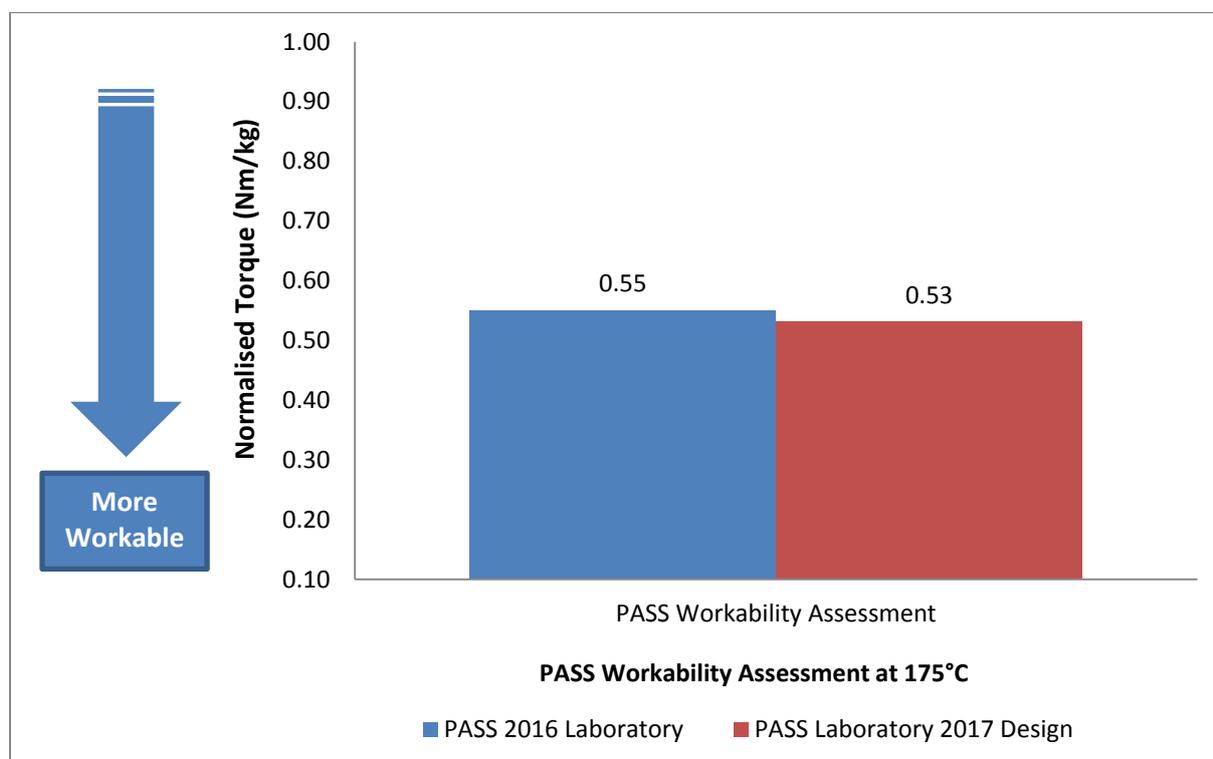


Figure 5: Workability Assessment of PASS

The volumetric properties of the produced PASS mixtures including the skid resistance tested using the skid pendulum in accordance with BS EN 13036-4 is shown below in Table 2. (Note: “The values in the bracket in the tables below represent average test results”).

Table 2: Volumetric Properties and Skid Pendulum Test Values for PASS Mixtures

SAMPLE	BULK DENSITY (kg/m ³)	MAXIMUM DENSITY (kg/m ³)	AIR VOIDS (%)	PENDULUM TEST VALUE (PTV)
PASS Laboratory 2016	2380	2500	4.8	59 – 64 (60)
PASS Alrewas Trial 2016	2416	2502	3.4	72 – 73 (73)
PASS Laboratory Design 2017 (3% Voids)	2436	2519	3.3	50 – 56 (53)
PASS Laboratory Design 2017 (6% Voids)	2346	2500	6.2	-

The macrotexture values for the PASS mixtures optimised in the laboratory are detailed in Figure 6.

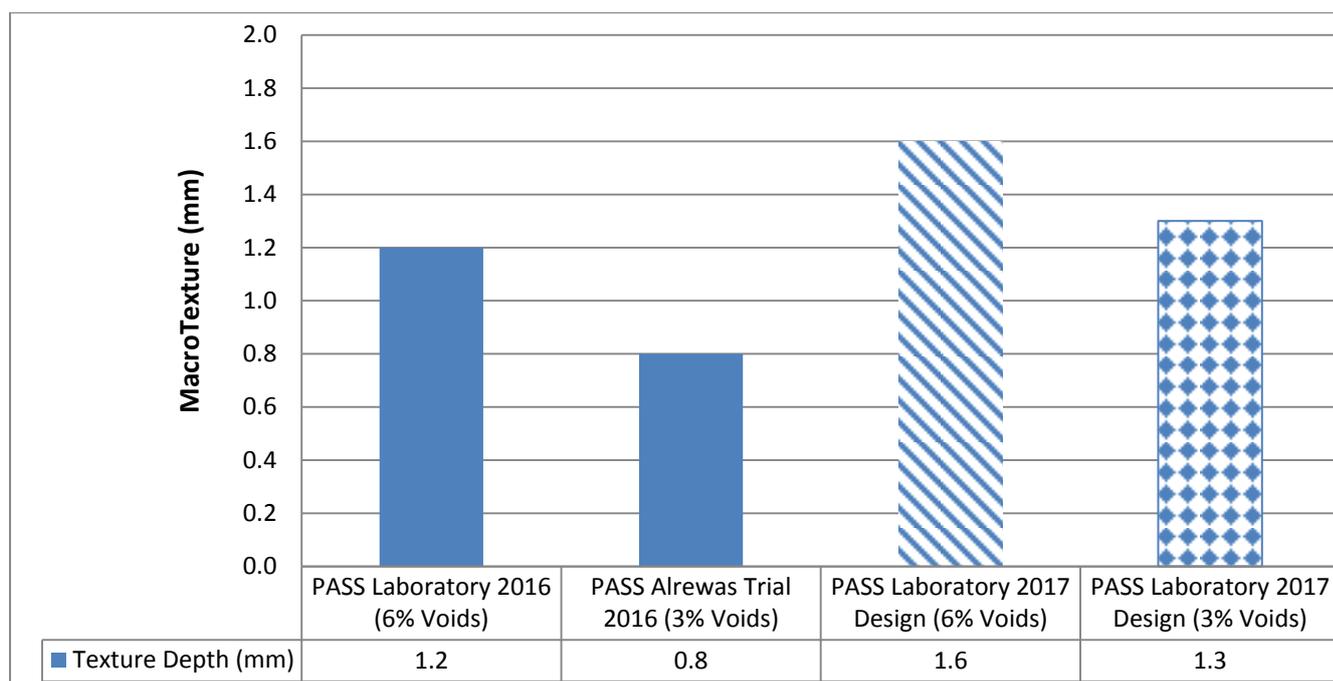


Figure 6: Macrotexture Values for PASS Mixtures

The test results as shown in Figure 6 indicated that an increase in the void contents resulted in an increase in the macrotexture values obtained. Both laboratories designed PASS mixtures at 3% and 6% had macrotexture values exceeding 1 mm (1.3 mm and 1.6 mm).

Wheel Tracking Tests (WTT) was carried out to ascertain the resistance to permanent deformation of the results for the PASS mixtures after 10,000 cycles in accordance with BS EN 12697-22. The test results are shown below in Table 3. *(Note: "The values in the bracket in the tables below represent average test results")*.

Table 3: Wheel Tracking Test Results for PASS Mixtures

SAMPLE	WHEEL TRACKING SLOPE IN AIR (mm/10 ³ cycles)	PROPORTIONAL RUT DEPTH AT 10,000 CYCLES (%)	MEAN RUT DEPTH AT 10,000 CYCLES (mm)
PASS Laboratory 2016 (6% Voids)	0.01 – 0.02 (0.01)	2.5 – 2.8 (2.7)	1.2 – 1.4 (1.3)
PASS Alrewas Trial (3% Voids)	0.03 – 0.14 (0.07)	3.6 – 5.8 (4.6)	1.9 – 3.5 (2.5)
PASS Laboratory 2017 Design (3% Voids)	0.02 – 0.04 (0.03)	2.5 – 3.5 (3.0)	1.2 – 1.8 (1.5)
PD 6691	1.00	-	-

The results from the WTT show that the mean rut depth for PASS mixtures developed in the laboratory in 2017 continue to show good performance against permanent deformation. PD 6691 states that the wheel tracking slope in the air should be less than 1 mm/1000 cycles. The wheel tracking slope in air values in comparison to values detailed in PD 6691 show that the PASS mixtures are exceeding the requirements indicating optimal performance after 10,000 cycles at 60°C.

Figure 7 presents the rut profile for the laboratory optimised mixtures showing mean rut depths of the PASS laboratory design mixtures at 1.5 mm after 10,000 cycles.

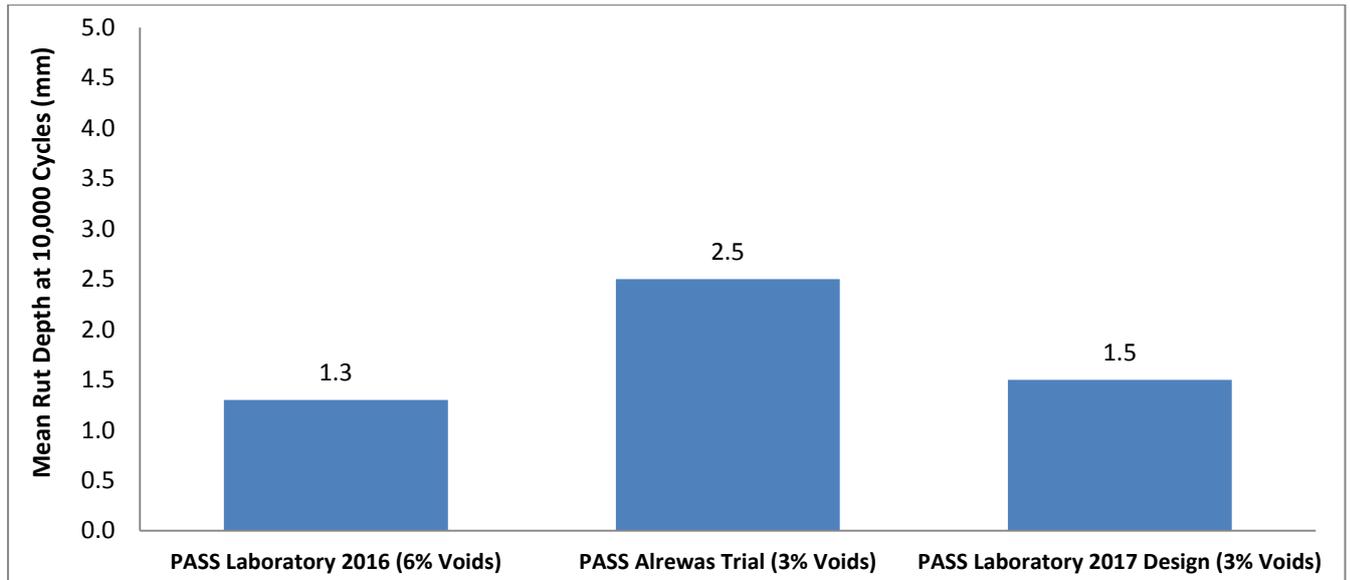


Figure 7: Rut Profile for the PASS Mixtures

The moisture susceptibility of the PASS mixtures was assessed in accordance with BS EN 12697-12. To improve the moisture susceptibility of the PASS mixtures, 1.5% hydrated lime (HL) was used in producing the samples. The test results are shown below in Figure 8.

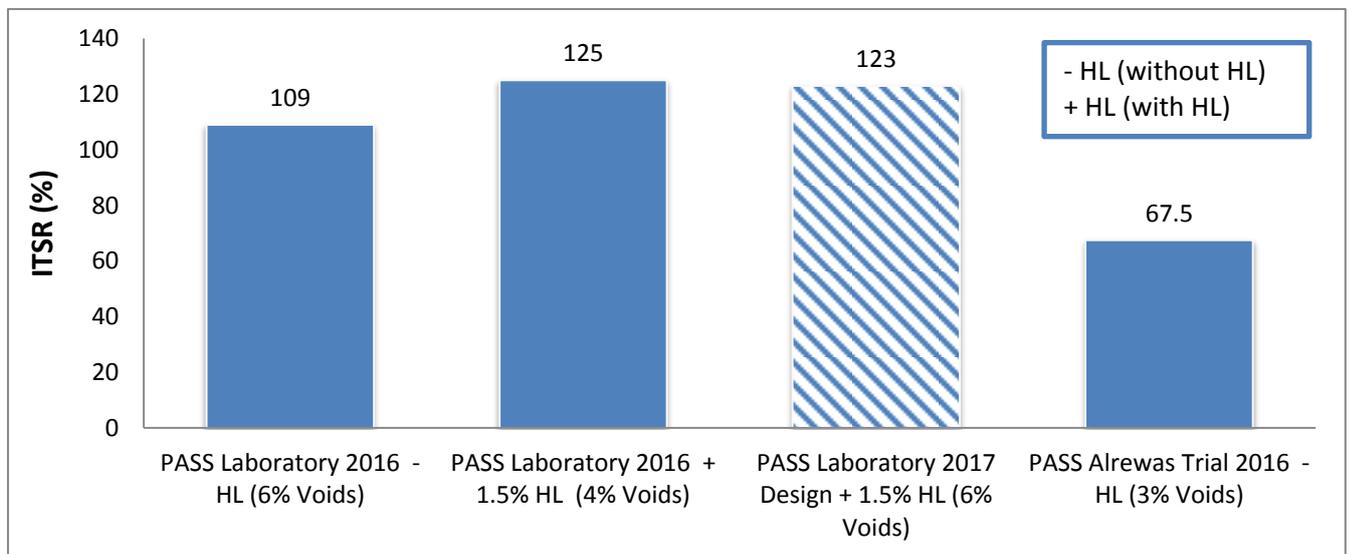


Figure 8: Moisture Susceptibility of PASS Mixtures

The inclusion of 1.5% hydrated lime improved the moisture susceptibility of the PASS Alrewas trial 2016 mixtures by about 1.8 times.

2.3 Key Findings and Summary

The major driver for further laboratory tests and analysis was to optimise the PASS mixtures by incorporating increased coarser fractions into the aggregate gradation in order to obtain macrotexture values in the region of 1.0 – 1.2 mm, improved mechanical and performance properties of the produced PASS mixtures.

The PASS mixtures were produced at 3% and 6% air voids. Macrotexture values were obtained as 1.3 mm and 1.6 mm respectively for the 3% and 6% air voids PASS mixtures. The rut profile for the laboratory optimised mixtures showed mean rut depths of the PASS laboratory design mixtures at < 2 mm after 10,000 cycles at 60°C.

The inclusion of 1.5% hydrated lime showed improved moisture susceptibility of the PASS mixtures in comparison to samples without hydrated lime. The PASS mixtures are workable as shown in test results in Figure 5.

As detailed in the project plan, the next phase of the project involves liaising with stakeholders about trial date and location. Engaging with contractor to facilitate installation of the PASS material, pre-road trial(s) of PASS, identify factors to be considered for the main road trial on the strategic road network, produce technical note for the road trial, review, assess and evaluate the mechanical and performance properties of the installed PASS material including noise tests. These are discussed in the next sections.

3. PASS Road Trials

3.1 Introduction

The main element of this work is to successfully develop the PASS material and successfully install the material by conducting a road trial on a section of the Strategic Road Network. The key properties of the PASS are to offer asphalt materials with significantly enhanced durability, improved ability to reduce noise, spray reduction and improved skid resistance characteristics.

This section presents details of the PASS road trials on a section of the Strategic Road Network. Following the laboratory optimisation of the PASS mixtures as detailed in Section 2 of this report. It should be noted that a pre-road trial for the PASS was carried out by Tarmac in Withybrook in April 2017.

Assessment of the PASS mixtures at the Withybrook pre-trial site was limited to ascertaining the macrotexture values taking into account the fact that the mechanical and performance properties of the PASS mixtures have shown satisfactory performance. The mean macrotexture value obtained for the PASS samples from Withybrook was 0.9 mm. Following this, slight modifications were made to the PASS aggregate structure for installation at the road trial.

3.2 PASS Trial Location

The trial was completed on 9th August (Night Time Works)/10th August. The site location for the PASS trial is the A46 Hykeham to Carholme (Southbound) part of the Area 7 scheme shown in Figure 9.



Figure 9: A46 Hykeham to Carholme (Southbound)

The road trial location including Chainage locations is detailed in Appendix B of this document.

The laying schedule for the PASS mixtures as provided by the contractor (Tarmac) is summarised in Table 4.

Table 4: PASS Road Trial 2017 Laying Schedule

PASS Road Trial 2017 Laying Schedule									
PASS	Chainage From	Chainage To	Lane	Length (m)	Width (m)	Area (m ²)	Depth (mm)	Shift	Date
PASS 1	1675	1775	1	100	4.75	475	50	8	9/8/17
PASS 2	1775	1875	1	100	4.75	475	50	8	9/8/17

3.3 Technical Details for the PASS Road Trials

The network trial installed two PASS mixes targeting 50 mm nominal thickness for the mixtures. The two aggregate gradations are detailed below in Table 5.

Table 5: Mix Design for the PASS Mixtures for the Road Trial

PASS Road Trial 2017 Design		
Sieve Size (mm)	% Passing	
	PASS 1	PASS 2
14	100	100
10	94	91.7
6.3	46	43
4	39	36
2	29	27
0.25	12	11
0.063	6.5	6.5
Binder Content (%)	5.4	

PASS 1 represents the same target grading as the pre-trial conducted by Tarmac at Withybrook. PASS 2 grading was redesigned to be more open targeting higher macrotexture values. The mix design properties are detailed in Table 5. The key factors for consideration for the PASS trial are detailed below:

- The aggregate material fractions were sourced from Mancetter quarry.
- The binder type for the PASS mixtures was PMB 45/80-60 with mixing and compaction temperatures of 175°C and 155°C respectively. The target binder content was 5.4%.
- The target mix design air void content was between 2% and 4%.
- The target in-situ macrotexture was 1.0 – 1.2 mm. It was agreed that if macrotexture values were < 0.7 mm, Highways England would arrange for the replacement of the test section.

- The contractor supplied two samples of loose mixtures for each PASS mix prior to leaving the mixing plant and two samples of loose mixtures during laying in accordance with BS EN 12697-27. These samples were used to determine mix properties including binder content and grading in accordance with BS EN 12697-1 and 2.
- Figure 10 presents the test layout, test samples and core dimensions for the PASS mixtures following the trial. 50 mm nominal thickness of the mixtures was targeted.
- A buffer/transition zone as depicted in Figure 10 of about 2.5 – 5 m was avoided to account for differential mix properties and other factors that could occur during the paving operations between endpoints of PASS 1 and 2.
- Noise survey was carried out using the Statistical Pass-By method to assess the acoustic performance of the PASS mixtures in accordance with ISO 11819-1:1997.

