T-TEAR Task 573: Vehicle Roadworthiness

Final Report

Highways England

28th April 2016

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Executive summary

The recently published Strategic Business Plan and Roads Investment Strategy (RIS) set out the future direction of the Strategic Road Network (SRN) for the next five and twenty-five years respectively. This included the reduction of Killed and Seriously Injured (KSI) casualties on the SRN by 40% in 2020.

Highways England recognises that vehicle roadworthiness is an important area of work in the reduction of all casualties therefore if Highways England can influence a decrease in the number of incidents caused by broken down or unroadworthy vehicles the number of casualties should also reduce.

Highways England devised this task to address four aims. These are:

1. Under the heading of the safe system approach (road, vehicle, people) identify the scale of unroadworthy vehicles on the SRN following:
   - Why is there a problem?
   - How big is the problem?
   - Where is the problem occurring – are there cluster areas?
   - Is the problem seasonal?
   - What can we do to overcome it?
2. Identify data sources (Stats 19, C&C, DVSA MOT, MIB, Insurance) which can provide information on how many unroadworthy vehicles are on the network
3. Identify "Lag & Lead" indicators for the breakdown of vehicles on our network against collision and casualty figures.
4. Identify the number and type of vehicles failing MOTs and the main causation factors to help identify avoidable incidents occurring on the network due to unroadworthiness - which leads to secondary collisions and or increased risk for road workers, recovery agents, emergency services and general road users.

The first part of this report addresses aims 1, 2 and 4 by detailing the methodology, analysis undertaken of existing datasets and the review of this data to produce quantitative findings. These are supplemented with feedback from industry wide stakeholder engagement to provide a set of qualitative findings.

These two approaches have been used to understand what, if any, trends exist with regards to vehicle roadworthiness on the Strategic Road Network. These have been considered regionally, seasonally and in the context of time of day and traffic flows. The potential output from this analysis is to identify a baseline from which to measure the impact of future work Highways England intends to undertake in this area.

The second part of this report addresses the 3rd aim; identify "Lag and Lead" indictors to support the reduction of KSI's specifically related to vehicle roadworthiness. This has been undertaken by building upon the findings detailed in the earlier parts of the report, where applicable, and existing reporting mechanisms currently available to Highways England.

1. Background

The recently published Strategic Business Plan and Roads Investment Strategy (RIS) set out the future direction of the Strategic Road Network (SRN) for the next five and twenty-five years respectively. This included the reduction of Killed and Seriously Injured (KSI) casualties on the SRN by 40% in 2020.

Highways England recognises that vehicle roadworthiness is an important area of work in the reduction of all casualties therefore if Highways England can decrease the number of incidents caused by broken down or unroadworthy vehicles the number of casualties should also reduce.

In line with the Strategic Business Plan and RIS Highways England has commissioned Atkins to identify the scale of unroadworthy vehicles on the SRN by considering:

- Why is there a problem?
- How big is the problem?
- Where is the problem occurring – are there cluster areas?
- Is the problem seasonal?
- What can we do to overcome it?
- What are the Lag and Lead indicators for vehicle breakdowns on the network?
- What type of vehicles are failing the MOT, how many are failing and what are the main causation factors?

2. Introduction

Atkins approach to this task was to collect quantitative data through the analysis of datasets made available from a range of providers and sources. In addition to this, Atkins gathered qualitative data from a wide cross section of stakeholders in order to understand their thoughts on the roadworthiness of vehicles, specifically in the context of the SRN.

This report gives an insight into the analysis of the quantitative data that Atkins received including STATS 19, Command and Control (C&C), Driver and Vehicle Standards Agency Ministry of Transport (DVSA MOT), Enterprise Holding, TyreSafe and from the RAC, and the results that have been obtained from this analysis. It will also summarise the outcomes from the stakeholder's engagement.

The quantitative data analysis that is covered within this report is as follows:

1. Analysis of the **C&C** data looking at:
   - The number of recorded breakdown incidents that happen regionally and seasonally in order to determine if there were any cluster areas.
   - The number of recorded breakdown incidents that occur in comparison to the traffic flow in order to determine if a trend is present.
   - The type of vehicle involved in the breakdown to see if one target area should be looked at.
2. Analysis of the **STATS 19** data looking at:
   - The number of Road Traffic Collisions that happen regionally and seasonally in order to determine if there were any trends.
   - The number of Road Traffic Collisions that occur in comparison to the traffic flow in order to determine if a trend is present.
   - The type of vehicle involved in the collision to see if one target area should be looked at.
   - Road Traffic Collisions where a vehicle defect was recorded in order to determine potential links to roadworthiness issues.
3. Analysis of the **DVSA MOT** data looking at:
   - The number and make of vehicles failing MOTs, cars and heavy goods vehicles.
   - The main causation factors for failures to help identify avoidable incidents.
4. Analysis of the **Enterprise Holding** data looking at:
   - The number and make of the Enterprise vehicles that are breaking down on the SRN.
   - The contributory factors that cause the breakdowns on the network.
5. Analysis of **TyreSafe** data looking at:
   - The number of cars and Light Commercial Vehicles (LCV) with illegal, borderline and legal tyre tread depths.

- Regional variations in the number and percentages of vehicles with illegal, borderline and legal tyre tread depths.

6. Alternate sources of information: **RAC.**

3. Quantitative data analysis

3.1. Introduction

To accomplish the analysis, the Atkins team has utilised the datasets provided by the Department for Transport of UK (Road Safety Data), by the Driver & Vehicle Standards Agency (Anonymized MOT tests and results), by the Highways England (C&C database), Enterprise Holdings (Fleet breakdown data) and finally TyreSafe (tread depth data).

- **C&C Data:** These files contain the records of incidents on the network, vehicles and drivers involved, and actions taken to resolve the incidents, since the year 2013 until 2015. These records only cover those incidents where Highways England and/or their service providers have responded to the incident.
- **Road Safety Data:** The STATS19 files provide detailed road safety data about the circumstances of personal injury road collisions in Great Britain, the vehicles involved and the consequential casualties. The statistics relate only to personal injury accidents on public roads that are reported to the police, and subsequently recorded, using the STATS19 accident reporting form.
- **Anonymized MOT tests and results**: These datasets include MOT tests and outcomes for cars and HGV's. The MOT data for cars includes make and model of vehicle, odometer reading and reasons for failure, since the MOT system was computerized in 2005. The MOT data for HGV's includes both the number of and type of failures for three different vehicle types; motor vehicles, PSV's and trailers.
- **Enterprise Holdings data:** This data provides information relating to the cause of breakdowns in the Enterprise fleet (cars and lorries) focusing on the make of the vehicle involved and the component part/parts at fault.
- **TyreSafe data:** TyreSafe provided Atkins with a copy of their report "TyreSafe tread depth at the point of replacement survey" which provided data on the number of tyres with tread depths over 2mm, under 2mm and below 1.6mm (below the legal limit).This report was commissioned by Highways England.

Other supporting information was obtained from the RAC which was analysed to see if there are useful comparisons with the other data sets.

3.1.1. Common approach methodology

During the analysis of the aforementioned data sets some common approaches were taken which are outlined below:

- **Date**: Each data set had data ranging over different periods. In order to compare the data sets a common month/yearly period needed to be agreed. It was therefore decided that the analysis would focus on the period from April 2013 to December 2014 only. By focusing on this period for all data sets it allowed for a cross analysis to be undertaken in order to compare the data and define any trends that were present.
- **Location**: The C&C and STATS 19 data were provided with the location of the incidents and Road Traffic Collisions in Eastings and Northings. This type of location information could not be directly linked to the separate Highways England regions and therefore was required to be modified into Latitudes and Longitudes. Post code information was then obtained from the Latitude and Longitude data allowing each incident and Road Traffic Collision to be assigned an individual region. The regions that were assigned included the North West, North East, West Midlands, East Midlands, South West, East of England or the South East. **Figure 1** shows these different regions.

Figure 1 - Different Highways England regions

Other more specific approaches were taken when analysing other aspects of the data, details of which can be found in the appropriate sections later in this report.

3.2. C&C

3.2.1. Overview

As described on the data.gov.uk website, the C&C database is “an incident management system which captures details of a carriageway impact. A carriageway impact results from any incident where the capacity (of one or more running lanes) has been reduced or where there is deemed to be a risk to a road user”. Some of the recorded risks to road users have included:

- Fuel spillages or outages
- Flat tyres
- Debris
- Vehicle fires
- Weather

Carriageway impact incidents include all recorded incidents, involving all types of vehicles, upon the SRN. Carriageway impact data can be split into two main categories; those on live lanes of the carriageway and those on non-live lanes. This can therefore include smart motorway sections even if the hard shoulder is not in use as well as when the hard shoulders is being used as a live lane.

3.2.2. Methodology

The supplied C&C data covers 436,023 recorded incidents between the period between April 2013 and October 2015. These 436,023 C&C recorded incidents are only those where a closure code was noted as a breakdown.

Analysis for this report focused on those recorded breakdown incidents, which for the purpose of this report will be referred to as RBI’s. This dataset was further reduced to cover only those RBI’s that occurred on the SRN between April 2013 and December 2014 reducing the data set to 288,821 RBI’s.

Once the data was filtered and cleansed, analysis was done by the date, time, location (easting and northings – see common approach methodology, **Section 3.1.1**) and type of vehicle involved in the RBI’s. The type of vehicles were categorised into 9 different types; Motorcycle, cars, light goods vehicles (vans/lorries 7.5 tonnes or less (LGV)), large goods vehicles (over 7.5 tonnes), mini buses, coaches, trailers (e.g. horseboxes etc.), agricultural vehicles and plant. Within these different categories UK, non-UK and abnormally loaded vehicles were included.

The number of RBI’s were then analysed by region with respect to the traffic flows in each region which was obtained from DfT’s table TRA0302 (Motor vehicle flow by road class and region and country in Great Britain). Other analysis considered trends between months and hours in the day comparing these across the different regions and the “free text” data within the closure summary field. Further details of these analyses can be found in **Section 3.2.3.**

It should be noted that the C&C data that was received was of relatively good quality for the purpose of this task, however there were a number of challenges with analysing it. As the duration of the incidents was not provided this could not be analysed and therefore the impact the breakdowns had on the SRN could not be investigated. The cause of the breakdowns could also not be analysed as this information was not available within the data sets provided. It should also be noted that the Highways England customer operations incident prevention team have developed a 5 year strategy which is looking at reducing lane impacts and the number of goods vehicle related incidents on the SRN. These include:

- Operation tramline – A HGV tractor unit which picked up not only driving issues but roadworthiness issues leading to vehicle prohibitions.
- Keele tyre monitoring – which has highlighted that 1 in 8 tyres are dangerously underinflated.
- Highways England – Joint on road working with the DVSA

These interventions are likely to provide additional data which may support the findings of this task.

There were also challenges with translating the easting and northing into regions; several of the easting and northings were switched which meant that each item needed to be carefully checked. Due to these challenges several iterations of the analysis had to be run before reliable results were produced.

It should also be noted that the C&C data provided was not verified for variations in how different regions may record data against the closure codes. It has been assumed that each region will use the closure codes in the same way.

Furthermore, the "free text" information that was included in the closure summary field was of varying quality. Details of the challenges that arose while analysing this element of the data are as follows:

- There were numerous variations of spelling and acronyms included in the field.
- There were several prompts for the operator, presumably to try and gain consistency around how the data was collected. These included; the nature of the breakdown, the mode of recovery, number of load cells used, peak force, clearance method, where was the vehicle moved to, location of breakdown and the marker post number. Due to this the data had to be sifted for those that contained the prompts only and those which contained responses, of which 34% of cases did not contain responses to the prompts.
- The information recorded was only the best guess of the fault as not all are visible or even when visible different operators will have different ways to record the fault, e.g. steam and smoke.
- The meaning of a word can be very different depending on the context in which it is used, for example "driver" can be a person or a particular side of a vehicle. When recorded as "drive" this will have further different meanings. This meant that each sentence had to be analysed separately to ensure the correct meaning was obtained.
- There were numerous inconsistencies between the other data entry fields and the information provided in the closure summary field. For example, in some cases the defined text fields stated that there was a breakdown however the free text field stated that it was an RTC or the vehicle was out of fuel.
    - There were almost 200 cases were there was a recovery due to a RTC.
    - Almost 600 cases were due to a comfort break, the driver adjusting something (load, mirror etc.), the driver being asleep or weather or road conditions.
    - Almost 16000 cases were a result of the vehicle running out of fuel.
- It was not possible to categorise some responses; belt, flat, pipe, valve etc. as further details would be required for a definitive categorisation.

The Atkins project team has spent a considerable amount of time cleansing the information to ensure reliable data and results have been obtained, however some loss of data is inevitable due to the inconsistencies that were present. The permutations that have been made during this analysis can be found in **Appendix A**.

It is recommended that C&C increase the number of defined text fields so that the prompts are answered correctly. In addition to this it may also be worthwhile providing further training to those who will input data into the C&C database to ensure correct, consistent and meaningful data is recorded.

3.2.3. Analysis

Distribution of RBI's per month and by time of day

The first analysis that was undertaken on the C&C data was to determine if there were trends in the occurrence of RBI's by month or by time of day.

From the results shown in **Figure 2** it is clear that in the period between April 2013 and December 2014 certain months had more incidents than others, with the percentage distribution of RBI's per month varying from 4.3% to 5.8% during the period. The months during this period with a larger amount of RBI's occurring were July and August which was a recurring trend in the 2013 and 2014 data, while January and February were the months with the least number of RBI's. **Figure 2** also shows that the number of RBI's occurring roughly corresponds to the average monthly traffic flow with the highest traffic flows being recorded between July and September each year and the lowest recorded in January.

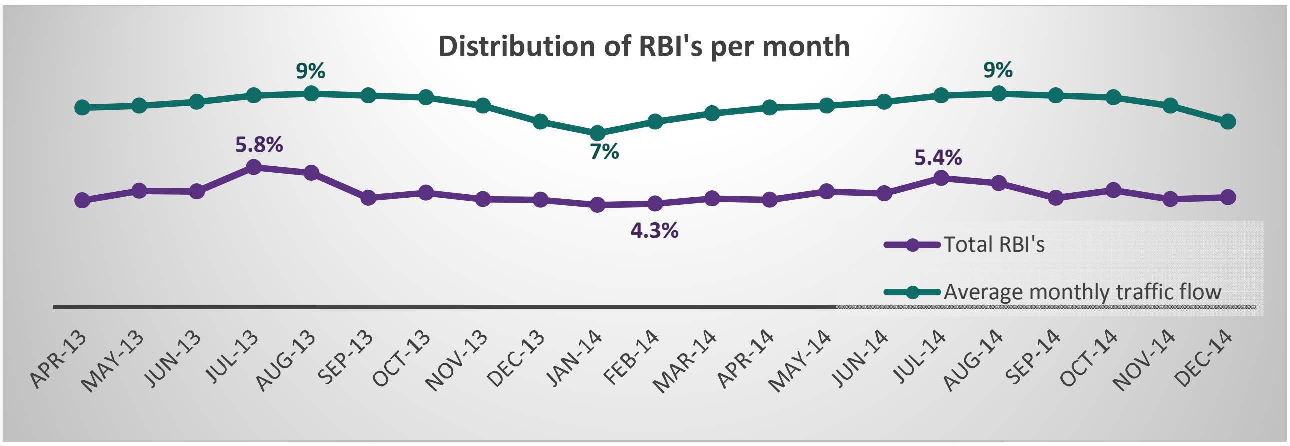

Figure 2 - Distribution of RBI's per month

In addition to this, **Figure 3** shows that the time distribution of the RBI's throughout the day mirrors the traffic flow per hour although it does not show as a pronounced morning peak. The peak hours identified were between 15:00 to 17:00 and the time with the fewest RBI's were between 03:00 and 05:00. It can also be seen from **Figure 3** that when the flow of traffic reduces between the hours of 20:00 and 06:00 the percentage of RBI's is greater than the percentage flow of traffic, corresponding with the hours of darkness.

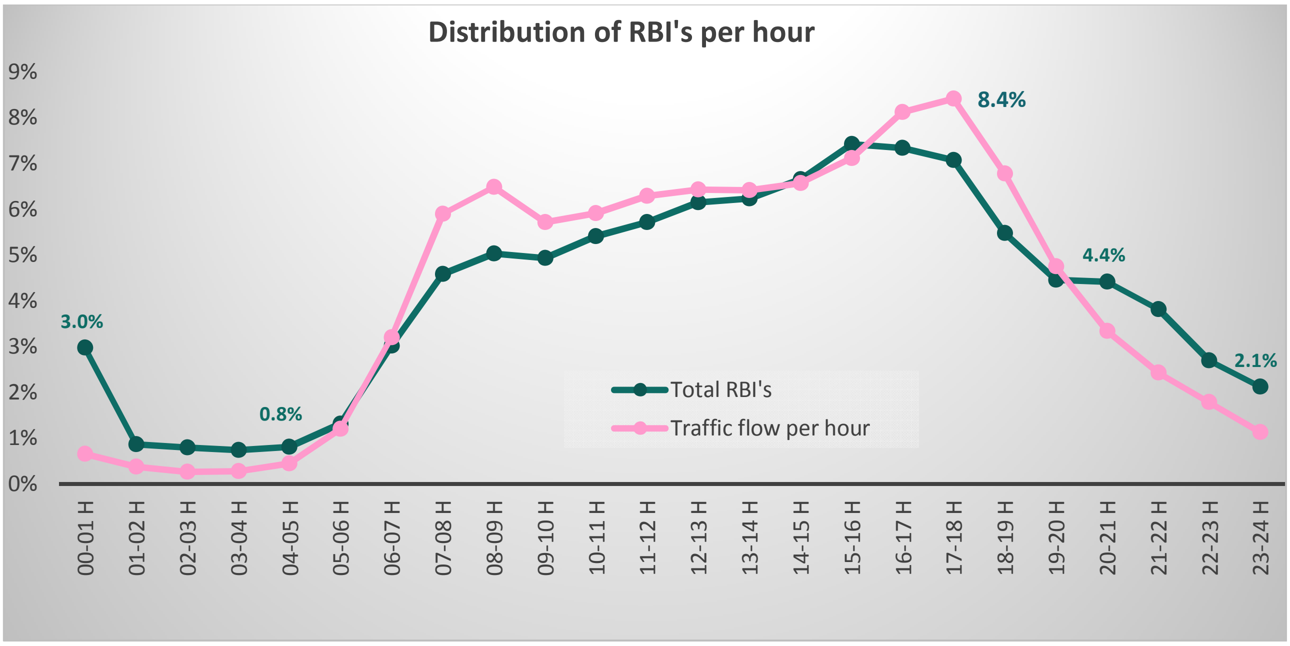

Figure 3 - Distribution of RBI's per hour

<u>**Average distribution of RBI's per hour and region**</u>

Figure 4 and **Table 1** shows the average number of RBI's that impact the SRN per hour between certain periods of the day across the UK. From the results it is evident that the largest number of the RBI's per hour take place during the hours when people are returning from work between 17:00 and 19:00 (28.3 per hour). With this in mind it should also be noted that there is also a large number of RBI's per hour (28.1) occurring during what we have defined as working time (09:00 and 17:00). The cause of this skew in results is unknown although it may be due to business traffic or it might also be that the traditional work and commuting periods have changed as such high results were not expected during this period. This could undergo future analysis.

It can also be seen in **Figure 4**, that there are similar trends between regions as there is a similar number of RBI's occurring in each region during the different time periods, nevertheless the East Midlands and the South West show slightly reduced numbers of RBI's.

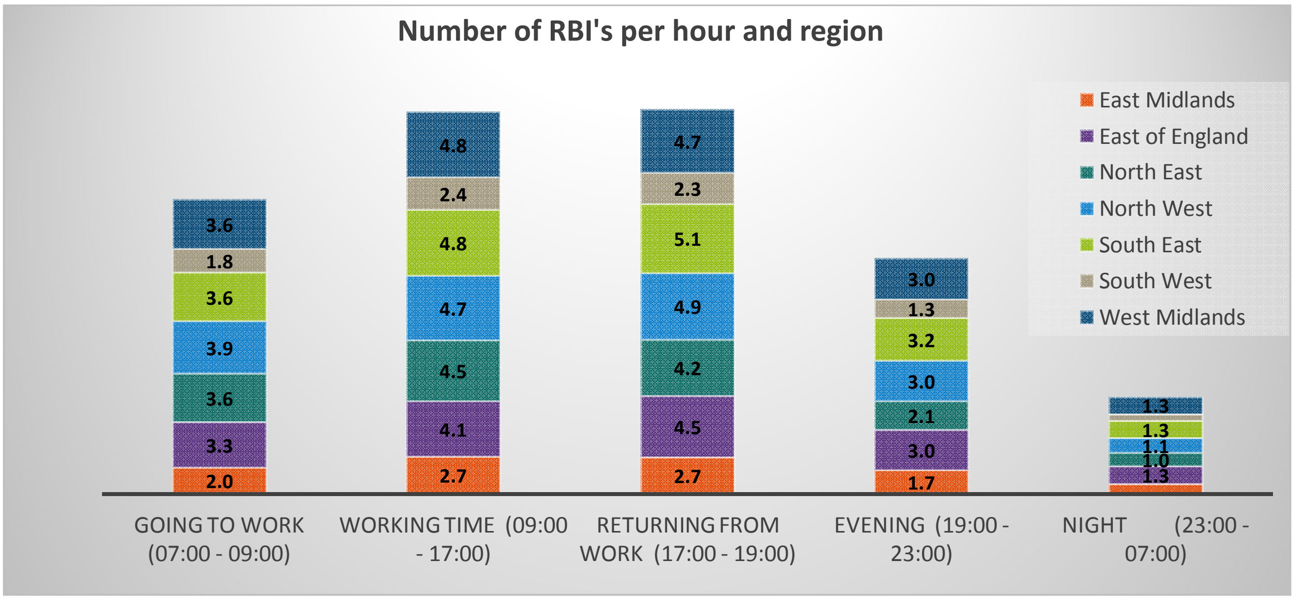

Figure 4 - Distribution of RBI's per hour and region

RBI's per hour		Going to work (07:00 - 09:00)	Working time (09:00 - 17:00)	Returning from work (17:00 - 19:00)	Evening (19:00 - 23:00)	Night (23:00 - 07:00)
Region	East Midlands	2.0	2.7	2.7	1.7	0.7
	East of England	3.3	4.1	4.5	3.0	1.3
	North East	3.6	4.5	4.2	2.1	1.0
	North West	3.9	4.7	4.9	3.0	1.1
	South East	3.6	4.8	5.1	3.2	1.3
	South West	1.8	2.4	2.3	1.3	0.5
	West Midlands	3.6	4.8	4.7	3.0	1.3
Total		**21.7**	**28.1**	**28.3**	**17.3**	**7.1**

Table 1 - Distribution of RBI's per hour and region

Distribution of RBI's per region

Table 2 shows the comparison between solely considering the number of RBI's per region and the affect that considering the traffic flows in each region has.

		Number of RBI's in a region with respect to the total number of RBI's in England, as a percentage	Number of RBI's in a region with respect to the daily traffic flow in that region, as a percentage
Region	East Midlands	9.8	29.5
	East of England	15.6	30.6
	North East	15	34.7
	North West	16.8	62.3
	South East	17.5	34.4
	South West	8.1	32.4
	West Midlands	17.1	60.9

Table 2 - Distribution of RBI's per region

Figure 5 illustrates the regional variation for where RBI's occur taking account of the traffic flow in each region as a rate. It shows that the worst regions for RBI's are the West Midlands and the North West. The North East, South East, South West, East of England and the East Midlands have similarly low rates of RBI's taking into account the traffic flows within each region.

