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# Calculation of Local Equilibrium Correction Factors for the 2020 skid resistance surveys

Stuart Brittain

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## Executive Summary

As part of the process for managing skid resistance on its network (the Strategic Road Network or SRN), Highways England carries out single annual skid resistance surveys (SASS). This data is used to identify sites where there is a need to undertake an investigation to determine whether a treatment to improve skid resistance would be beneficial in mitigating the risk of skidding collisions at a site. Further details on the site investigation process is given in the Skidding Resistance part of the DMRB (DMRB CS 228). In addition, this data feeds into the KPI for pavement condition.

The measurements from these surveys are corrected for seasonal variation by the application of correction factors called the “Local Equilibrium Correction Factors” (LECF). The procedure used since 2007 to calculate the LECFs was used again during 2020. This document provides a record of the procedure used to derive the LECFs that have been applied to the 2020 skid resistance survey data.

A high percentage (98.6%) of the SRN was surveyed in 2020, with each Highways England Area having at least 96.7% coverage of survey data. In addition to the Highways England Areas, LECFs were provided for the A1 Darrington to Dishforth, A249, A69, M25 and Second Severn Crossing DBFOs.

All of the Areas and DBFOs where LECFs were calculated were surveyed within their target survey period.

The spread of survey dates exceeded 28 days for a large number of localities which will have a slight negative effect on the robustness of the seasonal corrections applied.

Surveys of lanes other than lane 1 were undertaken for some Areas and DBFOs. For the Areas and DBFOs where LECFs were calculated these surveys were carried out in the same period as the lane 1 surveys and therefore had the lane 1 LECF applied.

Previous research by TRL identified that concrete does not appear to experience seasonal variation to the same degree as other surfacings. Therefore an LECF of 1.000 (i.e. no correction) was applied to concrete sections. An investigation into the application of LECFs on concrete sections using the 2020 data found no conflict with the previous investigations into concrete. Therefore due to the unsuitability of the calculated LECFs for concrete it is recommended that the application of an LECF of 1.000 for concrete sections is continued.

Analysis of the spread of 2020 survey data values suggests that there was a low level of variation over the survey season. It is possible that reduced traffic due to lockdown restrictions for COVID-19 may explain this lack of variation. It is recommended that the suitability of the survey periods should continue to be reviewed on an annual basis.

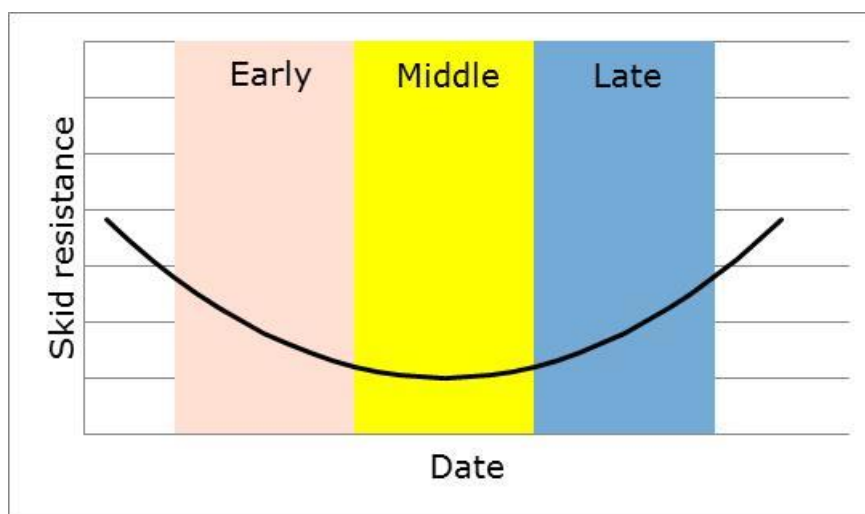
The weighted average LECF value was 1.02 for 2020, showing that the measured skid resistance of the network (i.e. before correction) was slightly lower than the average of the previous three years. Analysis of data from the Highways England benchmark sites that monitor long term trends in skid resistance across the network (Brittain, 2021) also identified that 2020 was slightly lower than the average of the previous three years.

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## 1 Introduction

As part of the process for managing skid resistance on its network (the Strategic Road Network or SRN) Highways England carries out single annual skid resistance surveys (SASS). The test season for these surveys is broadly over the summer months, and is divided into three survey periods (early, middle and late). The network has been divided so that approximately a third of its length is tested in each survey period; the survey period rotates to ensure that each length of the network is tested once in each period over three years. Skid resistance levels vary during the course of the year with the lowest levels of skid resistance generally experienced in the middle of the summer. The general trend for skid resistance is shown diagrammatically in Figure 1.1. Levels of skid resistance can also fluctuate from year to year.



**Figure 1.1 Idealised seasonal variation of skid resistance over the summer**

In order to correct for this seasonal variation (both within and between years), Local Equilibrium Correction Factors (LECFs) are calculated which are then applied to the speed corrected skid resistance data (SC). Once this data has been seasonally corrected it is termed the Characteristic Skid Coefficient (CSC). Further details on the use of CSC data are provided in the Skidding Resistance part of the DMRB (DMRB CS 228).

The network is split into “localities”, consisting of the length of each road within a specified Highways England Maintenance and Improvement Area, and a LECF value is assigned to each of these localities. The LECF is calculated from the average of the past three years’ SC data for the locality (known as the Local Equilibrium SC or LESC) and the current average for the locality (known as the Local Mean SC or LMSC).

For each locality two types of LECF are calculated. The first, known as the road LECF, is calculated using the data available for that locality only. The other LECF is called the Area LECF and uses all of the data available for the Area that contains the locality. The Area LECF uses data from surveys which can be spread over several weeks and are over a wide area. Since fluctuations in skid resistance can occur within this period of time, this generally means that the Area LECF is less robust than the road LECF. However, some localities are quite small and therefore have little data available for calculation of a robust road LECF. A

minimum length is therefore applied for the calculation of a road LECF. If a locality has 25km or more of valid SC data (i.e. SC data for the current year and a suitable dataset for the past years) then the road LECF is applied, otherwise the Area LECF is used. Full details of the LECF calculation procedure are given in Appendix A.

Once the LECF values have been calculated for each survey period, they are loaded into Highways England's Pavement Management System (HAPMS) so that they can be used in conjunction with the skid resistance survey data.

This document provides a record of the procedure used to derive the LECFs that have been applied to the 2020 skid resistance survey data.

The procedure developed in 2007 (Brittain, 2007) which incorporates a visual analysis and was refined in 2008 to include an automated analysis (Brittain, 2009) was used again this year.

A summary of the survey coverage and range of survey dates is given in section 3.1. Section 4 contains an overview of the calculation and delivery of the 2020 LECF values, along with any issues identified. Additional observations from the 2020 LECF calculation are discussed in Section 5 and Appendix B contains tables of the LECF values calculated.

## 2 Changes affecting the LECF calculation

Prior to the 2018 skid resistance surveys Areas 1 and 2 were combined into one Area now known as South West. Prior to merging, these two Areas had different survey rotations. During the 2017 LECF calculations (Brittain, 2018) it was identified that the most suitable survey rotation for this new Area South West was to match the pre-existing pattern for the old Area 2. The survey pattern for these Areas (including the plan for future years) is shown in Table 2.1.

**Table 2.1 Survey rotation for Areas 1, 2 and SW**

	2015	2016	2017	2018	2019	2020	2021
Area 1	L	E	M	-	-	-	-
Area 2	E	M	L	-	-	-	-
South West	-	-	-	E	M	L	E

It can be seen that for the LECF calculations in 2019 and 2020 the standard past years' dataset (i.e. the previous three years) is not suitable for the lengths that were previously part of Area 1 as it does not include a survey from each of the three survey periods. Therefore, for the calculation of the 2020 LECF values for South West an additional analysis was carried out using 2018, 2019 and 2020 for the past years' dataset (instead of 2017, 2018 and 2019). The values calculated from this analysis and the standard analysis were combined to produce the final LECF values for this Area. It is worth noting that it would also be possible to use 2015, 2018 and 2019, however this would involve old data and was therefore disregarded as an option.

### 3 Data quality

#### 3.1 Survey Coverage

The survey coverage obtained for 2020 is presented in Table 3.1. In some cases the value shown for “Over year” does not equal the sum of the percentages surveyed in the survey periods. This is because the same length was surveyed in more than one survey period.

A high percentage of the network survey was achieved this year (98.6% total coverage for Highways England Areas) with at least 96.7% coverage in each Highways England Area. All of the Highways England Areas were surveyed in the target survey period. The spread of survey dates is discussed further in section 3.3.

High survey coverage was also seen for the DBFOs with a defined (SASS compatible) survey rotation. As with previous years some data has also been loaded for some of the other DBFOs. All of the DBFOs with survey data loaded into HAPMS are discussed further in section 4.4.

**Table 3.1 Survey coverage in 2020 (analysis run 19<sup>th</sup> January 2021)**

Target period	Area	Percentage of Area surveyed (lane 1 not Ox Bow Lay-by)				
		Early	Middle	Late	Very Late <sup>1</sup>	Over year
Early	Area 3	99.7%	-	0.0% <sup>2</sup>	-	99.7%
	Area 9	98.3%	-	-	-	98.3%
	Area 13	99.0%	-	-	-	99.0%
	Area 14	99.7%	-	-	-	99.7%
Middle	Area 6	-	99.5%	-	-	99.5%
	Area 7	-	98.6%	-	-	98.6%
	Area 8	-	96.7%	-	-	96.7%
	Area 12	-	97.2%	-	-	97.2%
	A249 DBFO	-	99.1%	-	-	99.1%
Late	South West	-	-	98.8%	-	98.8%
	Area 4	-	-	99.1%	-	99.1%
	Area 10	-	-	98.1%	-	98.1%
	A1DD DBFO	-	-	97.8%	-	97.8%
	A69 DBFO	-	-	99.6%	-	99.6%
	M25 DBFO	-	-	96.7%	-	96.7%
	Second Severn Crossing	-	-	97.9%	-	97.9%
DBFOs with no defined survey rotation	A19 DBFO	-	-	-	-	-
	A1M DBFO	100.0%	99.6%	100.0%	-	100.0%
	A30/A35 DBFO	-	-	-	-	-
	A417/A419 DBFO	14.8%	14.8%	14.8%	-	14.8%
	M40 DBFO	-	-	-	-	-
n/a	HE Areas	n/a	n/a	n/a	n/a	98.6%

<sup>1</sup> The very late surveys are any surveys conducted between the end of the survey season (20th October) and the end of the calendar year.

<sup>2</sup> One section was moved from the M25 DBFO to Area 3 after the surveys were conducted causing this length to be surveyed in the wrong target period.

### 3.1.1 Survey load dates

After the surveys are conducted, the data are loaded into HAPMS and undergo independent checks (further discussed in section 3.2). The survey contract states that the Contractor must ensure that data has been loaded, passes the independent checks and is ready for further analysis (i.e. the LECF calculation) by specified dates. These dates are given in Table 3.2. The percentage of the data loaded by these dates for each Area is given in Table 3.3.