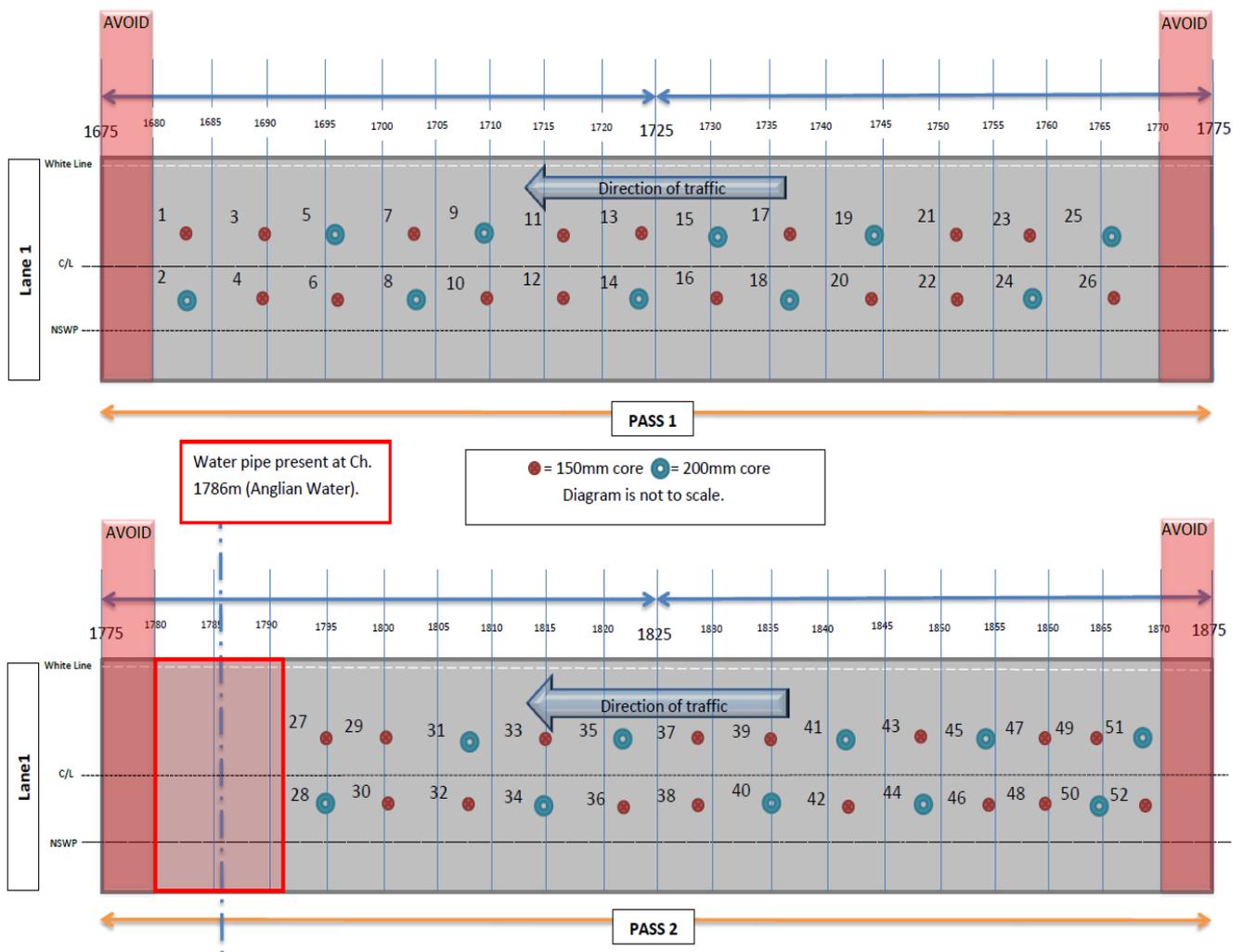


Figure 10: Test Layout for PASS Road Trial Mixtures

The PASS trial was carried out in accordance with MCHW Volume 1 SHW Series 900 and BS 594987:2015+A1:2017. The laying contractor (Tarmac) carried out standard control testing for the works in accordance with BS 594987:2015+A1:2017 to include but not limited to the application of bond coats on the substrate prior to laying the PASS, measurement of surface texture after PASS has been laid prior to trafficking. Production records and temperatures (mix and installation) were provided for the works by the contractor. These records are presented in Appendix C.

3.4 PASS Trial Test Report

Observations following the trial showed that the PASS material was relatively easy to lay and compact (see Figure 11). The same equipment and procedure used in the installation of typical Clause 942 thin surface course materials were utilised for the PASS trial.

The production test records obtained from the site showed that the surface macrotexture is comparable to that expected for thin surface course systems (1.0 to 1.4 mm). The major advantage of the PASS material is the fact that the design is performance based on requirements for controlled in situ air voids. This parameter is aimed at helping to improve the in-service durability of the PASS mixtures.



Figure 11: Installation of PASS Road Trial

Following the laying of the PASS, cores shall be obtained from the site as detailed in Figure 10 for further tests to ascertain the mechanical and performance properties of the PASS mixtures. The test layout, test samples and core dimensions for the trial are detailed below in Figure 10.

The test summary for the PASS mixtures following the installation on the A46 Hykeham to Carholme (Southbound) is detailed below in Table 6.

Table 6: Test Summary for PASS Trial Mixtures

MIX	SAMPLE	TESTS TO BE CONDUCTED
PASS 1	<ul style="list-style-type: none"> ▪ 2 bags of loose material from the asphalt plant. ▪ 2 bags of loose material during laying of the PASS. 	<ul style="list-style-type: none"> ▪ Compositional Analysis in accordance with BS EN 12697-1 and 2.
		<ul style="list-style-type: none"> ▪ Maximum density in accordance with BS EN 12697-5.
	<ul style="list-style-type: none"> ▪ 16 x 150 mm diameter cores. 	<ul style="list-style-type: none"> ▪ Bulk densities in accordance with BS EN 12697-6
		<ul style="list-style-type: none"> ▪ Water Sensitivity Tests in accordance with BS EN 12697-12.
	<ul style="list-style-type: none"> ▪ 10 x 200 mm diameter cores. 	<ul style="list-style-type: none"> ▪ WTT in accordance with BS EN 12697-22 using the small device to 10,000 cycles
		<ul style="list-style-type: none"> ▪ Surface Macrotexture in accordance with BS EN 13036-1
<ul style="list-style-type: none"> ▪ Skid Resistance using the Pendulum Test in accordance with BS EN 13036-4 		
PASS 2	<ul style="list-style-type: none"> ▪ 2 bags of loose material from the asphalt plant. ▪ 2 bags of loose material during laying of the PASS. 	<ul style="list-style-type: none"> ▪ Compositional Analysis in accordance with BS EN 12697-1 and 2.
		<ul style="list-style-type: none"> ▪ Maximum density in accordance with BS EN 12697-5.
	<ul style="list-style-type: none"> ▪ 16 x 150 mm diameter cores. 	<ul style="list-style-type: none"> ▪ Bulk densities in accordance with BS EN 12697-6
		<ul style="list-style-type: none"> ▪ Water Sensitivity Tests in accordance with BS EN 12697-12.
	<ul style="list-style-type: none"> ▪ 10 x 200 mm diameter cores. 	<ul style="list-style-type: none"> ▪ WTT in accordance with BS EN 12697-22 using the small device to 10,000 cycles
		<ul style="list-style-type: none"> ▪ Surface Macrotexture depth in accordance with BS EN 13036-1
<ul style="list-style-type: none"> ▪ Skid Resistance using the Pendulum Test in accordance with BS EN 13036-4 		
PASS 1 and 2	On sections of the PASS Trial (Table 4)	<ul style="list-style-type: none"> ▪ Noise survey using the Statistical Pass-By in accordance with ISO 11819-1: 1997.

The key findings following the testing and evaluation of samples obtained from the PASS trial as detailed in Table 6 are discussed below.

3.4.1 Visual Assessment of PASS Samples

The core logs are presented in Appendix D. The PASS samples (Layer 1) appeared to be dense with a high coarse aggregate content showing good interlocking properties. Typical cross section of the PASS material is shown below in Figure 12.



Figure 12: Typical Cross-Section of the PASS

3.4.2 Compositional Analysis

Compositional analysis was conducted in accordance with bulk loose samples obtained from the road trial in accordance with BS EN 12697-1 and 2. The test results show the target designs for PASS 1 and 2 detailed in Table 5. Further to this, aggregate gradations from bulk loose samples from the road trial on the A46 Hykeham to Carholme (Southbound) termed PASS 1 (A46) and PASS 2 (A46) is shown in Figure 13 and Table 7.

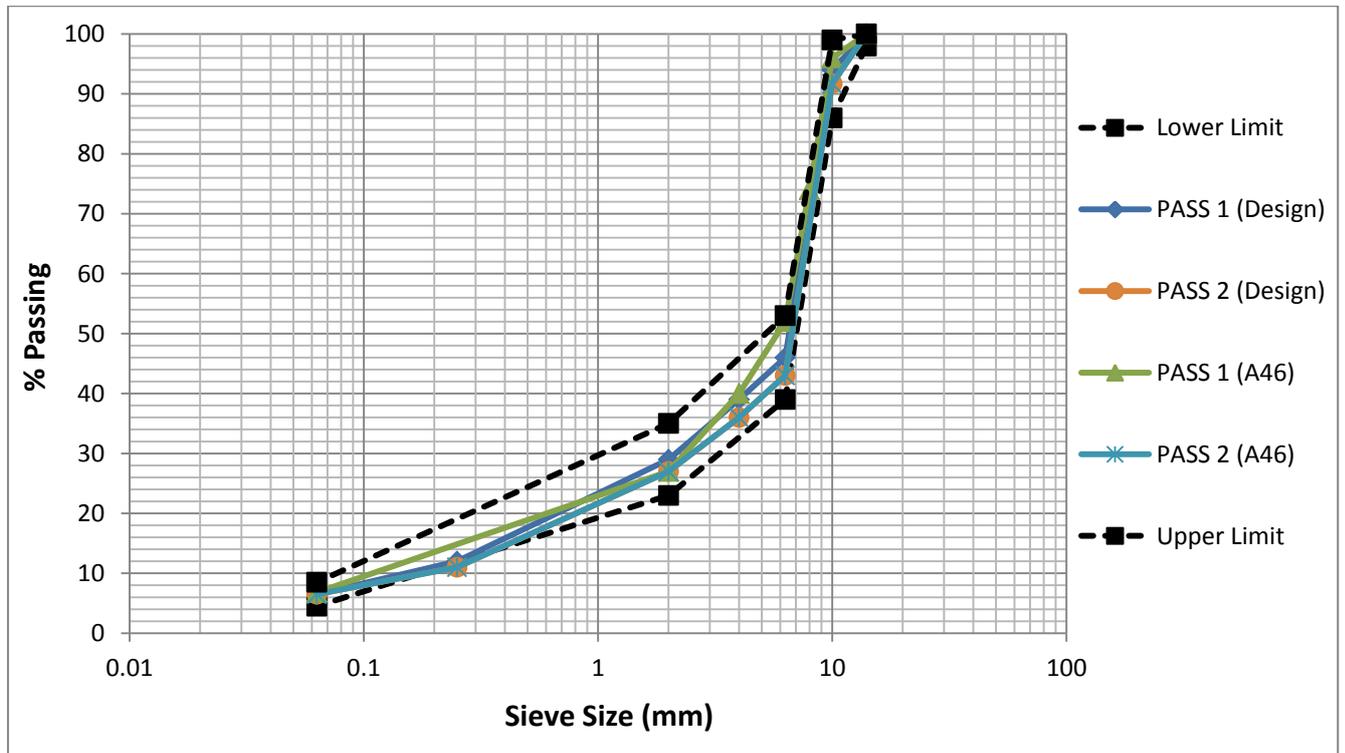


Figure 13: PASS Aggregate Gradations

Table 7: PASS Road Trial 2017 (A46 Bulk Loose Sample)

PASS Road Trial 2017 (A46)		
Sieve Size (mm)	% Passing	
	PASS 1 (A46)	PASS 2 (A46)
14	100	100
10	96	96
8	74	67
6.3	52	45
4	40	35
2	27	23
0.063	6.8	7.1
Binder Content (%)	5.5	5.6

3.4.3 Mixture Volumetrics and Functional Properties

The air void contents of the PASS mixtures are detailed below in Figure 14 with the mean results shown from an average of 26 samples per PASS mixture. The standard distribution is shown as a \pm after the mean value in the chart.

PASS 1 mixtures had a mean air void content of 10.6% with values ranging from 7.5% to 12.7%. PASS 2 mixtures had a mean air void content of 9.8% with values ranging from 7.4% to 12.3%. These values are however in contrast to the visual condition of these samples which suggested relatively ‘dense body’ materials (section 3.4.1 refers).

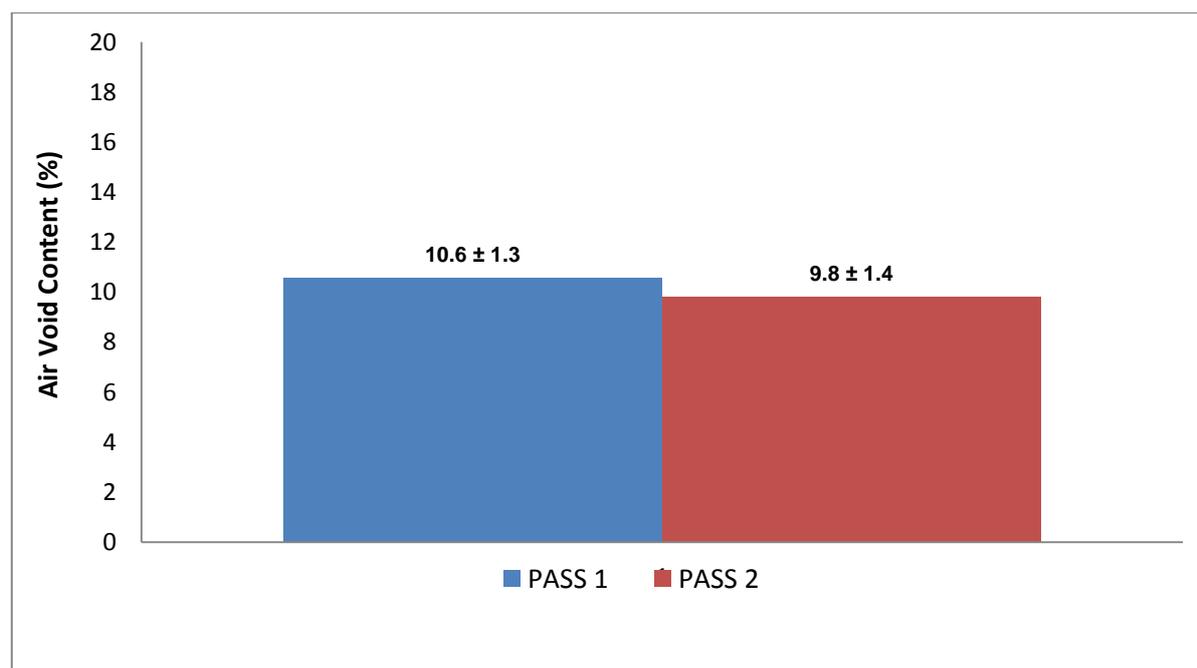


Figure 14: Air Void Content of PASS Mixtures

The pavement surface macrotexture in accordance with BS EN 13036-1 was obtained on site following installation of the PASS asphalt materials (Figure 15) representing an average of ten macrotexture measurements on site.

The macrotexture test results conducted on-site had mean macrotexture values of 1.2 mm for PASS 1 and 1.3 mm for PASS 2 as shown below in Figure 15.

The macrotexture values obtained from the road trial for the PASS mixtures met the target in-situ macrotexture levels of not less than 1.0 mm set for the project.

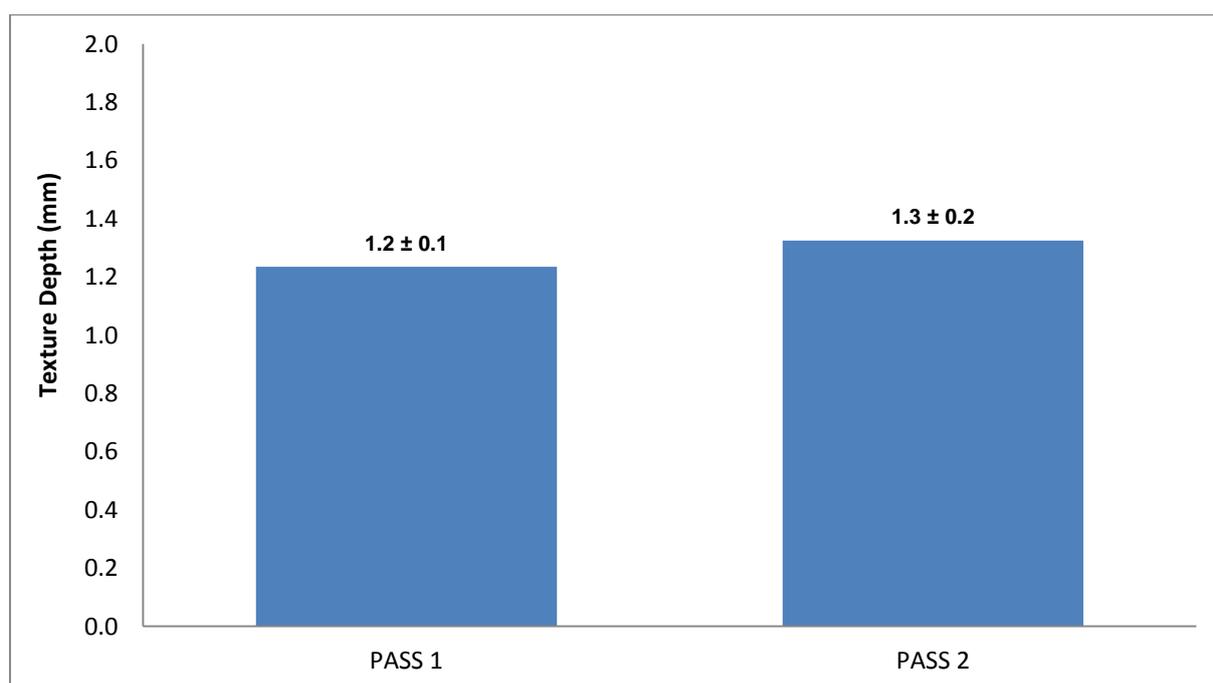


Figure 15: Pavement Surface Macrotexture - On Site

The skid pendulum test value (PTV) was obtained in accordance with EN 13036-4. The results are detailed in Figure 16. The results represent a mean of four measurements on 200 mm cores from the road trial site. The results show encouraging PTV values (exceeding 70) for the asphalt mixtures and are comparable to those obtained during the Alrewas quarry lane trial.

