



Department  
for Transport

## Experimental Statistics: Road Condition SCANNER data report, April 2017 to March 2021

### About this release

This statistical release presents experimental statistics using underlying SCANNER (Surface Condition Assessment for the National Network of Roads) data on the condition of local roads in England.

Automated SCANNER survey machines are used by local authorities (LAs) to determine the condition of sections of road, that are then aggregated so that condition can be assessed at a network level.

This is the first time that DfT have gained access to underlying data to enable more granular analysis.

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### What is the purpose of the Report?

► The report has been produced to supplement the analysis provided through the official statistics, which looks predominantly at roads categorised as red (i.e. where roads should be considered for maintenance). The narrative, seen in the official statistics at the national level, has in past been that the condition of local authority managed roads has remained broadly stable in recent years.

### What does this report cover beyond the official statistics?

- The experimental statistics offer more granular analysis and move away from a focus on the percentage of red roads and focus more on the road condition indicator (RCI) score as a more detailed measure of condition, presenting the average (mean) score, standard deviation and the skew of the distribution of RCI scores.
- The report also explores in more detail about the makeup of the red, amber and green categorised roads, with a particular focus on amber roads, a topic which key stakeholders have shown an interest in. The report covers how condition varies by local authority type (urban/rural) and local authority size. Further detail can be found in the methodology note published alongside the statistical release.

### How do the experimental statistics compare to the official statistics?

► The figures shown in this report are not directly comparable to the official statistics for the Road Conditions in England statistical release. Although processes have been replicated as closely as possible, processing rules will differ slightly by local authority when outputting their UKPMS results (source used for the Official Statistics). The Network used in the SCANNER report and, the coverage of local authorities included, differs slightly from that of the official statistics which will cause some differences between the two datasets.

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FURTHER INFORMATION:

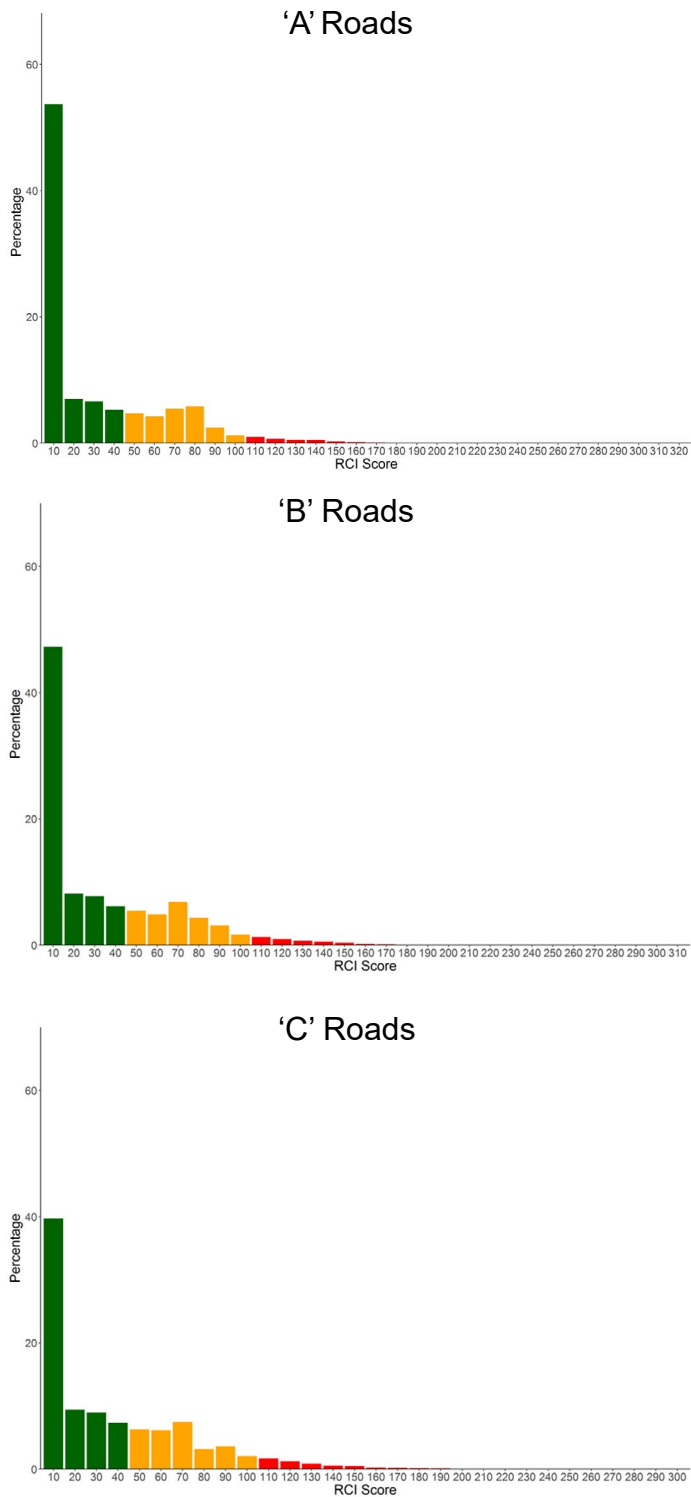
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# Key Findings