**Table 3.2 End of survey period and target data availability dates**

Survey period	End of survey period	Target date for data available for LECF calculation
Early	27 <sup>th</sup> June	9 <sup>th</sup> August
Middle	24 <sup>th</sup> August	7 <sup>th</sup> October
Late	20 <sup>th</sup> October	30 <sup>th</sup> November

**Table 3.3 Percentage of current data loaded by target date (analysis run 19<sup>th</sup> January 2021)**

Target survey period	Area	Percentage of current data loaded by expected survey load date
Early	Area 3	96.9%
	Area 9	90.6%
	Area 13	97.4%
	Area 14	99.6%
Middle	Area 6	98.2%
	Area 7	95.4%
	Area 8	91.1%
	Area 12	88.1%
	A249 DBFO <sup>1</sup>	0.0%
Late	South West	100.0%
	Area 4	98.6%
	Area 10	100.0%
	A1 Darrington to Dishforth DBFO	72.0%
	A69 DBFO <sup>1</sup>	100.0%
	M25 DBFO	97.9%
	Second Severn Crossing	100.0%

<sup>1</sup>The A249 DBFO and A69 DBFO are not covered in the Highways England Skid survey contract. As such these DBFOs may have different target delivery dates.

It can be seen from Table 3.3 that a large percentage of the survey data was loaded by the expected load date and not modified after this date due to the independent checks. There were some delays to the independent checks in part due to changes in the HAPMS support team and outside of the control of TRL.

In addition, some surveys included lengths where the skid resistance was recorded as zero to denote invalid data. Although this was one of two permitted options in the survey file specification, it was not accounted for in the HAPMS database which only flagged lengths recorded as 999 as being invalid. It was therefore agreed that these lengths would be removed. This process for the early survey data was completed on the 9<sup>th</sup> October. The

Middle and Late survey data was ready for the LECF calculation process on the 8<sup>th</sup> January 2021. This delay in the availability of the data caused a delay in the availability of the LECF values

### 3.2 Suitability of data loaded

During the survey season the survey data is inspected visually to help identify any issues that should be resolved. This process was undertaken after each survey period when the survey contractor had loaded and carried out initial checks on the data for that period.

The types of anomalies that are looked for in this review include:

- Lengths where the data suggests that either the test wheel was up or it had experienced a puncture
- Lengths where the data appears to be misaligned relative to the previous years' data (i.e. the section markers may be in the wrong place)
- Lengths which exhibited oscillating data or otherwise anomalous data
- Lengths with duplicate surveys loaded

During the review the following anomalies were found:

- Possible misalignment
- Very low values
- Invalid data entered as zeros (as discussed above)
- Unusual downward slope to values in a survey

The lengths identified by this analysis were supplied to Highways England and the survey contractor for review and, where necessary, amendment.

### 3.3 Survey spread

The purpose of the LECFs is to correct for the seasonal and between year variations in skid resistance experienced on the network. However, the longer the timescale for the survey of a road the more likely the correction will start to become unsuitable for parts of the survey due to changes in the weather. Therefore, in order to obtain the most robust data it is necessary to conduct surveys within an Area in a short timescale, with particular attention paid to the time taken to survey an individual road. The survey contract states that the time between the start and end of a survey for each locality is no more than 28 days. In addition any surveys not conducted in the target survey period will cause issues with the calculation of LECF values in future years.

The spread of survey dates for each Area is shown in Figure 3.1. The coloured bars represent the extent of the period during which the survey for that Area was undertaken, the vertical red lines show the survey period boundaries, and the crosses mark dates when surveys were conducted.

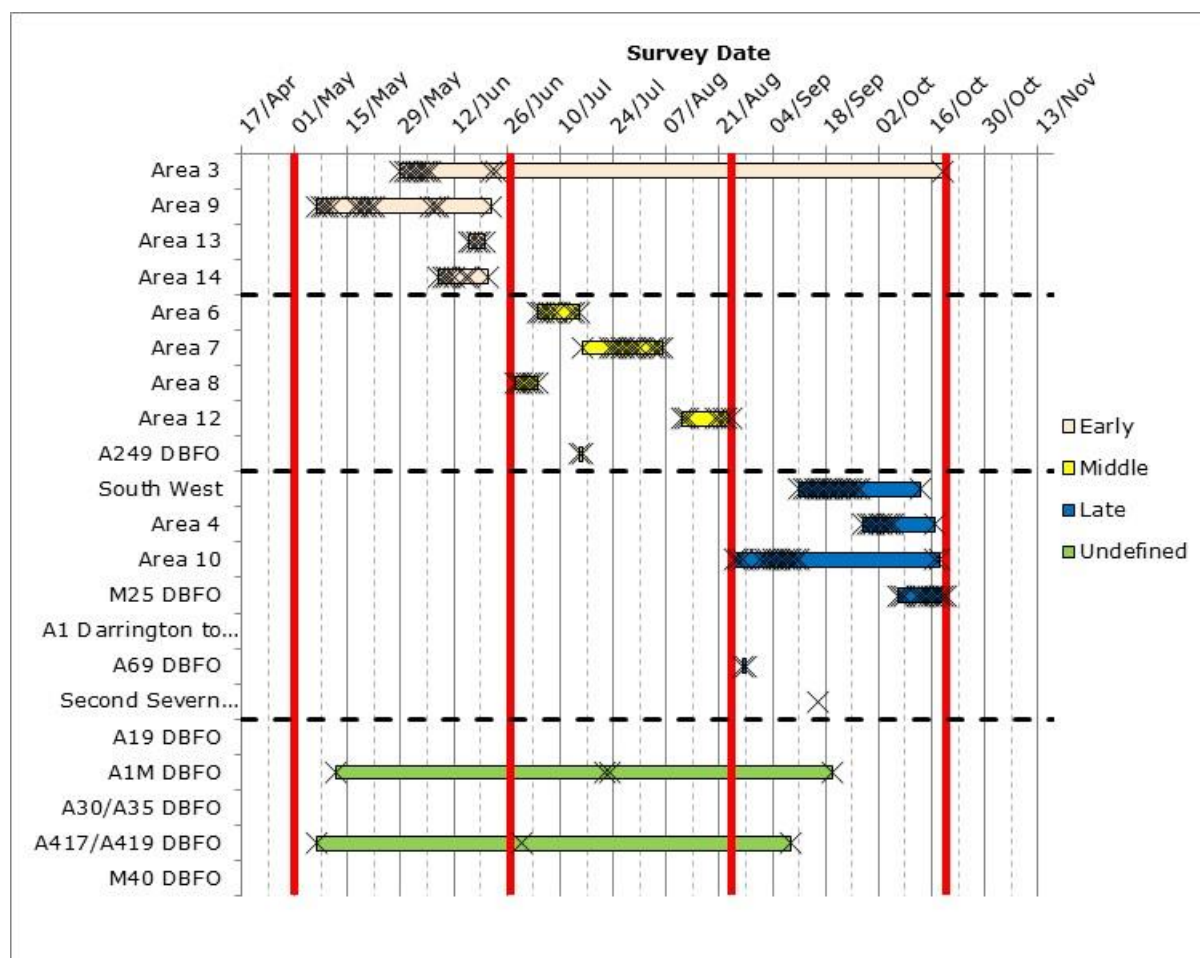


Figure 3.1 Spread of survey dates in 2020 (Lane 1 surveys)

The spread of survey dates was quite high for a number of Areas, notably Areas 3, 9, South West and 10. The spread of survey dates by road for these Areas are shown in Figure 3.2 to Figure 3.5.

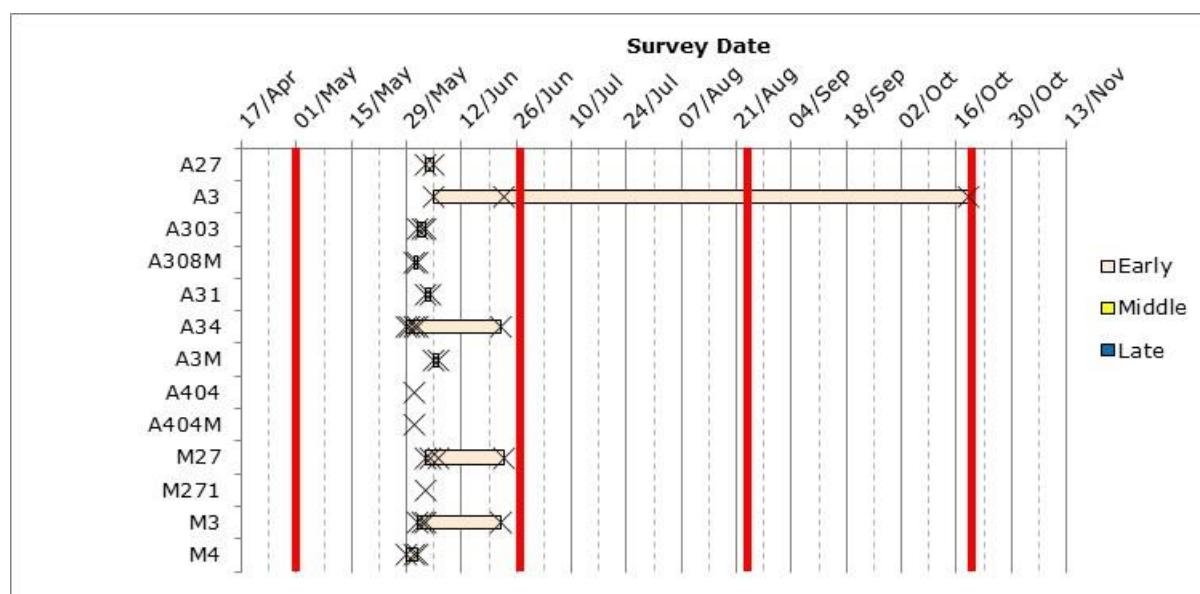


Figure 3.2 Spread of survey dates in 2020 in Area 3 (Lane 1 surveys)