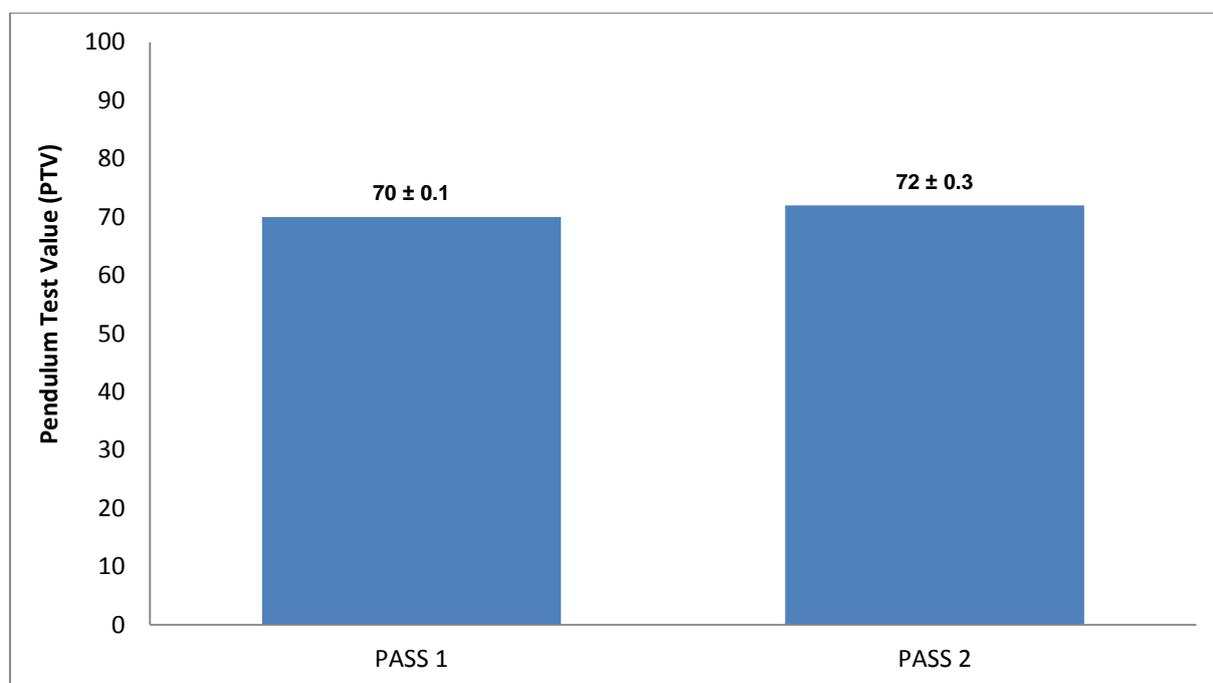


Figure 16: Skid Pendulum Test Value – On Cores from Site

3.4.4 Resistance to Deformation Measured by using the Wheel Track Test

Resistance to deformation was measured by using the Wheel Tracking Tests (WTT) in accordance with EN 12697-22 using the small device to 10,000 cycles. The results presented are the mean values of 4 samples per PASS mixture in order to obtain representative test results. Table 8 presents the WTT results. PD 6691 states that the wheel tracking slope in the air should be less than 1 mm/1000 cycles. As seen in Table 8, the PASS asphalt mixtures performance passed this satisfactorily and is comparable to those obtained for samples tested during the mix design stage and the Alrewas quarry lane trial.

Table 8: PASS Wheel Tracking Test Result

	Sample	Wheel Tracking Slope in Air (mm/10 ³ cycles)	Proportional Rut Depth at 10,000 cycles (%)	Mean Rut Depth at 10,000 cycles (mm)
PASS 1	Sample 1	0.06	4.7	2.2
	Sample 2	0.07	4.7	2.4
	Sample 3	0.06	4.7	2.3
	Sample 4	0.07	4.2	2.0
PASS 2	Sample 1	0.07	5.5	2.3
	Sample 2	0.04	3.6	1.7
	Sample 3	0.06	4.2	2.0
	Sample 4	0.06	5.4	2.4
	PD 6691	1.00	-	-

Figure 17 shows the typical rut profile for the PASS core samples obtained from the road trial. PASS 1 and 2 had identical mean rut profiles. The chart shows rut depths after 10,000 cycles were less than 5 mm for the PASS core samples.

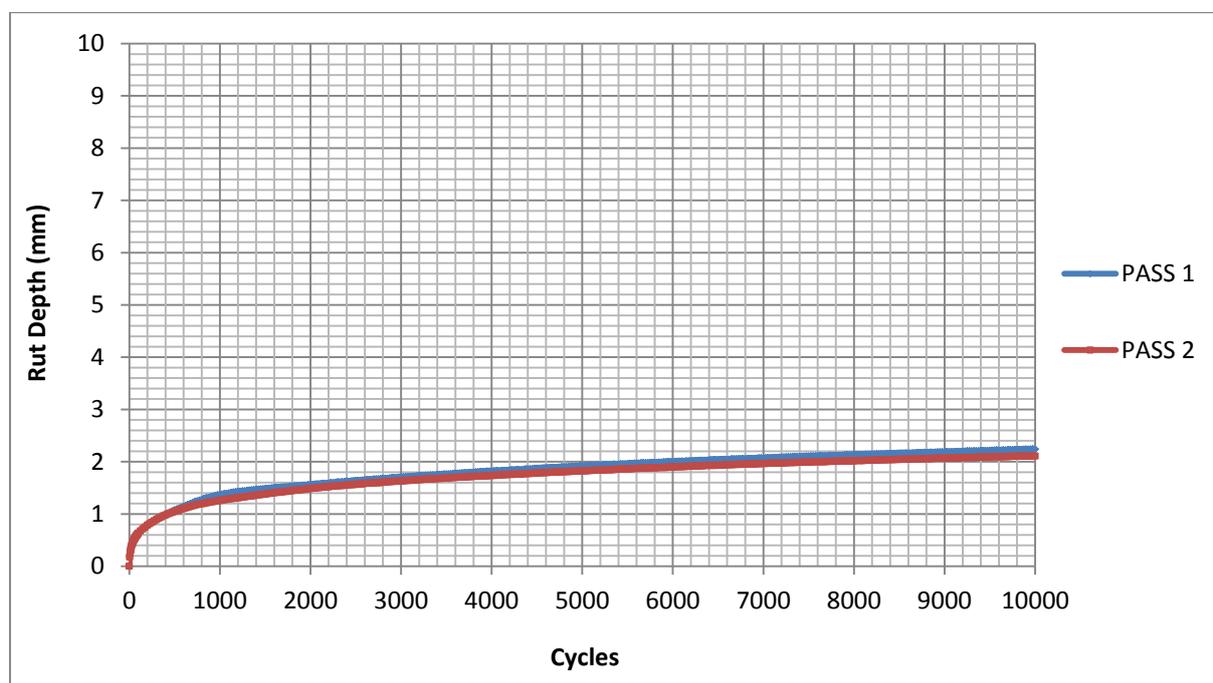


Figure 17: Rut Profile for PASS Samples

Typical appearance of the PASS samples after WTT is shown in Figure 18 indicating little or no rut on the surface of the asphalt mixtures following 10,000 cycles at 60°C.



Figure 18: PASS Samples after WTT

3.4.5 Resistance to Moisture Damage

Resistance to moisture damage was obtained by ascertaining the water sensitivity of the PASS mixtures in accordance with BS EN 12697-12. The test results are presented below in Figure 19. The obtained ITSR values were comparable to (PASS 2), or better than (PASS 1), that determined for PASS sample set during the Alrewas quarry trial.

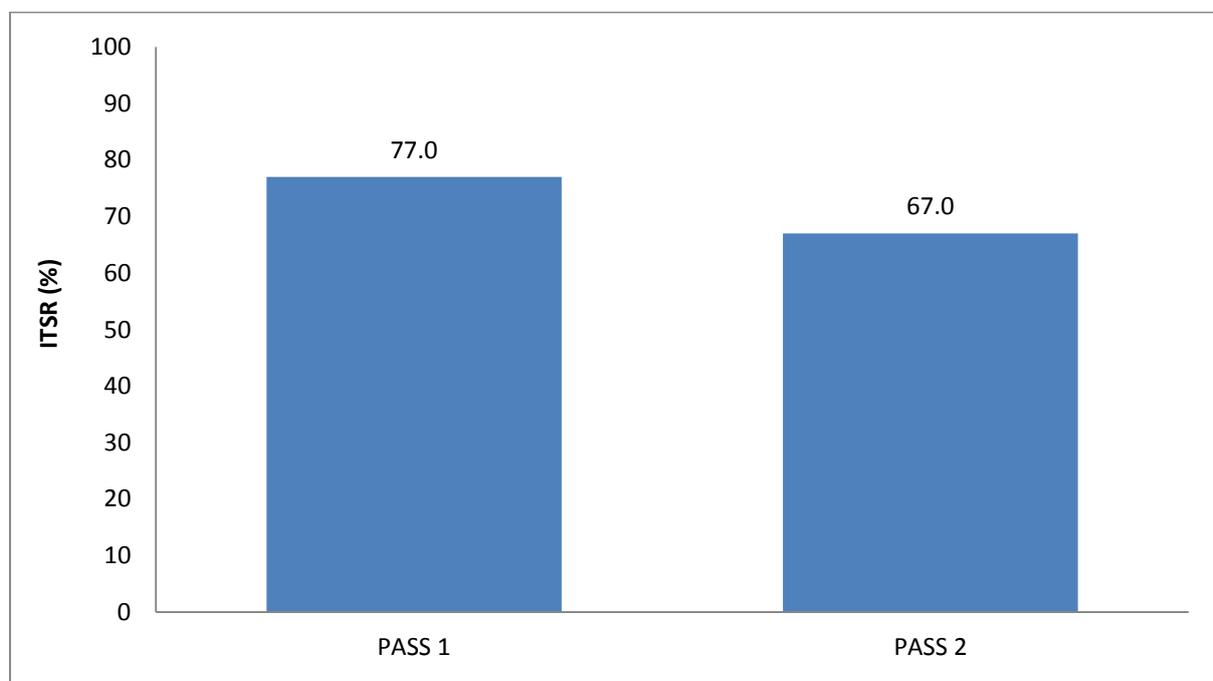


Figure 19: Determination of the Water Sensitivity - ITSR

3.5 Noise Assessment of the PASS Mixtures

3.5.1 Introduction

The Statistical Pass-By (SPB) method was used in assessing the noise properties of the PASS mixtures following the road trial to obtain the Road Surface Influence (RSI). The test method is detailed in BS EN ISO 11819-1:2001 with additional revisions in Appendix 8 of the Highways Authority Product Approval Scheme (HAPAS) guidelines document. The SPB survey was carried out on Thursday 14th September 2017.

This section of the report describes the methodology for the SPB method including details of the survey carried out at the 2 PASS locations as detailed in Table 4. The results obtained from this survey and subsequent analyses have been presented with RSI values for both PASS measurement locations.

3.5.2 Methodology

This section presents the methodology of the SPB method as well as the details of the survey carried out. The SPB measurement is the most frequently used procedure in the UK for assessing the influence of road surfaces on vehicle noise emissions. It is a relatively simple procedure, and the results can be directly applied to the surfacing correction used during traffic noise predictions. It is also the method used by Highways England for noise classification within their product approval scheme (HAPAS).

The methodology followed as part of this work is largely described in BS EN ISO 11819-1 (ISO, 2001), however the reference speeds and RSI values discussed below are those defined in Appendix 8 of the HAPAS guidelines document for the assessment and certification of thin surfaces for highways (British Board of Agreement, 2008).

During an SPB measurement, the maximum pass-by noise levels and speeds of individual vehicles selected from the traffic stream are measured at a reference distance of 7.5 m from the centre of the vehicle lane. Due to site limitations, measurements were taken at 4.5 m from the centre of the vehicle lane; a correction (based upon measurements undertaken by AECOM) has then been applied to the noise levels so they are representative of measurements taken at 7.5 m.

The traffic population is classified as follows:

- L – light vehicles, including passenger cars, derived vans, excluding vehicles towing trailers or caravans
- H_1 – commercial trucks with 2 axles and greater than 3.5 tonnes unladen weight
- H_2 – commercial trucks with more than 2 axles and greater than 3.5 tonnes unladen weight

To provide statistically robust results a sample size of at least 100 L vehicles and at least 80 trucks with a minimum of 30 H_1 and 30 H_2 vehicles is required. For each vehicle category, a linear regression equation is derived from the maximum pass-by noise level, L_{Amax} , and the logarithm of the vehicle speed (km/h). For each vehicle category, the estimated noise level, $L_{Amax,v}$, for a given reference speed, v km/h, is derived from the regression equation. For a road speed category, the RSI value provides an estimate of the difference in traffic noise levels for typical traffic conditions on a test surface with that from similar traffic on a reference surface. A reference surface is one for which no surface correction is required in the Calculation of Road Traffic Noise (CRTN); for high-speed roads this corresponds to a bituminous surface with a texture depth of 2 mm and in practice is generally considered as having the same acoustic performance as a 20 mm Hot Rolled Asphalt (HRA) surface.

Taking this into account, it is worth clarifying the terminology used in this report when comparing different RSI values. An RSI of -5 dB(A) will be referred to as being 'lower than' an RSI of -2 dB(A) since it directly reflects a lower traffic noise at the reference speed even though the surface itself may be thought of as having a 'higher' noise performance.

3.5.3 Survey

The SPB assessment was undertaken following the PASS trial on the layby of A46 Hykeham to Carholme (Southbound) section of the road. Table 9 provides the exact GPS coordinates for the measurement. Site 1 was located 50 m west of the layby, on the westbound carriageway approximately 950 m east of Skellingthorpe Roundabout. Site 2 was also located 100 m east of position 1, 850 m east of Skellingthorpe Roundabout.

Table 9: GPS Coordinates for SPB measurements

Site	Location	GPS Coordinates	Surface type
Site 1	A46 Westbound	SK 93926 71741	PASS 1
Site 2	A46 Westbound	SK 93866 71714	PASS 2

The equipment used during this survey is listed in Table 10. A sound level meter and speed gun were used to measure noise levels and vehicle speeds respectively. A digital surface thermometer and anemometer (with temperature measurement) were used to obtain the weather conditions.

Table 10: Survey Equipment Details

Type	Model	Serial Number	Calibration Date
Sound level meter	B&K 2250	2827269	03/08/2016 (valid 2 years)
Sound level meter calibrator	B&K 4231	2217877	11/01/2017 (valid 1 year)
Speed gun	Sports Radar Ltd. : Tracer SRA3000		

A photo of the measurement set-up at Site 1 can be seen in Figure 20.



Figure 20: Photo of Measurement Set-Up at Site 1 showing Sound Level Meter

The section of the A46 surveyed was subject to a speed limit of 70 mph (national speed limit). The speed of the vehicles met the criteria to class the road as ‘High Speed’ for the purposes of the analysis.

3.5.4 Results

The data collected during the survey have been compiled and analysed in order to calculate the RSI_H for the surface under assessment. Results from the survey are presented in this section.

Table 11 shows the weather conditions during the survey, confirming that the wind speed was within the requirements laid out in Section 11 of BS EN ISO 11819-1:2001. It should also be noted that there was no rainfall during the survey and the road surface was dry throughout. The air temperature and surface temperature measurements have been used to correct noise measurements for light vehicles, according to HAPAS guidelines Appendix A.8.

Table 11: Site Weather Conditions

Site	Date	Air Temperature (°C)	Surface Temperature (°C)	Wind Speed Average (m/s)
Site 1 (PASS 1)	14 September	14 - 16	13.0 – 19.0	1.0 – 1.3
Site 2 (PASS 2)	14 September	15 - 16	18.4 – 22.0	1.4 – 1.5

Comparative measurements were undertaken on a separate site at 4.5 m and 7.5 m on a selection of vehicles indicated that an appropriate correction factor to be applied to the obtained results at 4.5 m is -2.5 dB. Table 12 shows the corrected vehicle sound levels ($L_{veh,L}$, $L_{veh,H1}$ and $L_{veh,H2}$) at the reference speeds applicable to a high-speed road, according to HAPAS guidelines Appendix A.8.

Table 12: Sound Pass-By Levels and Road Surface Influence

Site	$L_{veh,L}$ (dB(A))	$L_{veh,H1}$ (dB(A))	$L_{veh,H2}$ (dB(A))	RSI_H with Correction (dB(A))
Site 1 (PASS 1)	79.2	82.4	84.1	-5.9
Site 2 (PASS 2)	79.5	82.3	84.7	-5.5

For light vehicles (L) the reference speed is 110 km/h and for both types of heavy vehicles (H_1 and H_2) the reference speed is 90 km/h. These vehicle sound levels have been used to calculate the RSI for each site using the formula in HAPAS guidelines Appendix A.8. The formula is detailed below:

For reference noise levels $L_{veh,L}$, $L_{veh,H1}$ and $L_{veh,H2}$ at 110 km/h, 90 km/h and 90 km/h respectively a high-speed RSI value is given by:

$$RSI_H = 10 \log_{10} \left(7.8 \times 10^{\frac{L_{veh,L}}{10}} + 0.578 \times 10^{\frac{L_{veh,H1}}{10}} + 10^{\frac{L_{veh,H2}}{10}} \right) - 95.9 \quad (A.1)$$

3.5.5 Summary

The RSI values established from this survey are -5.9 dB (A) for Site 1 (PASS 1) and -5.5 dB (A) for Site 2 (PASS 2). Therefore, taking a mean of these results, the RSI_H value for the PASS from this survey is -5.7 dB (A). Regression plots are detailed in Appendix E.

3.6 Key Findings and Summary

The network trial installed two PASS mixes (PASS 1 and 2) as detailed in Table 5 targeting 50 mm nominal thickness for the mixtures. Observations following the trial showed that the PASS material was relatively easy to lay and compact (see Figure 11). The same equipment and procedure used in the installation of typical Clause 942 thin surface course materials were utilised for the PASS trial.

Following installation, the PASS appeared to be dense with a high coarse aggregate content showing good interlocking properties. The production test records obtained from the site showed that the surface macrotexture is comparable to that expected for thin surface course systems. The macrotexture test results conducted on-site had mean macrotexture values of 1.2 mm for PASS 1 and 1.3 mm for PASS 2. The macrotexture values obtained from the road trial for the PASS mixtures exceeded the target in-situ macrotexture levels of 1.0 mm set for the project.

The major advantage of the PASS material is the fact that the design is performance based on requirements for controlled in situ air voids. This parameter is aimed at helping to improve the in-service durability of the PASS mixtures. The skid pendulum test value (PTV) results show encouraging PTV values (exceeding 70) for the asphalt mixtures. The WTT results indicated that the PASS asphalt mixtures performed satisfactorily with rut depth after 10,000 cycles less than 5 mm for the PASS core samples and compared with the results obtained from the previous work stages (mix design and quarry trial). There was little or no rut on the surface of the PASS specimens following WTT. The results from moisture sensitivity test showed performance at least comparable to, or better than, the result obtained from the Alrewas trial.

The SPB method was used in assessing the noise properties of the PASS mixtures following the road trial to obtain the Road Surface Influence (RSI). The obtained value for the PASS from this survey was obtained as -5.7 dB (A) which is a quieter surface than a standard Hot Rolled Asphalt (HRA).

This project has successfully arranged the installation of PASS trial sections on the strategic road network demonstrating that PASS can be installed using current practices to achieve the project requirements. Most importantly, the PASS mixtures have shown improved noise characteristics following the SPB tests conducted.

4. Conclusions and Recommendations

This project has successfully arranged the installation of trial sections on A46 Hykeham to Carholme (Southbound). The trial sections comprised two variants of PASS materials (PASS 1 and PASS 2). These trials aimed to demonstrate whether any of these PASS materials can be installed using current practices and achieved the target performance which included assessment of durability, road noise and surface characteristics.

It is recommended that further development and assessment of the PASS asphalt mixtures are continued leading to the development of guidance documents and specifications for the design, testing and use of these next generation asphalt mixtures. More specifically, an alternative approach is needed to manage the requirements for in-situ density particularly to account for the influence of macrotexture and air void contents. This is a very important element considering the PASS is designed to have a low voided dense body with improved surface characteristics.

It is recommended that a more advanced assessment of in-situ density that isolates the effects of surface texture is used in achieving this. Imaging techniques can be used to ascertain density variations within the depth and structure of the PASS mixture. A more rudimentary means of assessing the in-situ density of the PASS mixture is to slice/cut the top 5 – 10 mm of the PASS to validate the density structure of the PASS. These are important parameters required in order to produce durable PASS mixtures within the design air void target limits of 2-6% and macrotexture values between 1.0 – 1.4 mm.

In order to gain a better understanding of the long-term performance of the PASS asphalt mixtures, accelerated loading of the mixtures can be performed on these samples. A mobile load simulator (MLS), which will be available to AECOM from December 2017, can be used to compare the performance of PASS 1, PASS 2 and control thin surfacing under laboratory condition. This assessment will be able to estimate the serviceable life of the PASS materials relative to the control samples or in comparison to other asphalt mixture types.

The continuation of the development and assessment of the PASS material taking into account the key findings, lessons and recommendations is important. The network trial on the A46 undertaken in August 2017 should be monitored for its visual condition, mechanical and performance properties at regular intervals most especially the noise characteristics of PASS to assess suitability for its use on the SRN.