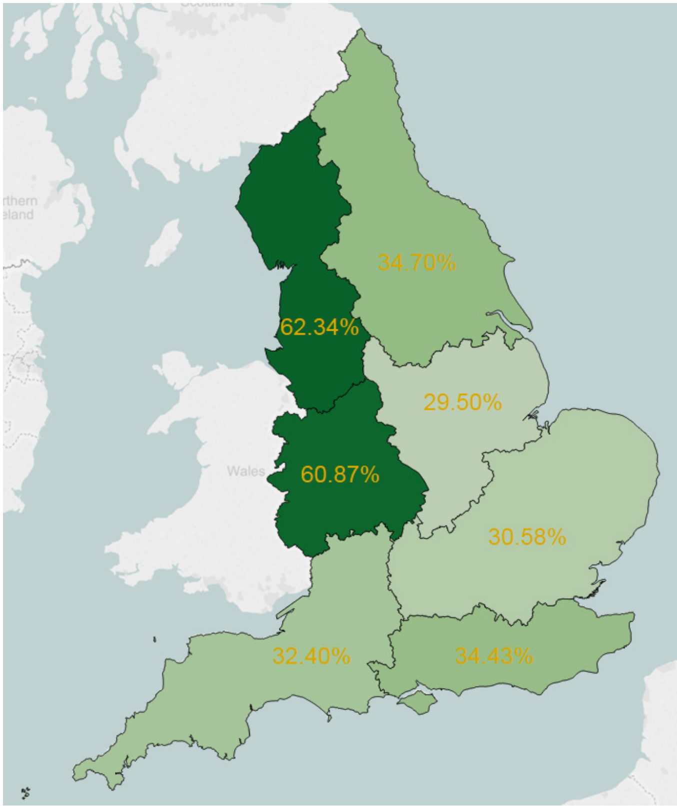

Figure 5 - Distribution of RBI's per region with respect to the daily traffic flow in that region

Distribution of RBI's per region and type of vehicle

The final analysis that was undertaken for C&C data was to understand the type of vehicles involved in RBI's in the different regions throughout England. **Table 3** categorises the number of vehicles that breakdown by region. It shows that most of the breakdowns are car breakdowns (69.3%), followed by large goods vehicles (over 7.5 tonnes) (13.1%) and light goods vehicles (vans / lorries: 7.5 tonnes or less) (11.8%). This also corresponds to the fact that cars are the most represented vehicle type; car journeys equate to 78.7% of all vehicle miles completed within England as recorded in the Department for Transport statistics data TRA0106 (Motor vehicle traffic (vehicle miles) by vehicle type, region and country in Great Britain).

	MOTORCYCLE	CAR	LIGHT_ GV	LARGE_ GV	MINIBUS	COACH	TRAILER	AGRIC_ VEH	PLANT
East Midlands	279	17,946	3,863	4,588	296	233	619	28	32
East of England	548	31,417	4,765	5,173	327	470	649	39	57
North East	486	28,842	5,747	6,735	410	426	1,057	20	110
North West	524	33,873	5,081	5,582	501	504	1,040	44	49
South East	870	35,948	5,721	4,567	632	643	859	108	59
South West	307	16,439	2,592	2,875	361	258	958	53	25
West Midlands	445	32,170	5,799	7,506	485	358	1,105	37	20

Table 3 - Distribution of RBI's per region and type of vehicle

The information provided in **Table 3** includes UK, non UK and abnormally loaded vehicle breakdowns, with 93% of these breakdowns involving UK vehicles. The total number of non UK vehicle breakdowns and vehicle breakdowns that include abnormally loaded vehicles are very small only 0.6% and 0.1% respectively across England during the data period, April 2013 to December 2014. Due to this these were not separated out as they will have only a very small impact on the overall statistics. Additionally, it was evident that not all non-UK and abnormally loaded vehicles were given a vehicle type category and therefore some have not been able to be included in **Table 3**.

Distribution of RBI's by failure type based on the closure summary data

Figure 6 illustrates the percentage of RBI failure types. It shows that the most common cause of RBI's on the network are what has been classed as no breakdowns followed by wheel/tyre related issues and engine issues. **Table 4** identifies what has been classed as no breakdowns. This includes instances where vehicles have run out of fuel, no reason has been given, where an RTC was the cause of the vehicle being removed from the network and others.

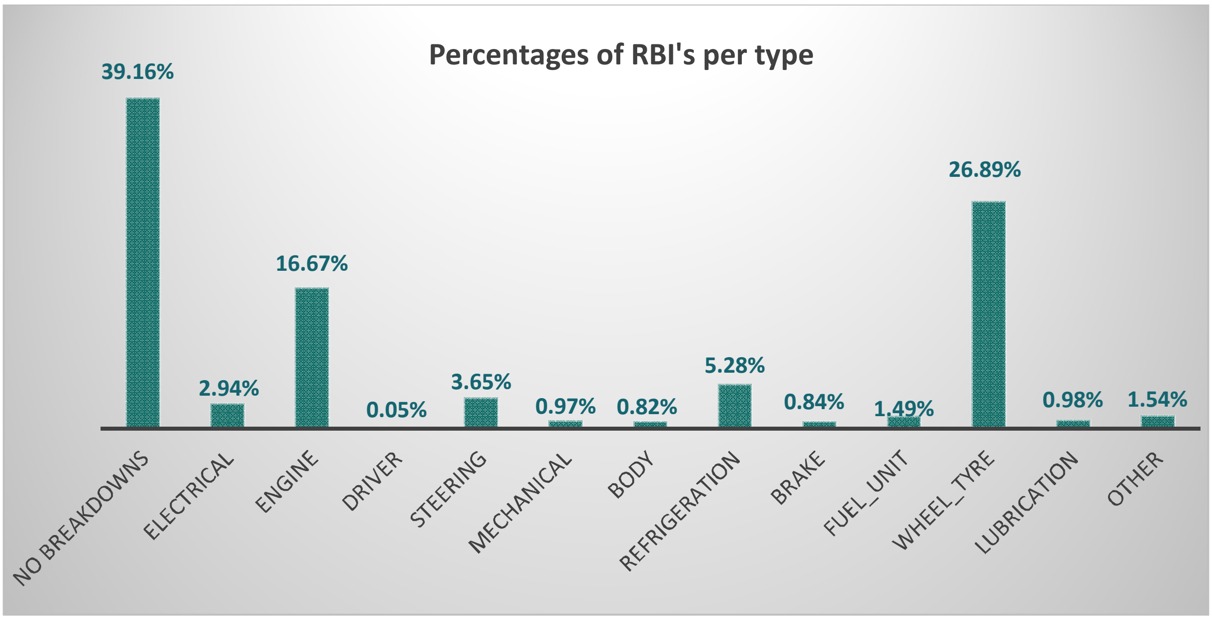

Figure 6 - Distribution of RBI's per failure type

	NO BREAKDOWNS				TOTAL	
REGION	Out of Fuel	NO REASON	RTC	DRIVER_OTHER		
East Midlands	1090	9432	20	70	**10612**	3.67%
East of England	2900	13754	49	64	**16767**	5.81%
North East	2150	17393	6	44	**19593**	6.78%
North West	2478	11447	18	63	**14006**	4.85%
South East	2939	11135	34	46	**14154**	4.90%
South West	1094	6861	15	46	**8016**	2.78%
West Midlands	3174	26525	29	220	**29948**	10.37%
Grand Total	15825	96547	171	553	**113096**	39.16%

Table 4 - Distribution of no breakdowns per region

Figure 7 shows the percentage of RBI faults per region. It shows that there is consistency between the regions and on average similar types and percentages of faults are occurring in each region.

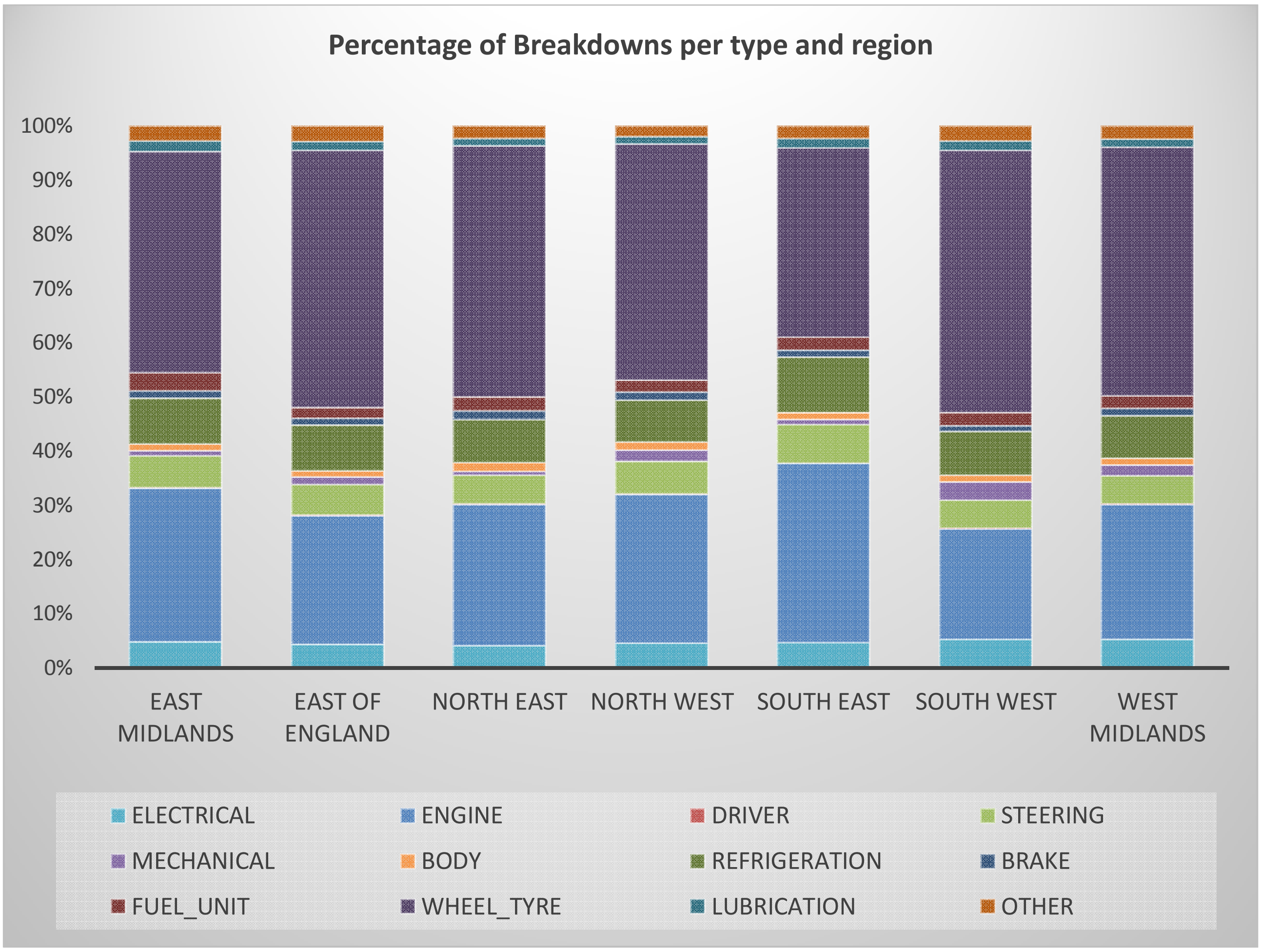

Figure 7 - Distribution of RBI per failure per region

3.2.4. Summary

When looking at the number of RBI's the following trends were identified:

- There is a peak of RBI's occurring between 07:00 and 09:00 and 15:00 and 18:00 (morning and evening commuting time), however there is also a high number of RBI's that occur during the working day which closely mirrors the hourly traffic flow. Although there is less traffic during working time the high number of RBI's could be potentially due to business traffic and grey fleet vehicle which may not be as well looked after.
- The months that have the highest number of RBI's are July and August which was a recurring trend, potentially due to this being the summer holiday period and more people traveling on the network for longer journeys.
- The West Midlands and the South East showed the highest numbers of RBI's however when compared to the traffic flow the worst affected regions were found to be the West Midlands and the North West.
- Similarly the lowest number of RBI's occurred in the East Midlands and the South West of England however when compared with the traffic flow the least affected regions were the East Midlands and the East of England.
- The results also show that the most common breakdowns are car breakdowns (69.3%), this corresponds to the fact that cars are the most represented vehicle type with car journeys equating to 78.7% of all vehicle miles completed within.
- There is a similar trend in breakdown faults occurring in each region.
- The largest number of breakdown faults were due to a combination of vehicles running out of fuel, no reason being given, RTC's and others, these were described as “no breakdowns”. Following these the other main reasons were wheel / tyre related issues and engine issues.

Following the initial analysis of the data sets it was clear there were some areas that additional data would have enabled a more in depth understanding of the results and would have allowed Atkins to quantify the results. Further analysis of the following would be suggested:

1. The duration of the breakdowns in order to understand how each breakdown impacts the network.
2. The causes of breakdowns on the SRN as given by defined text. This can be tied to work being carried out by other Highways England work streams.

3.3. STATS19

3.3.1. Overview

The STATS19 files provide detailed road safety data about the circumstances of personal injury due to Road Traffic Collisions (RTC's) in Great Britain, the vehicles involved and the consequential casualties. The statistics relate to collisions that result in personal injury on public roads which are reported to the police, and subsequently recorded, using the STATS19 accident reporting form.

3.3.2. Methodology

The supplied STATS19 data covered the period from 2009 to 2014 and included 163,654 records. Each record corresponded to a casualty or to a vehicle involved in a RTC; in some cases RTC's were recorded up to 7 times due to the number of vehicles and casualties involved. Due to this potential multiple reoccurrence, the unique RTC reference was examined so that the same RTC was not accounted for twice. This allowed the data sample to be reduced to include only the number of RTC's, 65,690. Additionally as the data covered RTC's across the full road network the sample size was further reduced to cover only those that occurred on the SRN between April 2013 and December 2014. In doing so it reduced the total number of RTC's to be analysed to 18,524.

Once the data was filtered and cleansed it was analysed by the date, time, location (easting and northings – see common approach methodology, **Section 3.1.1**), type of vehicle involved in the RTC and the contributory factors that contributed to the RTC. For the purpose of this report the only contributory factors that were analysed were those where a vehicle defect was present at the time of the RTC, however within the supplied data other contributory factors were recorded including the road environment, injudicious driver actions, driver error, impairment or distraction, behaviour/ inexperience, vision, pedestrians and special instances. The number of RTC's were also analysed with consideration to the traffic flows in each region, which was obtained from DfT's table TRA0302 (Motor vehicle flow by road class and region and country in Great Britain).

Additionally the project team was able to analyse the severity of the RTC's that occurred by allocating each collision a severity code. Collisions that resulted in only minor injuries were given 1, serious injuries were given a 2 and fatal injuries were given a 3. An average of these was then calculated for each region for all vehicle collisions, those where only cars were involved and those where only HGV's were involved. Furthermore, the severity for all vehicle collisions was calculated seasonally to see if any trends could be established. It should be noted that severity data was not available for the same data period used throughout the other sections of the report and therefore the data analysed in this section was for the year 2014 only.

3.3.3. Analysis

Distribution of RTC's per month and by time of day

The first analysis that was undertaken of the STATS 19 data was to determine if there were trends in the occurrence of RTC's by month or by time of day.

From the results shown in **Figure 8** there appears to be no clear trend between the numbers of RTC's where a vehicle defect was recorded per month and the total number of RTC's per month. However, it is clear that there are seasonal variations in the total number of RTC's per month. The graph identifies two peak periods for the total number of RTC's, the summer (July and August) and the autumn (October and November), September is also highlighted as a month were there are less accidents. The percentage distribution of total RTC's per month varies from 3.7% to 5.4%.

When comparing the total number of RTC's and the traffic flow per month there is unfortunately no clear trend as the months with the highest and lowest number of RTC's do not seem to correspond with the months with the highest and lowest traffic flows.

Focusing on those accidents where a vehicle defect was recorded there is also no definitive trend. It is possible that this is due to the small size of the sample (596 of RTC's with a vehicle defect recorded) that was used rather than there not being a trend. The statistical significance of the sample could therefore be questioned due to its size.

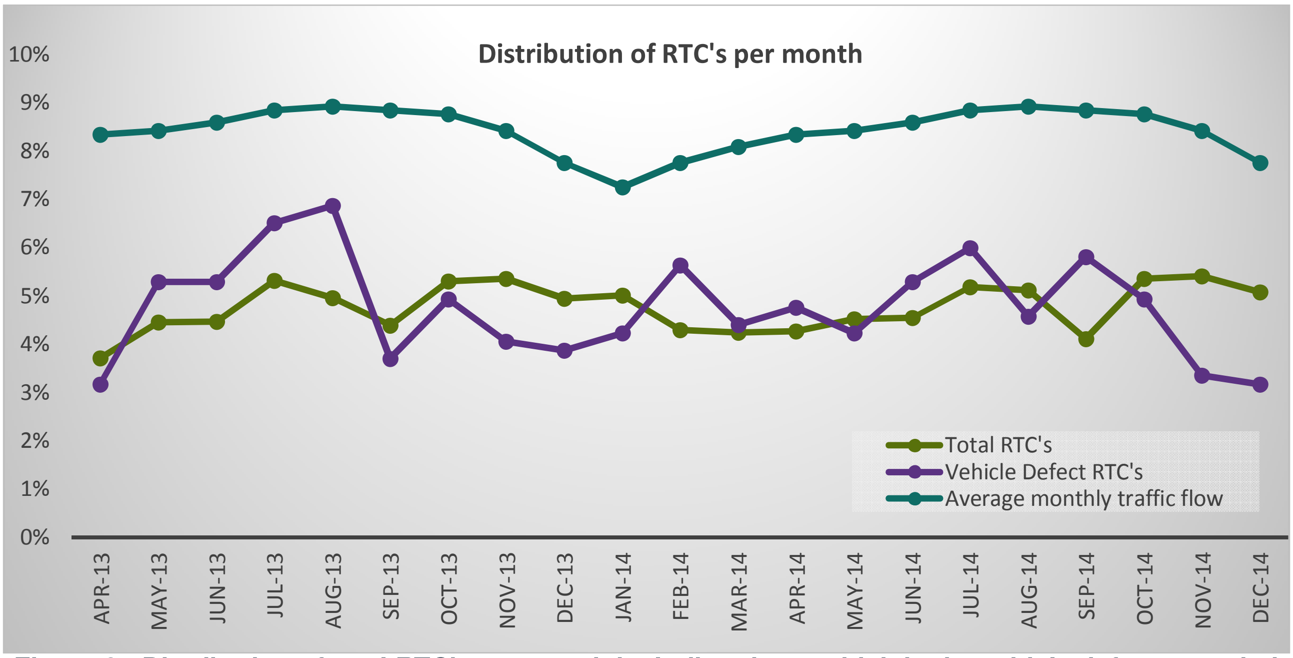

Figure 8 - Distribution of total RTC's per month including those which had a vehicle defect recorded

In addition to analysing the STATS 19 data by month the number of RTC's per hour were considered. **Figure 9** shows that the time distribution of total number of RTC's throughout a typical day is comparable to the traffic flow per hour. It shows that the peak hours are from 08:00 to 09:00 and from 17:00 to 18:00. The hours with the fewest incidents were recorded as being between 03:00 and 04:00.

When analysing the RTC's where a vehicle defect was recoded there are differences in peak periods although the overall trend is quite similar. The peak times appear to be offset by one hour compared to the data for the total number of RTC's, the morning peak is between 09:00 and 10:00, and evening peak is between 16:00 and 17:00, shortening the period of overall peak RTC's throughout the day. This is an area that could be considered for further analysis.

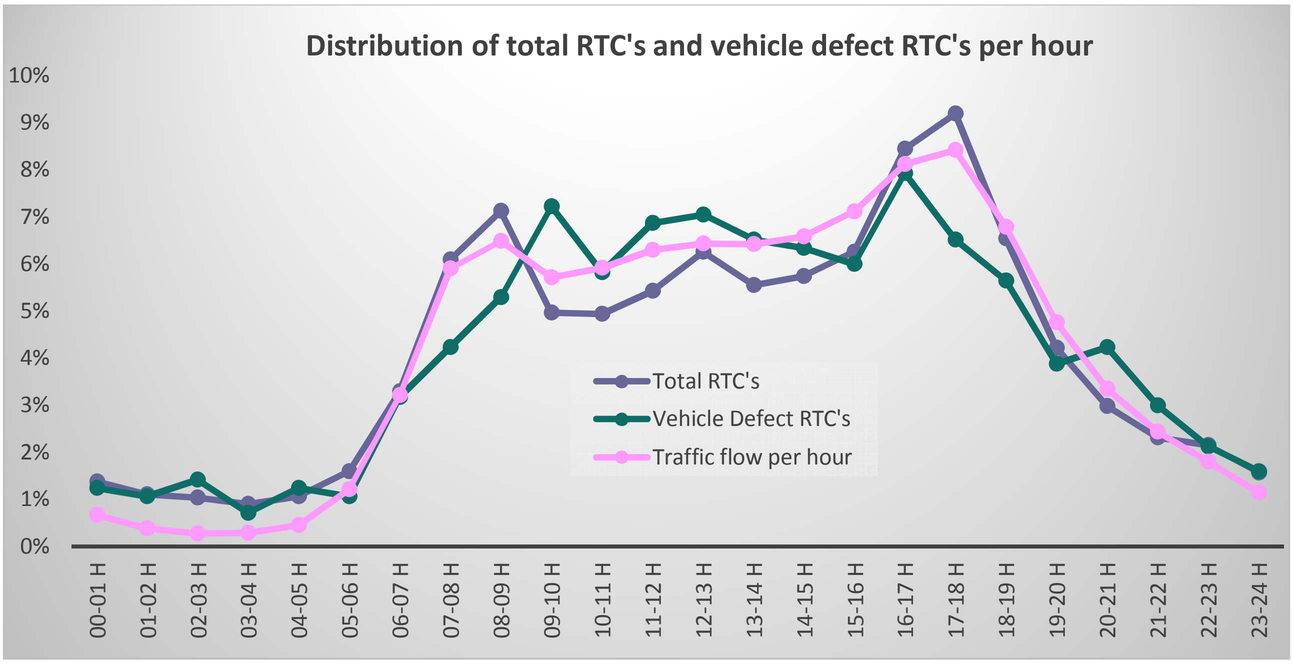

Figure 9 - Distribution of total RTC's per hour

Distribution of total RTC's per hour and region

From the results in **Figure 10** and **Table 5** it is evident that most of the RTC's take place during the hours when people are commuting to work between 07:00 and 09:00 (1.9 RTC's per hour) and when people are returning from work between 17:00 and 19:00 (2.3 RTC's per hour). It can also be noted that there are similar trends between regions with similar numbers of RTC's occurring in each region during the different time periods, nevertheless the South East and the East of England show slightly higher numbers of RTC's than the other regions which may be linked to higher traffic flows in these regions.