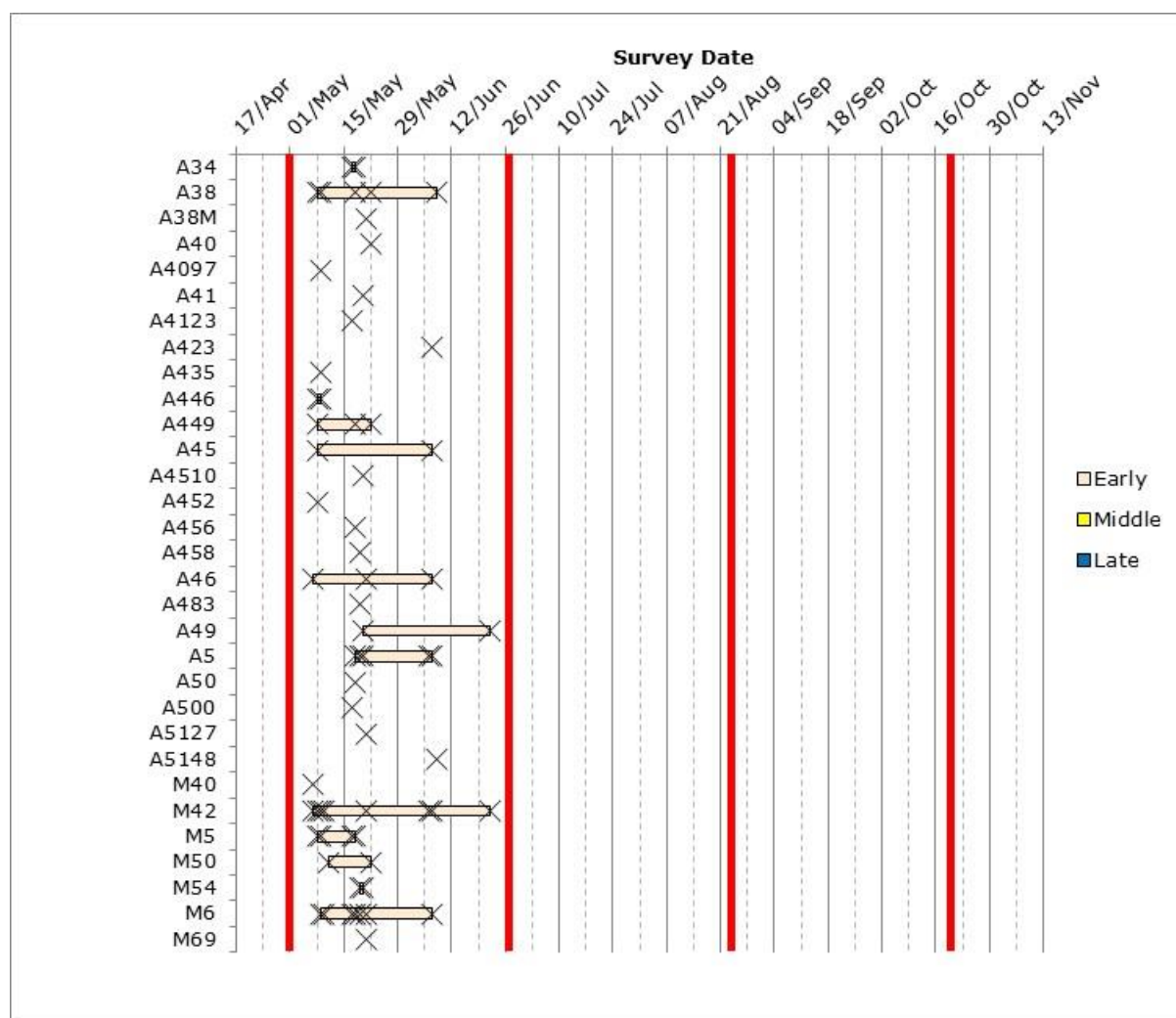


Figure 3.3 Spread of survey dates in 2020 in Area 9 (Lane 1 surveys)

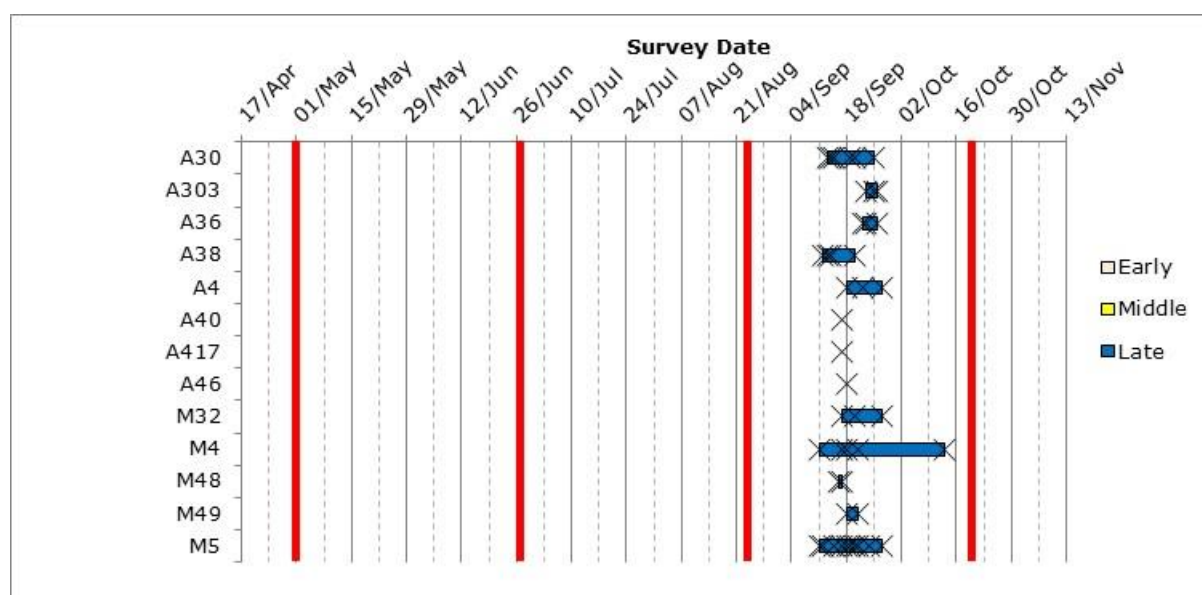
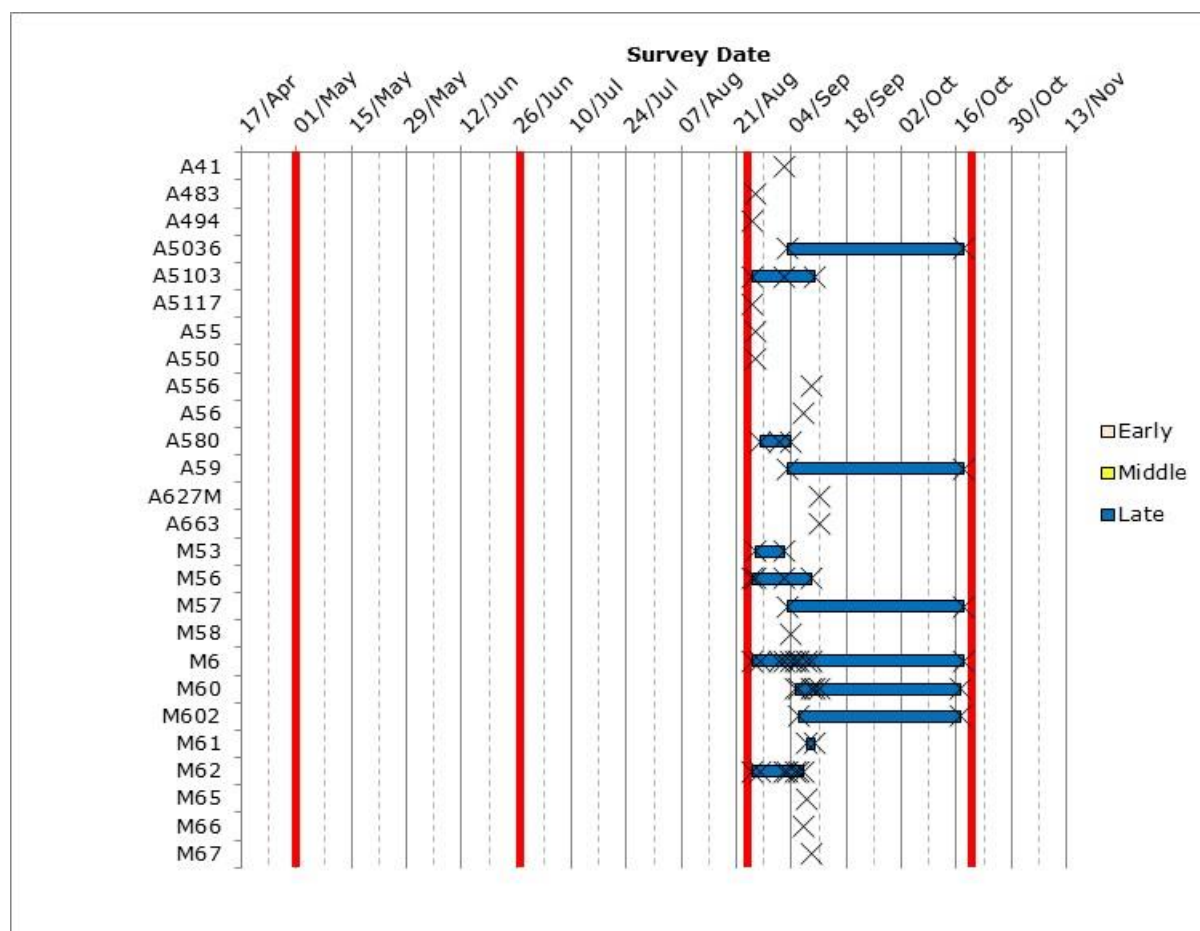


Figure 3.4 Spread of survey dates in 2020 in South West (Lane 1 surveys)



**Figure 3.5 Spread of survey dates in 2019 in Area 10 (Lane 1 surveys)**

From these graphs it can be seen that not only were these Areas surveyed over a period of more than 28 days, so were several of the roads within the Areas (with the exception of Area 3 which is discussed below). While this will therefore result in less robust CSC data, it will still be possible to consider the SC values for use in future LECF calculations.

Area 3 (see Figure 3.2) had some data in the database outside the target survey period. This was caused by one section being moved from the M25 DBFO to Area 3 after the surveys were conducted. The remaining data for this Area was collected within 28 days.

## 4 LECF Calculation and visual analysis

### 4.1 Early Period LECFs

An examination of the survey rotation for the past three years of surveys found that all Areas with a target of an Early survey in 2020 had a suitable combination of survey periods for calculation of the LECFs.

Visual analysis carried out on the early survey data identified a number of sections that needed to be removed from the LECF analysis due to anomalies (localised differences between the survey data from different years, for example, as a result of maintenance). The length of data removed and the length with skid resistance data remaining is shown in Table 4.1.

**Table 4.1 Data removed as a result of visual analysis for early surveys**

Area	Length removed by analysis (km)	Remaining length with data (km)
Area 3	91.52	1,188.75
Area 9	138.38	1,633.17
Area 13	57.40	761.84
Area 14	36.89	620.54

Eleven localities which had early surveys in 2020 had a significant length of data removed (>10km). These were:

- A3, A34, M3, M4 and M27 in Area 3
- A5 M6 and M54 in Area 9
- M6 in Area 13
- A1 and A1M in Area 14

Most localities that had sufficient data to calculate a road LECF prior to the visual analysis still had enough data for a road LECF calculation after the removal of anomalies identified by the visual analysis. The exception to this was A458 in Area 9.

### 4.2 Middle Period LECFs

As with the early period surveys, the past years' survey rotation was examined prior to calculation of the mid period LECFs. It was found that the standard past years' survey rotation was suitable for all Areas.

The visual analysis of the middle period surveys identified a number of sections for removal from the analysis, spread over the Areas as shown in Table 4.2.