Further to this, Sideway-force Coefficient Routine Investigation Machine (SCRIM) measurements should be conducted to measure the wet skidding resistance of the PASS mixtures. This is currently scheduled to be conducted in the summer of 2018 subject to confirmation from Highways England.

The current work has been limited to the use of single source aggregate, produced by a single supplier and installed on a section of the strategic road network. It is proposed that consideration is made on the possibility to arrange further network trials of PASS but using different aggregate sources, followed by a suite of assessment. Finally, it is recommended that the project reports are disseminated to a wider audience and to industry to promote research and innovation.

Bibliography

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British Standards BS EN 12697-1: Bituminous mixtures - Test methods for hot mix asphalt – Soluble binder content.

British Standards BS EN 12697-2: Bituminous mixtures - Test methods for hot mix asphalt – Part 2: Determination of particle size distribution

British Standards BS EN 12697-5: Bituminous mixtures - Test methods for hot mix asphalt - Determination of the maximum density

British Standards BS EN 12697-6: Bituminous mixtures - Test methods for hot mix asphalt - Determination of bulk density of bituminous specimens

British Standards BS EN 12697-12: Bituminous mixtures - Test methods for hot mix asphalt - Determination of the water sensitivity of bituminous specimens.

British Standards BS EN 12697-22: Bituminous mixtures - Test methods for hot mix asphalt - Wheel tracking

British Standards BS EN 12697-27: Bituminous mixtures - Test methods for hot mix asphalt - Sampling

British Standards BS EN 13036-1: Road and airfield surface characteristics - Test methods - Measurement of pavement surface macrotexture depth using a volumetric patch technique

British Standards BS EN 13036-4 Road and airfield surface characteristics -Test methods - Method for measurement of slip/skid resistance of a surface: The pendulum test

British Standards BS PD 6691:2015: Guidance on the use of BS EN 13108, bituminous mixtures – Material specifications

British Standards BS 594987:2015+A1:2017 Asphalt for roads and other paved areas — Specification for transport, laying, compaction and product type testing protocols

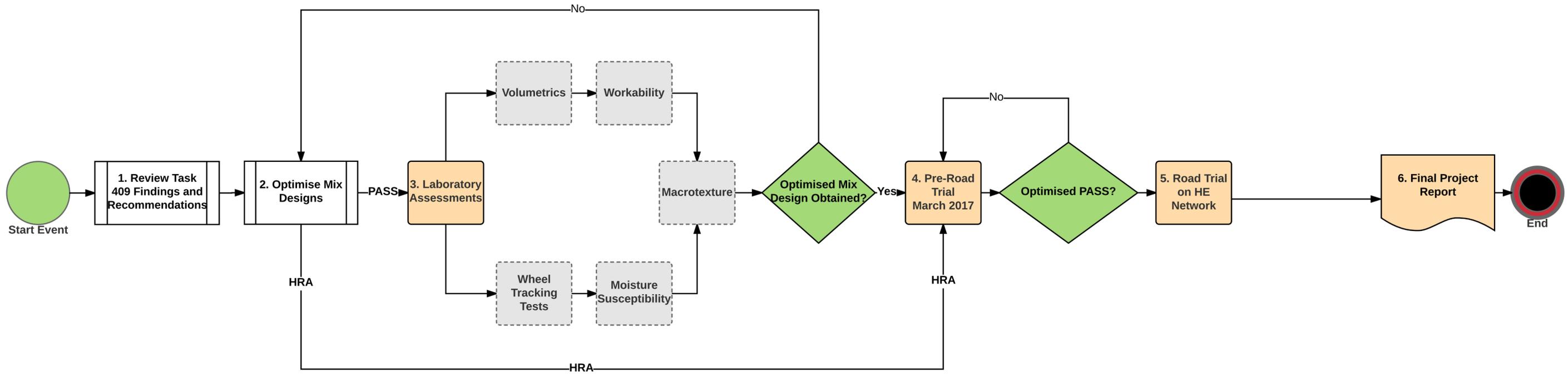
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ISO (2001) BS EN ISO 11819-1:2001, Acoustics – Measurement of the influence of road surfaces on traffic noise – Part 1: Statistical Pass-By method. Geneva, Switzerland: International Organisation for Standardisation.

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Muirhead M, Morris L and Stait RE (2010) The performance of quieter surfaces over time. Published Project Report 485. Crowthorne, UK: Transport Research Laboratory.

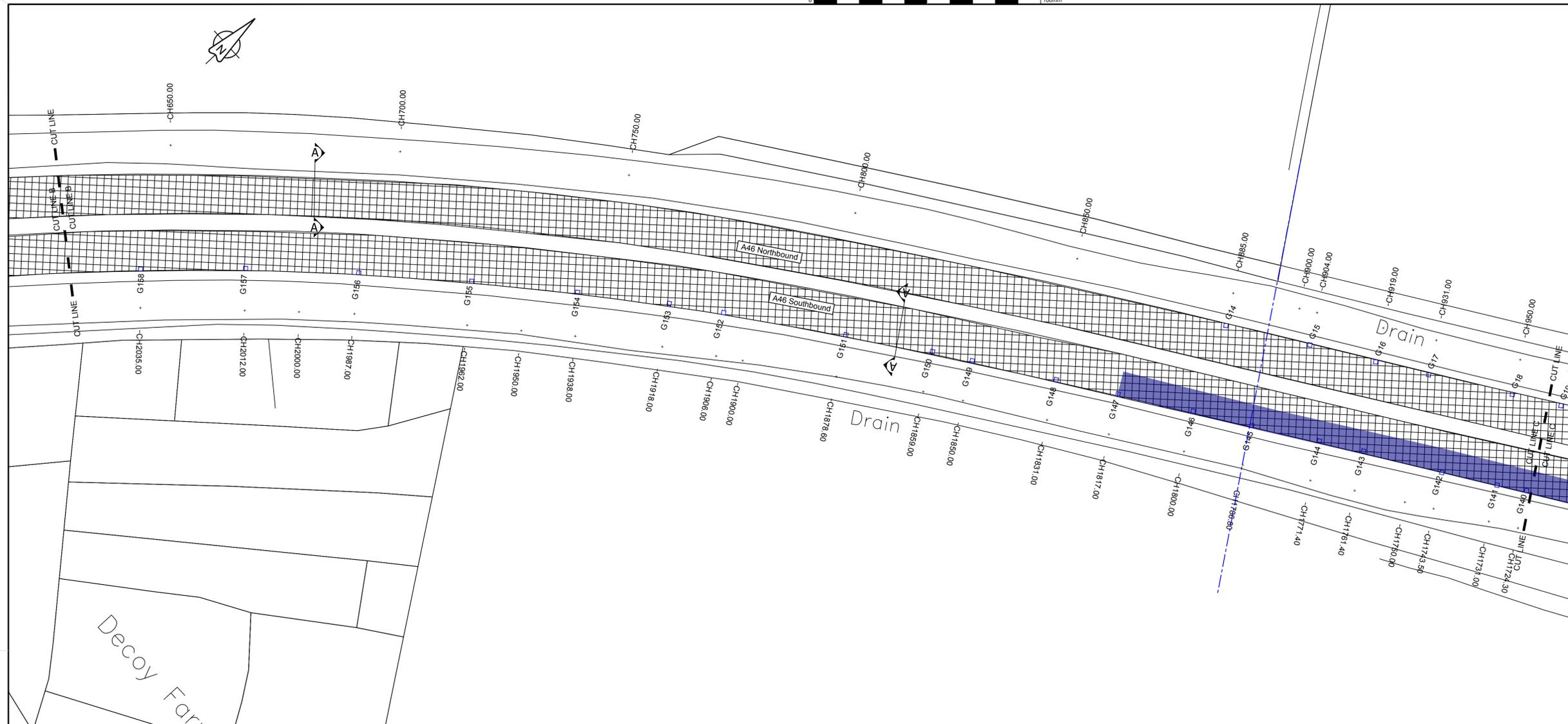
Appendix A – Action Plan and Timeline for the Project



Factors for consideration:
 Modified Chipper for 6/10 mm chippings
 Quality Control
 Ascertain macrottexture values - **Key**

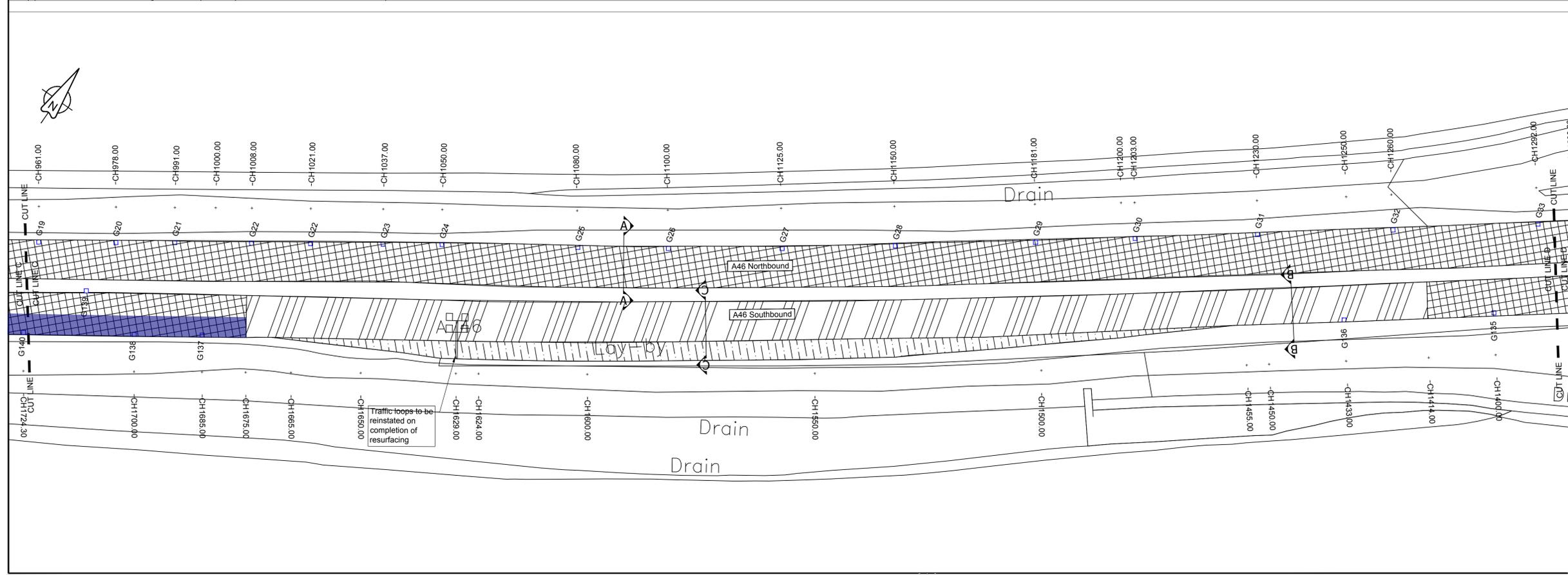


Appendix B – PASS Trial Location



- NOTES**
- Do not scale from drawing. All dimensions are in metres unless stated otherwise.
 - Chainage is wheeled along the nearside edgeline on the A46 Northbound and southbound carriageway. Chainage 00's starts at Location Reference Points from the departures of the roundabouts.
 - For permitted pavement options refer to Appendix 7/1.
 - For proposed cross section details, refer to Drawing Number HE560348-KIER-HPV-918944-DE-CH-0700-04.
 - All existing levels, cross falls and crown lines are to be retained.
 - For proposed road marking details refer to Drawing Numbers HE560348-KIER-HMK-918994-DE-CH-1203-01-04.
 - For details on reinstatement of traffic loops refer to Appendix 15/1.
 - All gullies located on the southbound carriageway are to be cleaned and jetted out.

- KEY:**
- PAVEMENT TYPE P1
50mm Inlay consisting of:
50mm Thin Surface Course - PSV 50 (TSC1)
 - PAVEMENT TYPE P2
50mm Inlay consisting of:
50mm Thin Surface Course - PSV 65 (TSC2)
 - PAVEMENT TYPE P3
50mm Inlay consisting of:
50mm Oil Resistant Thin Surface Course - PSV 60 (TSC3) 10mm Aggregate
 - Existing LRP (Location Reference Point)
 - LRP Number (Location Reference Point Number)
 - Traffic Loops to be reinstated
 - G1 Gully (See Note 8 for details)
 - Anglian Water
 - PASS Trial Location



0	First Issue	AH	JRW	28-02-17
REV	DETAILS	CHKD	APPD	DATE

DRAWN : LB	DRAWING STATUS
DESIGN : AH	WORKING DRAWING
CHKD : AH	PRELIMINARY DRAWING
APPD : JRW	EXTERNAL ISSUE
DATE : 28/02/2017	AS-BUILT

SUITABILITY : FOR CONSTRUCTION

CLIENT

AGENT

SCHEME NAME
A46 Hykeham - Carholme
Multidisciplinary Project

DRAWING TITLE
Proposed Pavement Details
Sheet 2 of 4

STATUS	SUITABILITY	ORIG DRAWING SIZE	A1	DIMENSIONS	m
03	A	SCALE	1:500	COPYRIGHT	© KIER

DRAWING NUMBER	PROJECT	ORIGINATOR	VOLUME	SCHEME REFERENCE No.
HE560348	918944	KIER	HPV	-
LOCATION	TYPE	ROLE	NUMBER	REVISION
				C--

Appendix C – Production Test Results for PASS

**LABORATORY TEST CERTIFICATE
MATERIALS LABORATORY**



Certificate No: 3383/17-4

To : Joe Poulsom

Order No:

Client : Tarmac Ltd
PO Box 7377
Granite House, Granite Way
Syston
Leicestershire
LE7 1WA

Dear Sirs,

FIELD TESTING

Introduction

We refer to site testing undertaken on the A46 Skellingthorpe to Carholme (JO65170021)

Material & Source

Tested By : P. Fox
Sample Reference : N/A
Description : SMA 10 Surf Total PMB PSV 60 Pass, SMA 10 Surf Total PMB PSV 60 Pass 2
Ultipave 14 Surf 40/60 H/S
Date Sampled : N/A
Date Tested : 09/08/2017
Source : Mountsorrel
Weather : See attached laying records

Test Results;

Please see attached

Comments;

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
All remaining samples for this project will be disposed of 28 days after issue of this test certificate

Remarks; All testing carried out by Tarmac technician

Approved for Issue Date: 10/08/2017

A handwritten signature in black ink, appearing to read "R. Bayliss".

R. Bayliss
Manager

Unit 5 Draycott Mills
Off Market Street
Draycott, Derby, DE72 3NB
Tel: 01332 873 168
Fax: 01332 875335
www.mattestlaboratories.co.uk
Email: info@mattestmidlands.co.uk
Registered in England 7060469

TARMAC TRADING LTD**Tarmac Contracting****Texture Depth by Volumetric Patch Method**

Tagge Lane,
Pendleton,
Salford,
Greater Manchester
M6 6JH



1076

LP 9.9

An electronic copy of Test Report No.**GW170809VP1****Version 2_1 July 2016****Contract Details**

Client:	Tarmac	Contract:	J065170021
Site Location:	A46 Skellingthorpe	Date:	09.08.17
Testing requested by:	Tarmac		

Material Details

Name of producer:	Tarmac	Quarry/Plant:	Mountsorrel
Material:	Pass 1	Spec:	EN13108-5

Equipment Details

Kit No:	A1		
Is Kit calibrated?	Yes		
Weather conditions:	Fine		
Carriageway:	S/B	Lane:	L1 Pass 1
Start chainage section to be tested:	1500-1550		
Starting longitudinal edge:	N/S		

Results

	Measurement of diameter				Mean D	T.D.
	1	2	3	4		
1	145	143	152	151	147.75	1.5
2	146	160	156	158	155	1.3
3	161	164	163	174	165.5	1.2
4	168	164	172	160	166	1.2
5	180	176	181	182	179.75	1.0
6	181	162	177	173	173.25	1.1
7	173	162	176	170	170.25	1.1
8	161	157	165	155	159.5	1.3
9	162	154	150	147	153.25	1.4
10	161	155	163	154	158.25	1.3
					Mean T.D.	1.2
Texture Depth this Test location =				1.2	mm	

Method : BS EN 13036-1 : 2010

Prepared for Tarmac Contracting by: Gary Wren

Date of Test: 09.08.17

Position: Senior Technician

Date of Report: 09.08.17

Checked by:

Page

TARMAC TRADING LTD**Tarmac Contracting****Texture Depth by Volumetric Patch Method**

Tagge Lane,
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1076

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Client:	Tarmac	Contract:	J065170021
Site Location:	A46 Skellingthorpe	Date:	09.08.17
Testing requested by:	Tarmac		

Material Details

Name of producer:	Tarmac	Quarry/Plant:	Mountsorrel
Material:	Pass 1	Spec:	EN13108-5

Equipment Details

Kit No:	A1		
Is Kit calibrated?	Yes		
Weather conditions:	Fine		
Carriageway:	S/B	Lane:	L1 Pass 1
Start chainage section to be tested:	1550-1600		
Starting longitudinal edge:	N/S		

Results

	Measurement of diameter				Mean D	T.D.
	1	2	3	4		
1	154	152	154	155	153.75	1.3
2	150	160	159	157	156.5	1.3
3	161	159	162	167	162.25	1.2
4	157	161	160	164	160.5	1.2
5	162	161	162	163	162	1.2
6	167	166	167	168	167	1.1
7	171	173	186	172	175.5	1.0
8	153	154	155	151	153.25	1.4
9	157	158	154	162	157.75	1.3
10	162	160	157	154	158.25	1.3
					Mean T.D.	1.2
Texture Depth this Test location =				1.2	mm	

Method : BS EN 13036-1 : 2010

Prepared for Tarmac Contracting by:	Gary Wren	Date of Test:	09.08.17
Position:	Senior Technician	Date of Report:	09.08.17
Checked by:		Page	

TARMAC TRADING LTD**Tarmac Contracting****Texture Depth by Volumetric Patch Method**Tagge Lane,
Pendleton,
Salford,
Greater Manchester
M6 6JH

1076

LP 9.9

An electronic copy of Test Report No.**GW170809VP1****Version 2_1 July 2016****Contract Details**

Client:	Tarmac	Contract:	J065170021
Site Location:	A46 Skellingthorpe	Date:	09.08.17
Testing requested by:	Tarmac		

Material Details

Name of producer:	Tarmac	Quarry/Plant:	Mountsorrel
Material:	Pass 2	Spec:	EN13108-5

Equipment Details

Kit No:	A1		
Is Kit calibrated?	Yes		
Weather conditions:	Fine		
Carriageway:	S/B	Lane:	L1 Pass 2
Start chainage section to be tested:	1600-1650		
Starting longitudinal edge:	N/S		

Results

	Measurement of diameter				Mean D	T.D.
	1	2	3	4		
1	144	140	158	143	146.25	1.5
2	167	168	172	166	168.25	1.1
3	165	165	170	166	166.5	1.1
4	167	165	179	168	169.75	1.1
5	157	154	153	159	155.75	1.3
6	162	160	163	155	160	1.2
7	157	155	153	153	154.5	1.3
8	158	161	161	155	158.75	1.3
9	160	140	153	144	149.25	1.4
10	153	150	151	143	149.25	1.4
					Mean T.D.	1.3
Texture Depth this Test location =				1.3	mm	

Method : BS EN 13036-1 : 2010

Prepared for Tarmac Contracting by: Gary Wren

Date of Test: 09.08.17

Position: Senior Technician

Date of Report: 09.08.17

Checked by:

Page

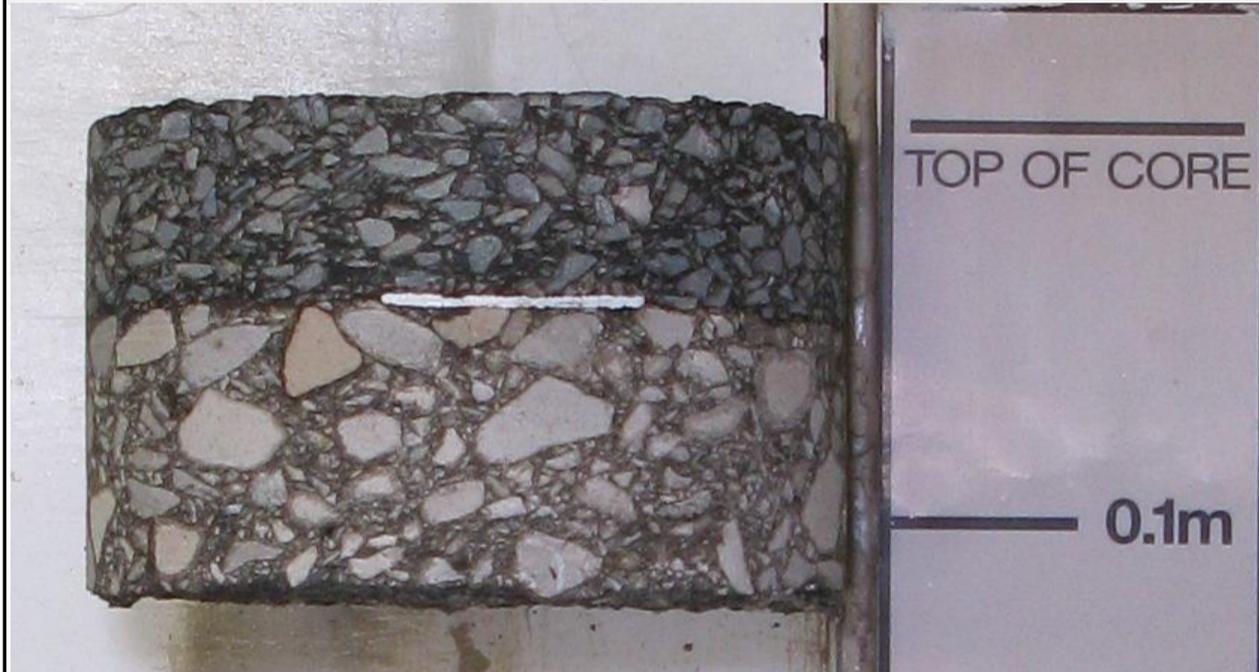
TARMAC TRADING LTD				Tagge Lane, Pendleton, Salford, Greater Manchester M6 6JH			
Tarmac Contracting							
Texture Depth by Volumetric Patch Method						1076	
						LP 9.9	
An electronic copy of Test Report No.				GW170809VP1			
						Version 2_1 July 2016	
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Site Location:	A46 Skellingthorpe			Date:	09.08.17		
Testing requested by:	Tarmac						
Material Details							
Name of producer:	Tarmac			Quarry/Plant:	Mountsorrel		
Material:	Pass 2			Spec:	EN13108-5		
Equipment Details							
Kit No:	A1						
Is Kit calibrated?	Yes						
Weather conditions:	Fine						
Carriageway:	S/B			Lane:	L1 Pass 2		
Start chainage section to be tested:	1650-1700						
Starting longitudinal edge:	N/S						
Results							
	Measurement of diameter				Mean	T.D.	
	1	2	3	4	D		
1	136	145	143	133	139.25	1.6	
2	151	141	150	150	148	1.5	
3	155	163	152	156	156.5	1.3	
4	176	170	181	172	174.75	1.0	
5	152	152	147	147	149.5	1.4	
6	145	140	151	146	145.5	1.5	
7	158	160	163	158	159.75	1.2	
8	153	146	150	152	150.25	1.4	
9	142	152	145	157	149	1.4	
10	141	150	150	138	144.75	1.5	
					Mean T.D.	1.4	
Texture Depth this Test location =				1.4	mm		
Method : BS EN 13036-1 : 2010							
Prepared for Tarmac Contracting by:	Gary Wren			Date of Test:	09.08.17		
Position:	Senior Technician			Date of Report:	09.08.17		
Checked by:				Page			

Appendix D – Core Logs

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 01	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	45	45	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	45	106	61	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 02	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 03	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

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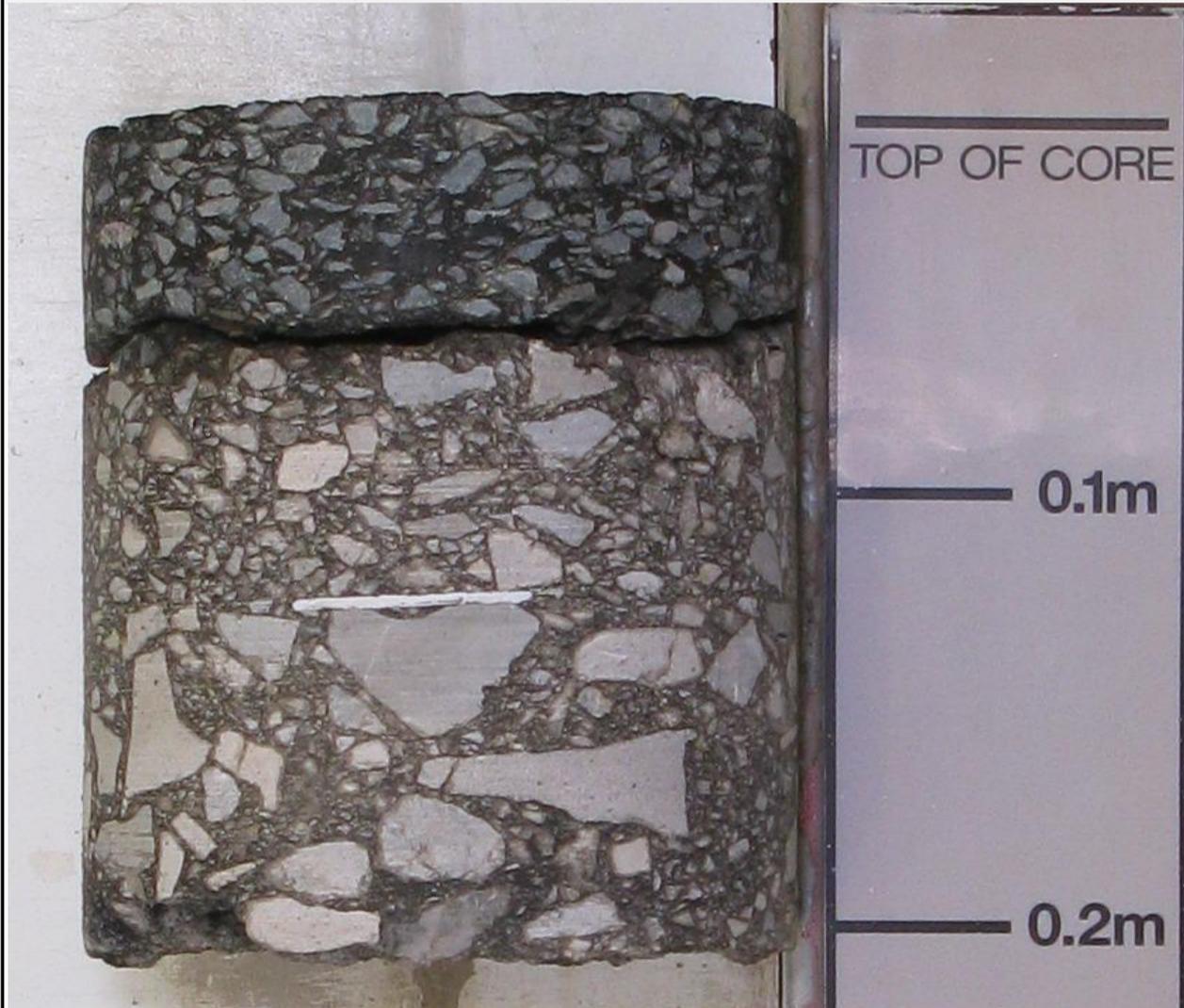
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 04	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	55	55	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
				Layers 1 & 2 Not Bonded					
2	55	115	60	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	115	197	82	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 05	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

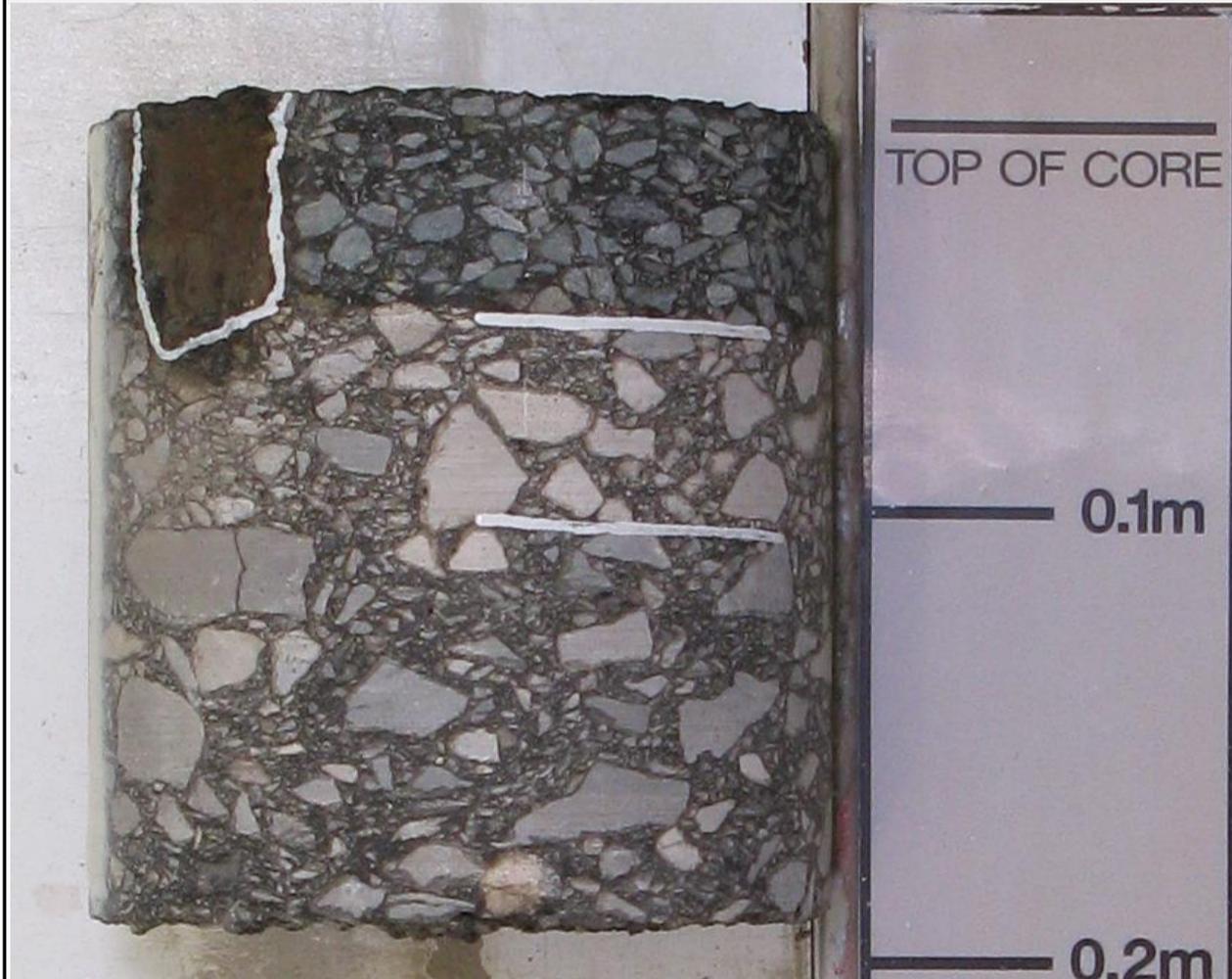
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 06	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock
2	50	95	45	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	95	180	85	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 07	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 08	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

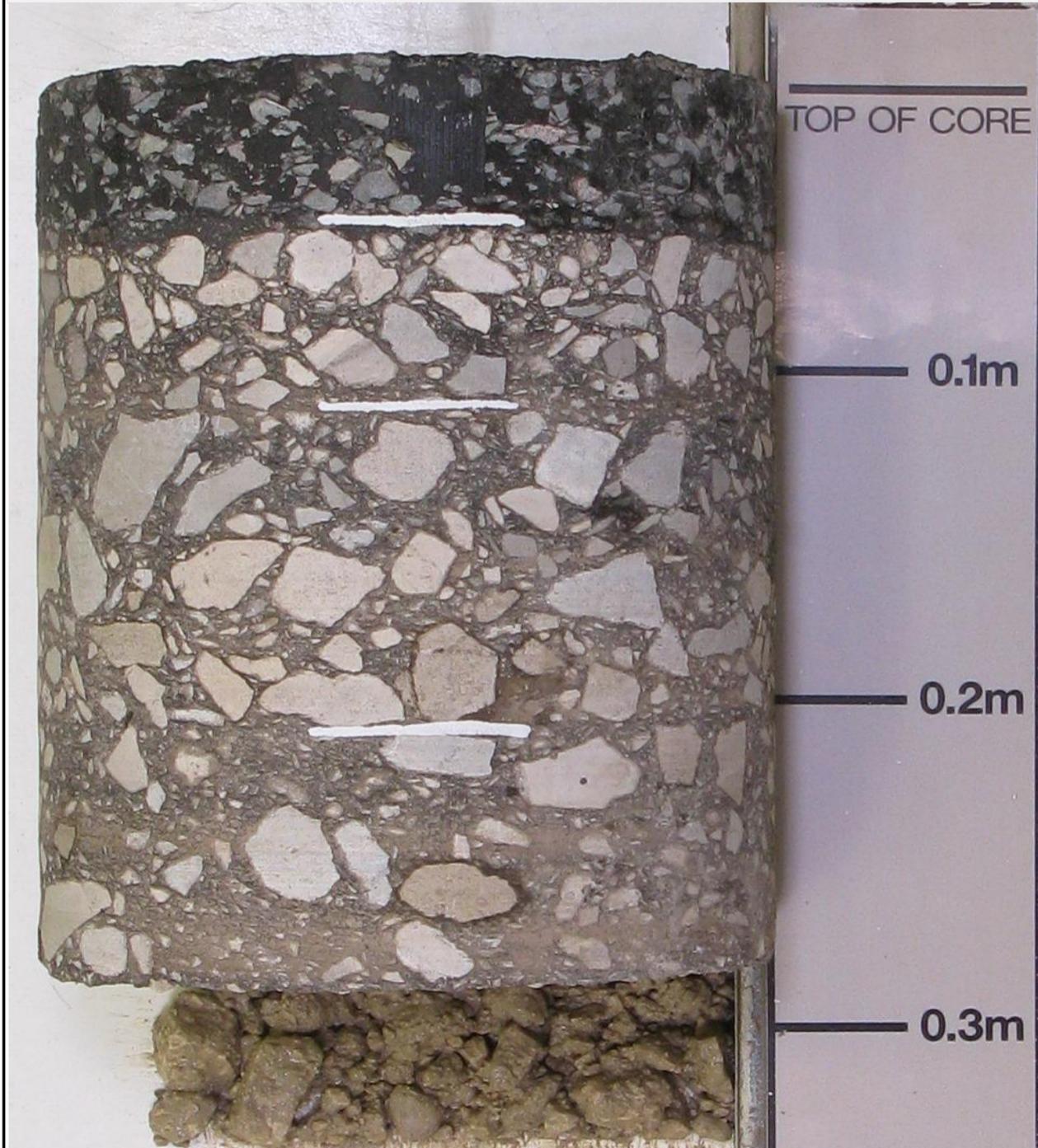
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 09	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	50	100	50	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	100	192	92	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
4	192	267	75	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
				Loose Granular Material					

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
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PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polycyclic aromatic hydrocarbons (PAHs) typically found in tar. PAHs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 10	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	55	55	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock

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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 11	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
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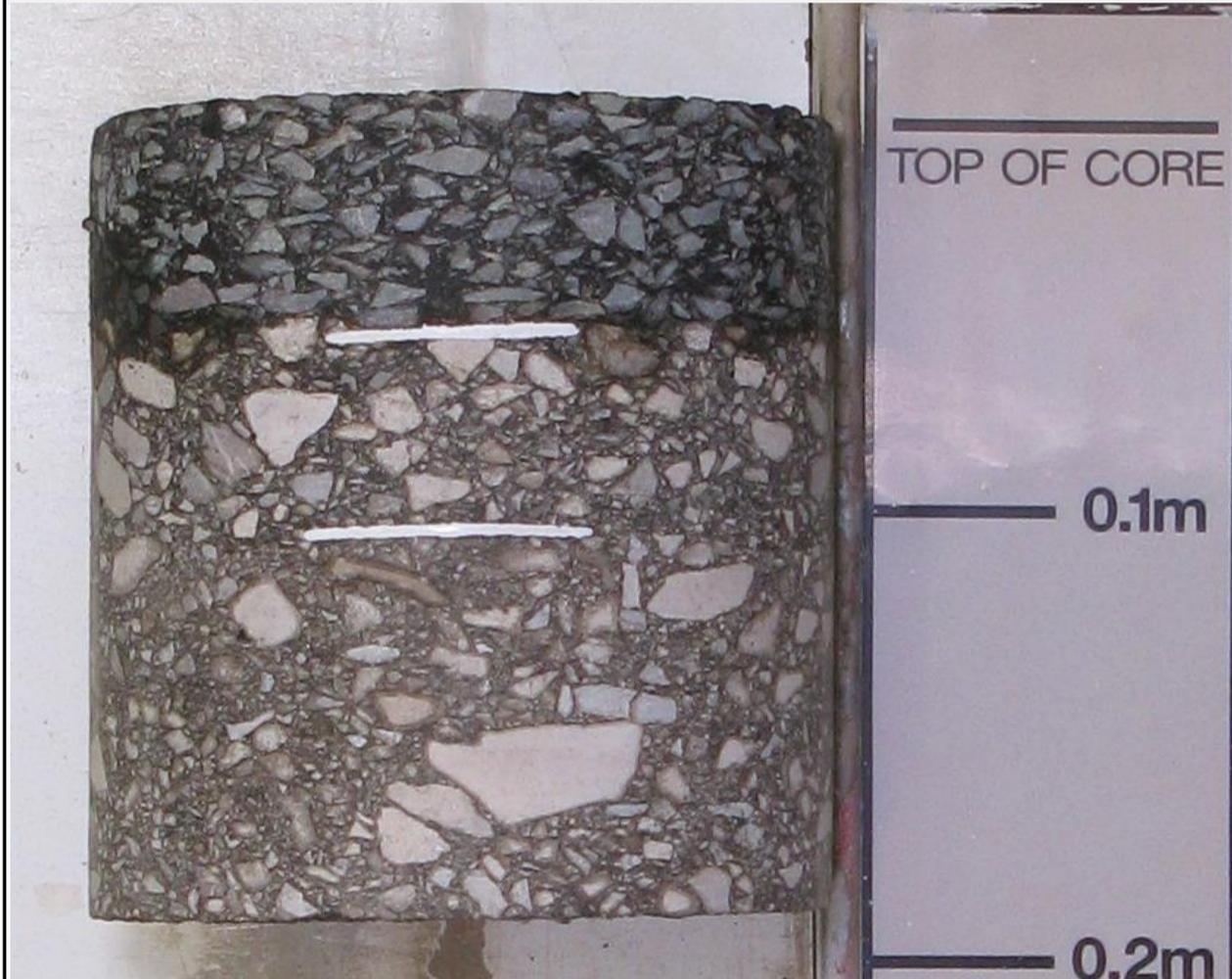
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 12	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	53	53	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	53	96	43	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	96	180	84	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
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 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 13	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 14	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	53	53	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	53	113	60	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	113	200	87	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
4	200	220	20	Asphalt Concrete (broken @ base)	No	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 15	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	47	47	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	47	103	56	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	103	190	87	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polycyclic aromatic hydrocarbons (PAHs) typically found in tar. PAHs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 16	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	50	115	65	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	115	190	75	Asphalt Concrete (broken @ base)	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