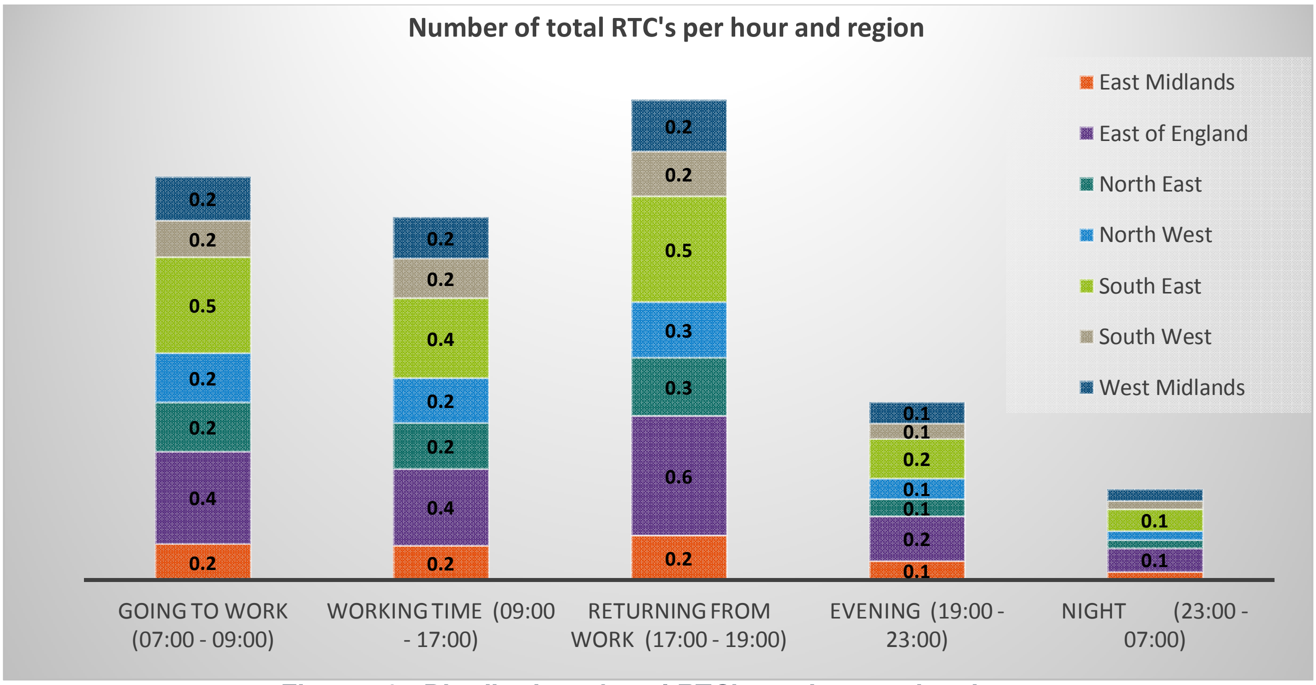

Figure 10 - Distribution of total RTC's per hour and region

Incidents per hour		Going to work (07:00 - 09:00)	Working time (09:00 - 17:00)	Returning from work (17:00 - 19:00)	Evening (19:00 - 23:00)	Night (23:00 - 07:00)	Total
Region	**East Midlands**	0.2	0.2	0.2	0.1	0.0	0.7
	East of England	0.4	0.4	0.6	0.2	0.1	1.7
	North East	0.2	0.2	0.3	0.1	0.0	0.9
	North West	0.2	0.2	0.3	0.1	0.0	0.9
	South East	0.5	0.4	0.5	0.2	0.1	1.6
	South West	0.2	0.2	0.2	0.1	0.0	0.7
	West Midlands	0.2	0.2	0.2	0.1	0.1	0.8
Total		**1.9**	**1.7**	**2.3**	**0.8**	**0.4**	**7.2**

Table 5 - Distribution of total RTC's per hour and region

Distribution of total RTC's per region

Table 6 shows the comparison between solely considering the number of RTC's per region and the affect that considering the traffic flows in each region has.

		Number of RTC's in a region with respect to the total number of RTC's in England, as a percentage	Number of RTC's in a region with respect to the daily traffic flow in that region, as a percentage
Region	East Midlands	9.5	1.83
	East of England	23	2.89
	North East	11.8	1.76
	North West	11.8	2.81
	South East	22.5	2.85
	South West	10	2.55
	West Midlands	11.4	2.59

Table 6 - Distribution of RTC's per region

Figure 11 only illustrates the regional variation for where RTC's occur taking into consideration the traffic flow in each region. It shows that the worst regions for RTC's are the East of England and South East, closely followed by the North West, West Midlands and the South West. The regions that have the lowest rate of RTC's based on the traffic flow are the North East and East Midlands.

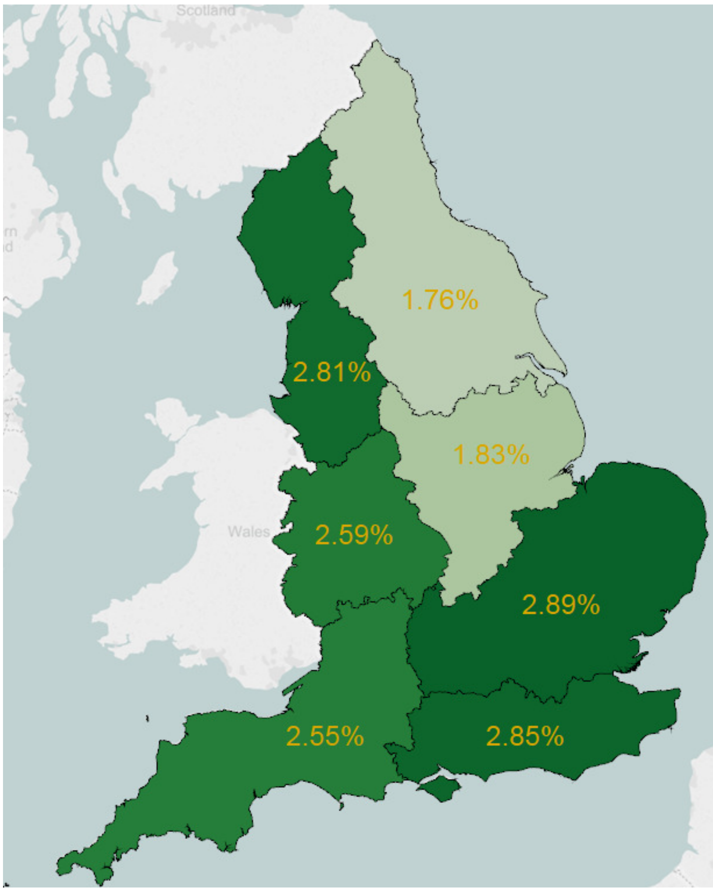

Figure 11 - Distribution of RTC's per region with respect to the daily traffic flow in that region

Distribution of RTC's, where a vehicle defect was recorded, per region

Table 7 shows the comparison between solely considering the number of RTC's with a vehicle defect per region and the affect that considering the traffic flows in each region has.

		Number of RTC's with a vehicle defect in a region with respect to the total number of RTC's in England, as a percentage	Number of RTC's with a vehicle defect in a region with respect to the daily traffic flow in that region, as a percentage
Region	East Midlands	7.1	0.04
	East of England	25.8	0.1
	North East	12.3	0.04
	North West	9.9	0.08
	South East	23.7	0.1
	South West	10.4	0.09
	West Midlands	10.9	0.08

Table 7 - Distribution of RTC's with a vehicle defect per region

Figure 12 illustrates the regional variation for where RTC's with a vehicle defect occur, taking into consideration the traffic flow in each region. It shows that the worst regions are the East of England and South East, closely followed by the South West, West Midlands and the North West. The regions that have the lowest rate of RTC's based on the traffic flow are the North East and East Midlands.

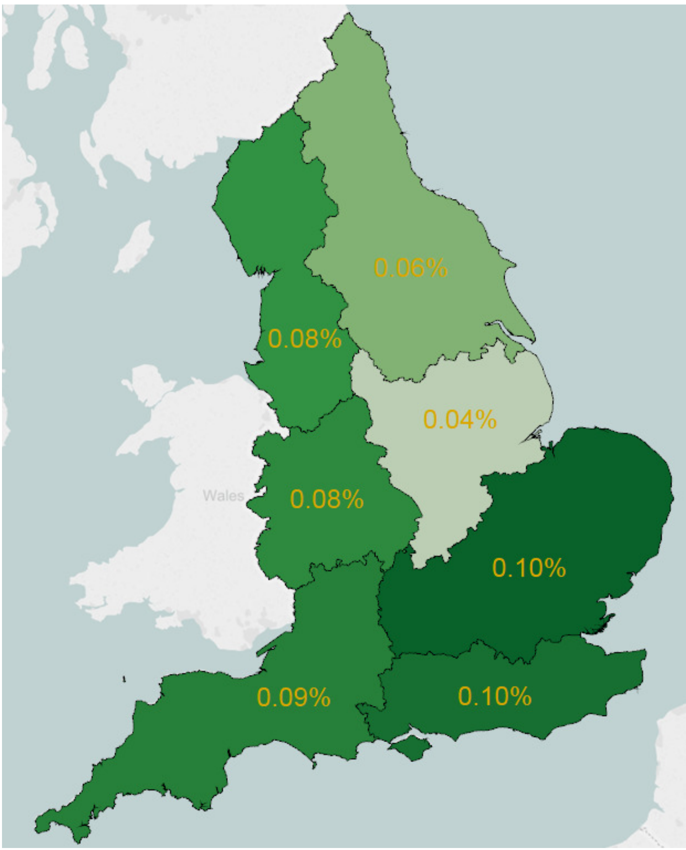

Figure 12 - Distribution of RTC's with a vehicle defect per region with respect to the daily traffic flow in that region

Distribution of total RTC's per region and type of vehicle

Table 8 presents the number of RTC's that occurred by region and type of vehicle. **Table 8** shows that most of the vehicles involved in RTC's were cars (67.4%) and goods vehicles (all goods vehicles up to 7.5 tonnes) (23.2%) with motorcycles (6.3%) and other vehicles (3.1%) only accounting for a small percentage of the RTC's. This corresponds to the fact that cars are the most represented vehicle type on the SRN, where car journeys equate to 78.7% of all vehicle miles completed within England as recorded in the Department for Transport statistics data TRA0106 (Motor vehicle traffic (vehicle miles) by vehicle type, region and country in Great Britain). The regions with a major number of non UK vehicles are the South West (1.2%) and East Midlands (0.8%).

	MOTORCYCLE	CAR	GOOD VEH	OTHER	TOTAL
East Midlands	167	1,557	604	100	2,428
East of England	356	3,864	1,437	160	5,817
North East	159	1,969	717	88	2,933
North West	123	2,030	610	109	2,872
South East	432	3,830	1,183	135	5,580
South West	178	1,667	453	96	2,394
West Midlands	145	1,908	789	90	2,932
Total	**1,560**	**16,825**	**5,793**	**778**	**24,956**

Table 8 - Distribution of total RTC's per region and type of vehicle

Figure 13 delves deeper into the causes of the defects separating them into six different categories; steering, brakes, load, mirrors, lights and tyres. **Figure 13** illustrates that there was a similar trend across each of the different regions with, on average, half of the RTC's that had a vehicle defect recorded are due to a problem with the tyres (51.6%), the brakes are the second largest contributory factor (16.4%), followed by the distribution of the load (16.2%) and the steering (13.2%). It can also be seen that problems with the lights (2.2%) and the mirrors (0.3%) were the least common contributory factor of RTC's.

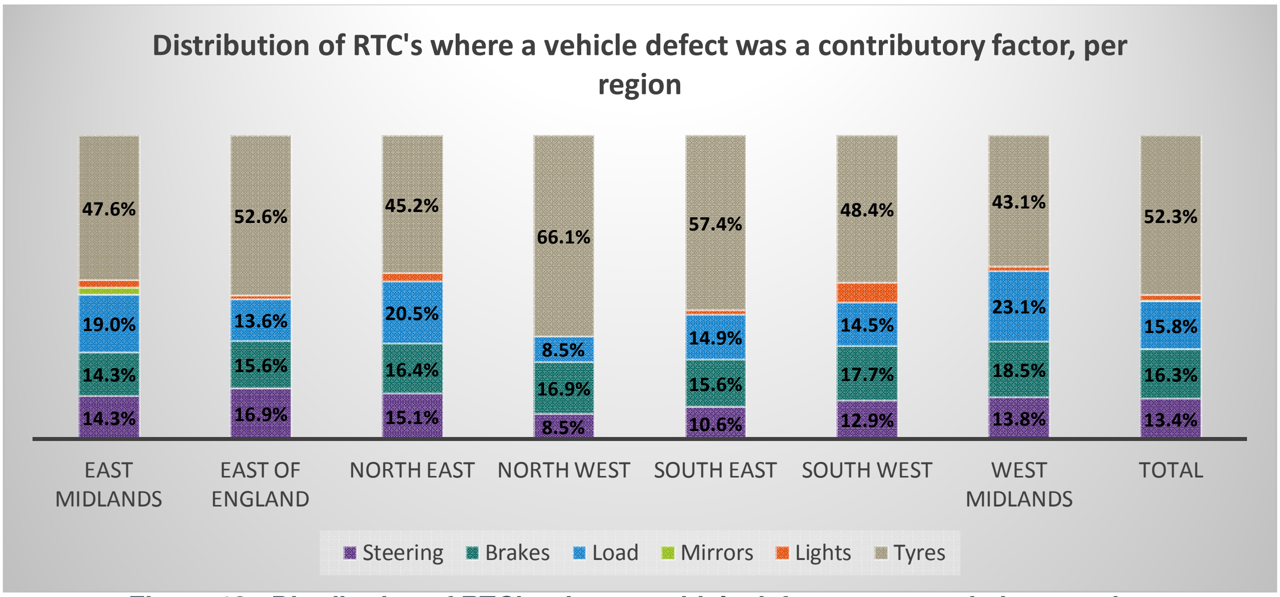

Figure 13 - Distribution of RTC's where a vehicle defect was recorded, per region

Severity of RTC's

Analysing the number of vehicles that were involved in the RTC's and the number of casualties in each RTC it was found that in 21.3% of the RTC's there was only 1 vehicle involved and in 54.5% of them there were 2 vehicles involved. Furthermore, 64.9% of the RTC's resulted in just one casualty and 21.8% with 2 casualties. This would indicate that the number of cars involved in a RTC does not always suggest that there will be more casualties.

Figure 14 illustrates the average severity of the "total all vehicle type collisions" and the "all vehicle type collisions that had a vehicle defect" which occurred in the dataset period. It can be clearly seen that the region with the highest average collision severity was the South West followed by the East Midlands, South East, North West and the East of England. The regions with the lowest average collision severity were the West Midlands and the North East.

When considering the vehicles that had a vehicle defect recorded at the time of the collision a similar trend in regions was found. The region with the worst average severity was the North West followed by the South West, East Midlands and South East. The regions with the lowest average severity were the North East, West Midlands and the East of England.

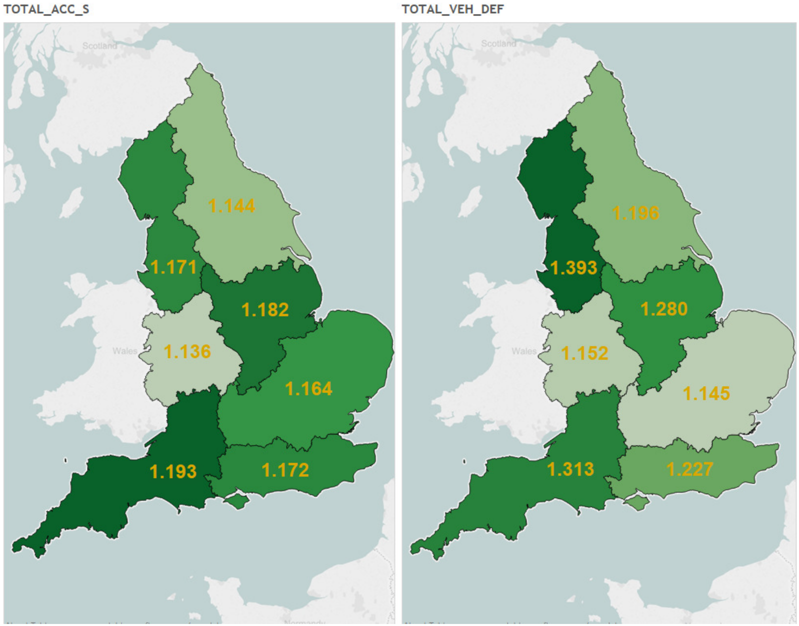

Figure 14 - Distribution of total RTC's and RTC's with a vehicle defect, average collision severity per region

To understand if there is any differences between the severity of collisions involving cars and HGV's the data has been split to show this.

Figure 15 shows the average severity of a RTC where a car has been involved. It shows that the severity of car RTC's shows the same trend as the all vehicle collision data in **Figure 14**.

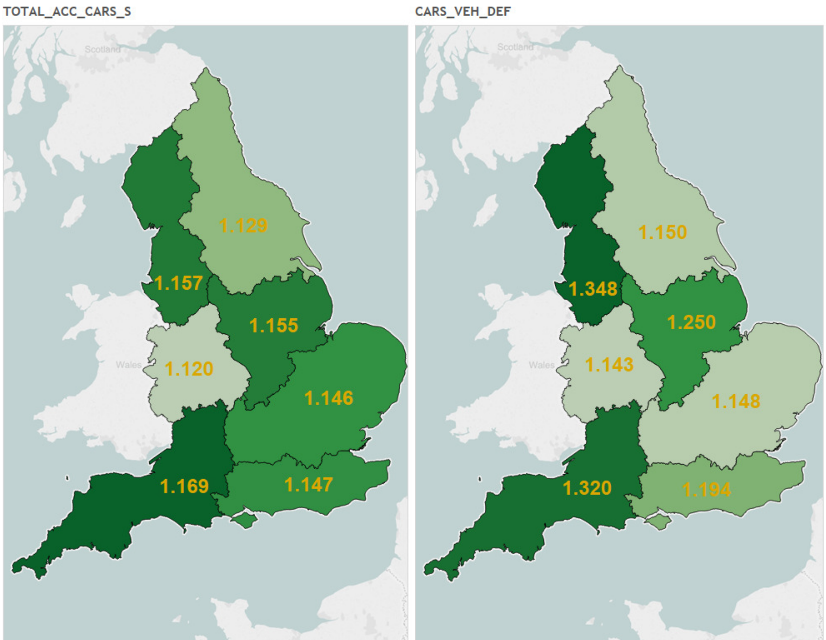

Figure 15 - Distribution of total RTC's and RTC's with a vehicle defect involving cars average collision severity per region

Figure 16 shows the average severity of a RTC were a HGV had been involved. It shows that the severity of all HGV collisions had a similar trend to cars however it appears that the collisions occurring in the South West where a vehicle defect had been recorded are not as severe as the previous trends show. From this it is evident that although the South West had the overall highest severity for HGV collisions these severe collisions do not appear to be due to vehicle defects.

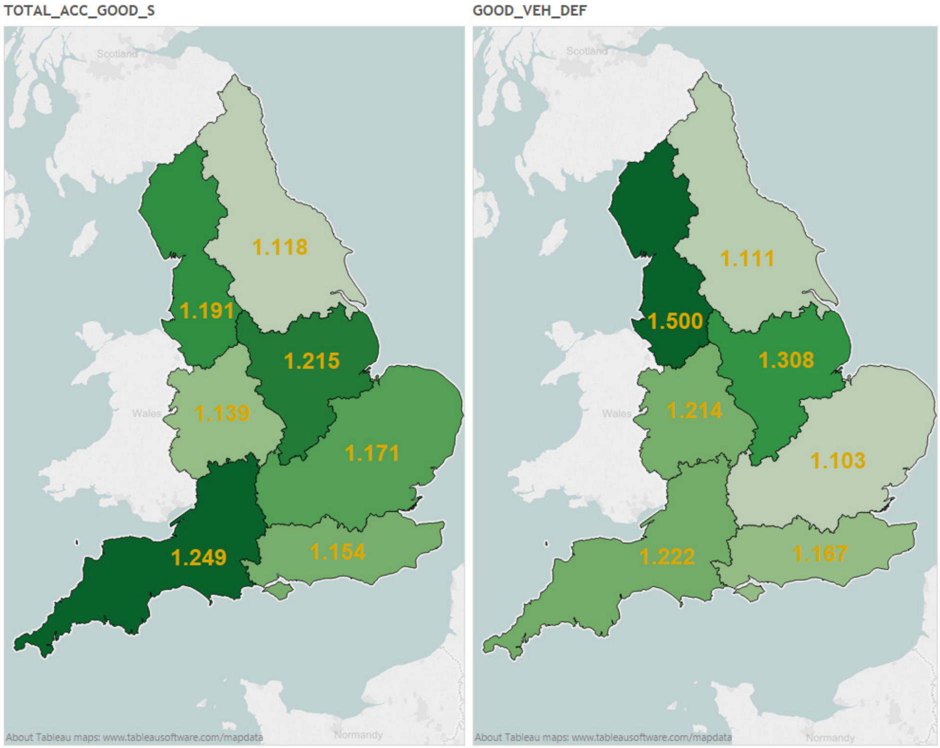

Figure 16 - Distribution of total RTC's and RTC's with a vehicle defect involving HGV's average collision severity per region

When analysing the severity of "all vehicle collisions" (see **Figure 15**) and "all vehicle collisions with a vehicle defect" seasonally (see **Figure 16**) some trends were evident. Despite this it was not clear if these trends were recurring trends as data was only available for certain year periods.

In spring were a vehicle defect was present the severity of the collision was higher than average for all but two regions, the East and West Midlands. The region with the highest overall severity rating and that where a vehicle defect was present was the South West.

In summer, the South East had the overall highest severity rating however the North West had the highest severity where a vehicle defect was recorded. The North East and the East of England were the only two regions where a vehicle defect was recorded with a lower than average severity rating. All other regions had a higher than average severity rating when there is a vehicle defect.

Similarly in autumn there was only one region with a lower than average severity where a vehicle defect was recorded, the East of England. The region with the highest severity rating where a vehicle defect was recorded was the East Midlands which was consistent with the region with the highest overall severity. It should be noted that the region with the lowest overall severity rating however had the 2nd highest severity rating when a vehicle defect was recorded.

In winter there were three regions that had lower than average severity ratings when a vehicle defect was recorded; the South West, South East and East of England. This meant that the North West, the North East and the East Midlands all had higher severity ratings when a vehicle defect was present.

Overall the seasons with the highest and lowest average collision severity ratings for all vehicle collisions were summer and winter respectively with an average of 1.187 and 1.144 each.

Overall the seasons with the highest and lowest average collision severity ratings for vehicle collision where a vehicle defect has been recorded were autumn and winter respectively with an average of 1.343 and 1.132 each. On average where a vehicle defect was recorded there was a higher severity rating recorded seasonally, except in winter.