**Chart 1: Distribution of RCI scores by condition category and road classification, 2019-21**



► The average Road Condition Indicator (RCI) score across all Local Authority managed classified ('A', 'B' & 'C') roads fell within that of the green category (0 to less than 40), ranging from 24.4 for 'A' roads to 32.0 for 'C' roads in 2019-21.

► In 2019-21 the RCI score for individual sections of roads was most frequently between 0 to 10 across all road categories, with at least four in ten roads having almost no detectable defects. This was also seen in 2017-19.

► A small minority of classified ('A', 'B' & 'C') roads in England have very high RCI scores, indicating significant defects on certain roads.

► There was little change in the average RCI between 2017-19 and 2019-21, with the distribution of RCI scores remaining fairly stable.

► Within each road classification, approximately a quarter of roads were categorised as amber. There was no indication, nationally, that there are significant clusters of roads at the upper threshold of the amber category, where roads are at risk of becoming 'red'. However, there is likely to be a greater degree of variation at a local level.

► In each road classification, 6% or fewer roads were categorised as red. RCI scores of red roads were more likely to be close to the lower threshold score of 100. This means that while red roads have defects, the majority are at the lower end of severity for the category. This was seen in both 2017-19 and 2019-21.

## Background

SCANNER data is collected using automated survey machines. They were developed to provide a consistent method of measuring the carriageway surface condition of classified local roads. Most of the parameters (defects) e.g. cracking are reported as average values over small sections of road, each approximately 10m in length.

This report contains new experimental statistics produced from the detailed SCANNER data which underlies the summary information published in the accompanying official statistics. This is the first time that DfT have gained access to underlying data to enable more granular analysis. The SCANNER information has been obtained via Transport Research Laboratory (TRL) and DfT have liaised with TRL to define appropriate methodologies, for more detail see the [methodology note](#).

## Data Coverage

Existing data requirements for SCANNER data meant that local authority (LA) managed classified 'A', 'B' & 'C' roads in England were within scope for this project. SCANNER does not measure the condition of footways, cycle paths or verges.

Data from 123 out of 151 LAs for 2017-19, and 85 out of 150 LAs in 2019-21 has been included in this analysis. Data was included only where permission was obtained from the LA, and valid data was held by TRL. There is no data for London LAs in 2019-21 due to changes in funding from TfL. As SCANNER data is collected over a two year cycle, the 2017-19 time period provided combines the financial years 2017/18 and 2018/19, and 2019-21 the financial years 2019/20 and 2020/21. This should give a more complete picture of network condition and better reflect changes over time.

## Measuring Condition - RCI and Condition Category

SCANNER surveys give quantitative measures of carriageway condition from a moving vehicle measuring different parameters continuously along a road. Further information is in section 1 of the [SCANNER specification](#).

Throughout this report road condition is quantified by the RCI. This combines a set of core parameters to give an overall measure of road condition. The aim of the RCI is to help LAs identify which roads may require planned maintenance, but is not the only evidence used by an LA.

Each 10m section of road is given an RCI score and categorised as red, amber or green:

- ▶ 0 to less than 40 = green (good condition)
- ▶ 40 to less than 100 = amber (lengths where some deterioration is apparent).
- ▶ 100 or more = red (likely in poor condition, will require further investigation)

**For full details of these categories please refer to the [technical guide](#).**

## Comparison to Official Statistics

### Percentage Red, Amber, Green

The tables below outline the percentage of red, amber and green (RAG) roads within the SCANNER data in this report compared to the official statistics. Although the RCI thresholds of the RAG categories are the same, due to differences in LA coverage, survey technologies and data processing, these percentages will vary slightly. The official statistics should be used as the definitive source of this information and are presented here for context.