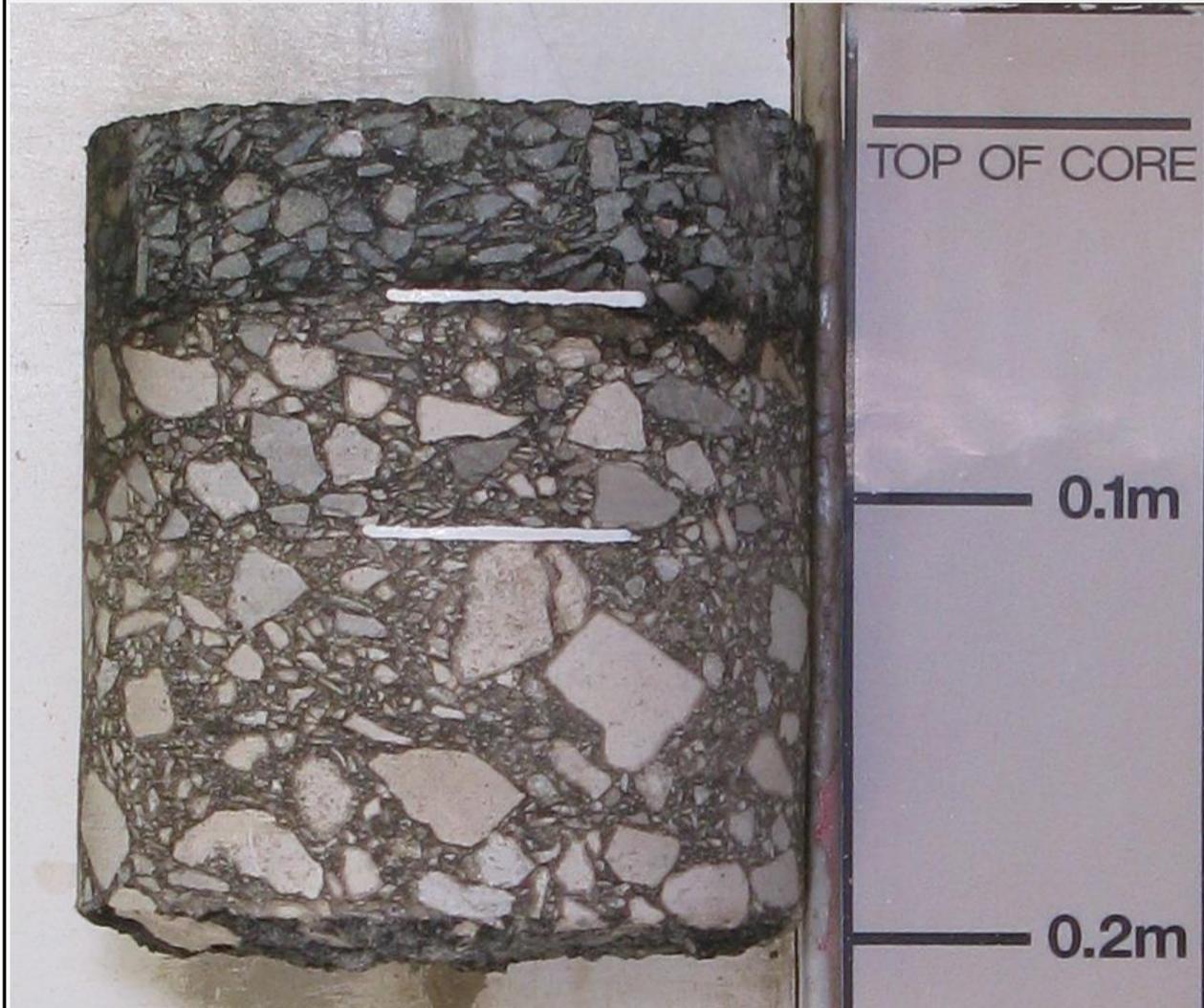
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 17	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	45	45	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	45	98	53	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	98	185	87	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 18	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	47	47	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

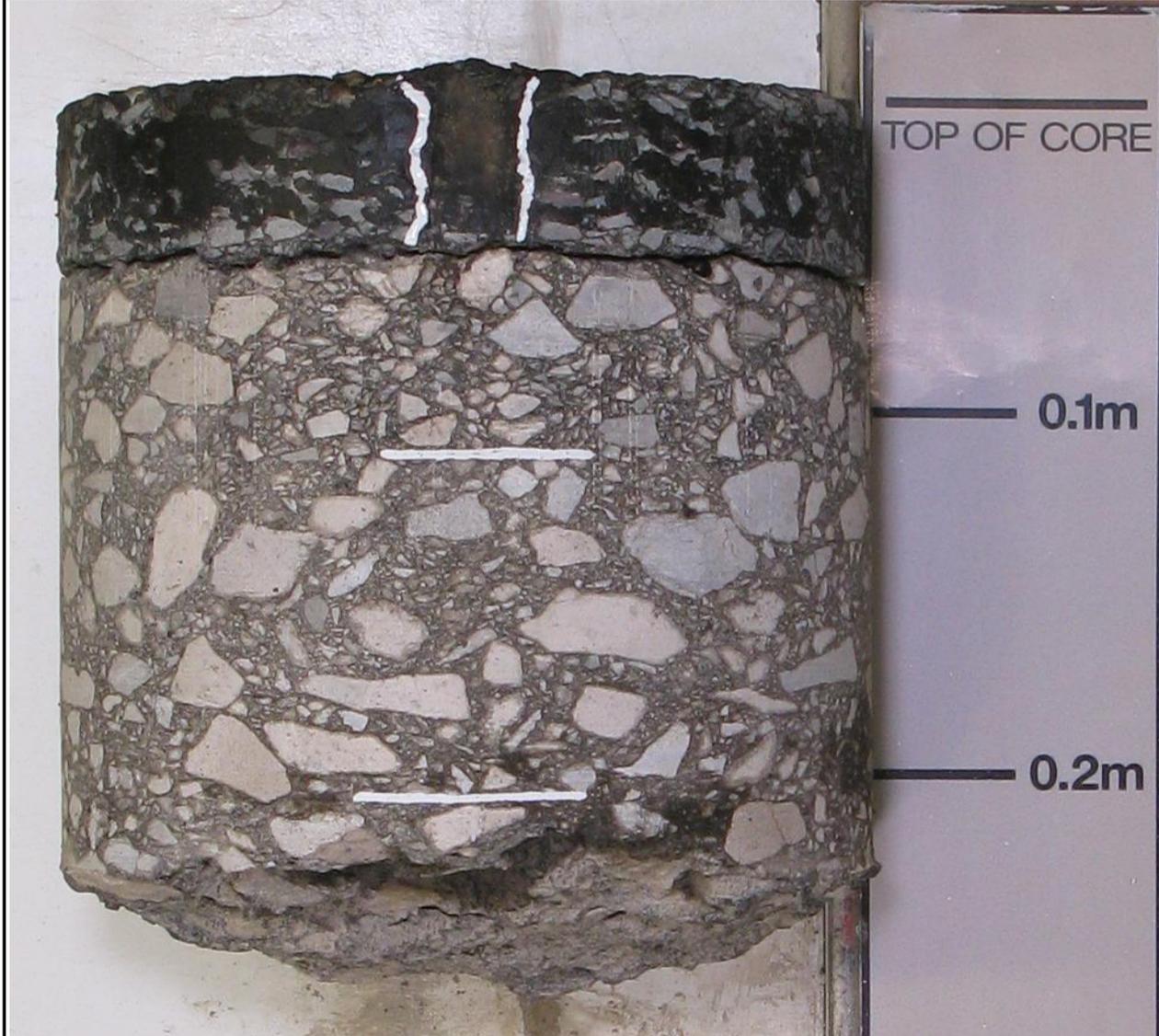
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 19	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face) Layers 1 & 2 Not Bonded	Yes	-ve	Bitumen	10	Crushed Rock
2	50	100	50	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	100	190	90	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
4	190	220	30	Asphalt Concrete (broken @ base)	No	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

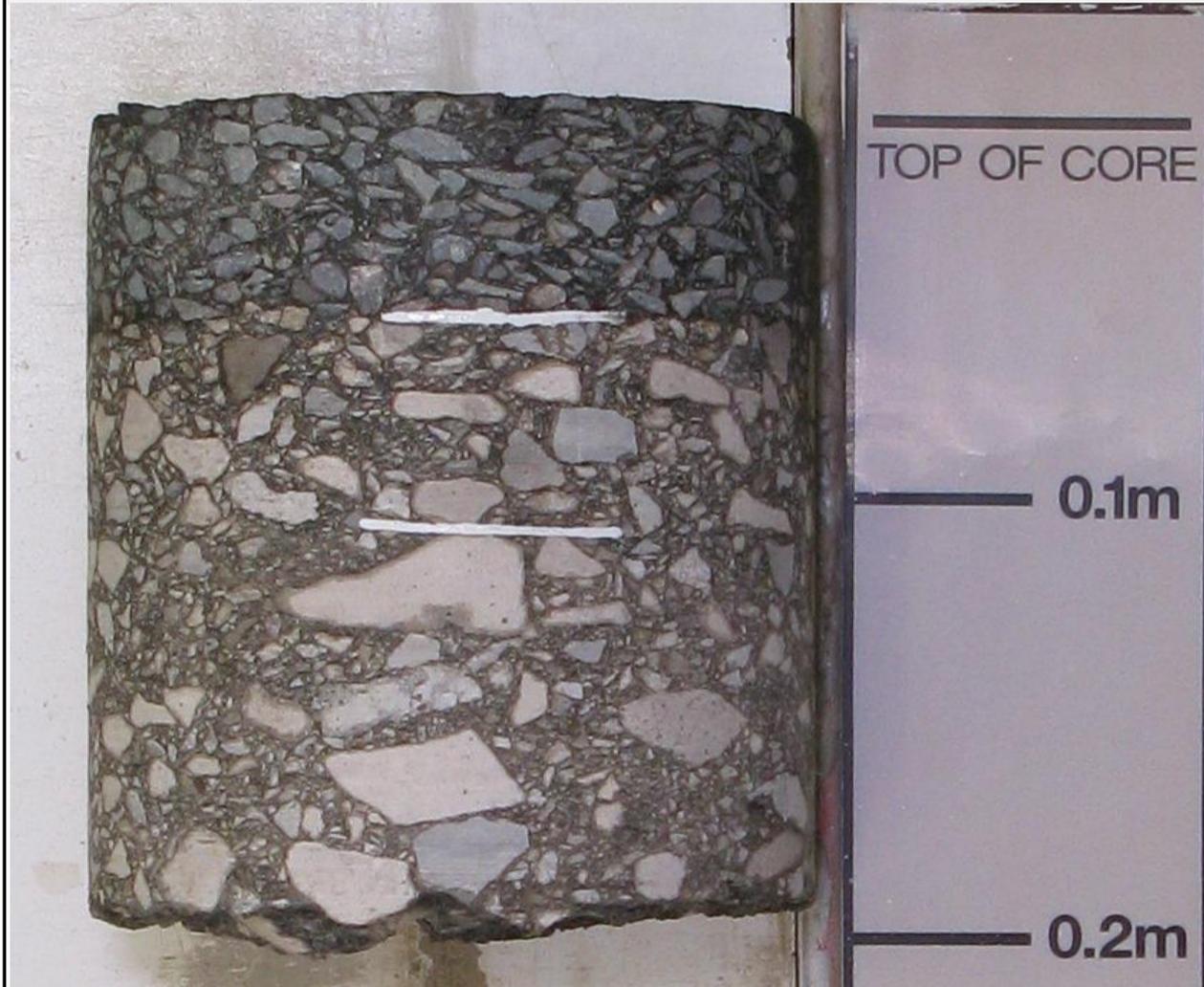
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 20	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	55	55	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	55	98	43	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	98	180	82	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 21	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	53	53	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	53	104	51	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	104	190	86	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 22	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

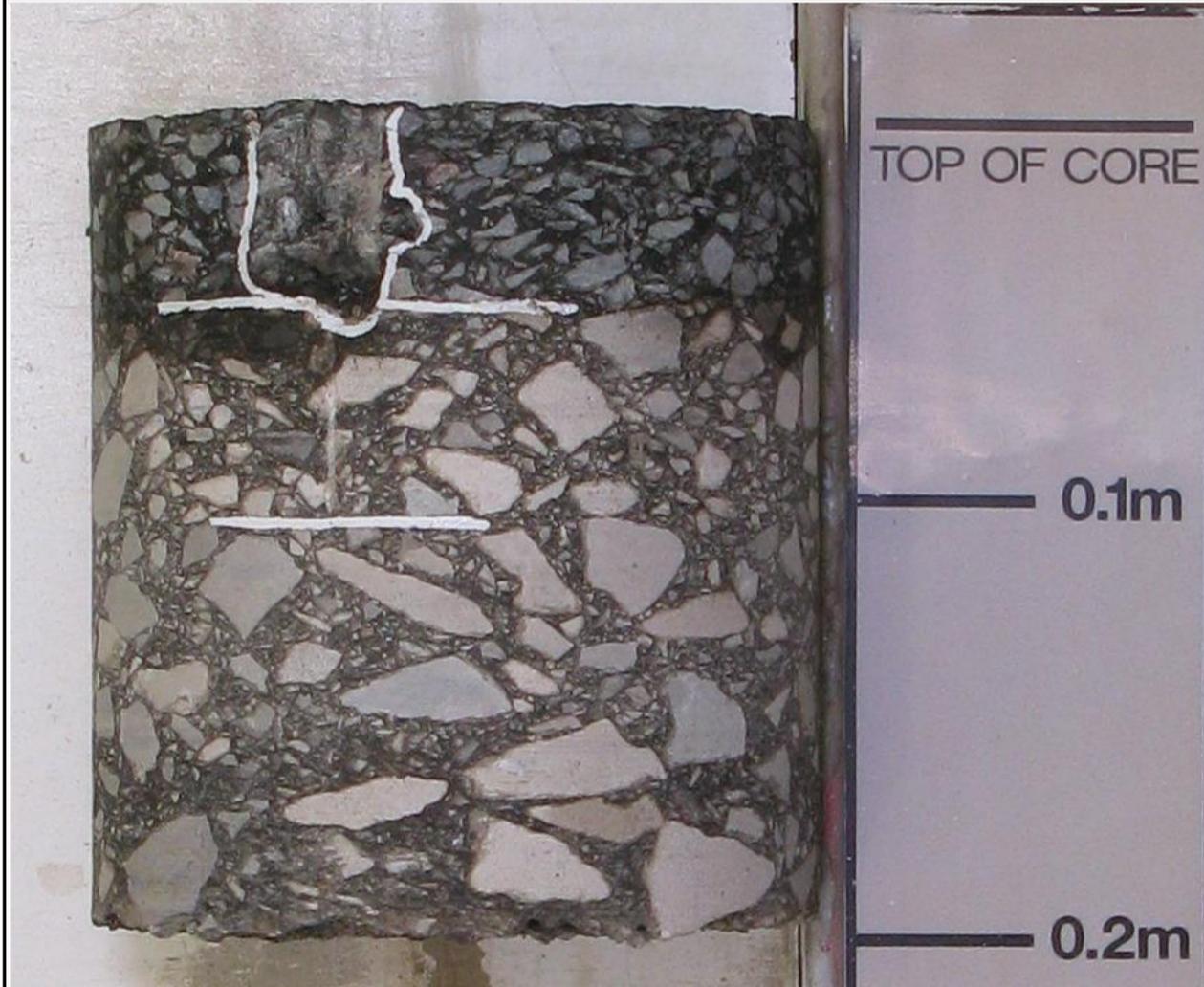
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 23	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	47	47	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock
2	47	95	48	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	95	185	90	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

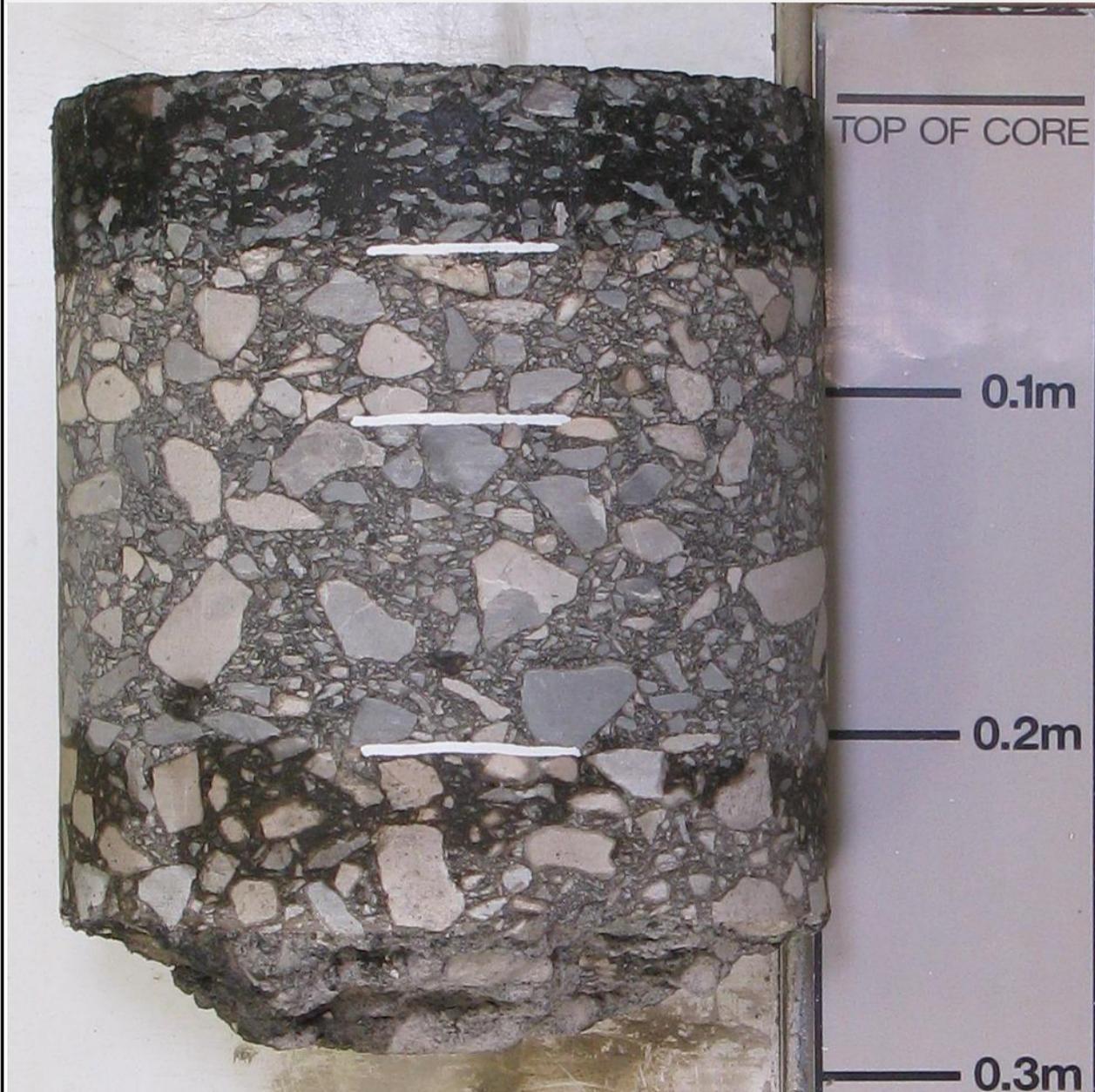
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 24	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	52	52	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	52	99	47	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	99	188	89	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
4	188	270	82	Asphalt Concrete (broken @ base)	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 25	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	48	48	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	48	97	49	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	97	180	83	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 26	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 27	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	42	42	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	42	98	56	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	98	180	82	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 28	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	47	47	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	47	97	50	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	97	175	78	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 29	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	45	45	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	45	105	60	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	105	180	75	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 30	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	45	45	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	45	104	59	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	104	185	81	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 31	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	48	48	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock
2	48	100	52	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	100	190	90	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 32	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 33	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	45	45	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 34	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	49	49	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	49	102	53	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	102	195	93	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
4	195	280	85	Asphalt Concrete (broken @ base)	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 35	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	55	55	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	55	95	40	Asphalt Concrete (voided)	Yes	-ve	Bitumen	20	Crushed Rock
3	95	190	95	Asphalt Concrete (voided)	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