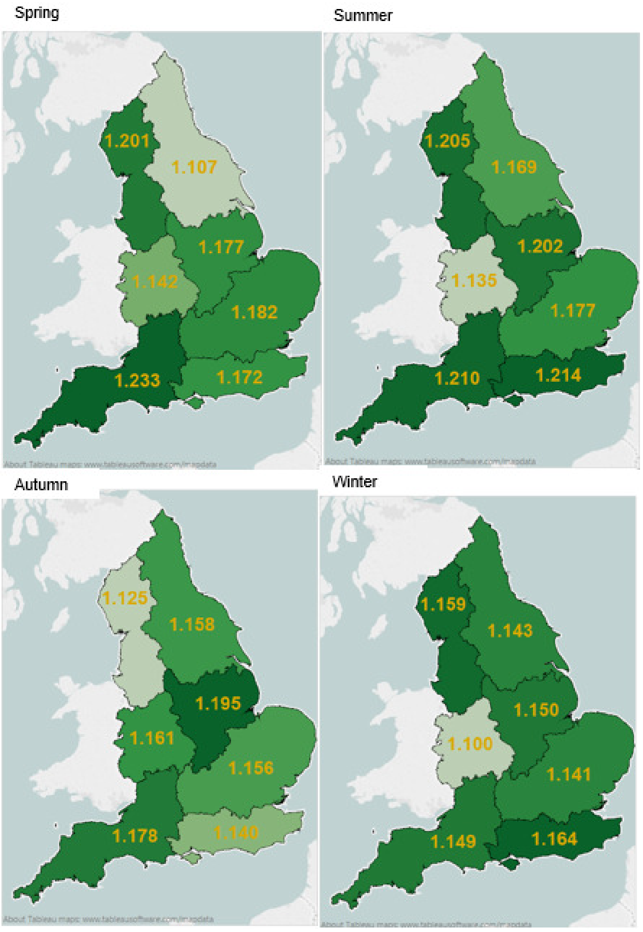

Figure 17 - Distribution of the average severity of all RTC's seasonally

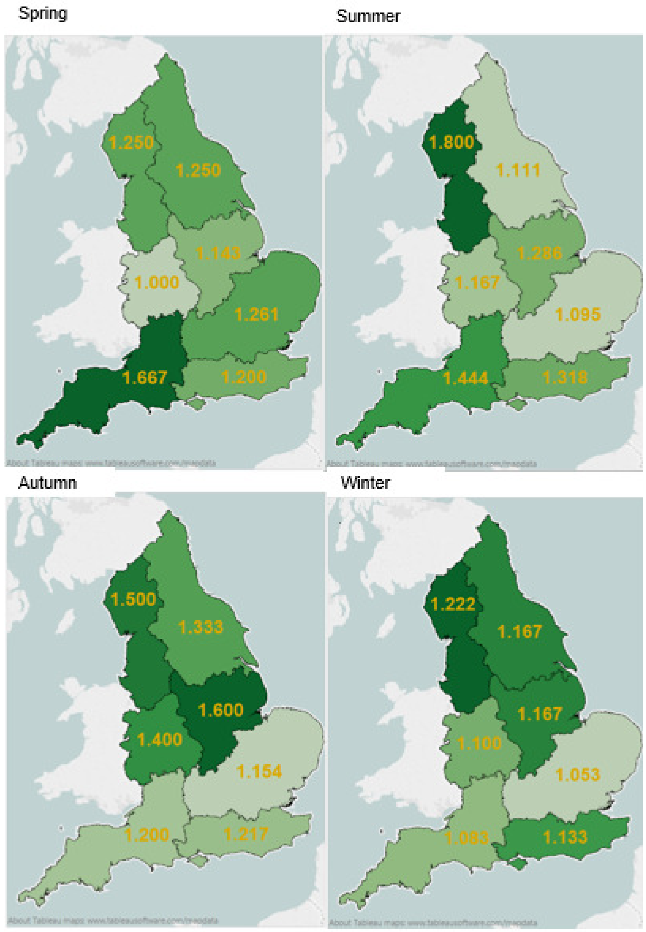

Figure 18 - Distribution of the average severity of all RTC's with a vehicle defect, seasonally

3.3.4. Summary

When looking at the number RTC's (with and without vehicle defects) the following trends were identified:

- The peak number overall RTC's occur during the peak traffic flows, between 08:00 and 09:00, and 17:00 and 18:00.
- The peak number of RTC's where a vehicle defect was recorded occurred between 09:00 and 10:00, and 16:00 and 17:00.
- The months that had the highest number of overall RTC's were July and August, and October and November which was a recurring trend. This could potentially be due to the summer holiday period and the initial Christmas shopping period were more people may be traveling on the network for longer journeys. There was no definitive trend for those RTC's where a vehicle defect was recorded.
- Seasonally, it should be noted that the winter period seemed to experience the fewest number of RTC's with or without a defect. There was little variation in the numbers of RTC's with or without a vehicle defect in the three other seasons.
- Regionally, the number of RTC's with and without a vehicle defect was greatest in the East of England and the South East of England. Similarly when the number of RTC's per region was compared with the traffic flow in each region the South East and East of England had the highest rate of RTC's. The regions with the lowest were the North East and the East Midlands.
- There was no definitive monthly trend in data where a vehicle defect was a contributory factor in a RTC, however, over 50% of the vehicles involved in a RTC's where a vehicle defect was reported had a problem with their tyres.
- The regions with the highest rating for collision severity were the South West, North West and East Midlands.
- The regions with the lowest rating for collision severity were the West Midlands, North East and East of England.
- It is unknown if the seasonal collision severity trends seen during the data period are recurring trends as some yearly data was missing so only the 2014 data was analysed.
- In general the regions with the highest rate for collision severity where a vehicle defect was recorded in the spring were the northern regions as well as the South West and East of England, in summer they were the North West, East Midlands, South West and South East (all generally holiday or port destinations), in autumn they were the northern regions and the Midlands and in winter they were the northern regions and the East Midlands.
- The seasons with the highest and lowest collision severity ratings for all vehicle collisions were summer and winter respectively.
- The seasons with the highest and lowest collision severity ratings for vehicle collision where a vehicle defect has been recorded were autumn and winter respectively. On average where a vehicle defect was recorded there was a higher severity rating recorded seasonally, except in winter.

Following the initial analysis of the data sets it was clear there were some areas that additional data could have enabled a more in depth understanding of the results and may have allowed Atkins to quantify the results. Further analysis of the following would be suggested:

1. A larger data set for the RTC's with a vehicle defect is required to identify more significant trends in data.
2. The peak times when RTC's with vehicle defects occur. The analysis shows the morning peak for RTC's with vehicle defects is between 09:00 and 10:00, and evening peak is between 16:00 and 17:00, shortening the period of peak RTC's with vehicle defects throughout the day in comparison with the total RTC's.
3. Additional severity data. It was evident that certain yearly periods had not been recorded. In order to understand if the trends seen in the 2014 data are recurring this information would be required.

3.4. MOT data - cars

3.4.1. Overview

MOT tests are required by law for any car registered in Great Britain that is over 3 years old. In the year 2013 this equated to a total of 22,830,300 cars registered in Great Britain that needed to be tested, as recorded in the Department for Transport statistics data VEH0207 (Licensed cars by year since registration, Great Britain, annually from 2000). These records also show that the average number of years since first registration has been increasing each year with the average age of a car being 7.9 years old in 2013. Due to the increasing age of car it is vitally important to understand what the main reasons for failing the MOT test are in order to assess how this could potentially impact the SRN.

3.4.2. Methodology

For this task the complete MOT dataset was examined, but it was decided that the efforts to process this vast dataset would not be best value. Therefore MOT test data was obtained from pre-processed publically available records based on data provided by the Driver and Vehicle Standards Agency (DVSA). This data had already been filtered and cleansed before being used for the purpose of this report. Though the data set is robust, it did prove limiting in the granularity that could be explored. The data set was divided into 3 sets:

- Failures by type of vehicle item: 1,089 records corresponding to the years 2006 – 2013.
- Failures by vehicle type (make): 4,795 records corresponding to the years 2006 – 2013.
- Failures by vehicle age: 4,195 records corresponding to the years 2006 – 2013.

In order to compare the MOT data with the other data sets, MOT data was required for the period April 2013 – December 2014. Unfortunately this period was not available from the data set that was obtained. This meant that the data obtained had to be extrapolated so that it would be characteristic of data for the period required for comparison. Due to the way the data was extrapolated it should be noted that for an in depth analysis to be undertaken additional factors would be required, including the economic state and population growth in each of the regions.

The MOT data for cars that was extrapolated has been analysed for the number and rate of MOT failures per region and by make of vehicle, to try and identify any trends which could focus further studies. It is assumed that the MOT data that was obtained is for all MOT's including retests however is unknown due to the original data being cleansed before it was obtained. Data contained within the Department for Transport Statistical Data TSGB0908 (Road vehicle testing scheme, percentage of vehicles failing by type of defect: Great Britain) shows that there was an average initial fail rate for cars of 40% in 2013/14 with the final fail rate being 30.7% in the same year. The final fail rate is the percentage of vehicles that still fail after corrective work has been carried out.

Health Warning: The total number of cars tested in Great Britain was 27,481,013 in 2013/14 based on the data supplied by the DVSA. This data appears to not correlate with the number of registered vehicles needing to be tested as it shows that more cars were tested than registered. This could be due to retests, however it is unknown and therefore caution should be taken when considering the results in this section. Going forward, there may be some benefit in processing or acquiring pre-processed data for both the number of vehicles that undergo a MOT test including the number of retests and the number of registered vehicles in order to fully understand why they vary.

3.4.3. Analysis

Table 9 shows the percentage rate of MOT failures by region and type of item failure. The percentage rate refers to the number of items failing the MOT. The regions with a larger average fail rate of MOT's by item are the North East and South West with an average failure rate of 8.7%, while East of England (6.6%) and South East (7.4%) are the regions with the lowest fail rates. Countrywide, the items that fail the most are shown to be the lamps, reflectors and electrical equipment (20% average) as well as the suspension (13.6% average) and the brakes (11.3% average). The items that have the lowest fail rate in cars are the seatbelts (2% average), body of the car (1.5% average) and registration plates (1.1% average).

	Body, Structure and General Items	Brakes	Driver's view of the road	Exhaust, Fuel and Emissions	Lamps, Reflectors and Electrical Equipment	Registration plates and VIN	Seat Belts & Supplementary Restraint Systems	Steering	Suspension	Tyres	Average
East Midlands	1.5%	12.2%	7.3%	5.5%	19.9%	1.1%	2.1%	3.6%	14.9%	7.9%	8.2%
East of England	1.2%	7.4%	6.8%	3.9%	19.6%	1.1%	1.5%	2.2%	9.7%	7.5%	6.6%
North East	1.6%	14.0%	7.9%	5.4%	19.8%	1.2%	1.9%	4.2%	15.8%	8.4%	8.7%
North West	1.6%	10.9%	8.0%	5.1%	19.6%	2.1%	2.1%	3.5%	13.9%	9.4%	8.2%
South East	1.2%	8.7%	7.6%	4.8%	20.8%	1.1%	2.2%	2.7%	11.6%	8.6%	7.4%
South West	1.9%	12.5%	9.1%	6.7%	22.1%	1.1%	3.0%	4.0%	15.7%	10.0%	8.7%
West Midlands	1.6%	11.4%	7.3%	5.4%	20.3%	1.0%	2.2%	3.7%	14.5%	8.1%	8.0%
Average	1.5%	11.3%	7.6%	5.2%	20.0%	1.1%	2.0%	3.5%	13.6%	8.5%	8.0%

Table 9 - Distribution of car MOT failure rate per item and region

As several items may fail on the same vehicle it was important to look at the number of vehicle failures. **Figure 19** and **Figure 20** shows the percentage number of failures for cars per region out of the total number of tests carried out in each region. These figures show a similar trend to **Table 9** as the highest failure rate of cars is also seen to be in the North East (38.0%) and South West (41.6%) regions, both of these regions show a higher than the average failure rate. The average failure rate across the whole of the SRN is shown to be 37.1%, which coincides with the North West region, as highlighted in **Figure 19**.

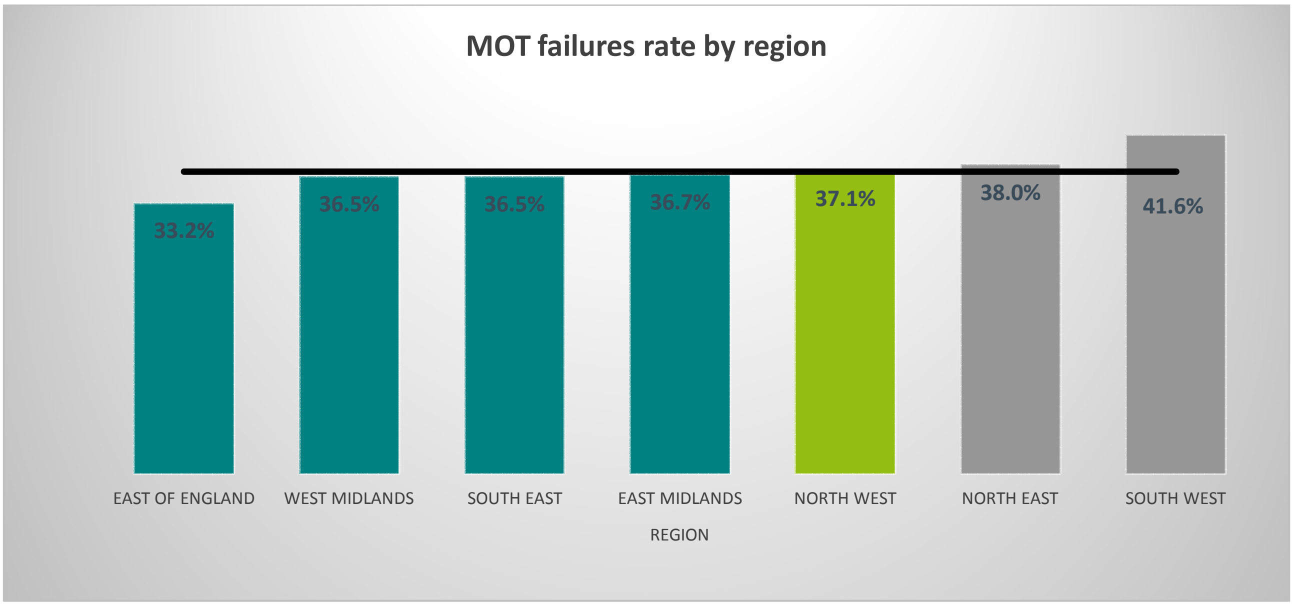

Figure 19 - Distribution of car MOT failures per region

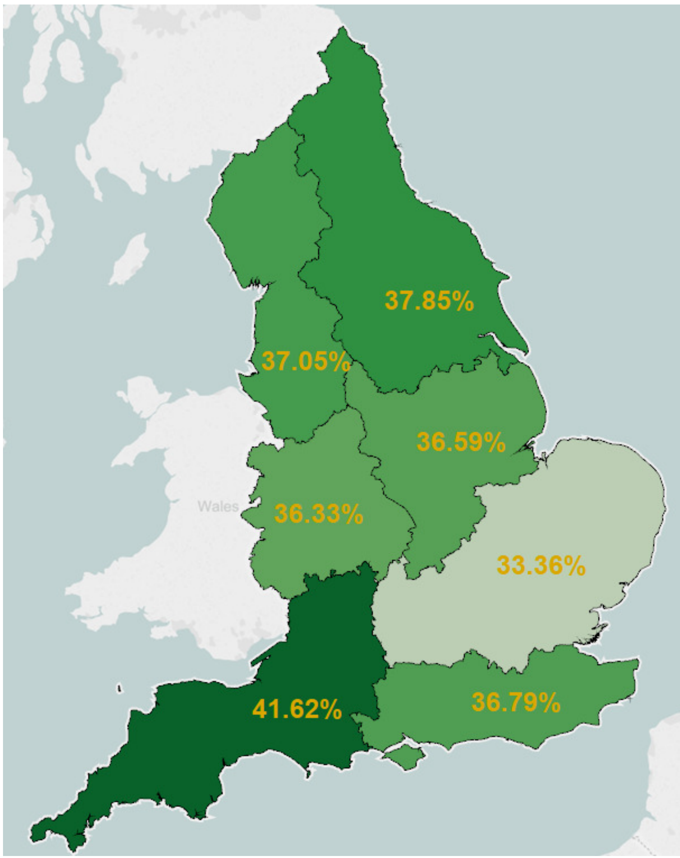

Figure 20 - Distribution of MOT failure rates per region

Figure 21 illustrates the failure rate (the percentage of MOT failures based on the number tested) by make which shows that Rolls-Royce (7.7%), Bentley (13.1%) and Aston Martin (13.4%) are the cars with the fewest failures. On the other hand Daewoo (54.5%), Talbot (51.7%) and Renault (50.5%) all have failure rates greater than 50%.

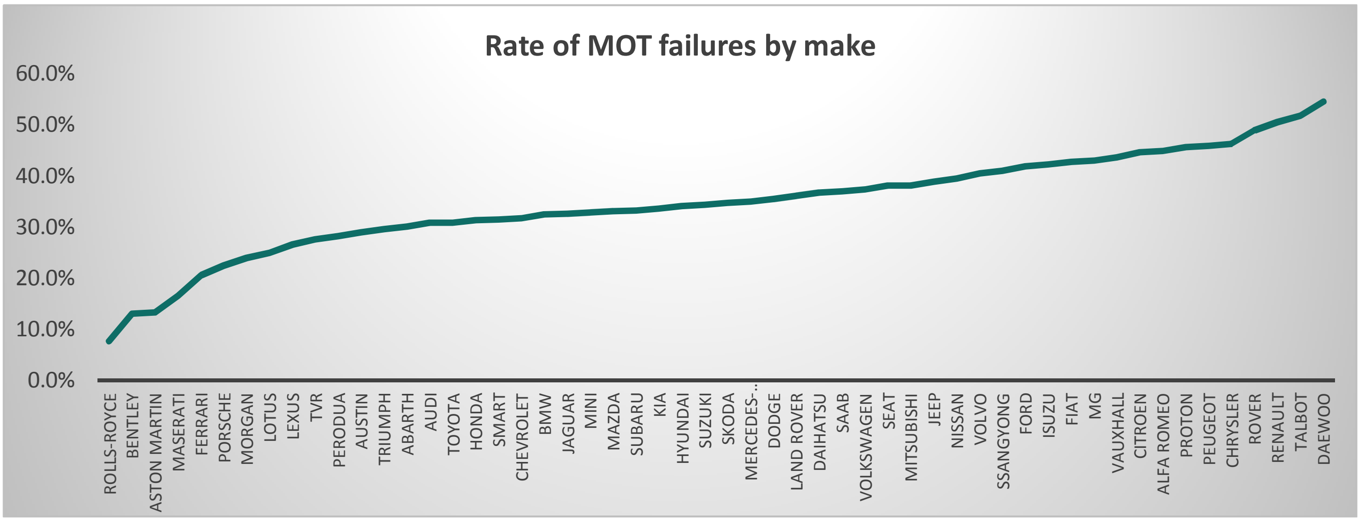

Figure 21 - Distribution of failure rate by make

A further analysis has been undertaken to understand how each MOT failure could potentially have an impact on the network. It can be seen in **Figure 22** that the makes Peugeot (183,068), Vauxhall (333,968) and Ford (423,604) are the makes which may have the biggest potential impact on the SRN due to them having the highest number of MOT fails. This also coincides with the fact that these are some of the most popular makes of cars. Bearing this in mind, the makes that have the lowest possibility of impacting the SRN are Rolls-Royce, Abarth and Morgan with just 2, 7 and 8 vehicles failing the MOT during the analysed period.

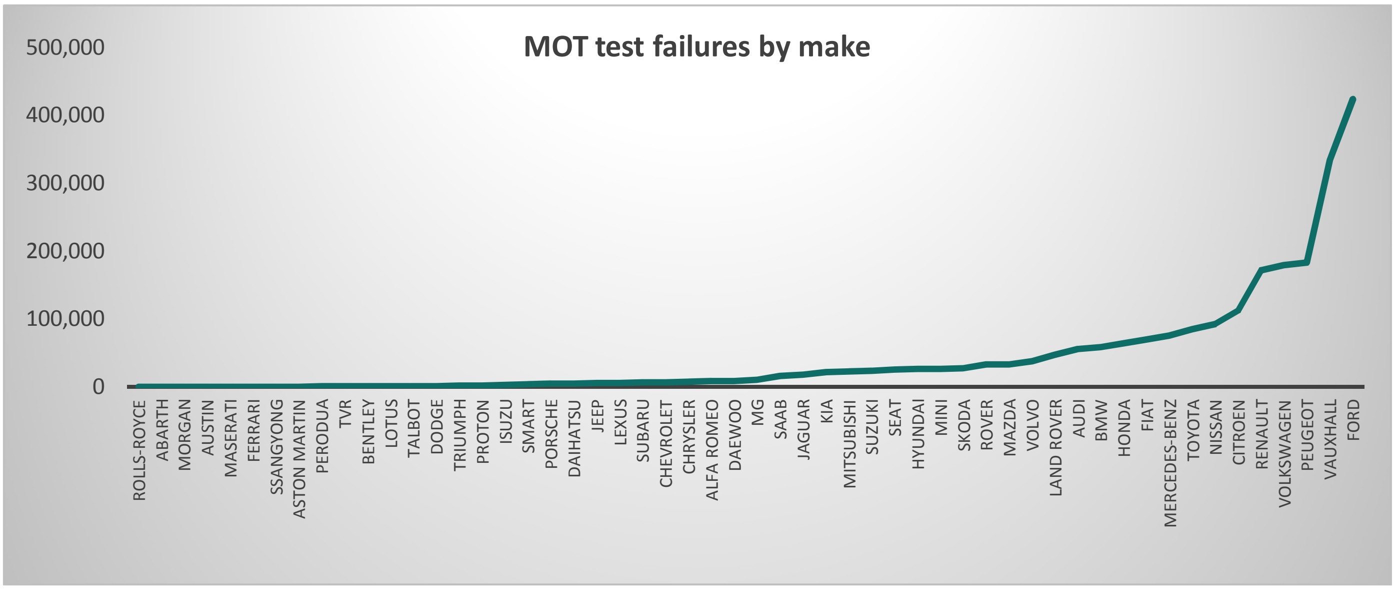

Figure 22 - Distribution of the potential impact to the SRN by vehicle make (total number of failures during the dataset period)

Figure 23 shows the total number of MOT failures that occurred per region during the dataset period. These results differ to the previous results in **Figure 20** as they compare the total number of failures in each region with the total number of failures throughout England however the results in **Figure 23** can be directly linked to the potential impact the unroadworthy vehicles may have on the network. In this case the East of England comes up as the worst region by far, with the percentage of failures being 22.9% of the total amount of failures. The second worst area for MOT failures is the North East with 13.0% of failures, then the South West, North West and South East (11.7%, 11.3% and 11.4% respectively). West Midlands (8.8%) and East Midlands (6.7%) are the regions with the lowest number of failures.

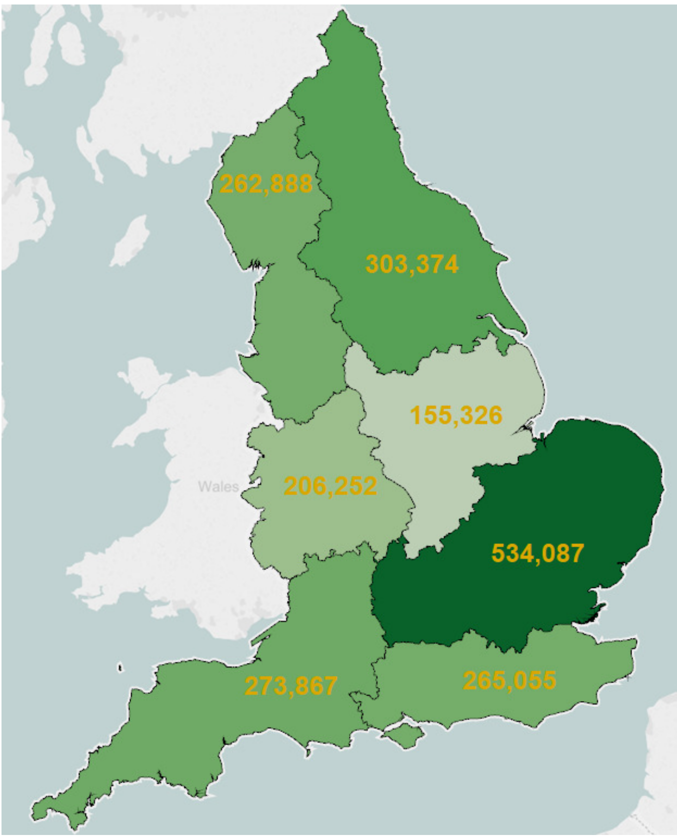

Figure 23 - Distribution of the potential impact to the SRN per region (total number of test failures per region during the dataset period)

3.4.4. Summary

When looking at the MOT results for cars the following trends were identified:

- The number of MOT car failures was concentrated in the East of England based on the total number of tests carried out however, the region that had the highest fail rate was actually the South West.
- The average fail rate across all 7 regions was 37.1%, both the South West and the North East had fail rates above this average.
- The MOT car data shows that the largest contributory elements for MOT failures was where the lamps, reflectors and the electronics failed, followed by the suspension and then brakes.