**Table 4.2 Data removed as a result of visual analysis for middle surveys**

Area	Length removed by analysis (km)	Remaining length with data (km)
Area 6	85.45	1,242.45
Area 7	107.59	1,554.80
Area 8	69.33	791.35
Area 12	58.83	1,133.13

Eleven localities had a significant length of data removed (>10km). These were:

- A12, A14 and A47 in Area 6
- A1, A45 and M1 in Area 7
- A14 and M1 in Area 8
- A180, M18 and M62 in Area 12

All localities that had enough data to calculate a road LECF prior to the visual analysis still had sufficient data following the removal of anomalies identified by the visual analysis.

### 4.3 Late Period LECFs

An examination of the survey rotation for the past three years of surveys found that all but two Areas/DBFOs (South West and A69 DBFO) had a suitable combination of survey periods for calculation of the LECFs.

The South West Area contains some data where the survey rotation for the previous three years is not suitable; the approach taken is discussed in section 2

The A69 DBFO was surveyed slightly outside of its target survey period in 2017. Therefore, an additional analysis was run for this Area with extended survey dates for 2017 to account for this.

The visual analysis carried out on the late period surveys identified a number of sections for removal. The lengths removed and the remaining lengths used in the LECF calculation, by Area, are shown in Table 4.3.

**Table 4.3 Data removed as a result of visual analysis for late surveys**

Area	Length removed by analysis (km)	Remaining length with data (km)
South West	71.30	1778.60
Area 4	146.10	907.87
Area 10	85.16	1192.29
A1DD DBFO	39.67	81.88
A69 DBFO	49.27	129.36
M25 DBFO	239.67	748.70
Second Severn Crossing DBFO	17.59	10.42

Eighteen localities had significant lengths of data removed (>10km). These were:

- A30, A303 and M5 in South West
- A23, A27, M2, M20 and M23 in Area 4
- M6, M60 and M62 in Area 10
- A1M in A1 DD DBFO
- A69 in A69 DBFO
- M1, M4, M25 and M26 in M25 DBFO
- M4 in Second Severn Crossing DBFO

All but three localities that had sufficient data to calculate a road LECF prior to the visual analysis still had enough data for a road LECF calculation after the removal of anomalies identified by the visual analysis. These localities were the A46 in South West and the A282 and M26 in M25 DBFO.

The remaining length of the second Severn crossing DBFO was lower than the threshold for a road LECF and it was therefore not deemed suitable for use. Instead the LECFs for the corresponding roads in Area South West were applied.

## **4.4 DBFOs**

LECFs are also calculated, where possible, for any DBFOs that have data loaded into HAPMS. No issues were identified for the A1 Darrington to Dishforth, and M25 DBFOs. Some additional work was required for the A69 DBFO and Second Severn Crossing DBFO which are discussed below along with observations on the A249 DBFO and the remaining DBFO data loaded into HAPMS.

### **4.4.1 A69 DBFO**

For the 2017 survey the A69 DBFO was targeted for a Late survey. However the survey contractor undertook the survey using the old survey boundaries (prior to the change in 2010; see Appendix A.2). This is believed to be due to contractual requirements that the DBFO is working under resulting in the survey periods not being updated to reflect the dates used on the majority of the Highways England SRN.

In terms of the current survey periods, the surveys were undertaken in the two days before the start of the Late survey period. It was therefore decided that an additional analysis would be undertaken to calculate the LECF values for this DBFO by extending the late survey period by the required amount (for the 2017 data).

### **4.4.2 Second Severn crossing DBFO**

The Second Severn Crossing DBFO contains just over 25km of main carriageway and approximately 2km of slip roads. This is only just over the threshold for a road LECF, and therefore it is likely that in most years (due to maintenance or anomalous data) this DBFO would not have sufficient data for the calculation of a LECF. However, the DBFO is wholly contained within the South West Area (which is surveyed in the same survey period) and other lengths of the two roads which make up the DBFO are also present in this Area. Therefore, in years with low survey coverage (or high maintenance) the LECFs calculated for the South West can be used for this DBFO.

For the 2020 survey approximately 9km of data was available for the LECF calculation. Therefore, the LECF values generated for the corresponding roads in the South West Area were applied.

#### 4.4.3 A249 DBFO

The A249 DBFO was surveyed with a suitable survey rotation between 2017 and 2020 (middle, early, late, then middle) and as such it was possible to calculate an LECF (it only contains one road) for this DBFO for the 2020 data.

It was noted that the 2019 survey data was loaded in February 2020, after the process for the calculation of the 2019 LECFs was complete, which meant that no LECF was calculated for the DBFO for the 2019 surveys. In addition, the 2020 data was loaded after the other middle season survey data. It is therefore recommended that the A249 DBFO company are notified that if they wish to have LECFs calculated and applied in HAPMS, they should make sure that their data is loaded on a similar timescale to the Highways England SASS data. In addition, they should make sure that the data continues to be collected using a suitable survey rotation. The recommended rotation (based on the current available data) is shown in Table 4.4.

**Table 4.4 Recommended survey rotation for A249 DBFO**

	2021	2022	2023	2024	2025	2026
A249 DBFO	Early	Late	Middle	Early	Late	Middle

#### 4.4.4 Other DBFOs loaded into HAPMS

This year data was also loaded into HAPMS for the A1M, and A417/A419 DBFOs. However, both of these appear to be undertaking surveys for a Mean Summer Skid Coefficient (MSSC) style calculation (i.e. were surveyed in all three survey periods) and the data are therefore unsuitable for calculating LECF values.

### 4.5 Surveys in lanes other than lane 1

Surveys were loaded into HAPMS for lanes other than lane 1 for some Areas and DBFOs. In the locations where LECFs were calculated (Areas SW, 6, 8, 10 and the DBFOs A249, A69, M25 and Second Severn Crossing) the outer lanes surveys were completed in the same survey period as the lane 1 surveys. Therefore, the LECFs calculated for the lane 1 surveys can be applied to the additional surveys.

## 5 Additional observations and further work

### 5.1 Applying LECFs on concrete sections

During the calculation of the 2007 LECFs (Donbavand & Brittain, 2007; Brittain, 2007) it was identified that concrete surfaces did not appear to experience seasonal variation to the same degree as other surface types. Therefore, an LECF of 1.000 (i.e. no correction) was applied to concrete sections. To determine if this assumption remains valid an additional investigation has been carried out in parallel to the calculation of the LECF values in subsequent years.

The effectiveness of the LECF correction can be determined by comparing the current year's SC data (i.e. the data prior to being corrected for seasonal variation) and the current year's CSC data (i.e. seasonally corrected data) to the average of the past years' SC data. The process of applying the LECF correction should make the average of this year's CSC data match the average of the past three years. Therefore, in this data set, the past years' average is effectively the expected value. If the LECF is reducing seasonal variation then the difference between the CSC data and this expected value should be less than the difference between the SC data and the same expected value. This can be visualised by plotting the distribution of these differences. In these plots a data set which has low seasonal effects would have a mean close to zero (i.e. on average the value of the data set is the same as the average of the past years' data). In addition, a seasonally corrected data set should have a lower standard deviation for these differences (i.e. more of the data set is closer to the past years' data).

This analysis was undertaken for HRA sections (approx. 2,400km), Thin Surfacing (TSCS) sections (approx. 9,000km) and concrete sections (approx. 400km), and the results are presented in Figure 5.1, Figure 5.2 and Figure 5.3 respectively. For the concrete sections (Figure 5.3), the CSC value shown is the value that would have been generated if the LECF calculated for that road/Area was used rather than the factor of 1.000 that was actually applied.

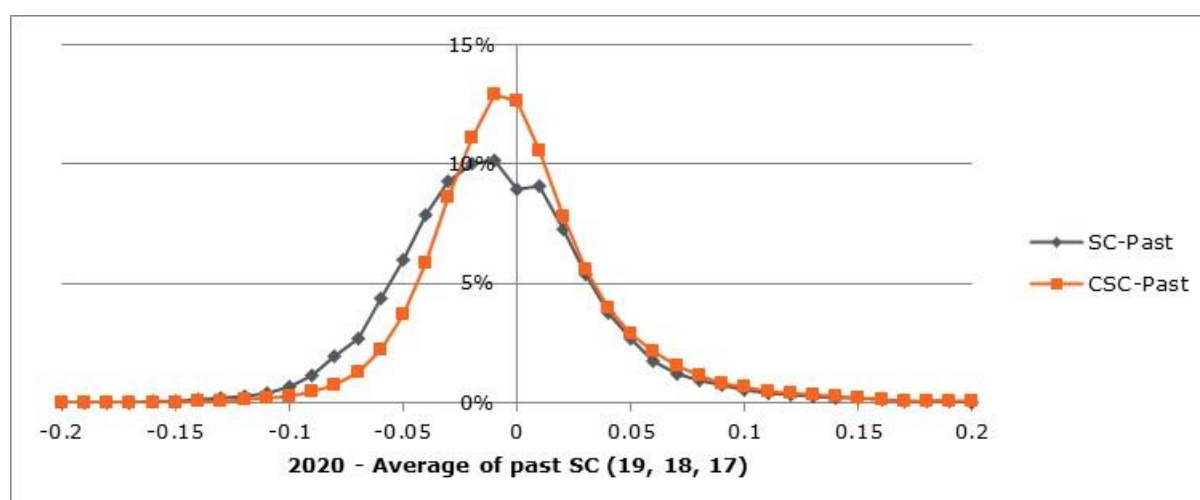
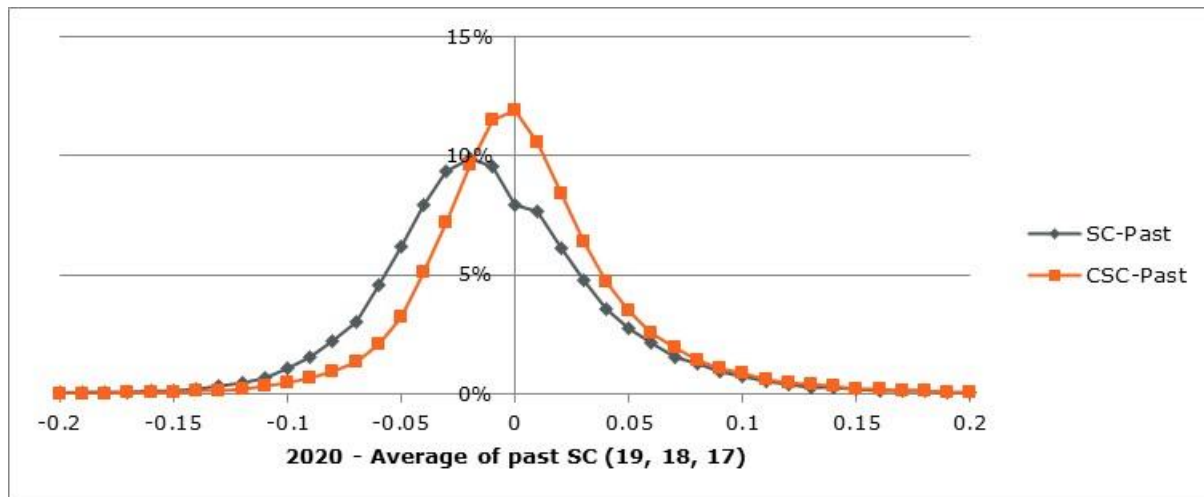
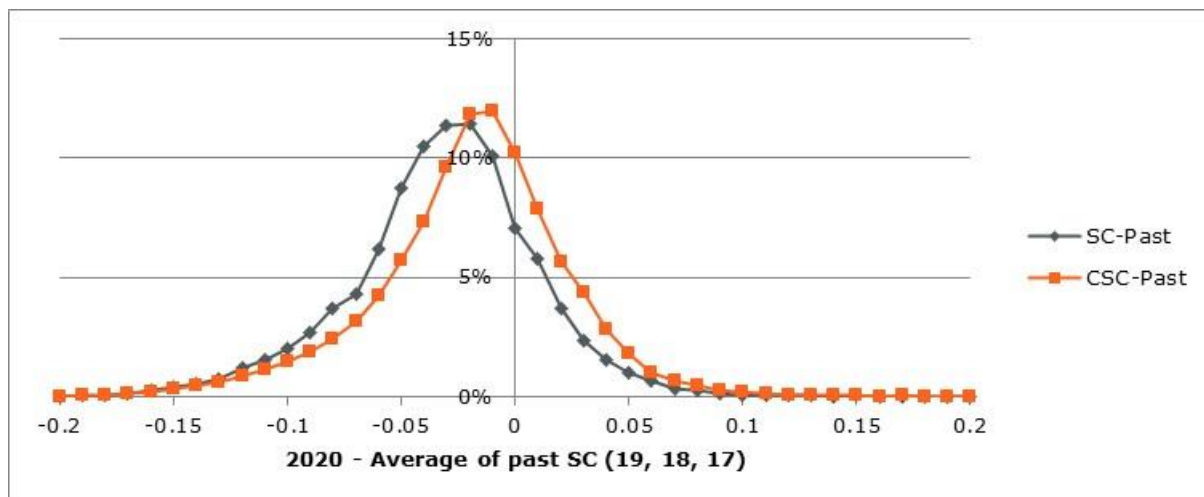