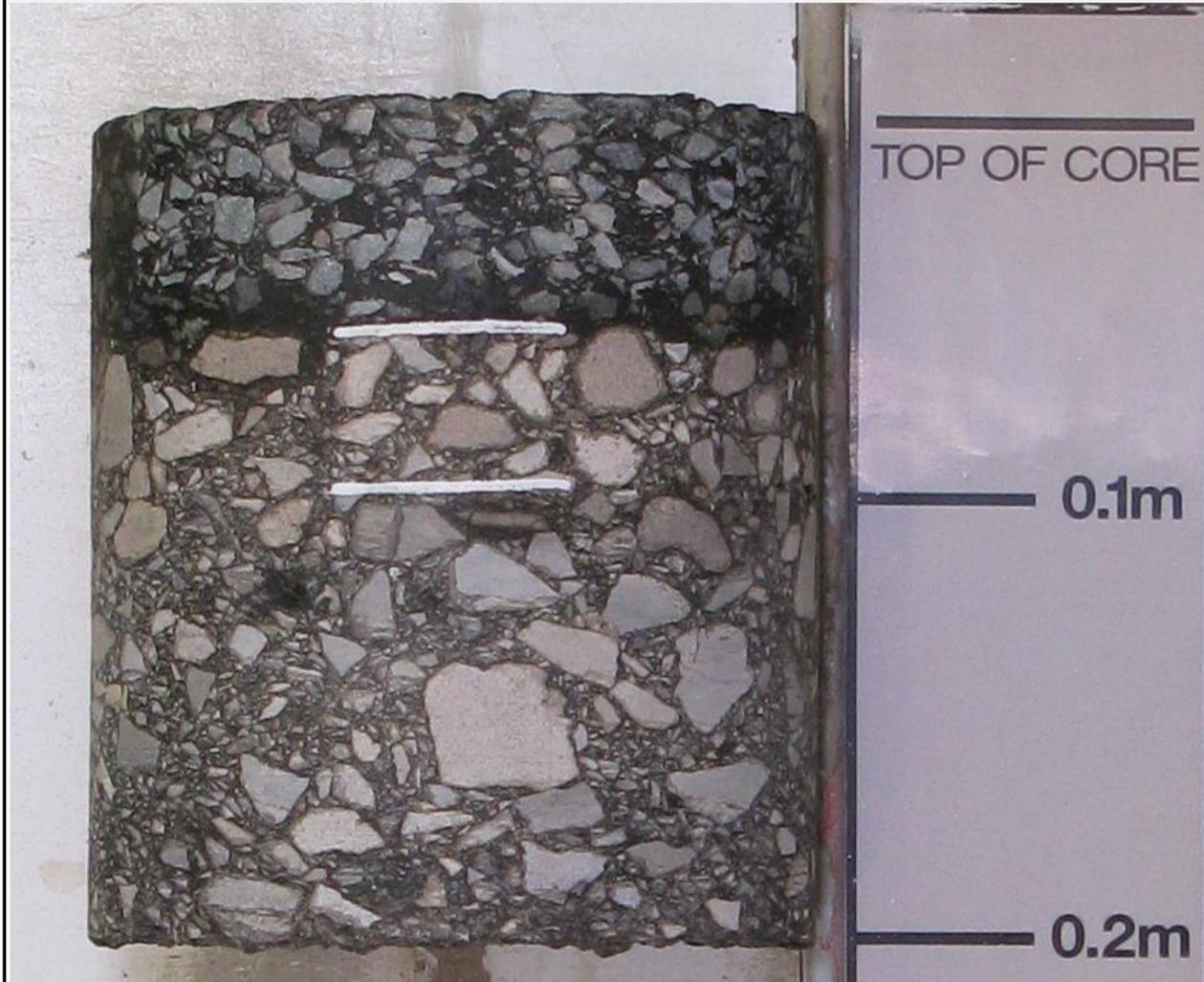
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 36	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	53	53	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	53	90	37	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	90	190	100	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
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PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 37	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	47	47	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 38	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 14-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	53	53	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 39	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	47	47	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	47	99	52	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	99	197	98	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
4	197	260	63	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
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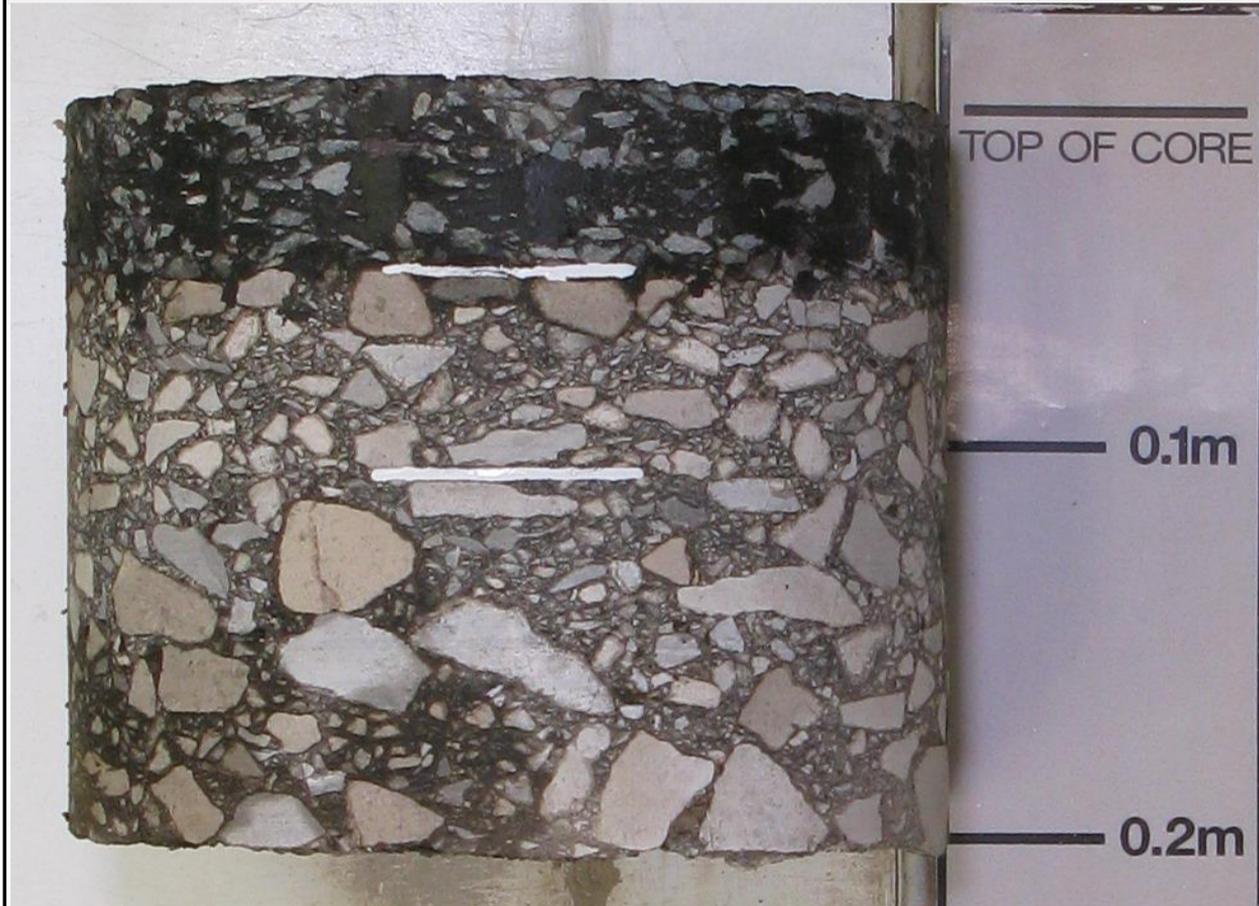
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 40	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	48	48	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	48	96	48	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	96	190	94	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

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Material Description ¹
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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 41	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	45	45	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock
2	45	95	50	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	95	220	125	Asphalt Concrete (broken @ base)	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 42	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	55	55	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 42	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	55	55	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

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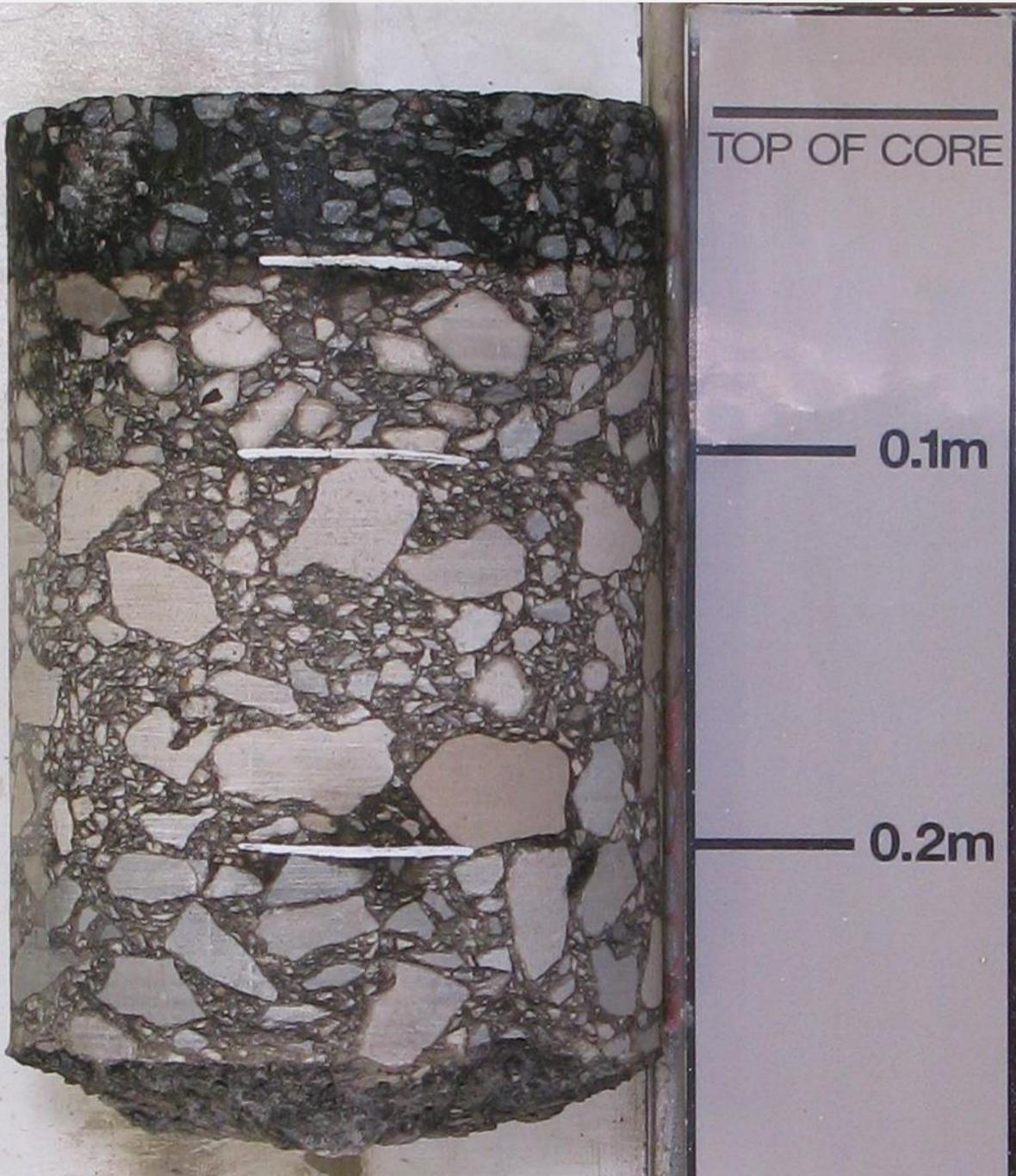
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 43	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	45	45	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	45	92	47	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	92	190	98	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
4	190	265	75	Asphalt Concrete (broken @ base)	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 44	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 45	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	45	45	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	45	98	53	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	98	200	102	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 46	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

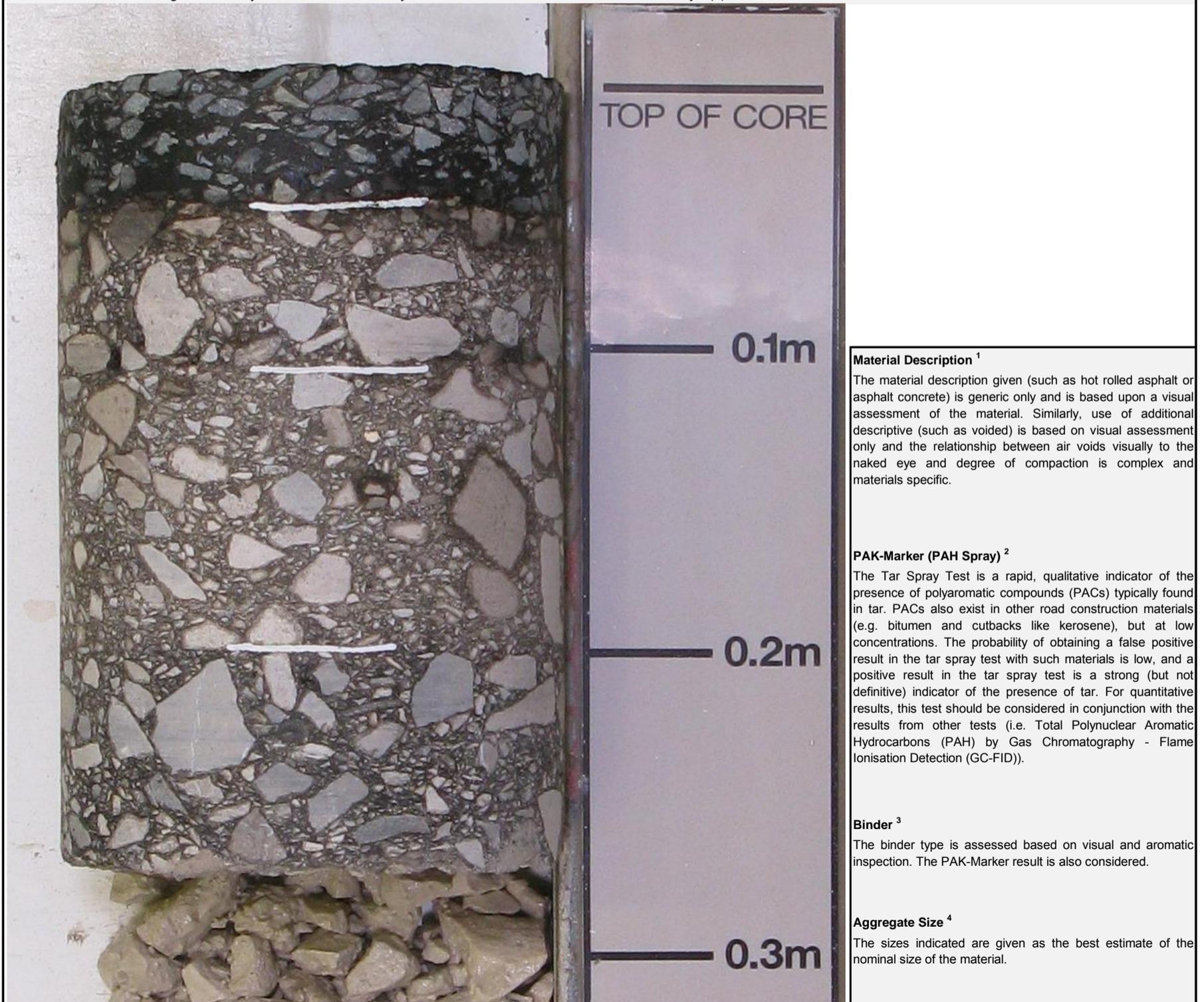
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 47	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	47	47	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	47	100	53	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	100	190	90	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
4	190	260	70	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
				Loose Granular Material					

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 48	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
 The Tar Spray Test is a rapid, qualitative indicator of the presence of polyaromatic compounds (PACs) typically found in tar. PACs also exist in other road construction materials (e.g. bitumen and cutbacks like kerosene), but at low concentrations. The probability of obtaining a false positive result in the tar spray test with such materials is low, and a positive result in the tar spray test is a strong (but not definitive) indicator of the presence of tar. For quantitative results, this test should be considered in conjunction with the results from other tests (i.e. Total Polynuclear Aromatic Hydrocarbons (PAH) by Gas Chromatography - Flame Ionisation Detection (GC-FID)).

Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 49	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	45	45	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	45	95	50	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	95	190	95	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
4	190	260	70	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
				Loose Granular Material					

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 50	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 16-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

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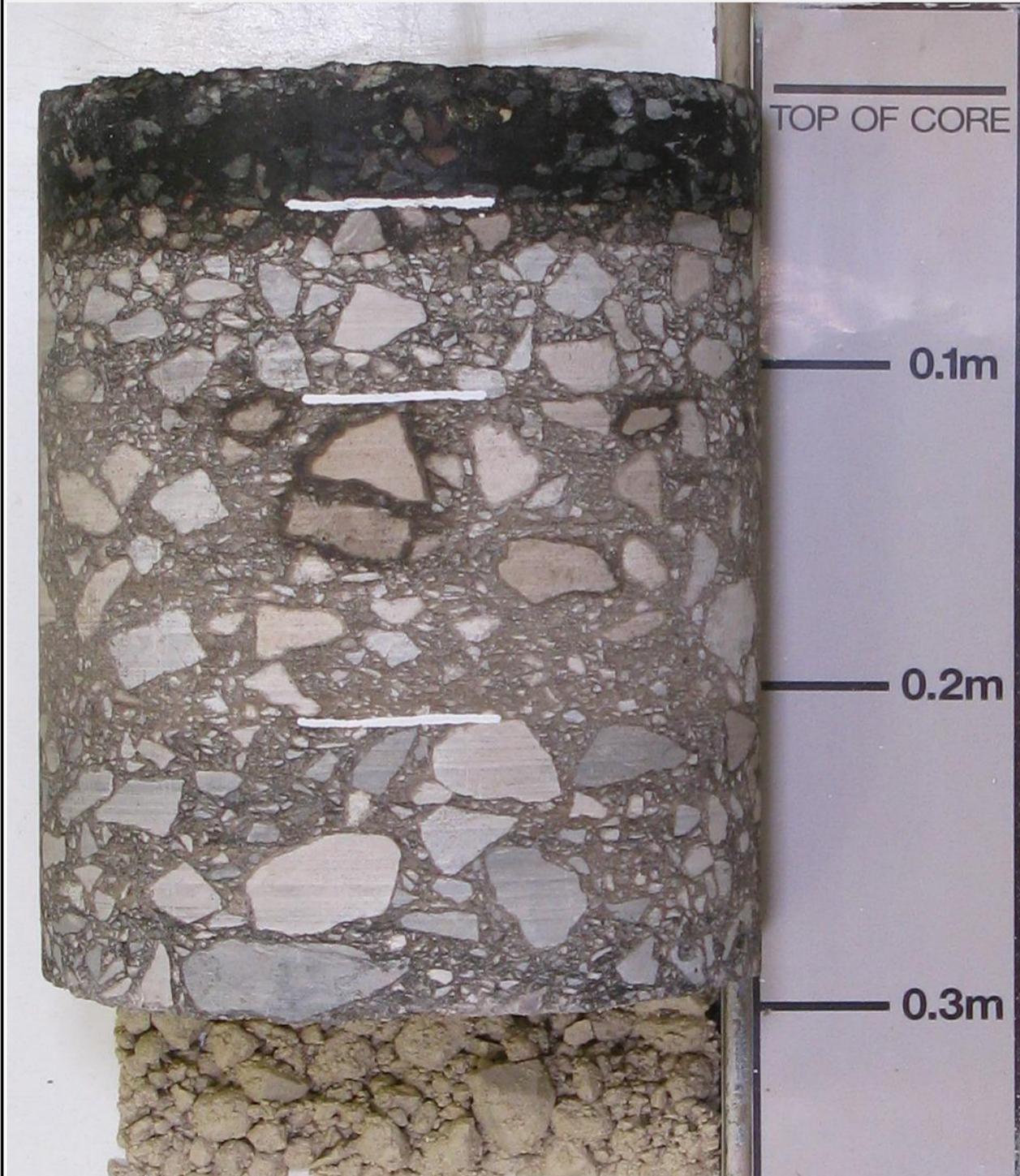
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 51	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 16-08-17 / 16-08-17	
Nominal Diameter : 200mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	42	42	Asphalt Surfacing	Yes	-ve	Bitumen	10	Crushed Rock
2	42	100	58	Asphalt Concrete	Yes	-ve	Bitumen	20	Crushed Rock
3	100	193	93	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
4	193	280	87	Asphalt Concrete	Yes	-ve	Bitumen	32	Crushed Rock
				Loose Granular Material					

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



Material Description ¹
 The material description given (such as hot rolled asphalt or asphalt concrete) is generic only and is based upon a visual assessment of the material. Similarly, use of additional descriptive (such as voided) is based on visual assessment only and the relationship between air voids visually to the naked eye and degree of compaction is complex and materials specific.