Following the analysis of the pre-processed data sets obtained for the purpose of this report, it was clear there are some areas where more detailed analysis of a better data set could enable a more in depth understanding of the results and allow Atkins to better quantify the results. Further analysis of the following is suggested:

1. A set of MOT data for cars that can be analysed for the period within the report (April 2013 to December 2014). If this is not possible additional information needs to be provided in relation to the economic state and population growth in each region so that the extrapolated data could be improved.
2. 1st time MOT data. The MOT data set for cars that was used did not separate out 1st time MOT's.
3. Number of vehicles registered and the number of vehicles that undergo a MOT as they currently do not correlate, most likely due to the potential inclusion of re-tests within the data used in this report.

3.5. MOT data – goods vehicles (HGV's, PSV's and trailers)

3.5.1. Overview

MOT's are required by law for any goods vehicle registered in Great Britain regardless of the age of the vehicle and must be carried out annually. In the year 2013 the total number of Heavy Goods Vehicles (vehicles over 3.5 tonnes) (HGV) that were registered in Great Britain was 468,900 and in 2014 it was 473,900, as recorded in the Department for Transports Statistical Data VEH0506 (Licensed heavy goods vehicles by weight, Great Britain, annually from 2000). With the increasing number of goods vehicles being registered within Great Britain it is important to assess what the main causes of HGV MOT failures are as these vehicles could potentially lead to an impact on the network prior to having the MOT test carried out. For the purpose of this report it is assumed that the region that the MOT failure is recorded in, would be the region that the potential impact on the SRN would be felt.

3.5.2. Methodology

The test data for this analysis was obtained from the DVSA – Information Access Team for the period April 2014 to March 2015. This period differs from the other analysed results in this Report due to only one years' worth of data being made available.

In the data provided, the total number of tests during the period was 640,283, with 84.4% of the vehicles being HGV's (over 3.5 tonnes), 14.1% were public service vehicles (PSV) and just 1.5% were trailers. It should be noted that the number of registered HGV's that were over 1 year old and requiring an MOT in 2014 was 437,600 (DfT's statistical table VEH0507), the total number of PSV's was 136,500 (DfT's statistical table VEH0604) and there is no record of the number of trailers that were registered for this period. These figures differ from the number of tests completed which may be potentially due to retests however caution should be taken when considering the results of this analysis. In order compare the data and ensure it is correct the number of registered PSV's by age should be obtained along with the registered trailers by age and the number of retests that have been undertaken for each vehicle type.

The variables that were considered for this analysis included the location the tests were carried out, the type of vehicle being tested and whether the vehicle passed or failed the test.

Several steps were taken to analyse the data:

1. In order to transform the data into the Highways England regional locations the test facilities location was selected by city/town before assigning them to their respective regional location.
2. Three types of vehicles were tested; HGV's, trailers and PSV's (the results are shown for each vehicle type).
3. The result of the test was originally provided in 5 different categories; abandoned, fail, pass, prohibition and pass after rectification at the station (PRS). For the purpose of this analysis only those tests that resulted in fail or PRS were considered. The percentage of abandoned tests was only 0.3% and therefore was not included. Vehicles under prohibition are not permitted on the road unless an exemption notice has been issued or when exceptional circumstances (listed on the prohibition notice) apply. Due to this, vehicles under prohibition have also not been considered in this analysis.

3.5.3. Analysis

Figure 24 shows the rate of MOT failures by type of goods vehicle. A similar trend is present across all three types of vehicles, with the South West and West Midlands having the highest failure rate for each type of vehicle, except for the PSV's where the North East also has a high failure rate and the East Midlands for trailer failures. Despite these aforementioned regions having the highest failure rates it should be noted that on average most regions have a similar failure rate for the three different categories of vehicles. In addition to this **Figure 24** also shows that trailers have a higher fail rate (24.1%), than the HGV (19.7%) and finally the PSV (16.3%).

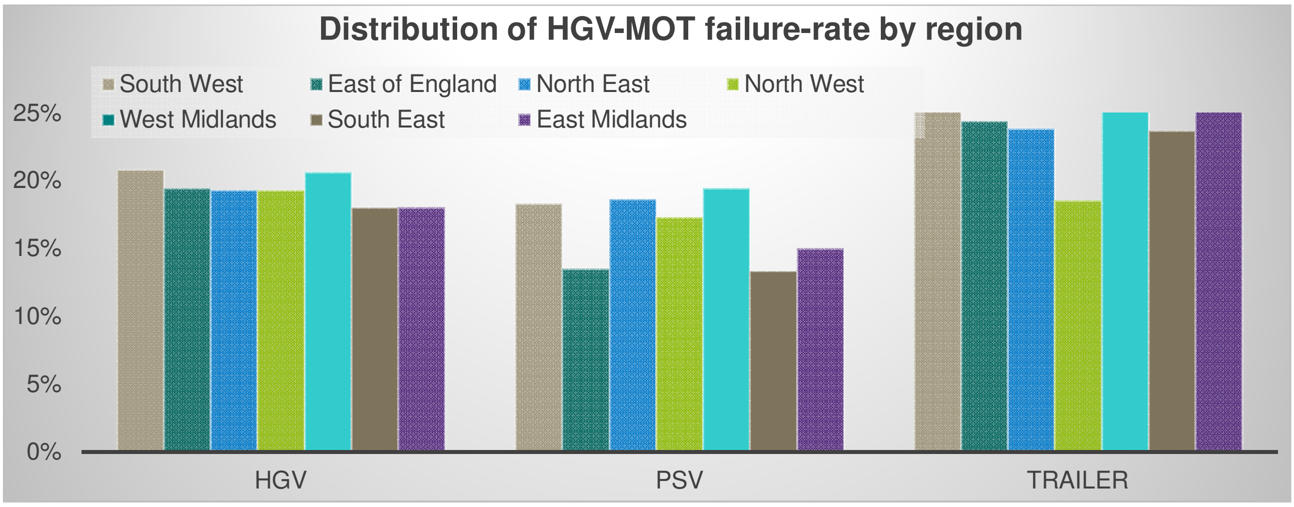

Figure 24 - Distribution of HGV MOT failure rates by region

Figure 25 considers all three vehicle types together for the average regional failure rates. The regions with a larger average MOT fail rate are the West Midlands (22.1% of the tests failed), South West (21.5%) and the North East (20.6%), while the North West (18.4%) and South East (18.3%) are the regions with the lowest fail rates.

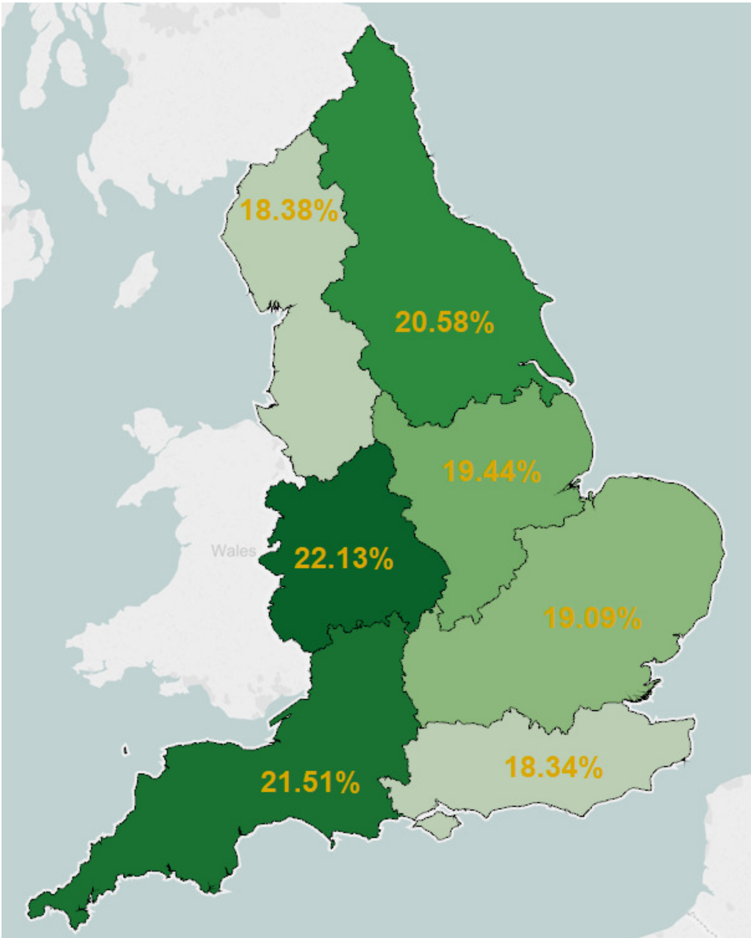

Figure 25 - Distribution of HGV MOT failure rates per region

Figure 26 and **Figure 27** show the percentage of failures that occur in each region and the total number of failures in each region respectively. They show that the South West is the region with the largest number of MOT failures (35% of the total amount of failures) followed by the East of England (20.4% of the total amount of failures) and the North East, North West and West Midlands (13%, 9.6% and 8.1%). The South East (6.7%) and East Midlands (7.2%) are the regions with the lowest number of MOT failures.

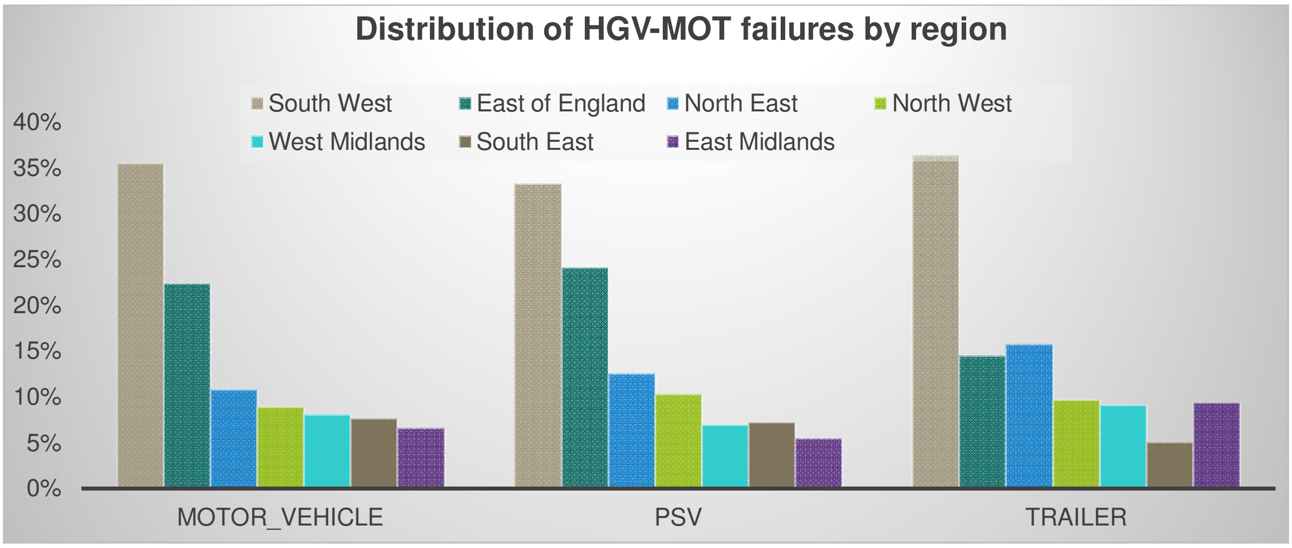

Figure 26 - Distribution of HGV MOT failure by region

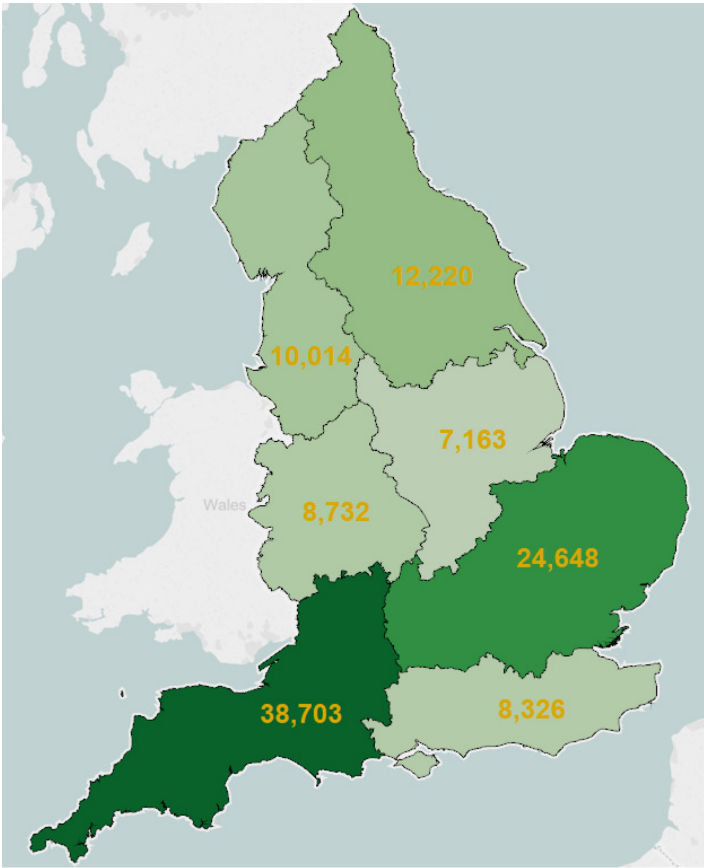

Figure 27 - Distribution of the potential impact to the SRN per region taking into taking account of the number of vehicle tested in each region

3.5.4. Summary

When analysing the HGV MOT data the following trends were identified:

- The number of HGV MOT failures was concentrated in the South West and East of England based on the total number of tests carried out, although the regions with the highest fail rates are the South West, West Midlands and North East.
- The average fail rate for goods vehicles (trailers, PSV and HGV) across the different regions is 20%, with trailers having the highest fail rate, 24.1%.

Following the initial analysis of the data sets made available for the purpose of this report, it was clear there are some areas were more detailed analysis would enable a more in depth understanding of the results that may allow Atkins to better quantify the results. Further analysis of the following is suggested:

1. The number of registered PSV's by age should be obtained, if available, along with the registered trailers by age and the number of retests that have been undertaken for each vehicle type.

3.6. MOT vs STATS19 vs C&C – All vehicle types

Seasonal Variance

Now considering the STATS 19 and C&C data together we can see that, in general, similar seasonal trends appear. However the data for RTC's where a vehicle defect was recorded is slightly different, potentially due to the small available sample size.

The general trend is that the summer period (July and August) has more RBI's and RTC's (both with and without a vehicle defect). From **Figure 28** it is also evident that the period between February and June has the lowest number of RBI's and RTC's. This period covers the end of the winter period and all of the spring period.

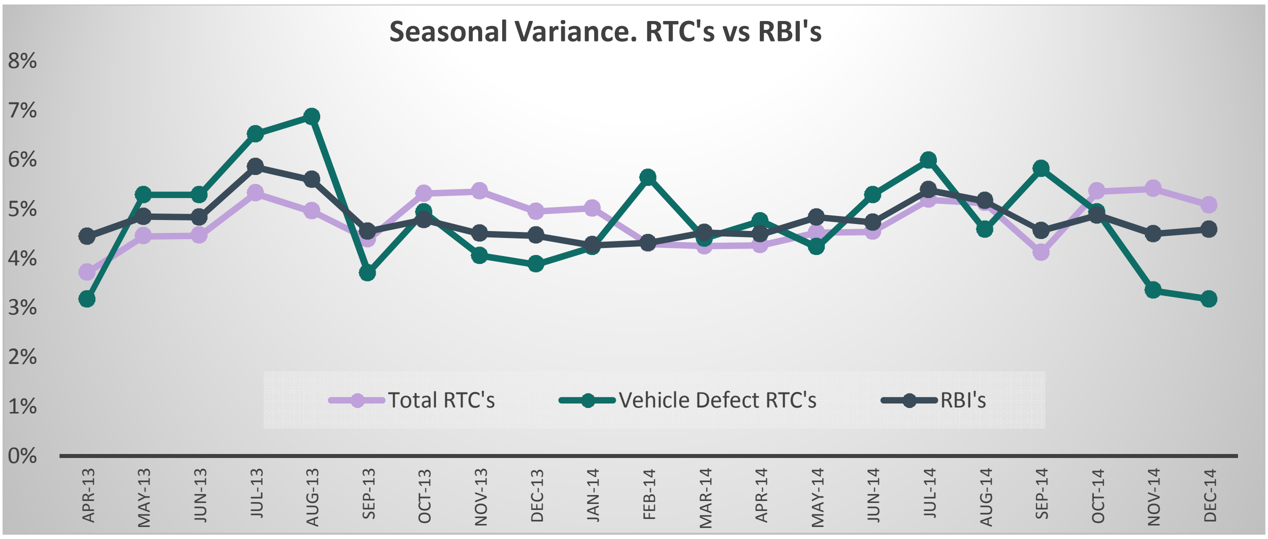

Figure 28 - Distribution of RBI's, total RTC's and RTC's with vehicle defects per month

Initially it was thought that that the RBI's data did not follow the normal trend however it can be seen in **Figure 29** that the trends between the RBI's and all RTC's are similar. Despite this there is one main difference between them as the RBI peaks are not as pronounced as would be expected during the morning and evening peak periods.

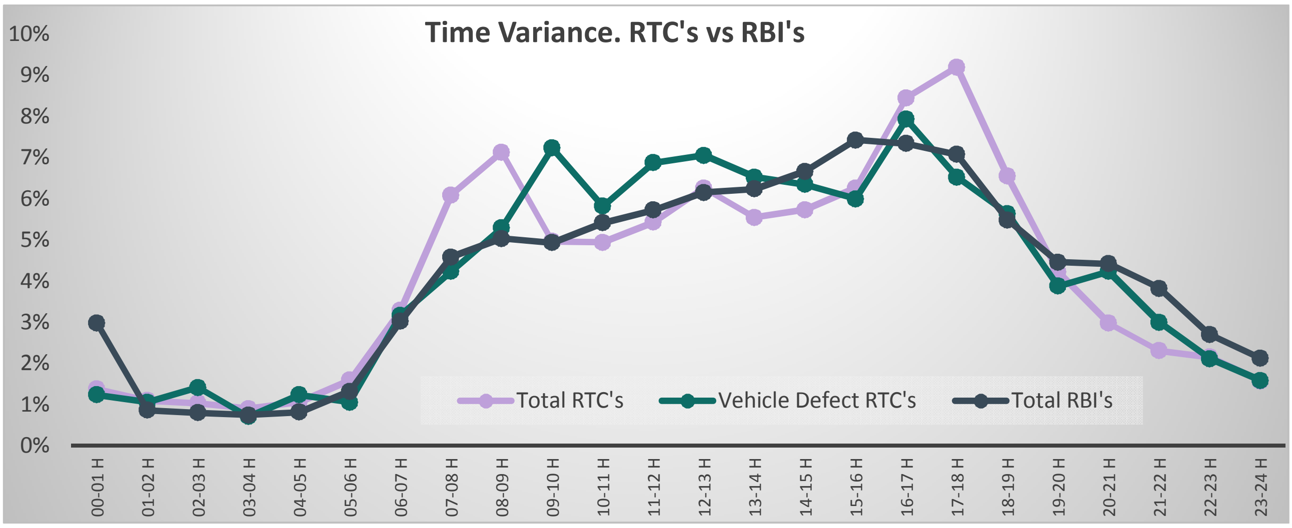

Figure 29 - Distribution of RBI's, total RTC's and RTC's with vehicle defects per hour

Regional variance for all types of vehicles

Figure 30 illustrates that the total RTC's and the RTC's with vehicle defects and traffic flows have a similar trend showing concentrated RTC's in the South East, East of England and North West regions. The regions that have the highest RBI's with respect to traffic flows in the region are however the North West and the West Midlands.

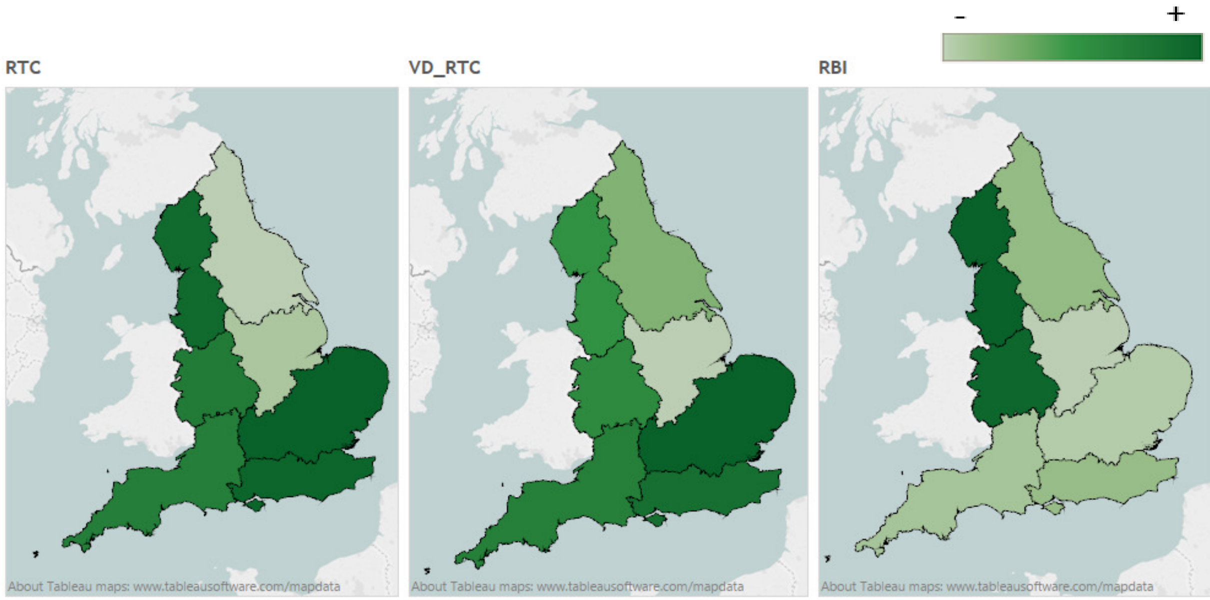

Figure 30 **- Regional Distribution of total RTC's, RTC's with vehicle defects and RBI's for all vehicle types**

Regional variance for cars

Figure 31 shows similar results to **Figure 30** but the data for the RBI's and RTC's only covers cars. It can be stated that by focusing solely on the number of RBI's and RTC's involving cars does not change the trend across the regions as the worst regions for RTC's are still noted as being the South East, East of England and the North West. For the RBI's the worst regions are the North West and West Midlands. The trend of MOT rate differs however as it shows that the South West is the worst region for MOT failures and the East of England is the best.