Figure 5.1 2020 data – Past year average for HRA surveys



**Figure 5.2 2020 data – Past year average for TS surveys**



**Figure 5.3 2020 data – Past year average for concrete surveys**

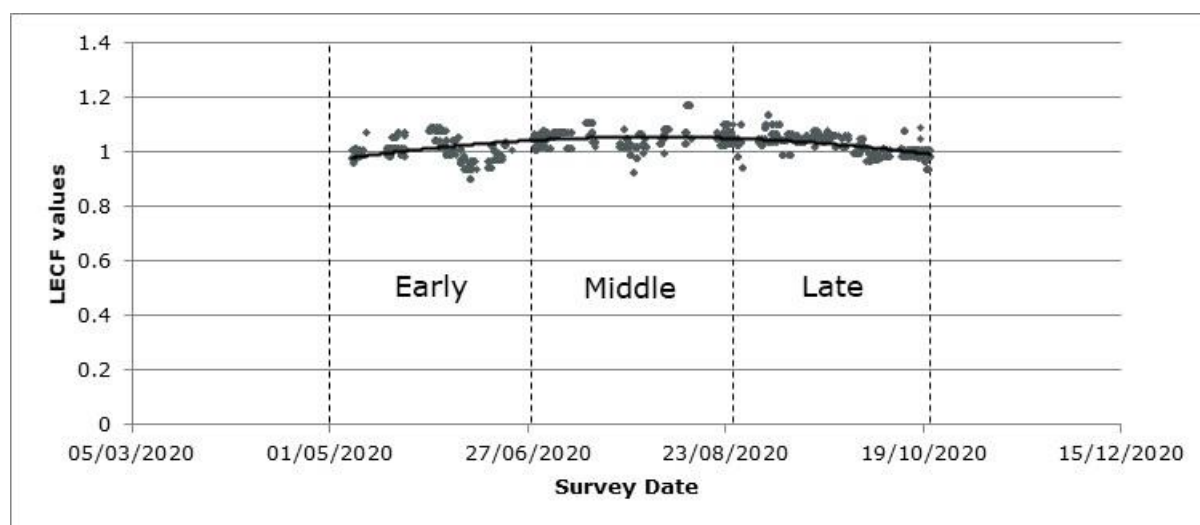
As expected, the LECFs reduce the seasonal variation for the HRA and TSCS sections. This can be seen by the narrower distribution/higher mid peak (with mean closer to zero) in Figure 5.1 and Figure 5.2 for the 2020 CSC minus the average of past SC values in comparison to the same distribution for the 2020 SC data. The concrete sections (Figure 5.3) show a slight shift towards a mean of zero but no significant tightening of the distribution/increase in the mid peak. This verifies the assumption that concrete sections do not experience the same seasonal variation as HRA and TSCS sections.

It can also be seen that the distribution of the 2020 SC data minus the average of past SC values was just below zero for both the HRA and TSCS sections. This means in comparison to the past three years (i.e. the long term seasonal variation) this was a slightly lower skid resistance year.

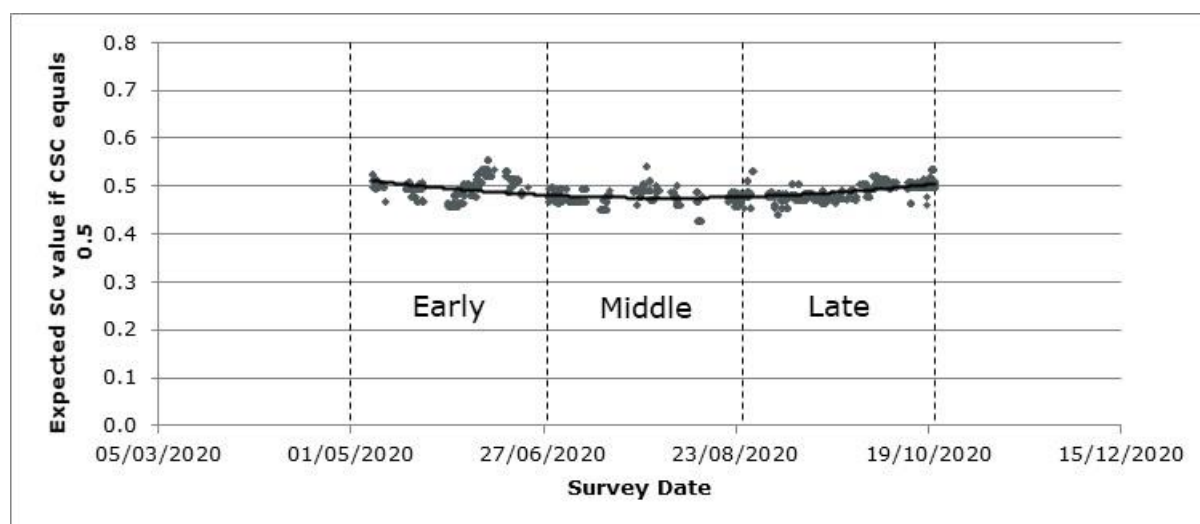
## 5.2 LECF Distribution by date

As stated previously, the levels of skid resistance vary during the course of the year. To investigate this effect and to monitor the suitability of the survey dates, the spread of LECF values was plotted. This investigation has been carried out at the same time as the LECF calculation since 2008 and is discussed further in the annual reports on the LECF calculation for each year.

The first part of this analysis is to plot the LECF values by date (2020 data shown in Figure 5.4), which gives an impression of the spread of values. However, this can be hard to interpret in terms of SC data and therefore a second plot is generated. This second plot is created by taking a typical value for CSC (0.5 is used in this case) and dividing by the LECF to determine an estimated SC value (2020 data shown in Figure 5.5).



**Figure 5.4 Distribution of LECF values by date from SASS analysis**



**Figure 5.5 Expected SC if CSC equals 0.5 from SASS analysis**

From the analysis of the 2020 data, it can be seen that there is quite a flat trend with regards to variation over the course of the survey season. However, the lowest values appear to occur in the middle of the middle period. It is possible that reduced traffic due to

lockdown restrictions for COVID-19 may explain this lack of variation. It is recommended that the suitability of the survey periods should continue to be reviewed on an annual basis (as part of the LECF calculation and as part of the benchmark sites work).

### 5.3 Usage of LECF values by length

Figure 5.6 shows the length of the network to which each LECF value was applied (excluding concrete sections). The weighted average of the LECF for 2020 is 1.02 which corresponds to a slightly lower skid resistance year compared to the previous three years (as noted in section 5.1).

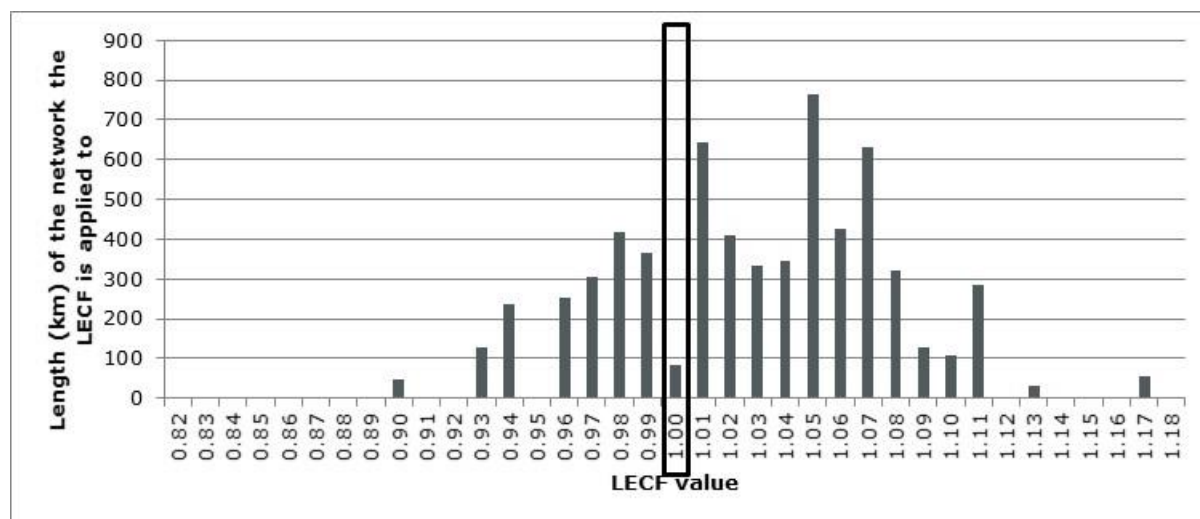


Figure 5.6 Length to which each LECF was applied

### 5.4 Seasonal trend and the skid resistance benchmark sites

As noted in sections 5.1 and 5.3 this analysis has identified that 2020 appears to be a slightly lower skid resistance year compared to the previous three years. In addition to the work done in analysing the SASS network data and resulting LECFs, Highways England also commissions annual surveys of benchmark sites to examine long term trends in skid resistance on the network. These sites are surveyed three times a year (once in each survey period) in addition to the routine annual survey. The analysis of the 2020 benchmark sites data is discussed in (Brittain, 2021). That analysis also identified that 2020 appeared to be a “slightly low skid resistance year” in comparison to the average of the previous three years.