PAK-Marker (PAH Spray) ²
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Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

Job Number : 60523058	Scheme : A46 Hykeham to Carholme PASS Trial
Sample Number : T 688	Location :
Core Number : 52	
Cored / Logged By : DW / RBB	
Date Cored / Logged : 15-08-17 / 15-08-17	
Nominal Diameter : 150mm	Notes: N/A

Layer	Depth (mm)		Thickness (mm)	Material Description ¹	Suitable for NAT/CS Testing (Yes/No)	PAK-Marker ²	Binder ³	Aggregate	
	From	To						Size ⁴	Type
1	0	50	50	Asphalt Surfacing (damage to face)	Yes	-ve	Bitumen	10	Crushed Rock

Notes : The scale is for guidance only. It does not necessarily reflect the actual thicknesses of individual layer(s).



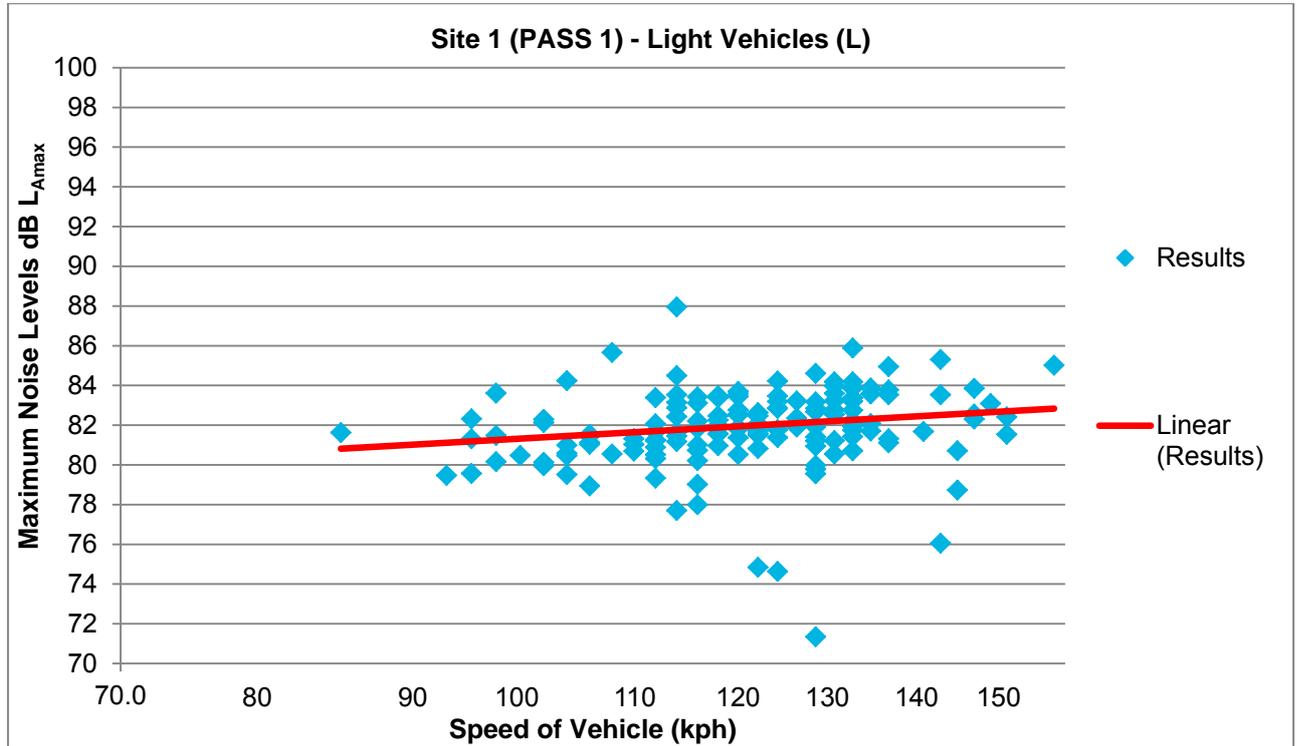
Material Description ¹
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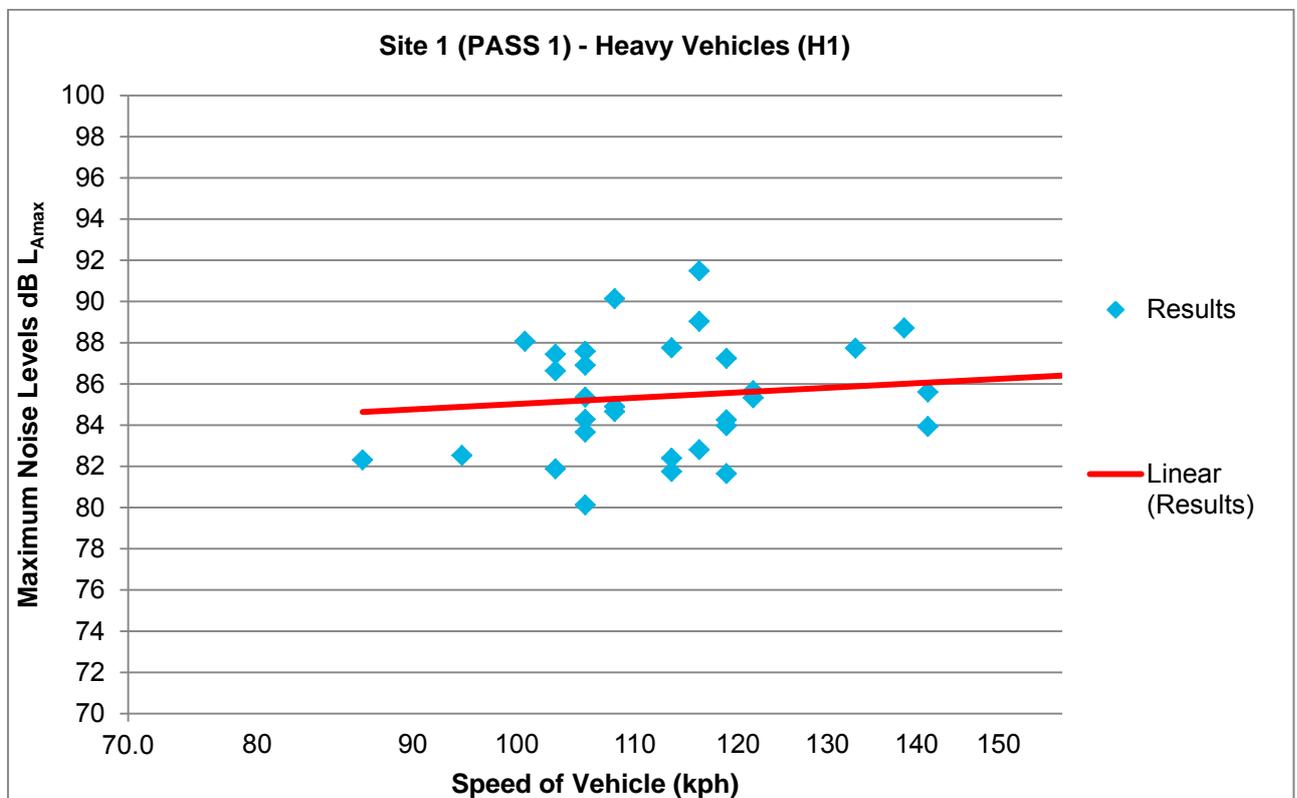
Binder ³
 The binder type is assessed based on visual and aromatic inspection. The PAK-Marker result is also considered.

Aggregate Size ⁴
 The sizes indicated are given as the best estimate of the nominal size of the material.

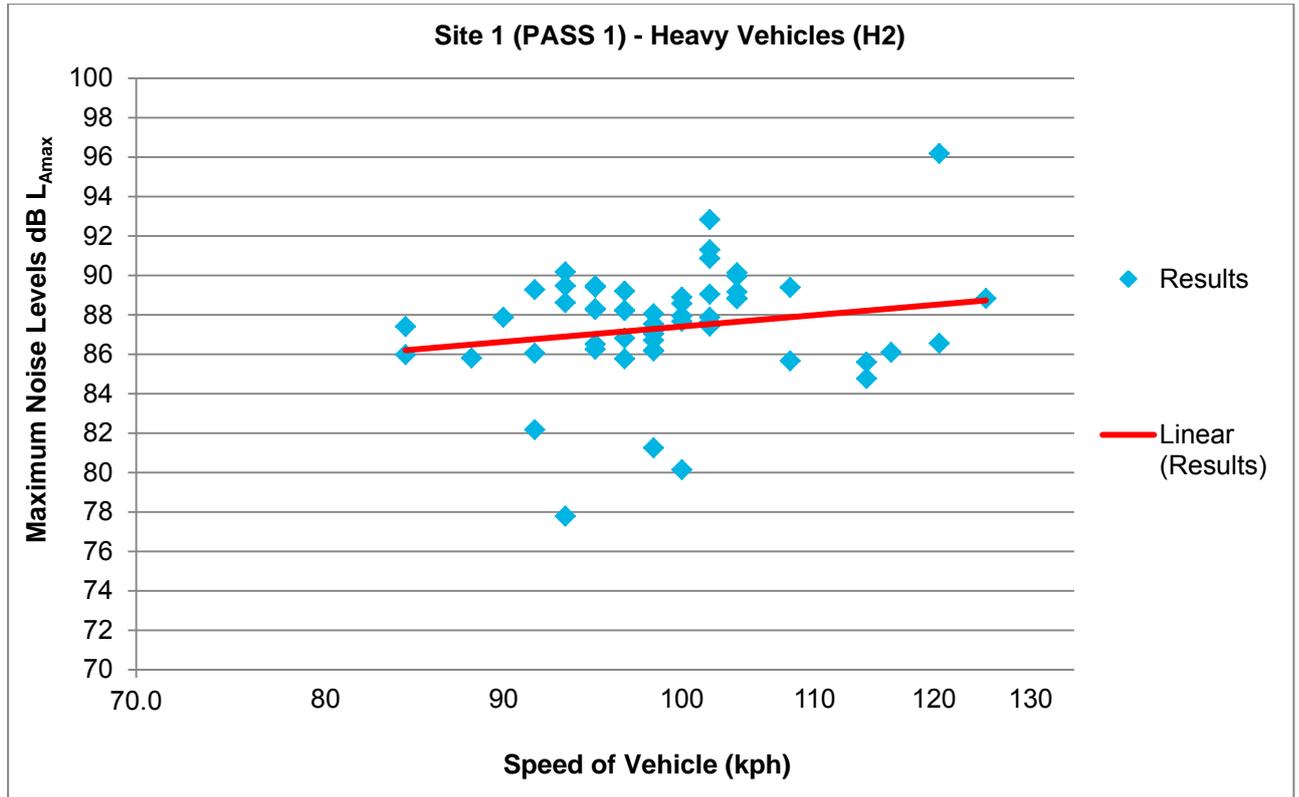
Appendix E – Regression Plots for the SPB Test

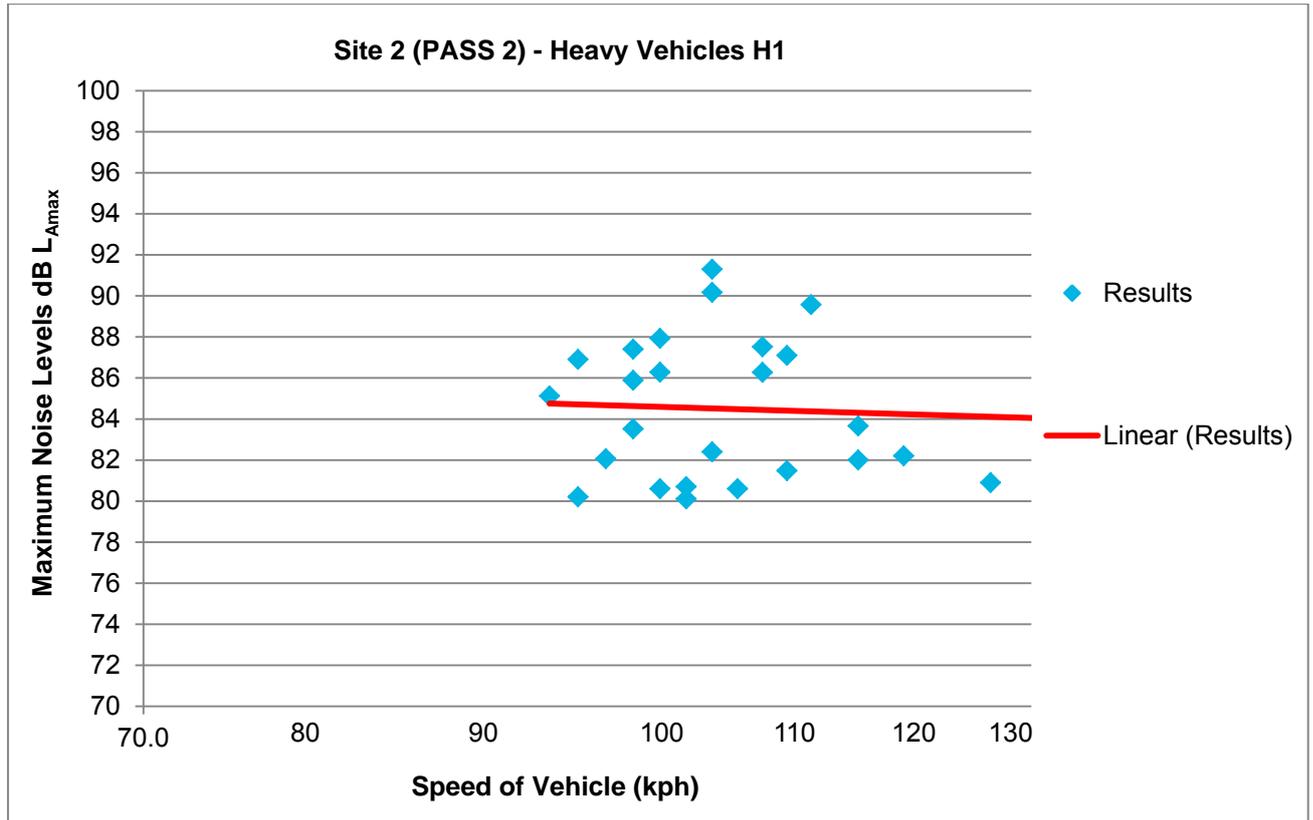


Appendix E1: Recorded Data for Light Vehicles at Site 1 (PASS 1)

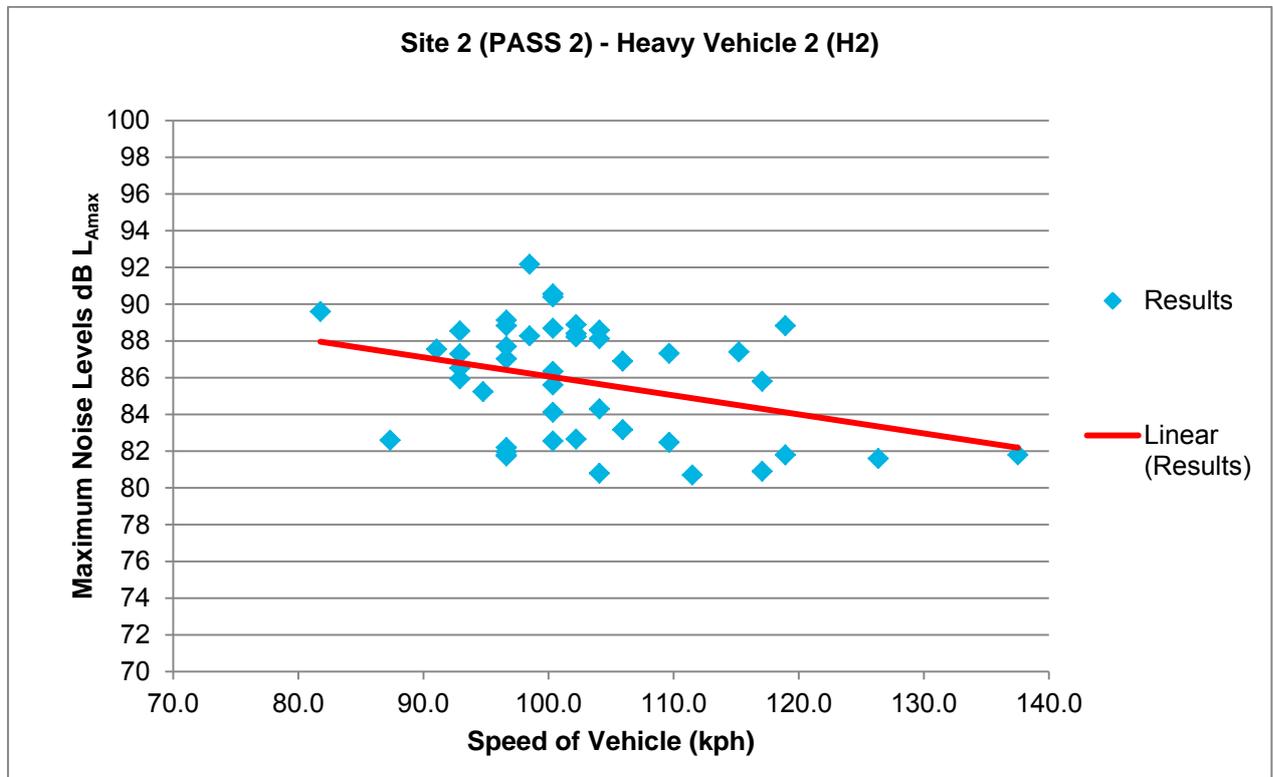


Appendix E2: Recorded Data for Twin-Axle Heavy Vehicles at Site 1 (PASS 1)





Appendix E5: Recorded Data for Twin-Axle Heavy Vehicles at Site 2



Appendix E6: Recorded Data for Multi-Axle Heavy Vehicles at Site 2 (PASS 2)

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