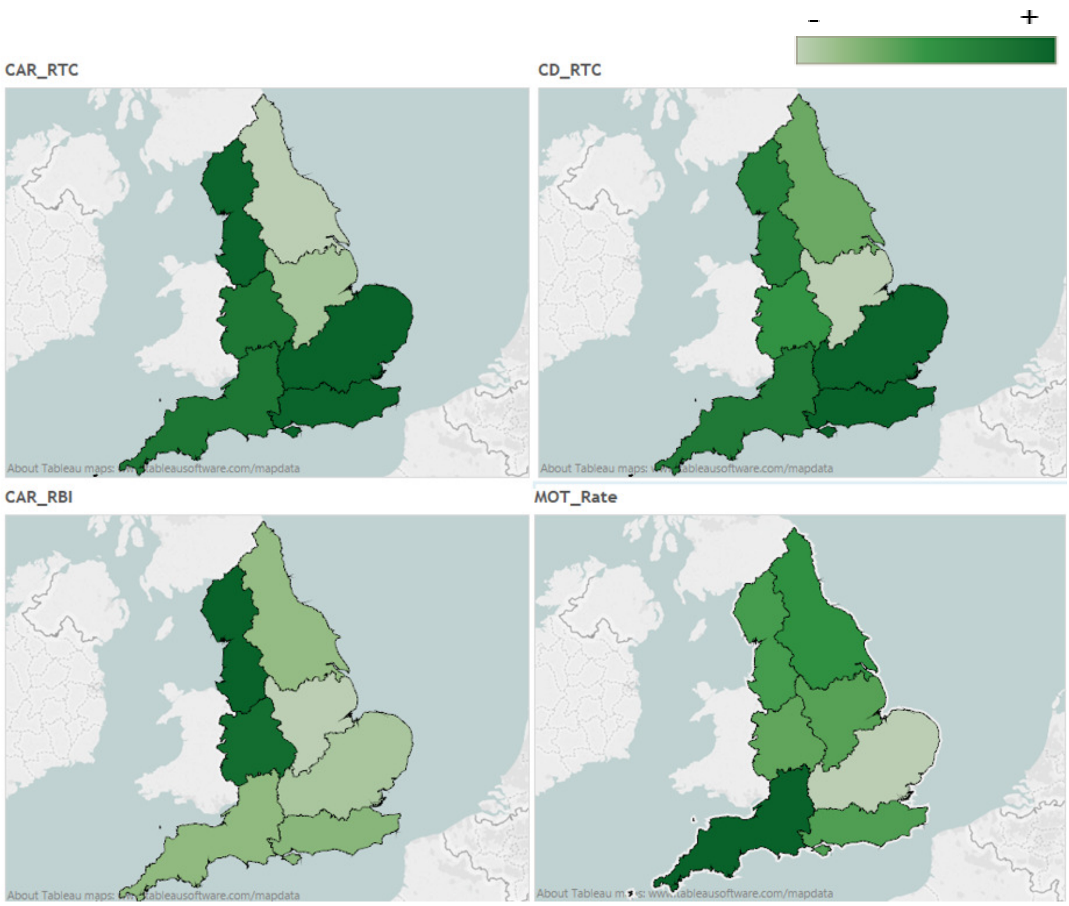

Figure 31 **- Regional Distribution of total RTC's, RTC's with vehicle defects and RBI's for cars and regional distribution of the MOT test failures**

Regional variance for all goods vehicles

There are little significant trends that can be made between the RBI's, RTC's and MOT data for goods vehicles as each data set records goods vehicles differently;

- RBI's consider goods vehicles to be vehicles greater than 3.5 tonnes including plant, PSV's, trailers and agricultural vehicle.
- RTC's consider goods vehicle to be those greater than 3.5 tonnes not including other types of vehicles.
- MOT data considers goods vehicles to be those greater than 7.5 tonnes, PSV and trailers.

Despite this focusing on **Figure 32** and the RTC's, we can see that the regions that have the highest percentage of goods vehicle RTC's with respect to traffic flow are the North West, West Midlands, East of England and the South East regions. When considering only those RTC's with respect to traffic flow and where a vehicle defect was recorded, the worst regions were the West Midlands, East Midlands, South West and East of England.

The results for the RBI's with respect to the traffic flow in each region differ from the RTC's as the regions that have the worst figures are the North West, West Midlands and the North East. All other regions appear to have comparatively low RBI's with respect to the traffic flows.

The goods vehicle MOT failure rate was highest in the South West, West midlands and the North East, all other regions showed considerably lower rates of failures with regards to the number of tests carried out in each region.

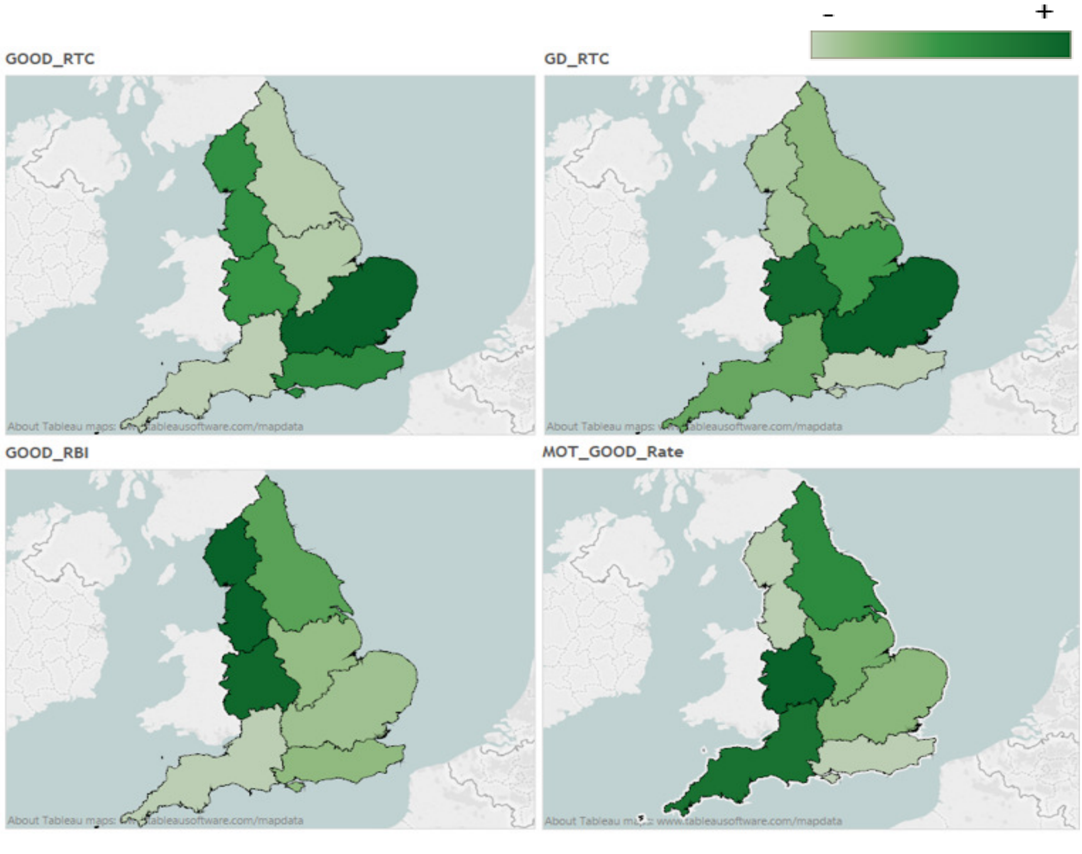

Figure 32 - Regional Distribution of RTC's and RBI's for goods vehicles

Seasonal and regional variance for all types of vehicles.

Figure 33 illustrates the seasonal and regional variations for all types of vehicles analysed in this report. It indicates that there is generally little seasonal variation in the number of RBI's or the number of RTC's (with and without a vehicle defect) between the seasons.

It can be seen that overall the South East and East of England are the regions with the highest number of RTC's with respect to traffic flow while the regions with the highest number of RBI's with respect to traffic flow are the North West and West Midlands, throughout all seasons.

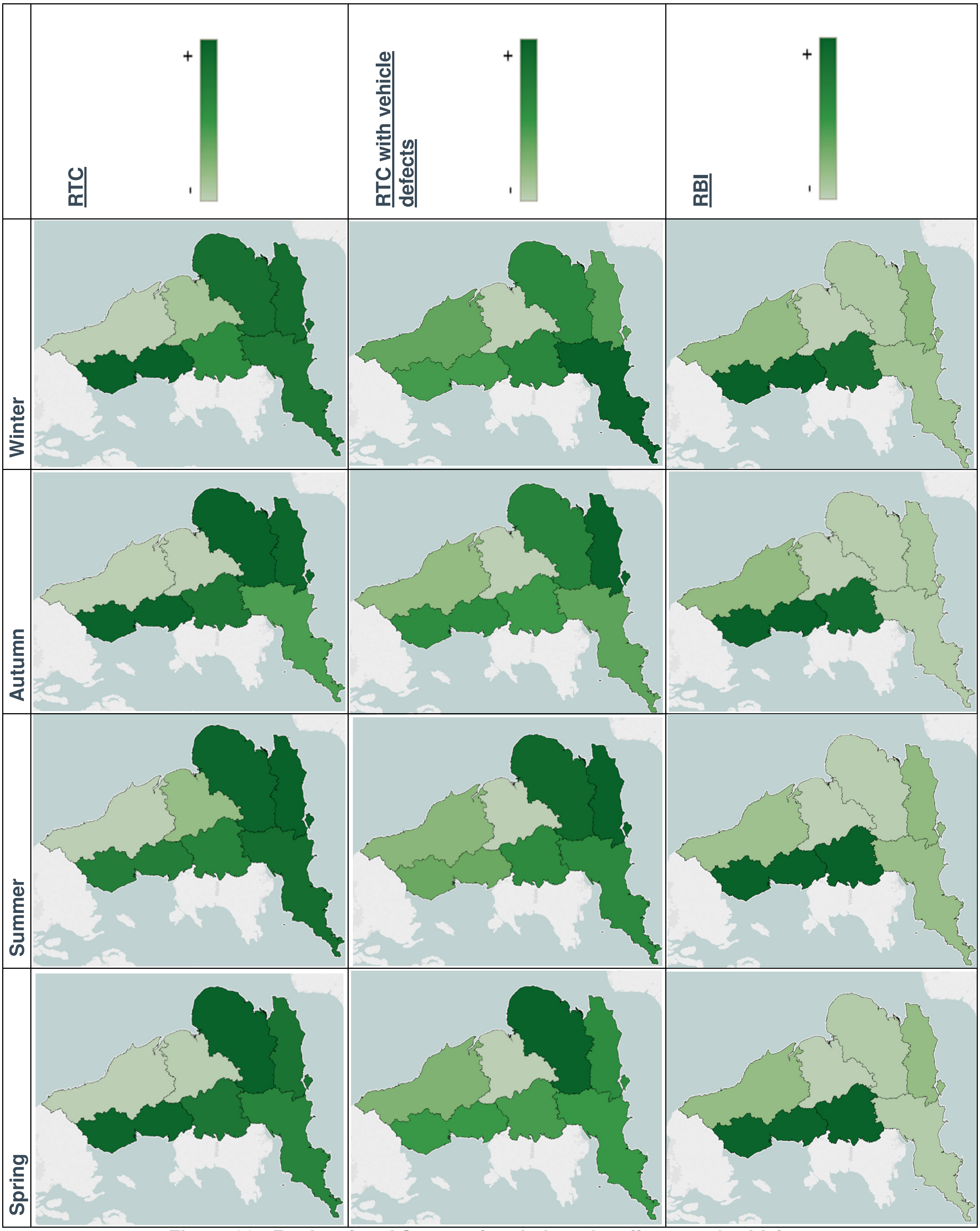

Figure 33 - Regional and Seasonal variations for all types of vehicles

3.6.1. Summary

When comparing the RBI, RTC (with and without vehicle defects) and the MOT data the following trends were identified:

- The summer period (July and August) has more RBI's and RTC's (both with and without a vehicle defect).
- The period between February and June has the lowest number of RBI's and RTC's.
- The trends between the RBI's and all RTC's are similar. Despite this there is one main difference between them, the RBI peaks are not as pronounced as would be expected during the morning and evening peak periods.
- There is some similarity between the total RTC's, RTC's where a vehicle defect has been recorded and the RBI data for all vehicle types. The North West and the West Midlands were recorded as the worst regions for the RBI's and whilst these also recorded high numbers of RTC's with respect to the traffic flow other regions that were particularly bad included South East, South West and East of England.
- Similar trends as those for the total vehicles were recorded for the RTC's (with and without vehicle defects) and RBI's for cars only. The worst region for MOT failures was the South West while the best region seemed to be the East of England.
- Unlike the data for cars it is very difficult to make a comparison between the RTC's (with and without a vehicle defect), the RBI's and the MOT failures because they are all recording different data.
- When comparing the data seasonally there was little to no seasonal variation.

3.7. Enterprise Holdings incident list

3.7.1. Overview

Enterprise Holdings is a worldwide company who specialises in renting cars and vans to the public and businesses. Set up in 1957 Enterprise has a presence in more than 30 countries with over 7,200 locations worldwide including nearly every city in the United Kingdom. It is estimated that Enterprise Holdings have over 90,000 vehicles in the UK of which roughly 60,000 are cars.

3.7.2. Methodology

The data that has been received from Enterprise Holdings covers breakdowns of their cars and lorries (assumed to be LGV) across the whole of the UK between January 2015 and November 2015. The total number of breakdowns recorded by Enterprise Holdings that occurred in this period was 23,171.

The received data was categorised by make, location, component at fault, fault description and service given. Due to the way in which some of the information was recorded (free text) it was not analysed as part of the analysis however the variables that were analysed include the make and component at fault.

The component at fault was separated into 10 individual categories: Tyres and wheels; Windows, windscreens and mirrors; ABS system and brakes; Suspension; Lamps, sensors and Electrical Equipment; Engine, security systems and other mechanical systems; Body and General Items; other and unknown.

The main variable that Atkins would have liked to analyse was the location of the breakdowns, but this could not be easily done due to the location being part of the free text input.

3.7.3. Analysis

Taking the number of breakdowns by make of vehicle, as shown in **Figure 34,** it is clear that the make that has the most breakdowns is Vauxhall with 35.2%. The makes that have the next highest number of breakdowns are Ford, Toyota and Renault (11.4%, 8.2%, and 7.5% respectively).

It should be noted that despite the results showing that the larger number of breakdowns happen with the aforementioned makes it is not known how many vehicles of each make Enterprise have in their UK fleet at any one time. It could be that the majority of Enterprises fleet are made up of these makes or just that they are the most commonly rented vehicles. To fully understand the impact of these results the number of vehicles by make and how often they are rented would be needed.

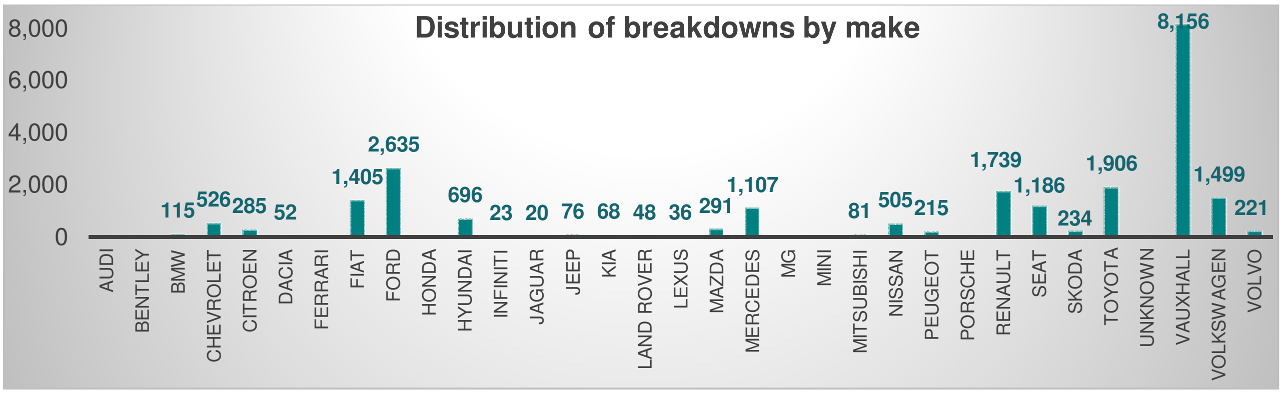

Figure 34 - Distribution of breakdowns by make

Additionally, **Figure 35** shows the number of breakdowns by the component that was at fault. It is evident that the tyres and wheels are the main reason for breakdowns, followed by unknown reasons and the electrical equipment. Unfortunately there were several recovery's that did not record either the component at fault or a description of the fault these therefore had to be classified as unknown. Due to the high number of faults that are classed as unknown this could be of significant importance. It is recommended that further discussions are had with Enterprise about this information in order to understand why there are so many breakdowns where a fault is not reported how this could be rectified in the future. The areas that are lower than expected, based on a comparison with the MOT test data, are the brakes and the suspension. The faults with the lamps, sensors and electrical equipment, although one of the highest causes is not as high as anticipated, similarly the tyres and wheels cause a lot more breakdowns than initially anticipated. The reasons for these variations could be due to the fact that the vehicles are rented and are therefore potentially better maintained but do more millage.

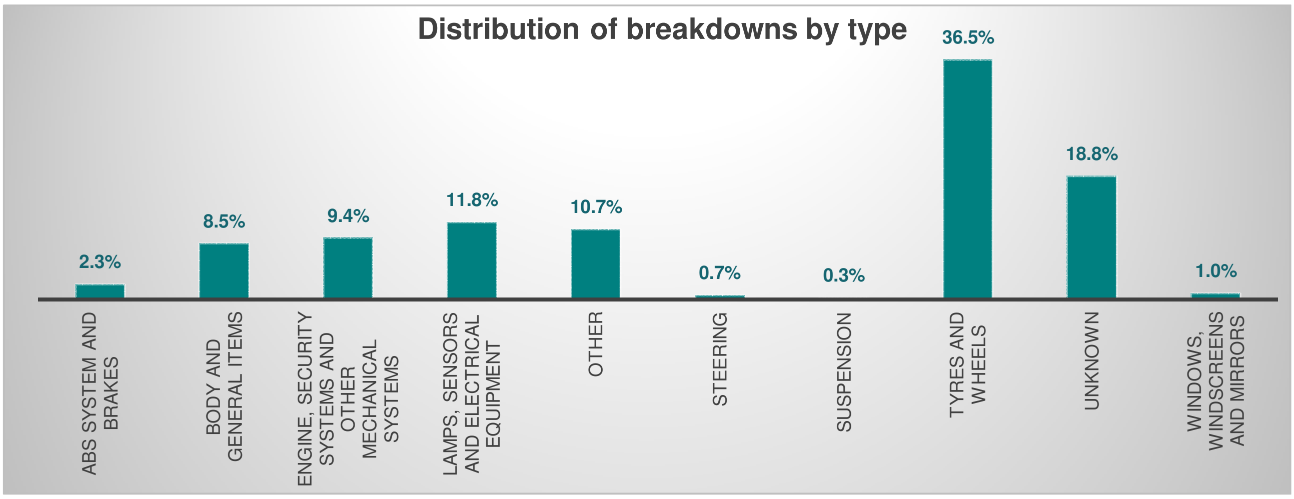

Figure 35 - Distribution of breakdowns by type of breakdown

3.7.4. Summary

In summary some trends have been identified although cannot be qualified until additional information is obtained. These trends are:

- Enterprise Holdings Vauxhall vehicles have the most breakdowns (35.2%) followed by Ford (11.4%), Toyota (8.2%) and Renault (7.5).
- The main contributor to the faults are the tyres and wheels (38.5%) followed by unknown causes (18.3%) and lamps, sensors, and electrical equipment (11.8%).
- The lowest contributors were the steering (0.7%), suspension (0.8%) and windows, windscreens and mirrors (1%).

In order to confirm the above trends additional information would be required including; the number of vehicles by make that Enterprise Holdings have at any one time, how often each make of car is rented, why some breakdown faults have not been recorded and how this information could be collected more accurately in the future. In addition to this the location of the breakdowns was recorded in a free text field and therefore was not able to be analysed in the timeframe of the project. It would be beneficial if this information could be recorded by co-ordinates as well in order to improve the accuracy of the data and make analysis quicker in the future.

3.8. TyreSafe tread depth survey

3.8.1. Overview

TyreSafe is one of the UK's leading tyre safety organisations who are dedicated to raising awareness about the dangers associated with defective or illegal tyres. Since its establishment in 2006, TyreSafe's states that its activities have helped to reduce the number of people killed or seriously injured each year by tyre related accidents by 30%.

3.8.2. Methodology and main results

TyreSafe produced a report "TyreSafe tread depth at the point of replacement survey", which was commissioned by Highways England, covering the periods February 2015 to May 2015 and submitted it to Highways England on the 8th June 2015. This report and data has been used in this report for the analysis of tread depth.

Within the TyreSafe report it was made clear that the information in **Table 10** was based on a sample of the total number of cars and light commercial vehicles defined as commercial vehicles below 3.5 tonnes gross (LCV) (known as 'car parc' or 'vehicle parc' respectively). Details of how this information was extrapolated can be found within the "TyreSafe tread depth at the point of replacement survey" report.

Cars' tread depth survey details	Cars on the road	% of tyres changed at illegal tread depth	Annual total: cars with an illegal type	Sample size (tyres)	Sample size as % of tyres changed in this period	Sample size as % of car parc
England	27,442,451	27.4%	7,527,429	85,905	1.25%	0.31%
Great Britain	30,024,488	27.4%	8,646,085	96,340	1.28%	0.32%
LCVs' tread depth survey details	**LCVs' on the road**	**% of tyres changed at illegal tread depth**	**Annual total: LCVs' with an illegal type**	**Sample size (tyres)**	**Sample size as % of tyres changed in this period**	**Sample size as % of car parc**
England	3,255,083	22.1%	717,942	4,707	0.58%	0.14%
Great Britain	3,736,956	21.7%	818,169	5,627	0.60%	0.15%

Table 10 - TyreSafe tread depth survey

The headline results within the TyreSafe report for the combined car & LCV data across England was that 27.2% of replaced tyres were illegal (<1.6mm of tread depth) and 65.3% of replaced tyres were illegal or borderline (<2mm of tread depth).

Figure 36 on the other hand separates these results for cars and LCV's and illustrates the percentage of illegal, borderline and good tread depths reported for England between February 2015 and May 2015.

Figure 36 shows that 65.4% of tested car tyres and 63.4% or LCV tyres were reported to be borderline or illegal.

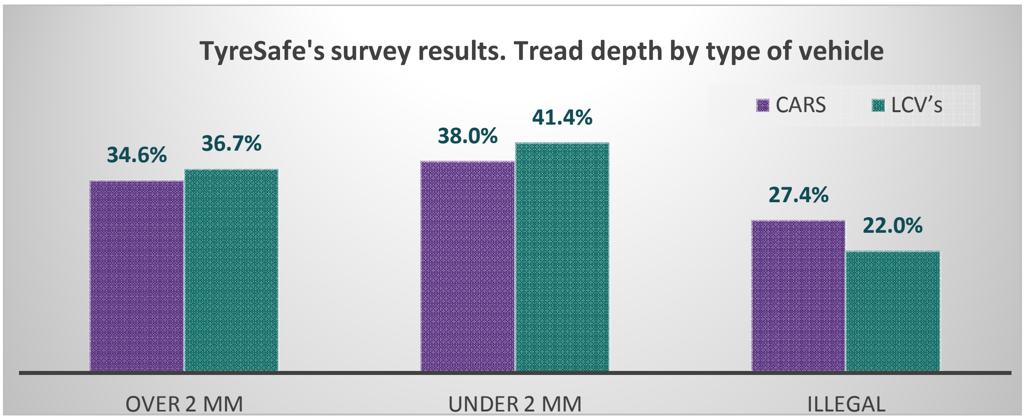

Figure 36 - TyreSafe survey results: Tread depth by type of vehicle

3.8.3. Atkins analysis of TyreSafe data

Taking account of the results obtained by TyreSafe for the 14 Highways England regions (identified within their report); Atkins has converted these into the 7 regions used throughout this report for consistency.

Figure 37 and **Figure 38** show the percentage of the total 85,905 car tyres and 4,707 HGV tyres that have been checked in each region for tread depth of over 2mm, under 2mm and those under 1.6mm (illegal). These figures show that the South East (34.5%), North West (32.5%) and the West Midlands (31.0%) appear as the regions with the highest percentage of illegal tyres in cars. The regions with the highest percentage of illegal tyres in LCV's are the North West (27.2%), West Midlands (25.8%) and East Midlands (25.1%).