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## 6 Summary

### 6.1 Lane 1 survey coverage

When combined together (and considering only the lengths used for the calculation of LECF values) 98.6% of the length of the Highways England Areas had data coverage. Individually each of the Highways England Areas had at least 96.7% data coverage.

Survey coverage for the DBFOs with defined survey rotations for LECF calculation (A1 DD, A249, A69, M25 and Second Severn crossing) also had high survey coverage and provided data suitable for the LECF calculation. Two more DBFOs had data loaded into HAPMS, however the survey pattern suggested the MSSC approach is being used for the DBFO and was therefore unsuitable for LECF calculation.

The skid resistance survey contract states that survey data should be loaded into HAPMS, pass independent checks and be ready for further analysis (i.e. the LECF calculation) by specified dates. For the 2020 surveys these dates were not met but this was in part due to changes in the HAPMS support team within Highways England.

### 6.2 Suitability of data loaded

During the processing of the data for the LECFs a few anomalies were found with the data. The types of anomalies identified were:

1. Possible misalignment
2. Very low values
3. Invalid data entered as zeros
4. Unusual downward slope to values in a survey

The lengths identified by this analysis were supplied to Highways England and the survey contractor for review and where necessary amendment.

### 6.3 Lane 1 survey dates and timescales

At the time of the surveys all of the Highways England Areas were surveyed within the target survey period. After the surveys were completed, one section was reassigned from the M25 DBFO to Area 3 which meant that data was no longer for the correct survey period.

The spread of survey dates exceeded 28 days for Areas South West, 9 and 10. On examination of the localities (road and Area combination) within the affected Areas it could be seen that there were several localities where the spread of the survey data was also above this range. As only one LECF is applied to each locality this spread in survey data will result in a reduced robustness to the seasonal correction of the data for that locality. Therefore, where possible the spread of survey dates for each locality should be kept as small as possible.

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## 6.4 Calculation of LECF

The modified LECF procedure used since 2007 (Brittain, 2007) was used again for the 2020 data. To aid the visual analysis of the data the automated analysis developed during 2008 (Brittain, 2009) was also used.

The survey rotation pattern established for the Highways England Areas meant that, for the lane 1 surveys, most of the Areas had valid past years' data in the standard years (2017, 2018 and 2019). However, the 2017 survey of the A69DBFO was undertaken slightly outside of the target dates and as such an additional analysis (with extended dates for the 2017 data) was carried out for this DBFO. In addition, prior to the 2018 skid resistance surveys Areas 1 and 2 were combined into one area known now as South West. Areas 1 and 2 had different survey rotations and as such an additional analysis (using 2018, 2019 and 2020 for the past years' dataset) was also carried out for this Area in the 2020 calculation.

Visual analyses of the survey data were carried out which identified several sections for removal. All but four localities that had sufficient data to calculate the more robust road LECF prior to the visual analysis still had enough data for that calculation following removal of lengths identified during the visual analysis.

As with previous years, the lane 1 LECFs were calculated for DBFOs with sufficient data loaded into HAPMS. This year LECFs were calculated for the A1DD, A249, A69, M25 and Second Severn Crossing DBFOs.

## 6.5 Surveys of lanes other than lane 1

Surveys were loaded into HAPMS for lanes other than lane 1 for some Areas and DBFOs. In the locations where LECFs were calculated these additional surveys were done in the same period as the lane 1 surveys. Therefore the LECFs calculated for the lane 1 surveys are suitable for use with the additional lane surveys.

## 6.6 Seasonal variation of concrete sections

An investigation into the application of LECFs on concrete sections confirmed the findings from previous studies that concrete sections do not experience the same seasonal variation as asphalt sections.

## 6.7 Variation of LECF values during the survey season

As with previous years, the spread of LECF values (by date) was investigated. This analysis suggests that for 2020 there was very little within year variation. It is possible that reduced traffic due to lockdown restrictions for COVID-19 may explain this lack of variation. In addition the weighted average LECF value for the network was 1.02 showing that the skid resistance of the network was slightly lower than the average of the previous three years. The benchmark sites analysis (Brittain, 2021) also identified 2020 as slightly lower than the average of the previous three years.

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## References

*Note: this list of references contains both unpublished reports (UPR) and client project reports (CPR) produced for Highways England. Please make a personal application to Highways England if you wish to obtain a copy of either a UPR or CPR.*

Brittain, S. (2007). *Task 1 Methodology for deriving Local Equilibrium Correction Factors for the 2007 SCRIM surveys (UPR/IE/213/06)*. Wokingham: TRL.

Brittain, S. (2009). *Task 1: Methodology for deriving Local Equilibrium Correction Factors for the 2008 SCRIM surveys (CPR 215)*. Wokingham: TRL.

Brittain, S. (2018). *Calculation of Local Equilibrium Correction Factors for the 2017 Skid resistance surveys (PPR862)*. Wokingham: TRL.

Brittain, S. (2021). *Skid resistance benchmark surveys 2020 (PPR 989)*. Wokingham: TRL.

DMRB CS 228. (n.d.). *Design Manual for Roads and Bridges Volume 7 Section 1, CS 228 Skidding resistance*. London: The Stationery Office.

Donbavand, J., & Brittain, S. (2007). *Task 3: Review of Correction Factors (UPR/IE/213/06)*. Wokingham: TRL.

Donbavand, J., & Kennedy, C. (2010). *Task 2: Benchmark Surveys 2009 (UPR/IE/07/08)*. Wokingham: TRL.

## Appendix A Calculating the LECF

### A.1 Derivation of LECF

The following equation is used to calculate an LECF:

$$LECF = \frac{\text{Local Equilibrium Skid Coefficient (LESC)}}{\text{Local Mean Skid Coefficient (LMSC)}} \quad \text{A.1}$$

where LESC is the estimate of the local, long term skid resistance obtained from the average of the previous 3 years' surveys and LMSC is the average of the current year's survey in the same locality as the LESC.

The LESC incorporates one survey from each of the 3 survey periods to avoid bias in the estimate of long term skid resistance. Table A.1 shows all possible combinations of early (E), middle (M) and late (L) survey periods for the past years and current year that were used to calculate a LECF. For each current year survey period a length-weighted average<sup>1</sup> LECF was calculated for three localities: each road individually within each Area, for all roads within each Area, and for all roads in all Areas.

**Table A.1 LECF Calculation**

Combination of past years' survey periods				Current survey period	LECF calculation
2017	2018	2019	2020		All combinations combined to give length weighted value for the 3 current year survey periods for each Area, road and survey period
E	M	L	E	E	<ul style="list-style-type: none"> <li>By road</li> <li>By Area</li> <li>By Survey period</li> </ul>
E	L	M	E		
M	E	L	E		
M	L	E	E		
L	E	M	E		
L	M	E	E		
E	M	L	M	M	<ul style="list-style-type: none"> <li>By road</li> <li>By Area</li> <li>By Survey period</li> </ul>
E	L	M	M		
M	E	L	M		
M	L	E	M		
L	E	M	M		
L	M	E	M		
E	M	L	L	L	<ul style="list-style-type: none"> <li>By road</li> <li>By Area</li> <li>By Survey period</li> </ul>
E	L	M	L		
M	E	L	L		
M	L	E	L		
L	E	M	L		
L	M	E	L		

<sup>1</sup> An Average of all six valid combinations of past and current surveys, weighted by the length of road that each individual combination was based on.

The LECFs are applied by locality because the influence of climate and the type of road could affect the within year skid resistance variation and hence the LECF. Table A.2 shows the order of LECF allocation that is applied to each road. If an LECF by road does not exist or the length of road data is less than 25km<sup>2</sup>, the Area LECF is applied; this also occurs when a given road is surveyed but does not have a valid combination of past years' data. If an LECF by road or by Area does not exist, an LECF by survey period is applied; in practice this has only occurred in 2005 on a few sections where there was no valid past years' data for any road in a given Area and survey period. There has been no occurrence of this since then.

**Table A.2 Allocation of LECFs**

Order of allocation	Calculation type	Description
1	Road	Calculation by individual road within an Area
2	Area	Calculation by all roads within an Area
3	Survey Period	Calculation by all roads and all Areas

## A.2 Survey period boundaries

The current survey period boundaries for skid resistance surveys are given in Table A.3.

**Table A.3 Survey period boundaries from the 2010 survey season onwards**

Survey Period	Start Date	End Date
Early	1 May	27 June
Middle	28 June	24 August
Late	25 August	20 October

These dates were developed based on work carried out on the Highways England benchmark sites, which are used to monitor long term trends in skid resistance, (Donbavand & Kennedy, 2010). Prior to 2010 the survey periods were the dates shown in Table A.4.

**Table A.4 Survey period boundaries prior to the 2010 survey season**

Survey Period	Start Date	End Date
Early	1 May	20 June
Middle	21 June	10 August
Late	11 August	30 September

To help smooth the transition from the MSSC (Mean Summer Skid Coefficient) approach to the SASS (Single Annual Skid Survey) method, introduced in 2005, extended survey period boundaries were used when extracting the data. This approach was taken to maximise the lengths upon which the LECF was calculated. This was originally required due to the smaller time scales allowed for the survey season, which on occasion resulted in surveys conducted outside of the planned dates. Due to the extension of the survey season in 2010, extending

<sup>2</sup> This was implemented to ensure that the LECFs by road were not based on small lengths that could have been unrepresentative of the overall road length that it was applied to. It was originally set at 50km, however after investigation into the effects during the 2007 LECF calculation it was reduced to 25km.

the dates for extraction of data is no longer necessary. The dates for these extended survey periods are shown in Table A.5.

**Table A.5 Extended survey period boundaries for data before 2010**

Survey Period	Start Date	End Date
Early	1 May	27 June
Middle	14 June	17 August
Late	4 August	7 October

### A.3 Construction cut-off

Data from roads re-surfaced during the 5 year period covering the current year, 3 past years and a wear in year were excluded from the analysis because a comparison in skid resistance between past years and the current year was not valid. To ensure that these sections were not included in the analysis a construction cut-off date was employed to ignore any such maintenance. For the 2018 LECFs this meant that the construction cut off was 1st May 2014. Employing an extra gap of one year before the first year of the past years' data means that new surfaces will have had time for the skid resistance level to stabilise; therefore, the within year skid resistance variation for the data will not be influenced by early life skid resistance changes.

### A.4 Concrete sections

It was observed in 2007 (Donbavand & Brittain, 2007; Brittain, 2007) that concrete sections do not experience seasonal variation in the same manner as asphalt sections. Highways England therefore decided that concrete sections would have an LECF of 1.00 applied (i.e. no correction). Given this, it is therefore necessary to exclude all sections which include concrete from the LECF analysis.