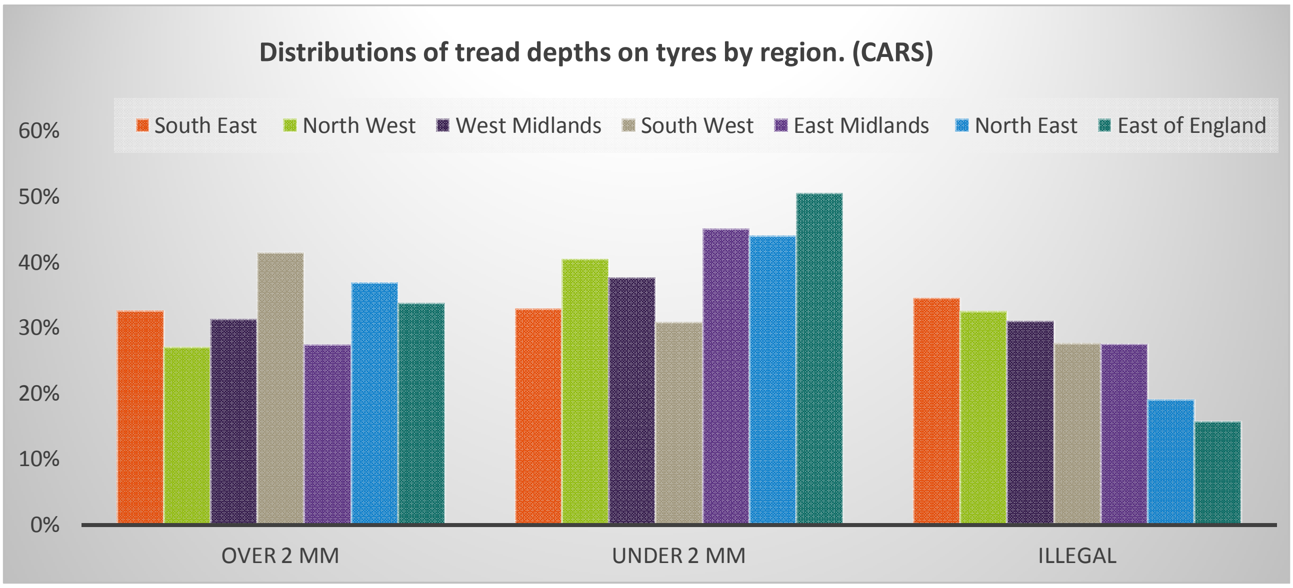

Figure 37 - Distribution of tread depths on car tyres by region

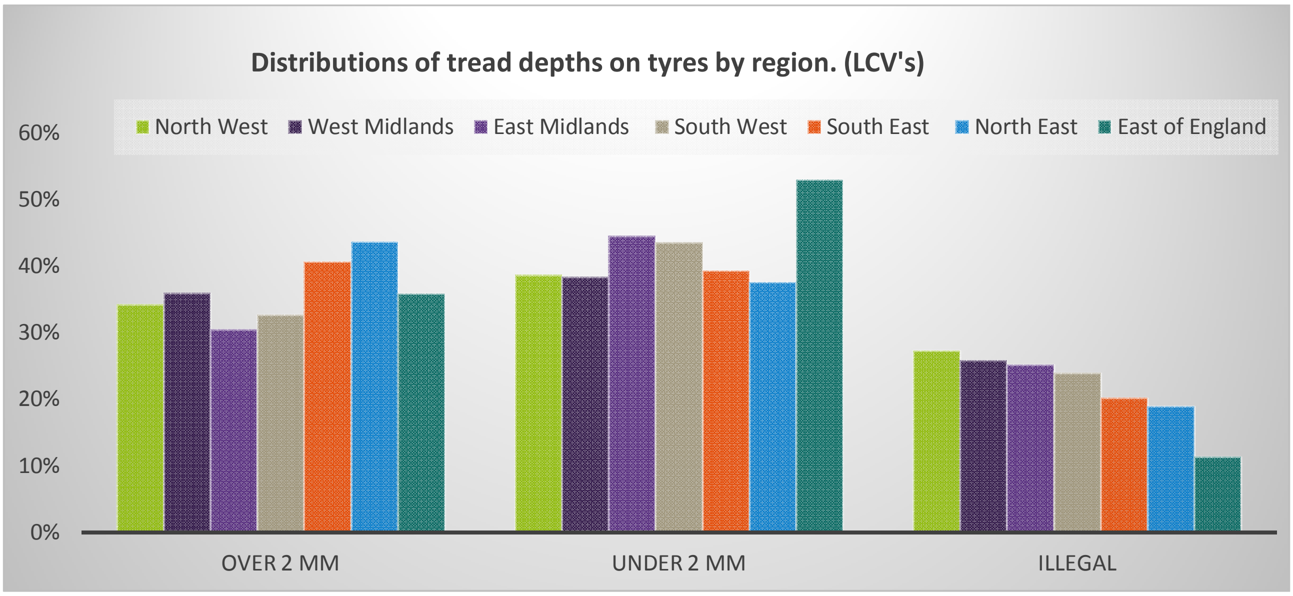

Figure 38 - Distribution of tread depths on Light Commercial Vehicle tyres by region

3.8.4. Summary

From the TyreSafe data it was clear that a large percentage of car and LCV's have either borderline (<2mm) or illegal (<1.6mm) tread depth on their tyres when they are replaced. When analysing the car and LCV data separately it was evident that 65.4% of car tyres and 63.4% of LCV tyres fall within this borderline/illegal range. Furthermore the regions that showed the highest percentage of illegal tyres on cars were the South East (34.5%), North West (32.5%) and the West Midlands (31%) while the regions with the highest percentage of illegal tyres on LCV's were the North West (27.2%), West Midlands (25.8%) and the East Midlands (25.1%).

3.9. Data from alternate sources

3.9.1. RAC data

Data included in **Table 11** was provided as presented here in its original form by the RAC in December 2015 and covers the different percentage of faults that the RAC have found to cause breakdowns on the motorway in the period of 1st October 2012 and 30 September 2015 inclusive.

Table 11 shows that according to the RAC the greatest causes of breakdowns on the motorway are due to vehicles requiring wheel changes (average of 18% of the time) and mechanical issues with engines (average of 19.3% of the time). The results also show which faults are affected by seasonal changes and which have a significant change over time.

Some of the significant changes have included:

- The number of breakdowns requiring wheel changes have decreased in more recent years, potentially due to the increase in PNS (puncture no spares) which has seen a steady increase across the same period. PNS are increasing in number as more vehicles are being sold without spare tyres.
- The number of vehicles that have run out of fuel has had a steady decrease, which could be related to the fuel prices reducing in the same period. The Department of Energy and Climate Change recorded a 20.9% reduction in unleaded fuel prices and a 22.9% reduction in diesel fuel prices between 1st October 2012 and 30 September 2015.
- The number of breakdowns due to fuel auxiliaries have reduced since 2012. This may also be linked to reduction in fuel prices.
- The number of breakdowns due to fuel contamination have reduced. This could potentially be linked to the reduction in fuel costs as people may be using more reputable sellers or higher quality fuel for the same price as previously.

The RAC have also noted that some faults have seasonal trends including breakdowns due to cooling HVAC (Heating, Ventilation and Air-conditioning), Road Traffic Accidents (RTA's), Induction Intake Airflow, Body Electrical (wipers), faults with the battery and motorcycle breakdowns.

Analysis of fault mix on motorway breakdowns in England - by 6 month period

Fault Category	Share of Fault Category						Comment
	01Oct12 31Mar13	01Apr13 30Sep13	01Oct13 31Mar14	01Apr14 30Sep14	01ct14 31Mar15	01Apr15 30Sep15	
Wheel Change	19.5%	17.3%	19.5%	17.3%	17.7%	16.6%	Some seasonality . Slow decline offset by increasin PNS
Engine Mechanical	17.8%	21.1%	17.7%	19.8%	18.3%	20.9%	No change
Engine Management Fuel	8.9%	8.7%	9.0%	9.3%	9.3%	9.3%	No change
Charging	6.4%	5.3%	6.2%	5.4%	6.6%	5.6%	No change
Cooling HVAC	5.6%	7.4%	5.1%	7.0%	5.3%	6.3%	Seasonality
PNS	5.3%	5.8%	6.5%	6.9%	7.7%	7.4%	Steady growth in vehicles supplied with no spare
Out Of Fuel	4.9%	3.9%	4.2%	3.7%	3.6%	3.2%	Decline in over last year reflecting lower pump prices
Clutch	4.1%	4.2%	4.1%	4.4%	4.5%	4.2%	No change
RTA	3.2%	2.3%	3.3%	2.4%	3.4%	2.7%	Seasonality - influenced by contract mix
Wheels & Tyres	3.0%	3.0%	3.7%	2.7%	2.8%	2.7%	No change
Fuel Auxillaries	2.6%	2.4%	2.5%	2.5%	2.6%	2.2%	Decline in recent period - Significance?
Roadside Incidents	2.3%	2.4%	1.9%	1.9%	2.3%	2.5%	No change
Induction Intake Airflow	2.3%	2.7%	2.3%	2.9%	2.3%	2.8%	Seasonality
Gearbox Transmission	2.2%	2.3%	2.2%	2.5%	2.4%	2.6%	No change
Exhaust	2.0%	2.2%	2.2%	2.2%	2.0%	2.2%	No change
Body Electrical	1.9%	1.3%	2.1%	1.4%	1.7%	1.4%	Seasonality (wipers)
Engine Management Ignition	1.9%	1.6%	1.7%	1.7%	1.8%	1.8%	No change
Battery	1.2%	1.0%	1.1%	0.9%	1.1%	0.9%	Seasonality
Suspension Steering	1.0%	1.2%	1.2%	1.1%	1.3%	1.1%	No change
Fuel Contamination	1.0%	0.9%	0.9%	1.0%	0.7%	0.6%	Recent decline
Body	0.8%	0.8%	0.8%	0.7%	0.7%	0.7%	No change
Driveline	0.7%	0.6%	0.6%	0.6%	0.6%	0.6%	No change
Brakes	0.7%	0.8%	0.7%	0.9%	0.8%	0.8%	No change
Starting	0.2%	0.3%	0.2%	0.2%	0.2%	0.2%	No change
Keys Locks Alarms Immobilisers	0.2%	0.1%	0.1%	0.1%	0.1%	0.1%	No change
Motorcycles	0.2%	0.4%	0.2%	0.4%	0.2%	0.4%	Seasonality
Lockouts	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	No change

Significant change (yellow)   Seasonal effects (green)

Table 11 - RAC data for breakdowns on motorway network

3.9.2. Summary

In summary the RAC data shows that the greatest causes of breakdowns on the motorway are due to vehicles requiring wheel changes (average of 18% of the time) and mechanical issues with engines (average of 19.3% of the time).

They have also recorded significant changes in the following reasons for vehicle breakdowns:

- Wheel changes have decreased in more recent years.
- PNS (puncture no spares) has seen a steady increase.
- The number of vehicles that have run out of fuel has had a steady decrease.
- The number of breakdowns due to fuel auxiliaries have reduced since 2012.
- The number of breakdowns due to fuel contamination have reduced.

Seasonal trends have been recorded in the following breakdown causes:

- Cooling HVAC (Heating, Ventilation and Air-conditioning)
- Road Traffic Accidents (RTA's)
- Induction Intake Airflow
- Body Electrical (wipers)
- Faults with the battery; and
- Motorcycle breakdowns

4. Stakeholder engagement

4.1. Qualitative data

4.1.1. Overview

In order to understand the extent of vehicle roadworthiness issues and the causes of breakdowns and incidents, the project team engaged with industry specialists and stakeholders in order to get their opinions on the main causes and issues. Each specialist/stakeholder was separated into one of 11 query groups:

- Governmental Agency & Department
- Road safety organisations
- National vehicle recovery organisations
- Insurance companies
- Leading garages & service centres
- Vehicle manufactures
- Leading rental companies
- Franchise & non-franchise dealerships
- Trade bodies & fleet operators
- Non-car organisations
- Others

Atkins used a variety of approaches to engage with respondents tailored to their preferred ways of responding to enquiries, including emails, telephone calls and face to face meetings.

The preferred primary method of engagement for established / known contacts was via email. The main purpose of the email was to provide a background of the project and to ask for a suitable time to have a discussion.

The preferred method of engagement for new contacts was via phone calls as this was considered to be most effective in gaining positive interest in the task.

Where phoning was not an option a letter was sent on behalf of Highways England.

Prior to engagement with the various stakeholders, Atkins designed a structure for questions that complimented the data analysis. The questions were designed to facilitate discussion and direct the conversation to draw out useful information. Many of the questions were repeated; however there were also specific questions asked of the individual groups. This coordinated approach allowed for answers to be compared and enabled a harmonised view of the subject of vehicle roadworthiness in the industry to be formed.

The questions asked and stakeholder groupings can be found in **Appendix B,** with findings detailed in the following summary.

4.1.2. Summary

Of the 11 query groups that were contacted no responses were received from the following:

- Leading garages & service centres
- Vehicle manufacturers
- Franchise & non-franchise dealerships
- Non-car organisations
- Others

From the 10 respondents (out of 44) that provided information the following issues and improvement suggestions were commonly raised:

1. There were no foreseen issues with raising the MOT to 4years as long as the vehicles follow the manufactures service plan as a minimum.
2. Failures with brakes, steering and tyres were seen as the main cause of breakdowns.
3. Newer vehicles are seen as more roadworthy that older vehicles due to improvements in new technology which helps to alert drivers of issues (tyre pressure warnings and telematics).
4. Currently it is believed that the extra money received from the 45p/mile for business mileage above fuel costs is not being used for maintenance as it should, causing grey fleet vehicles to be a cause for concern.
5. There is currently no seasonal data collected by the stakeholder groups and therefore no definitive trends have been found, however it was suggested by many that hot weather may affect vehicles travelling long distances or up steep gradients and that heavy rainfall or snow may cause more breakdowns/incidents due to the road conditions.
6. People should only use 5* Euro NCAP vehicles.
7. The use of the DVSA/VOSA to undertake more checks. These checks could concentrate solely on tyres.
8. Improved use of technology, i.e. autonomous brakes.
9. Encourage people to service their vehicles prior to the MOT, rather than using the MOT as a service checklist.

4.2. Commercial vehicle workshop

4.2.1. Background

On October 12th 2015, a national light commercial vehicle workshop was held at Tally Ho conference centre in Birmingham. The event hosted by the National Roads Policing Intelligence Forum and was attended by representatives of companies that had a large Light Goods Vehicles (LGV) fleet and those that worked with the LGV industry. The purpose of the event was to discuss issues and improvements regarding the safety and security of commercial vehicles.

A survey designed by Atkins as part of this project was provided to the attendees to obtain information on the roadworthiness of their vehicles. The survey included questions relating to causes of vehicle issues, thoughts on potential changes to first time MOT tests and factors that contribute to unroadworthy vehicles. A full list of the questions can be found in **Appendix C.**

4.2.2. Results

Proportion of fleet breakdown and those who incur 1st time MOT failures

Ten of the respondents indicated that their fleet had broken down. With a further ten indicating that vehicles within their fleet had failed their MOT but in most cases this was 5% or less. There was no single reason identified in the causes of unroadworthy vehicles. The main causes were brakes, headlights, tyres and mechanical faults.

One respondent indicated that 15% and 10% of their fleet had broken down and failed their MOT respectively. The main cause for this breakdown was due to a mechanical & electrical fault. This company had a combination of company owned and leased vehicles with a lease period of over four years. The respondent had indicated that servicing levels and driver behaviour were the areas that contributed to roadworthiness issues in their organisation.

Choice of Fleet

Of the 21 respondents 16 (76%) had indicated cost was a factor in the choice of their fleet, though only 10 (48%) people indicated the reliability was a factor. Whilst the other 6 respondents (29%) indicated the warranty was an issue. This information suggests that most fleets consider cost to be a larger factor in selecting vehicles rather than the reliability of a vehicle.

Review and monitoring of roadworthiness data

Ten out of 21 (48%) respondents had indicated that their companies review/monitor roadworthiness data for trends. The data sources provided were:

- Operator Compliance Risk Score (OCRS) reports
- Interactive Driving System (IDS)
- MOT Feedback
- Telematics

Contributory factors

Out of the 21 respondents 17 (81%) identified the following factors that contributed to vehicle roadworthiness:

- Servicing Levels (71%)
- Driver Behaviour (88%)
- Organisations Pressures (24%)

The respondents also highlighted the following points as other contributory factors that lead to vehicle unroadworthiness:

- No sense of ownership by the driver
- Health and safety culture
- Training and assessment
- Insisting on 12 month services or service after 15,000 miles are clocked, vehicles are not serviced before these requirements although may need to be.

Vehicle Related Issues

The respondents were asked what vehicle related issues does the organisation and/or drivers encounter. 11 respondents indicated the following unique issues:

- Seating issues
- Electrical failure
- Lack of general maintenance
- Changing from analogue to digital tachos
- Tyre pressure & wear
- Daily checks
- Mobile phones
- Theft from vehicles
- Staying within weight/towing limit

Tyre related issues was the only common issue that was repeated among the respondents. The information above suggests that organisations have different vehicle issues.

Thoughts on planned changes to MOT

Out of all the respondents 14 provided their views on the proposed MOT requirements for new cars increasing from three to four years. All respondents except one (93%) suggested it was not a positive decision.

Three respondents suggested mileage should be taken into account with another source suggesting it was 'not safe, particularly for high mileage vehicles.' Other sources suggested undertaking a pre-MOT inspection every 6 months and that adopting the requirements for testing as required for HGV's was needed.

Desired vehicle features to reduce breakdowns and incidents

Twelve respondents provided their views on what vehicle features or external facilities they would like all vehicles to have in order to reduce number of incidents and breakdowns. The following answers were provided:

- Telematics / Blackbox
- Speed limiters / 60mph for all vans
- Automated tyre pressure controls
- 360° camera
- Auto brake assist
- Collision avoidance system
- On-board vehicle weighing
- Daily/weekly vehicle checks followed by monitoring of checks
- All manufacturers should supply vehicles with all available safety technology

The respondents provided a broad range of answers. The use of telematics, tyre sensors, restricting speed and collision avoidance system were repeated between different people.

4.2.3. Summary

From the comments received at the commercial vehicle workshop it is clear that on average most of the leading LGV organisations have a relatively low level of breakdowns and first time MOT failures, typically less than 5%. Given that the larger companies exceed the average annual mileage of a vehicle, mileage is taken into account when determining service levels. This is usually a requirement when companies that use leased vehicles need to follow to ensure they maintain the vehicle warranty.

Cost appears to be a more significant driver than reliability in the vehicle selection process for company usage. While this does appear commercially sensible as an initial decision, understanding the costs incurred from breakdowns and addressing roadworthy vehicles may prove to be more costly in the longer term. Further work would be needed to understand whether using more reliable vehicles offer any significant whole life cost savings to LGV companies.

The respondents indicated the main vehicle related issues vary across different companies however there were common responses on improving vehicle roadworthiness. The use of on-board vehicle weighing systems, tyre sensors, collision avoidance systems and speed restrictions were improvements that were identified by the LGV industry. 93% respondents agreed the increase to four years for first time MOT was not a positive decision with some suggesting mileage should be taken into account. The consideration of mileage was also picked up at the companies LGV workshop with some suggesting their vehicles are serviced before MOT dates.

While approximately half of the companies surveyed do review roadworthiness data, the general consensus at the LGV workshop was that it is a commercial risk to share data as it can provide advantageous intelligence. It is possible this could be in reference to routes that are chosen, travel patterns, etc. However the workshop attendants did agree they would like to help and share information where possible. Obtaining vehicle roadworthiness data and breakdown information could add value to companies on optimising their business and reducing downtime caused by breakdowns and offering advice on locations/routes to avoid.

From the information collected, the simplest method to improve vehicle roadworthiness is to ensure vehicles are inspected weekly and monitor the checks. Advising LGV operators of ensuring this relatively basic task is undertaken regularly will not only improve drivers understanding of potential vehicle issues but reduce the likelihood of vehicles breaking down during business hours.

5. Lag and lead indicators

5.1. Indicator selection

Traditionally Highways England safety interventions have been measured using 'Lag' indicators. This type of indicator simply records the outcome retrospectively at the end of a specific time period. An example of an existing Lag indicator would be the annual reporting of the number of KSIs on the SRN. This type of indicator is generally easy to measure but are often a result of a number of complex factors. As such, lag indicators provide an easy gauge but are not easy to influence in terms of progress. In many cases Lag indicators are not only published after the period which they cover, but some time into the next reporting period. As such these indicators are a historic record of performance and in isolation provide limited intelligence. This makes any type of proactive intervention or response to a developing trend impossible to achieve.

The intention of this report is to focus on the development of a number of 'lead' indicators. A lead indicator is typically a way of recording an input to the system or process in question. The element being measured by the indicator typically precedes the event occurring i.e. it measures the activities carried out to prevent and control the event occurring. In contrast to lag indicators, it is usually more difficult to quantify or measure a lead indicator. However, the point of lead indicators is that they are easy to influence and could be used as a measure of the effort invested in addressing the issues at hand; such as the contribution of un-roadworthy vehicles to the number of KSIs on the SRN.

The focus of the lead indicators identified in this report is on continuous improvement. In some respects it may appear to be too early to identify these indicators when there are few specific interventions being applied to improve vehicle roadworthiness. Nonetheless the creation of a matrix of lead indicators will help measure the current initiatives and no doubt provide supporting data. This initial intelligence could help with the identification on new measures or result in adjustments to the lead indicators themselves to improve their usefulness.

The project team held an internal workshop to develop the lag and lead indicators described in Sections 5.2 and 5.3 of this report using the following primary sources of information:

- Findings of Technical Note 1
- Review of existing Highways England documents.
- Review of the measures developed by Atkins for the Highways England Road Safety Delivery Plan.

The proposed indicators are included in **Appendix D** and **E**; the content of the tables is as follows:

- **Description** – The title of the indicator. In many cases the title will relate to a condition or future intervention that could have a bearing on vehicle road worthiness on the SRN.
- **Metric** – Records how the indicator is to be measured i.e. a number of occurrences or a rate per billion vehicle miles travelled etc...
- **Theme** – The indicators have been grouped into loose categories.
- **Measurement frequency** – An initial recommendation for how often the indicator could be measured and recorded.
- **Regional breakdown** – Where it would be desirable to split the indicator into regional measures this has been identified in the table.
- **Data source** – If the indicator can be measured using an existing data source this is indicated in this column. In some cases it may be necessary for Highways England to collate new data sets using information gathered from third parties.
- **Purpose** – This column contains a description of how and why the indicator links to vehicle road worthiness. This column also includes any other general comments on the applicability and measurement of the indicator.
- **Timescales and risks** – This final column indicates whether the project team believe the indicator could be measured in the near future (short term) or whether further work is needed (medium or long term). Where there are risks or challenges, such as the creation of new interventions, before the indicator can be brought into use these are described here.

5.2. Lag indicators

Appendix D includes the Lag indicators recommended for tracking progress on addressing vehicle road worthiness. Fundamentally the indicators recommended are either existing metrics or will be a new metric that can be reported by simply modify existing reporting metrics, and have been identified through the knowledge of existing data sets, trends highlighted in the first part of this report, or where gaps in data collected have been identified that if addressed could provide more robust reporting with regards to the impact vehicle roadworthiness has on the SRN.

5.3. Lead indicators

Appendix E includes the Lead indicators recommended as part of this task, although there are only a small number of indicators included at this time. Those selected represent a range of inputs to vehicle road worthiness. In developing the list cognisance has been given to the fact that:

- Lead indicators have not traditionally been used by Highways England.
- A long list of indicators would create a significant analysis workload, especially the majority of possible indicators would need to be measured by region.
- A small number of indicators focuses efforts and attention on key areas.
- To be true lead indicators Highways England should be able to control some of the indicators through the allocation of resources, funding or the roll out of interventions.
- Nonetheless where significant external factors, outside of Highways England's direct control, should also be included.

The majority of the indicators require further work before measurement can begin. The project team have tried to avoid simply capturing business as usual activities in developing the list. As such some of the indicators require new approaches or interventions to be implemented for the measurement of the lead indicator to be useful. However there a small number of quick win measures included which are based on existing activities. Some of the interventions have been identified from the research undertaken as part of this report, such as the analysis of 3rd party data and the stakeholder engagement.