### A.5 Visual Analysis

A visual analysis of the survey data is carried out in order to identify data which do not conform with the general pattern; these data can then be investigated further and, where appropriate, removed from the LECF calculation. The visual analysis process consists of an inspection of line charts of the current and historic data, and can be used to identify sections which appear to have been resurfaced (but do not have appropriate construction records) and other anomalies (e.g. negative skid resistance values). Once a section has been identified it is removed if more than 20% of the section is deemed to be unrepresentative.

### A.6 Verification of LECF values

Once the LECF values have been calculated they are then verified in order to identify any inconsistencies. Two processes are used to do this:

1. The difference (absolute value) between the past years' values and the current year's CSC values are compared to the difference between the past years' values and the current year's SC values (values which have not had the LECF correction applied).

If there is an issue with the LECF then the current year's SC values will be closer to the past years' values than the current year's CSC values.

2. The line charts for the current year's CSC values against the past years' CSC values are inspected and compared to the line chart for the current year's SC values against the past years' CSC values. If an LECF value is unsuitable then the lines seen in these charts would have similar shapes, i.e. they are representative of the same surface, but the average values would be different.

The verification processes were found to be particularly useful during the calculation of the Early 2007 LECFs. During the survey period, one of the survey machines underwent a repair. The verification process identified that the skid resistance values were found to be characteristically different before and after the repair. This was particularly relevant to the M25 which had surveys carried out with the machine in both states. This was resolved by producing two LECF values for the M25 (along with two "Area" LECFs), one for before the repair and one for after.

### A.7 Example detail of LECF calculation – Area 3 (Late 2005 surveys)

The tables below show the LECF calculation process for late period surveys in Area 3. Table A.6 shows the length weighted LECF calculated for each road that had valid combinations of current year and past years' data. These values were applied as the preferred option.

Table A.7 shows the LECF calculated for all roads in the Area, which was applied as a secondary option where there were roads with insufficient valid data for a LECF to be calculated or if the LECF was based on less than 25km of data. These two options would provide a LECF for the majority of roads. The final option was to apply a national LECF calculated by survey period, which is shown in Table A.8. This is based on all roads and Areas and reflects the seasonal variation experienced for England as a whole for the late period survey in comparison to the surveys in the previous years.

The LECF method applied to Area 3 2005 late surveys is shown in Table A.9. Seven of the road based LECFs were applied, with four roads requiring the Area LECF; two of which were due to the application of the minimum 25km data rule.

**Table A.6 LECF calculated by road**

Area	Road	Calculation Length (km)	LESC	LMSC	LECF
Area 3	A27	83	0.565	0.577	0.980
Area 3	A3	112	0.516	0.492	1.049
Area 3	A303	138	0.523	0.519	1.008
Area 3	A308M	0	-	-	-
Area 3	A31	101	0.543	0.495	1.097
Area 3	A34	139	0.530	0.535	0.991
Area 3	A3M	0	-	-	-
Area 3	A404	37	0.576	0.574	1.004
Area 3	A404M	16	0.565	0.575	0.982
Area 3	M27	3	0.532	0.519	1.026
Area 3	M271	28	0.499	0.500	0.998
Area 3	M3	288	0.522	0.520	1.003
Area 3	M4	77	0.524	0.521	1.005

**Table A.7 LECF calculated by Area**

Area	Calculation Length (km)	LESC	LMSC	LECF
Area 3	1023	0.530	0.523	1.013

**Table A.8 LECF calculated by survey period**

Area	Calculation Length (km)	LESC	LMSC	LECF
All Areas	5423	0.496	0.481	1.031

**Table A.9 Application of LECF to 2005 surveys (Area 3 – late season surveys)**

Area	Road	LECF	Calculation Type
Area 3	A27	0.979	Road
Area 3	A3	1.049	Road
Area 3	A303	1.007	Road
Area 3	A308M	1.013	Area
Area 3	A31	1.097	Road
Area 3	A34	0.991	Road
Area 3	A3M	1.013	Area
Area 3	A404	1.004	Road
Area 3	A404M	1.013	Area
Area 3	M27	1.013	Area
Area 3	M271	0.998	Road
Area 3	M3	1.003	Road
Area 3	M4	1.005	Road

## Appendix B 2020 LECF values

Note: the dates shown here refer to the cut off (applied at midnight) for the surveys, i.e. a survey end date of 28<sup>th</sup> June here would include all of the surveys on the 27<sup>th</sup> but none of the surveys on the 28<sup>th</sup>.

**Table B.1 Early season surveys**

Area	Road	LECF	Type	Survey period start date	Survey period end date
Area 3	A27	1.039	AREA	01/05/2020	28/06/2020
Area 3	A3	1.004	AREA & ROAD	01/05/2020	28/06/2020
Area 3	A303	1.018	AREA & ROAD	01/05/2020	28/06/2020
Area 3	A308M	1.039	AREA	01/05/2020	28/06/2020
Area 3	A31	0.996	AREA & ROAD	01/05/2020	28/06/2020
Area 3	A34	1.09	AREA & ROAD	01/05/2020	28/06/2020
Area 3	A3M	1.039	AREA	01/05/2020	28/06/2020
Area 3	A404	1.039	AREA	01/05/2020	28/06/2020
Area 3	A404M	1.039	AREA	01/05/2020	28/06/2020
Area 3	M27	0.991	AREA & ROAD	01/05/2020	28/06/2020
Area 3	M271	1.039	AREA	01/05/2020	28/06/2020
Area 3	M3	1.079	AREA & ROAD	01/05/2020	28/06/2020
Area 3	M4	1.075	AREA & ROAD	01/05/2020	28/06/2020
Area 9	A34	1.01	AREA	01/05/2020	28/06/2020
Area 9	A38	0.982	AREA & ROAD	01/05/2020	28/06/2020
Area 9	A38M	1.01	AREA	01/05/2020	28/06/2020
Area 9	A40	1.06	AREA & ROAD	01/05/2020	28/06/2020
Area 9	A4097	1.01	AREA	01/05/2020	28/06/2020
Area 9	A41	1.01	AREA	01/05/2020	28/06/2020
Area 9	A4123	1.01	AREA	01/05/2020	28/06/2020
Area 9	A423	1.01	AREA	01/05/2020	28/06/2020
Area 9	A435	1.01	AREA	01/05/2020	28/06/2020
Area 9	A446	1.01	AREA	01/05/2020	28/06/2020
Area 9	A449	1.01	AREA	01/05/2020	28/06/2020
Area 9	A45	0.97	AREA & ROAD	01/05/2020	28/06/2020
Area 9	A4510	1.01	AREA	01/05/2020	28/06/2020
Area 9	A452	1.01	AREA	01/05/2020	28/06/2020
Area 9	A456	1.01	AREA	01/05/2020	28/06/2020
Area 9	A458	1.01	AREA	01/05/2020	28/06/2020
Area 9	A46	0.956	AREA & ROAD	01/05/2020	28/06/2020
Area 9	A483	1.01	AREA	01/05/2020	28/06/2020
Area 9	A49	1.069	AREA & ROAD	01/05/2020	28/06/2020
Area 9	A5	1.05	AREA & ROAD	01/05/2020	28/06/2020
Area 9	A50	1.01	AREA	01/05/2020	28/06/2020
Area 9	A500	1.014	AREA & ROAD	01/05/2020	28/06/2020
Area 9	A5127	1.01	AREA	01/05/2020	28/06/2020
Area 9	A5148	1.01	AREA	01/05/2020	28/06/2020
Area 9	M40	0.976	AREA & ROAD	01/05/2020	28/06/2020

Area	Road	LECF	Type	Survey period start date	Survey period end date
Area 9	M42	1.006	AREA & ROAD	01/05/2020	28/06/2020
Area 9	M5	0.985	AREA & ROAD	01/05/2020	28/06/2020
Area 9	M50	1.073	AREA & ROAD	01/05/2020	28/06/2020
Area 9	M54	1.01	AREA	01/05/2020	28/06/2020
Area 9	M6	0.99	AREA & ROAD	01/05/2020	28/06/2020
Area 9	M69	1.01	AREA	01/05/2020	28/06/2020
Area 13	A585	0.999	AREA & ROAD	01/05/2020	28/06/2020
Area 13	A590	0.981	AREA & ROAD	01/05/2020	28/06/2020
Area 13	A595	1.037	AREA & ROAD	01/05/2020	28/06/2020
Area 13	A66	1.023	AREA & ROAD	01/05/2020	28/06/2020
Area 13	A69	0.994	AREA	01/05/2020	28/06/2020
Area 13	A7	0.994	AREA	01/05/2020	28/06/2020
Area 13	A74M	0.994	AREA	01/05/2020	28/06/2020
Area 13	M55	1.007	AREA & ROAD	01/05/2020	28/06/2020
Area 13	M6	0.971	AREA & ROAD	01/05/2020	28/06/2020
Area 14	A1	0.962	AREA & ROAD	01/05/2020	28/06/2020
Area 14	A167	0.944	AREA	01/05/2020	28/06/2020
Area 14	A168	0.944	AREA	01/05/2020	28/06/2020
Area 14	A177	0.944	AREA	01/05/2020	28/06/2020
Area 14	A184	0.944	AREA	01/05/2020	28/06/2020
Area 14	A19	0.944	AREA	01/05/2020	28/06/2020
Area 14	A194M	0.944	AREA	01/05/2020	28/06/2020
Area 14	A195M	0.944	AREA	01/05/2020	28/06/2020
Area 14	A1M	0.934	AREA & ROAD	01/05/2020	28/06/2020
Area 14	A6055	0.944	AREA	01/05/2020	28/06/2020
Area 14	A61	0.944	AREA	01/05/2020	28/06/2020
Area 14	A66	0.901	AREA & ROAD	01/05/2020	28/06/2020
Area 14	A66M	0.944	AREA	01/05/2020	28/06/2020
Area 14	A68	0.944	AREA	01/05/2020	28/06/2020
Area 14	A689	0.944	AREA	01/05/2020	28/06/2020
Area 14	A690	0.944	AREA	01/05/2020	28/06/2020
Area 14	A696	0.944	AREA	01/05/2020	28/06/2020