5.4. Further indicator development

When setting Key Performance Indicators it is normal to retain the same indictors for a number of years, potentially in line with overarching plans or during the roll out of a particular programme. In setting the 'Lag' indicators it would be appropriate to baseline these measures and continue to record these until the end of the RIS 1 period. However the intention of the lead indicators is to be more flexible and respond proactively to the emerging trends in the data, potentially by amending or creating new lead indicators.

There are a number of aspects of the recommended lead indicators that could be developed over time. The following information should be collected for each indicator where possible:

Vehicle Ownership - Firstly it would be useful to determine the owner of the vehicle and subdivide each measures where possible in this regard. As noted in the stakeholder engagement exercise, there are clearly different motivations for the drivers of vehicles which are hired, leased or directly owned.

Vehicle Age – If vehicle age was to be collected, this would provide very useful comparator data for identifying trends and future work in this area.

Driver category – Finally it would be useful to collect more data on the status of the driver i.e. CPC qualified, driving for work or driving for leisure.

The integration of each of these additional sub-categories, along with reporting by region, would create a complex reporting matrix of indicators for vehicle road worthiness. The information has the added benefit in that it can be used to tie to a number of the lag indicators.

5.5. Summary

An initial list of 'Lag' and 'Lead' Indicators have been identified in order to begin to address vehicle roadworthiness on the SRN for the first time. Implementation of these measures and the creation of a reporting system will provide further insight into the appropriateness of the metrics identified. It is recommended that the lead indicators are reviewed regularly to ensure they are aligned to identify the significant external factors and the interventions being delivered by Highways England and their supply chain. The lead indicators are primarily a tool for those working within Highways England to help proactively manage improvements to vehicle roadworthiness. As such a flexible, accessible and easy to understand online dashboard should be created so for those who would benefit from access to the information.

6. Recommendations

Each section of this report has a detailed summary of findings, trends and actions. The following key findings of these summaries have been rolled into four key recommendations.

Data

Across the data sets that were used for this task, all had elements that if improved could provide more robust data sets which would enhance the intelligence already provided in this report.

Generally most had either fields that were under populated or not provided or had quality issues down to how the systems were either set up or used.

Recommendation 1 - Better quality control, training of data recorders, and simplification or standardisation of inputs.

It may be advantageous if Highways England formed strategic partnerships with some of the external data set owners in order to get more complete data sets within a defined update frequency, aligned to reporting timelines, such as quarterly. These could then be better aligned to the proposed Lag and Lead indicators.

Recommendation 2 – Form strategic partnerships with key data set holders to influence how data is captured with joint working and sharing of data where appropriate.

Trends

Overall trends point to most breakdowns / incidents being caused by cars during the commuting periods of 9am to 10am and 4pm to 5pm that are exacerbated during the summer period, in the context of higher traffic volumes / longer journeys. The analysis overall from the various data sets and stakeholder consensus suggest that tyres are the main cause of breakdowns, with stats such as 38.5% of the grey fleet having tyre issues, 18% of RAC call outs being tyre related and TyreSafe observations indicating that 65.4% of car tyres are borderline or illegal when presented at their members sites for inspection. Car's also have a higher failure rate of MOT's (37.1% on average) vs. HGV's (20% on average)

Recommendation 3 – Further campaigns targeted at car drivers, with potentially specific grey fleet and pre summer holiday season for general maintenance and more specifically tyre safety.

Lag and Lead Indicators

We believe the lag and lead indicators presented in this report provide a robust set of KPI's that should be straightforward to implement.

Recommendation 4 - All lag and lead indicators are recommended to be considered and taken forward.

Appendices

Appendix A. C&C permutations

During the analysis of the C&C data several groupings were made. Examples of these have been summarised:

Grouping for wheel related breakdowns

- Tyre
- Wheel
- Puncture
- Debris
- HUB
- COW: Cell on Wheel
- ROS: Rear off side
- RNS: Rear near side
- FNS: Front near side
- FOS: Front off side
- LRSL: Left rear side
- FRNS: Front rear near side
- Blown out
- Flat

Grouping for brake related breakdowns

- ABS
- Brake: brake, air brake, airline brake, air pip brakes, emergency brake, hand brake, airline leak on brakes
- DISC
- Drum: Drum fell off
- EBS

Grouping for steering related breakdowns

- Steering: heavy steering, electronic power steering (EPS)
- Gearbox: Gbox, Gear, Gearing, Gearbox overheating
- Transmission: Automatic Transmission
- Traction (traction control)
- Drive Shaft
- Drive system, drive train
- Ball joint
- Axle

Grouping for fuel system related breakdowns: Out of Fuel (OOF) (16,101 cases)

- Fuel System, fuel unit, fuel management
- Wrong fuel, contaminated fuel, fuel contamination
- Fuel tank, fuel cap loose, fuel fender broken off, fuel flap
- Fuel leak, leaking fuel, losing fuel, fuel spill, fuel loss, fuel dumped, fuel pressure, fuel smell, fuel supply
- Fuel line, fuel pipe, fuel hose
- Injector, injection
- Fuel pump, piston, comperfuel gauge, fuel regulator, fuel valve, fuel strap, fuel filter
- Fuel airline, air in fuel, air lock in fuel, fuel over pressured
- Fuel blockage, fuel feed, fuel supply, fuel hire
- Petrol: leaking petrol, loose petrol pipe
- Diesel: Diesel filter, diesel tank, leaking diesel

Grouping for engine related breakdowns

- Engine: Engine management, engine malfunction, engine (EDC)
- Turbo, turbo pipe
- Ignition, starter
- Gasket: Head gasket
- Accelerator, accelerator (EAC), throttle
- Exhaust, header pipe
- Catalytic converter
- Emissions
- Carburettor
- Won't start, cut out, blown out, blown out spark
- LOP
- Crank: crankshaft
- Cylinder: Head cylinder, gas pedal, gas cylinder
- Distributor
- Generator
- Fan belt, belt, idler pulley

Grouping for electrical related breakdowns

- Electrical: EMU, electronic, antitheft malfunction, EPS
- Alternator
- Plug, fuse, coil, differential, glow plug, sensor, fuel fuse relay electrical
- Battery
- Lighting, no lights, bulb, indicator, intermittent
- Computer, gauge
- Limp mode
- Cruise control, alarm, tacho break
- Cable, earth wire, wiring, loose wire

Grouping for refrigeration system related breakdowns

- Overheated, heat sensor
- Heater, freezer (hose, antifreeze, heat shield, refrigeration)
- Radiator, condenser, compressor
- Intercooler, cooling, cooler
- Water, air, fume, coolant, steaming (leak, loss, block line, pip, pressure, pump, tank, system, seal hose, water in distributor, valve, system, filter, drier, connector, canister, cushion), flooded, fluid top up

Grouping for bodywork related breakdowns

- Body: bodywork, body panel, class wagon
- Cover, carcass, chassis, underside, undercarriage, belly pan, drip tray
- Roof, bonnet, canopy. Awning, boot, top box, tarpaulin
- Front guard, front end, back end, rear end, mudguard, bumper, trim, flap
- Curtain, door, window, windscreen, mirror, wipers, wing
- Cab, horsebox, panel

Grouping for lubricant system related breakdowns

- Oil
- Sump

Grouping for mechanical related breakdowns	
• Bracket: Towing bracket	• Foot pedal
• Towing: Tow bar, towing ball, towing bar, towing dolley, towrope	• Suspension: Absorber
• Trailer bar	• Hydraulic system
• Mechanical	• Bearing, washer, bolt sheared off, screw lost, bottle screws, joint
• Airbag, seat belt	• Immobiliser, mobilizer

Grouping for other related breakdowns		
• Tray: Drip tray, kick tray, undertray, plastic tray, tray	• Noise, juddering, knocking from under van, shuttering	• Car seat, locker
• Wisbon	• Smoke, smoking	• Frame, horn
• Windbreaker	• Smell	• Mud
• Ventilation	• Dash board lights on	• Hatching
• Vehicle stuck, vehicle old, vehicle in standby, veh hit something	• Fire	• others
• Wobbling, vibration, jumping, shaking, rattling, swaying, swapping	• Valve, tank, pump, pressure, pipe, filter, leak, leaking, hose	

Appendix B. Stakeholder engagement qualitative data

B.1. Questions

Governmental Agency & Department

1. What are your Agency's / Department's views on the potential change of the first MOT test from three to four years?
2. From your perspective, what are the leading causes of breakdowns on the SRN?
3. Are you aware of the number of vehicles that are serviced annually in the UK? Is there a relationship between this and the number of vehicles breaking down / failing the MOT?
4. Do you see a pattern on the number and / or type of breakdowns that occur on the SRN? Are there issues that vary depending on the time of year, type of vehicle or geographical location of where the vehicles are based?
5. Do you consider the proportion of roadworthy vehicles on the network improving or declining in the near future?
6. How could Highways England reduce the number of vehicles that are unroadworthy?

Road safety organisations

1. What are your views on the leading causes of vehicles being unroadworthy? (Tyre organisations will focus on specific answers).
2. Do you see a pattern on the number and / or type of breakdowns that occur on the SRN? Are there issues that vary depending on the time of year, type of vehicle or geographical location of where the vehicles are based?
3. What steps have you taken to reduce the number of vehicles that are unroadworthy? What were their impacts? What initiatives have been successful in reducing unroadworthy vehicles? Is there any evidence to support this?
4. Do you regard any breakdowns as avoidable? If so, what types?
5. What are your views on the recent proposed change in the first MOT test from three to four years? Should other factors, such as mileage, be taken into account?
6. How could Highways England reduce the number of vehicles that are unroadworthy?

National vehicle recovery organisations

1. From your experience of attending call outs, particularly those on motorways and major trunk roads, what are the leading causes of breakdowns?
2. How many of these breakdowns / incidents have a vehicle defect as a contributory factor?
3. Do you regard any of the breakdowns as avoidable? If so, what types?
4. Do you see a pattern on the number and / or type of breakdowns that occur on the SRN? Are there issues that vary depending on the time of year, type of vehicle or geographical location of where the vehicles are based?
5. What are your views on the recent proposed change in the first MOT test from three to four years? Should other factors, such as mileage, be taken into account?
6. How could Highways England reduce the number of vehicles that are unroadworthy?

Insurance companies

1. Approximately how many breakdowns are reported to you each a year? From your perspective, what are the main causes of vehicles breaking down?

2. Do you see a pattern on the number and / or type of breakdowns that occur on the SRN? Are there issues that vary depending on the time of year, type of vehicle or geographical location of where the vehicles are based?
3. Do you see vehicle defects playing a larger part in vehicle incidents and collisions in the future?
4. As the first MOT test for cars is being considered to be increased from three to four years, how could Highways England look to reduce the number of vehicles that are unroadworthy (which will likely reduce the number of claims and costs your company incurs)?
5. Of the number of claims you investigate, what proportion have a vehicle defect as a contributory factor?
6. Before offering / recommending breakdown cover, does you organisation consider a vehicle's roadworthiness?
7. From your perspective, is roadworthiness more dependent on the quality of vehicle build or the way it is maintained?
8. If there is an increase in vehicle unroadworthiness how will this affect the breakdown cover you provide?

Leading garages & service centres

1. What are the main issues you encounter during vehicle servicing that do not get picked up in the MOT test? Are there any occurring trends?
2. Do you change your operational behaviour based on the time of year? Do you see a certain pattern on the number and / or type of breakdowns that occur on the network? Are there issues that vary depending on the time of year, type of vehicle or geographical location of where the vehicle is based?
3. What are your views on the recent proposed change in the first MOT test from three to four years? Should other factors, such as mileage, be taken into account?
4. Are there any particular components which disproportionately lead to vehicles being unroadworthy?
5. How could Highways England reduce the number of vehicles that are unroadworthy?

Vehicle manufacturers

1. What are your views on the recent proposed change in the first MOT test from three to four years? Should other factors, such as mileage, be taken into account?
2. From vehicles that are serviced, what issues do you see that contribute to breakdowns or can be attributed to a vehicle being roadworthy?
3. Is there a relationship between the number of vehicles serviced and vehicles breaking down / failing their MOT test?
4. What key elements will affect your decision to offer longer warranty? (Including):
    - shortened service schedules
    - changes to component design
5. Which areas of a vehicle's road worthiness would impact on your decision to offer a longer warranty?

Leading rental companies

1. From your experience of known breakdowns, particularly those on motorways and major trunk roads, what are the leading causes?
2. Do you see a pattern on the number and / or type of breakdowns that occur on the SRN? Are there issues that vary depending on the time of year, type of vehicle or geographical location of where the vehicles are based?
3. What are the frequent vehicle issues that get picked up during their servicing? Is there a relationship between the number of vehicles serviced and vehicles breaking down or failing their MOT test?
4. How could Highways England reduce the number of vehicles that are unroadworthy?

Franchise & non-franchise dealerships

1. From your perspective, what are the leading causes that affect vehicle roadworthiness?

2. What are your views on the recent proposed change in the first MOT test from three to four years? Should other factors, such as mileage, be taken into account?
3. Are you aware of the number of your vehicles that are serviced each year? Is there a relationship between the number of vehicles serviced and vehicles breaking down or failing their MOT test?
4. How could Highways England reduce the number of vehicles that are unroadworthy?

Trade bodies & fleet operators

1. What are your views on the recent proposed change in the first MOT test from three to four years? Should other factors, such as mileage, be taken into account?
2. Do you see a pattern on the number and / or type of breakdowns that occur on the SRN? Are there issues that vary depending on the time of year, type of vehicle or geographical location of where the vehicles are based?
3. Do you consider that any vehicle breakdowns are avoidable? If so, what are their causes?
4. Are you aware of any vehicle issues that are commonly encountered during their servicing that do not get picked up in the MOT test? Are there any occurring trends?

Non-car organisations

1. From your experience, what are the main causes of vehicle breakdowns? (*relating question to specific vehicle*)
2. What are the main vehicle issues that you are aware of from their servicing that do not get picked up in the MOT? Are there any occurring trends (time of year or location)?
3. What are your views on the recent proposed change in the first MOT test from three to four years? Should other factors, such as mileage, be taken into account?
4. From your knowledge of MOT test failures and breakdowns, what can be done to prevent them from occurring?

B.2. Stakeholder consultation list

Governmental staff
DfT
DVSA (VOSA)
Road safety organisations
Road Safe
PACTS & Road Safe
TyreSafe
RAC Foundation
National vehicle recovery organisations
AA
RAC
Green Flag
NVRS
Britannia Rescue
Insurance companies
Motor Insurance Bureau
Zurich Financial Service
Motor Trade Insurance
AXA Insurance
Aviva
Leading garages & service centres
Halfords
Kwik - Fit
Mr. Clutch
UK Car Servicing
South London Service Centre
UCCC
Vehicle manufacturers
BMW
Citroen
Ford
Jaguar/Land Rover
Nissan
Peugeot
Vauxhall
Leading rental companies
Enterprise
Europcar
Sixt
Zenith
Franchise & Non-Franchise Dealerships
Pendragon
Auto Trader

Trade Bodies & Fleet Operators
BVRLA
SMMT
ACFO
RHA
Non-car organisations
Motorcycle Industry Association
National Motorcycle Dealers Association (NMDA)
Others
IRTE
Leeds University (Institute for Transport Studies)

Appendix C. Vehicle Roadworthiness Survey

Name:

Organisation:

Type of fleet used:

1. **Are the vehicles your organisation use hired, leased, company owned or grey fleet?** Please tick all that apply

- ☐ Hired
- ☐ Leased
- ☐ Company Car
- ☐ Grey Fleet

2. **Where vehicles are leased, over what period are they leased?**

☐ 12 months ☐24 months ☐36 months 4☐ months 48☐months or more

1.
3. **Is your maintenance programme undertaken internally or externally?**

2☐ Internally ☐Externally

3.
4. **Has any of your fleet suffered a break down before or failed its 1st MOT. If possible, approximately what %?**

- ☐ Vehicle breakdown ____ %
- ☐ Failed MOT ____ %
- ☐ N/a

Please could you provide information on the main cause of your breakdown/MOT failure

____

____

____

____

5. **Are your vehicles generally pooled or allocated to drivers?**

- ☐ Pooled
- ☐ Allocated

6. Is your choice of fleet based on:

- ☐ Cost
- ☐ Reliability
- ☐ Warranty Period
- ☐ Other (please specify)

____

7. **Does your organisation review/monitor roadworthiness data on its vehicles for trends?**

☐ No

☐ Yes (please provide details)

---

8. **What vehicle related issues does your organisation and/or your drivers encounter?**

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9. **What are your views on the planned changes to the MOT? (MOT not required for first 4 years)**

4.

10. **What vehicle features or external facilities would you like all vehicles to have to reduce the number of incidents and breakdowns (e.g. remote diagnostics or monitoring)?**

5.

11. **Which areas do you feel contribute to roadworthiness issues in your organisation?** Please tick all that apply

☐ Servicing Levels

☐ Driver Behaviour

☐ Organisation Pressures

☐ Other (please specify)

6.

12. **To make vehicles on the road safer, would you be happy in providing Highways England further support in identifying roadworthiness issues and their causes?**

☐ Yes

☐ No

If you answered Yes, please could you provide your contact information:

Telephone Number: ______________________

Email Address: ______________________

Appendix D. Lag Indicators

Ref	Description	Metric	Theme	Measurement frequency	Regional breakdown possible?	Data source	Purpose	Timescale and barriers to implementation
1	Number of KSI casualties.	Number	N/A	Annual.	Yes	Casualties on the SRN annual report.	Highways England has an overall aim that "No one should be harmed when travelling or working on our roads network". In the shorter term there is a commitment to reducing the number of people killed to seriously injured by 40% by the end of 2020. Each region already has its own KSI reduction to achieve.	Short term - This indicator already exists and is reported annually.
2	No of breakdowns recorded on the SRN	Per billion vehicle miles travelled on SRN	N/A	Quarterly.	Yes	C&C Logs	Known breakdowns are already recorded in C&C logs and although this would not capture all breakdowns that occur it would appear to be a good proxy.	Short term - This is likely already reported by the regional intelligence units.
3	No of statutory breakdown removals	Per billion vehicle miles travelled on SRN	N/A	Monthly	Yes	Service provider records	This Lag indicator will provide a level of intelligence on the total number of breakdowns occurring.	Short term - This indicator is likely already being measured.
4	No of 3rd party recoveries from the SRN.	Per billion vehicle miles travelled on SRN	N/A	Monthly	Yes	Working with SURVIVE member organisations.	This Lag indicator will provide a level of intelligence on the total number of breakdowns occurring.	Medium term - Relationships would need to be strengthened with the recovery operators and data sharing issues resolved.
5	No of electric vehicle breakdowns	Per billion vehicle miles travelled on SRN	N/A	Annual	Yes	C&C Logs	This indicator will help determine if there is a developing issue with this type of vehicle. Intelligence gathered can be used to adjust other indicators or design new interventions.	Medium term - C&C logs may need to be altered to collect this data.

Appendix E. Lead Indicators

Ref	Description	Metric	Theme	Measurement frequency	Regional breakdown	Data source	Purpose	Timescale and risks
1	Toolbox talks on vehicle road worthiness attended by TOS	Number	TOS activity	Quarterly	Yes	Customer Operations	On road traffic officers meet the travelling public regularly and an increase in the number of sessions attended could increase there effectiveness in numerous ways. This could lead to them providing better intelligence on vehicle roadworthiness or providing better advice to road users or increase the submission of safety reports to other agencies such as the DVSA.	Medium term - This type of toolbox talk would need to be designed with different topics for different times of the year. Ideally Traffic Officers would have the opportunity to engage with the public on these topics at MSAs, not just when dealing with incidents.
2	TOS engagements where vehicle roadworthiness is discussed	Number	TOS activity	Quarterly	Yes	Customer Operations	On road traffic officers could keep a record of where they have intervened or held a conversation with a road user about the maintenance and or condition of their vehicle.	Short term - Although this could be implemented straight away the quality of advice given could be improved by better informing traffic officers on the issues.
3	TOS roadside identification of defective tyres.	Percentage	TOS activity	Quarterly	Yes	Customer Operations	On road traffic officers could be encouraged to check the condition of tyres and windscreens on the vehicle at all incidents they attend, regardless of the cause. This type intervention could be extended to MSAs.	Short term - Although this could be implemented straight away the quality of advice given could be improved by better informing traffic officers on the issues.
4	TOS roadside identification on defective lights.	Percentage	TOS activity	Quarterly	Yes	Customer Operations	On road traffic officers could be encouraged to check the condition of headlights on the vehicle at all incidents they attend, regardless of the cause.	Short term - Although this could be implemented straight away the quality of advice given could be improved by better informing traffic officers on the issues.
5	Free tyre checks given by national tyre repair centres	Number	Tyres	Annual	Yes	Third parties	The number of drivers requesting these checks could provide an indication of the level of awareness of tyre safety in the general driving population.	Medium term - Relationships would need to be developed with the companies involved.
6	Defective tyres identified by national tyre repair centres	Number	Tyres	Annual	Yes	Third parties	The number of defective tyres would be a useful indicator of the level of vehicle maintenance being undertaken.	Medium term - Relationships would need to be developed with the companies involved.
7	SRN vehicle survey	Percentages	SRN vehicles	Annual	Yes	Survey provider	A repeatable vehicle census could be developed which would help Highways England understand the composition of the fleet of vehicles on the SRN.	Long term - This would require a significant investment by Highways England. Use of ANPR cameras would make this census easier to undertake.

Ref	Description	Metric	Theme	Measurement frequency	Regional breakdown	Data source	Purpose	Timescale and risks
8	Vehicle Road Worthiness awareness questionnaire via Road User Survey.	Various	SRN driver awareness	Annual	Yes	Survey provider	The existing Road User Surveys could be improved to include new questions on vehicle roadworthiness.	Medium term - Discussions would need to take place on the form of the questions.
9	Social media followers	Number	SRN driver awareness	Quarterly	No	Communications team.	This indicator would give an indication of how many road users are seeing messages related to vehicle road worthiness.	Short term - This data is likely already reported.
10	Hits on Highways England Youtube channel.	Number	SRN driver awareness	Monthly	No	Communications team.	This indicator would give an indication of how many road users are seeing messages related to vehicle road worthiness.	Short term - This data is likely already reported.
11	Users of Highways England app	Number	SRN driver awareness	Monthly	No	Communications team.	This indicator would give an indication of how many road users are seeing messages related to vehicle road worthiness.	Long term - Road Safety and vehicle road worthiness messages are not currently distributed using this medium.
12	Hire car companies providing Highways England with data	Number	SRN vehicles	Quarterly	No	Third parties	This interim indicator could be used to show progress with hire car companies providing their data in a format suitable for Highways England purposes. Once the major companies are all compliant this indicator could be dropped.	Medium term - A standard format for data would need to be agreed by Highways England and the different companies.
13	Accuracy of C&C data.	Percentages	Data reliability	Monthly	Yes	Customer Operations	This indicator would establish which data fields are required for further work on road worthiness and identify what percentage of entries contain the correct data.	Medium term - Amendments to the C&C data to capture the necessary information may be required before this is rolled out.
14	MSA tyre pressure checks	Number	Tyres	Monthly	Yes	MSA operators	This indicator would simply record the use of these facilities in MSAs. This could be further subdivided by general traffic and HGV based on the location of the facility in the MSA. If it was not possible to record the number of individual users then the cubic metres of air supplied could be recorded instead.	Medium term - This would need to be explored with the MSA operators.
15	Vehicle Road Worthiness campaigns.	Number	SRN driver awareness	Annual	Yes	PTS	This indicator would track the number of campaigns run by Highways England.	Short term - This data would be easy to capture.
16	MOT Failures	Percentage	SRN vehicles	Quarterly	Yes	DfT	This indicator would provide information on any developing trends in terms of the reliability of vehicles on the entire road network.	Short term - This data would be easy to source.

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