Table B.2 Middle season surveys

Area	Road	LECF	Type	Survey period start date	Survey period end date
Area 6	A1	1.072	AREA	28/06/2020	25/08/2020
Area 6	A11	1.061	AREA & ROAD	28/06/2020	25/08/2020
Area 6	A12	1.073	AREA & ROAD	28/06/2020	25/08/2020
Area 6	A120	1.011	AREA & ROAD	28/06/2020	25/08/2020
Area 6	A14	1.069	AREA & ROAD	28/06/2020	25/08/2020
Area 6	A47	1.106	AREA & ROAD	28/06/2020	25/08/2020
Area 6	M11	1.073	AREA & ROAD	28/06/2020	25/08/2020
Area 7	A1	1.082	AREA & ROAD	28/06/2020	25/08/2020
Area 7	A14	1.018	AREA & ROAD	28/06/2020	25/08/2020
Area 7	A38	1.027	AREA	28/06/2020	25/08/2020
Area 7	A42	0.979	AREA & ROAD	28/06/2020	25/08/2020
Area 7	A43	0.989	AREA & ROAD	28/06/2020	25/08/2020
Area 7	A45	1.049	AREA & ROAD	28/06/2020	25/08/2020
Area 7	A453	0.996	AREA & ROAD	28/06/2020	25/08/2020
Area 7	A46	1.062	AREA & ROAD	28/06/2020	25/08/2020
Area 7	A5	0.926	AREA & ROAD	28/06/2020	25/08/2020
Area 7	A50	1.027	AREA	28/06/2020	25/08/2020
Area 7	A5111	1.027	AREA	28/06/2020	25/08/2020
Area 7	A516	1.027	AREA	28/06/2020	25/08/2020
Area 7	A52	1.046	AREA & ROAD	28/06/2020	25/08/2020
Area 7	A6	1.027	AREA	28/06/2020	25/08/2020
Area 7	M1	1.02	AREA & ROAD	28/06/2020	25/08/2020
Area 7	M45	1.027	AREA	28/06/2020	25/08/2020
Area 7	M6	1.027	AREA	28/06/2020	25/08/2020
Area 7	M69	1.083	AREA & ROAD	28/06/2020	25/08/2020
Area 8	A1	1.066	AREA & ROAD	28/06/2020	25/08/2020
Area 8	A1081	1.044	AREA	28/06/2020	25/08/2020
Area 8	A11	1.078	AREA & ROAD	28/06/2020	25/08/2020
Area 8	A1307	1.01	AREA & ROAD	28/06/2020	25/08/2020
Area 8	A14	1.051	AREA & ROAD	28/06/2020	25/08/2020
Area 8	A141	1.044	AREA	28/06/2020	25/08/2020
Area 8	A1M	1.015	AREA & ROAD	28/06/2020	25/08/2020
Area 8	A414	1.044	AREA	28/06/2020	25/08/2020
Area 8	A421	1.036	AREA & ROAD	28/06/2020	25/08/2020
Area 8	A428	1.038	AREA & ROAD	28/06/2020	25/08/2020
Area 8	A5	1.008	AREA & ROAD	28/06/2020	25/08/2020
Area 8	A5183	1.044	AREA	28/06/2020	25/08/2020
Area 8	M1	1.048	AREA & ROAD	28/06/2020	25/08/2020
Area 8	M11	1.073	AREA & ROAD	28/06/2020	25/08/2020
Area 12	A1	1.073	AREA	28/06/2020	25/08/2020
Area 12	A1033	1.073	AREA	28/06/2020	25/08/2020
Area 12	A160	1.073	AREA	28/06/2020	25/08/2020
Area 12	A162	1.073	AREA	28/06/2020	25/08/2020
Area 12	A180	1.073	AREA	28/06/2020	25/08/2020

Area	Road	LECF	Type	Survey period start date	Survey period end date
Area 12	A1M	1.029	AREA & ROAD	28/06/2020	25/08/2020
Area 12	A57	1.073	AREA	28/06/2020	25/08/2020
Area 12	A58	1.073	AREA	28/06/2020	25/08/2020
Area 12	A61	1.073	AREA	28/06/2020	25/08/2020
Area 12	A616	1.073	AREA	28/06/2020	25/08/2020
Area 12	A62	1.073	AREA	28/06/2020	25/08/2020
Area 12	A628	1.073	AREA	28/06/2020	25/08/2020
Area 12	A63	1.031	AREA & ROAD	28/06/2020	25/08/2020
Area 12	A631	1.073	AREA	28/06/2020	25/08/2020
Area 12	A638	1.073	AREA	28/06/2020	25/08/2020
Area 12	A64	1.171	AREA & ROAD	28/06/2020	25/08/2020
Area 12	M1	1.048	AREA & ROAD	28/06/2020	25/08/2020
Area 12	M18	1.026	AREA & ROAD	28/06/2020	25/08/2020
Area 12	M180	1.097	AREA & ROAD	28/06/2020	25/08/2020
Area 12	M181	1.073	AREA	28/06/2020	25/08/2020
Area 12	M606	1.073	AREA	28/06/2020	25/08/2020
Area 12	M62	1.052	AREA & ROAD	28/06/2020	25/08/2020
Area 12	M621	1.073	AREA	28/06/2020	25/08/2020
A249 DBFO	A249	1.038	AREA & ROAD	28/06/2020	25/08/2020

Table B.3 Late season surveys

Area	Road	LECF	Type	Survey period start date	Survey period end date
South West	A30	1.049	AREA & ROAD	25/08/2020	25/08/2020
South West	A303	1.018	AREA & ROAD	25/08/2020	25/08/2020
South West	A36	1.057	AREA & ROAD	25/08/2020	25/08/2020
South West	A38	1.035	AREA & ROAD	25/08/2020	25/08/2020
South West	A4	1.046	AREA	25/08/2020	25/08/2020
South West	A40	1.016	AREA & ROAD	25/08/2020	25/08/2020
South West	A417	1.046	AREA	25/08/2020	25/08/2020
South West	A46	1.046	AREA	25/08/2020	25/08/2020
South West	M32	1.046	AREA	25/08/2020	25/08/2020
South West	M4	1.075	AREA & ROAD	25/08/2020	25/08/2020
South West	M48	1.046	AREA	25/08/2020	25/08/2020
South West	M49	1.046	AREA	25/08/2020	25/08/2020
South West	M5	1.059	AREA & ROAD	25/08/2020	25/08/2020
Area 4	A2	1.013	AREA & ROAD	25/08/2020	25/08/2020
Area 4	A20	1.021	AREA & ROAD	25/08/2020	25/08/2020
Area 4	A2070	0.993	AREA	25/08/2020	25/08/2020
Area 4	A21	0.975	AREA & ROAD	25/08/2020	25/08/2020
Area 4	A23	0.992	AREA & ROAD	25/08/2020	25/08/2020
Area 4	A249	0.993	AREA	25/08/2020	25/08/2020
Area 4	A259	0.962	AREA & ROAD	25/08/2020	25/08/2020
Area 4	A26	0.993	AREA	25/08/2020	25/08/2020
Area 4	A27	0.97	AREA & ROAD	25/08/2020	25/08/2020
Area 4	M2	1.049	AREA & ROAD	25/08/2020	25/08/2020
Area 4	M20	0.993	AREA	25/08/2020	25/08/2020
Area 4	M23	0.993	AREA	25/08/2020	25/08/2020
Area 10	A41	1.047	AREA	25/08/2020	25/08/2020
Area 10	A483	1.047	AREA	25/08/2020	25/08/2020
Area 10	A494	1.047	AREA	25/08/2020	25/08/2020
Area 10	A5036	1.047	AREA	25/08/2020	25/08/2020
Area 10	A5103	1.047	AREA	25/08/2020	25/08/2020
Area 10	A5117	1.047	AREA	25/08/2020	25/08/2020
Area 10	A55	0.98	AREA & ROAD	25/08/2020	25/08/2020
Area 10	A550	1.047	AREA	25/08/2020	25/08/2020
Area 10	A556	1.047	AREA	25/08/2020	25/08/2020
Area 10	A56	1.047	AREA	25/08/2020	25/08/2020
Area 10	A580	1.047	AREA	25/08/2020	25/08/2020
Area 10	A59	1.047	AREA	25/08/2020	25/08/2020
Area 10	A627M	1.047	AREA	25/08/2020	25/08/2020
Area 10	A663	1.047	AREA	25/08/2020	25/08/2020
Area 10	M53	1.023	AREA & ROAD	25/08/2020	25/08/2020
Area 10	M56	1.042	AREA & ROAD	25/08/2020	25/08/2020
Area 10	M57	1.088	AREA & ROAD	25/08/2020	25/08/2020
Area 10	M58	1.133	AREA & ROAD	25/08/2020	25/08/2020
Area 10	M6	1.035	AREA & ROAD	25/08/2020	25/08/2020

Area	Road	LECF	Type	Survey period start date	Survey period end date
Area 10	M60	1.062	AREA & ROAD	25/08/2020	25/08/2020
Area 10	M602	1.047	AREA	25/08/2020	25/08/2020
Area 10	M61	0.989	AREA & ROAD	25/08/2020	25/08/2020
Area 10	M62	1.098	AREA & ROAD	25/08/2020	25/08/2020
Area 10	M65	1.039	AREA & ROAD	25/08/2020	25/08/2020
Area 10	M66	1.047	AREA	25/08/2020	25/08/2020
Area 10	M67	1.047	AREA	25/08/2020	25/08/2020
A1 DD DBFO	A1M	1.058	AREA & ROAD	25/08/2020	25/08/2020
A1 DD DBFO	A63	1.058	AREA	25/08/2020	25/08/2020
A69 DBFO	A69	0.941	AREA & ROAD	25/08/2020	25/08/2020
M25 DBFO	A1	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A10	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A1001	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A1023	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A1089	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A12	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A127	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A13	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A1M	0.933	AREA & ROAD	25/08/2020	25/08/2020
M25 DBFO	A2	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A20	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A21	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A23	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A282	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A3	0.935	AREA & ROAD	25/08/2020	25/08/2020
M25 DBFO	A30	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A3113	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A312	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A316	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A40	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	A405	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	M1	0.965	AREA & ROAD	25/08/2020	25/08/2020
M25 DBFO	M11	1.009	AREA & ROAD	25/08/2020	25/08/2020
M25 DBFO	M20	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	M23	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	M25	1.006	AREA & ROAD	25/08/2020	25/08/2020
M25 DBFO	M26	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	M3	0.982	AREA	25/08/2020	25/08/2020
M25 DBFO	M4	0.982	AREA	25/08/2020	25/08/2020
Second Severn Crossing	M4	1.075	AREA & ROAD	25/08/2020	25/08/2020
Second Severn Crossing	M48	1.046	AREA	25/08/2020	25/08/2020

# Calculation of Local Equilibrium Correction Factors for the 2020 skid resistance surveys



Highways England manages levels of skid resistance on their network (the Strategic Road Network or SRN) by carrying out single annual skid resistance surveys (SASS). This data is used to identify sites where there is a need to undertake an investigation to identify if a resurfacing treatment would be beneficial in mitigating the risk of skidding collisions at the site. In addition, this data feeds into the KPI for Pavement Condition. These surveys are corrected for seasonal variation by the application of correction factors called the “Local Equilibrium Correction Factors” (LECF). The procedure used since 2007 to calculate the LECFs was used again during 2020. This document provides a record of the procedure used to derive the LECFs that have been applied to the 2020 skid resistance survey data.

## Other titles from this subject area

<b>PPR 951</b>	Calculation of Local Equilibrium Correction Factors for the 2019 Skid resistance surveys. S Brittain. 2020
<b>PPR 906</b>	Calculation of Local Equilibrium Correction Factors for the 2018 Skid resistance surveys. S Brittain. 2019
<b>PPR 862</b>	Calculation of Local Equilibrium Correction Factors for the 2017 Skid resistance surveys. S Brittain. 2018
<b>PPR 826</b>	Calculation of Local Equilibrium Correction Factors for the 2016 Skid resistance surveys. S Brittain. 2017

## TRL

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

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