**The percentage of roads categorised as red, amber and green, in England, 2019-21.** Source: [\[RDC0122 RDC0123\]](#)

Road Classification	Red	Amber	Green
'A'	4%	24%	72%
'B'&'C'	7%	29%	64%

**The percentage of roads categorised as red, amber and green, in England, 2019-21.** Source: [\[RDC1001\]](#)

Road Classification	Red	Amber	Green
'A'	3.3%	24.0%	72.6%
'B'	4.3%	26.3%	69.3%
'C'	5.7%	28.8%	65.5%

# Surface Condition of Classified Roads

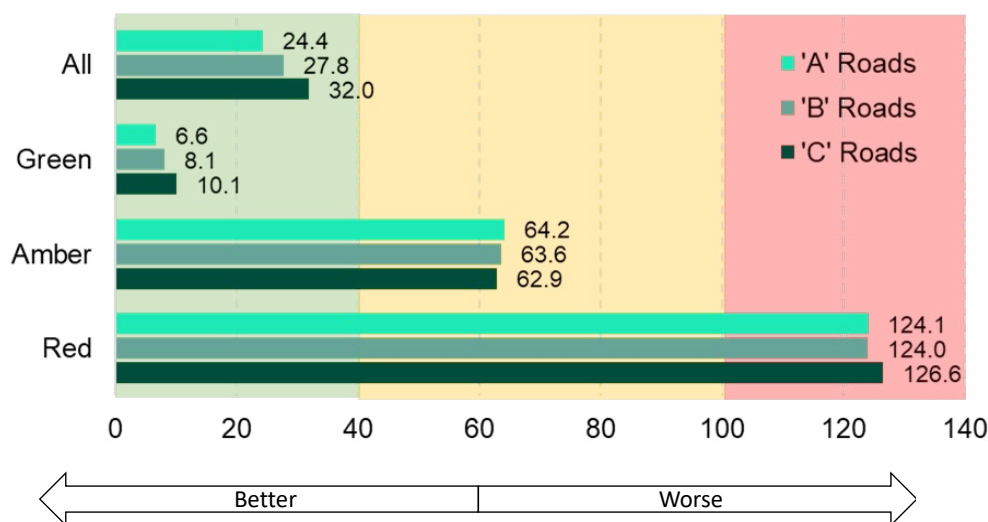
## The Average RCI

The average (mean) RCI of a 10 metre sub-section of road within each road classification in 2019-21 was 32.0 or below. This correlates with the majority of roads being categorised as green, which are roads with an RCI of 0 to 40. These low average RCI scores indicate that the overall condition of roads is relatively good.

Across the different road classifications, the average RCI of roads categorised as green ranged from 6.6 to 10.1 in 2019-21. This correlates with roads within this category tending to be closer to the lower threshold of 0 than the upper threshold of 40, with at least four in ten roads having an RCI of 0-10. 'A' roads had the highest proportion of green roads and the lowest average RCI (24.4).

In 2019-21 roads in the amber category had an average RCI of 62.9 for 'C' roads, 63.6 for 'B' roads and 64.2 for 'A' roads. These average scores fall into the lower half of the amber category which ranges from 40 to 100 (with lower scores indicating better condition). Roads categorised as amber accounted for approximately a quarter of roads across each road classification.

**Chart 2: The average RCI (mean) scores by condition category and road classification, 2019-21** [\[RDC1001\]](#)



The average RCI for roads categorised as red ranged from 126.6 to 124.1, by road classification in 2019-21.

There are fewer roads within the red category, accounting for 6% or less of roads within each classification, therefore the average RCI is likely to be influenced more by a small number of roads with very significant defects (i.e. very high RCI scores).

## Average RCI

SCANNER data is split into 10m sub-sections of road.

The average RCI is the mean score of a 10m sub-section of road within the category being assessed.

This measure provides a more detailed look at the average quality of the road network, than the traditional red, amber, green condition categories.

## Comparisons Across Road Classifications

Comparisons of road condition between different classifications should be made with caution due to differences in the thresholds applied in the RCI calculation for different road classifications. For example, if an 'A' road and 'C' road appear to be in a similar condition, the 'A' road is likely to have a higher (worse) RCI score than the 'C' road.

## The level of skew in RCI scores

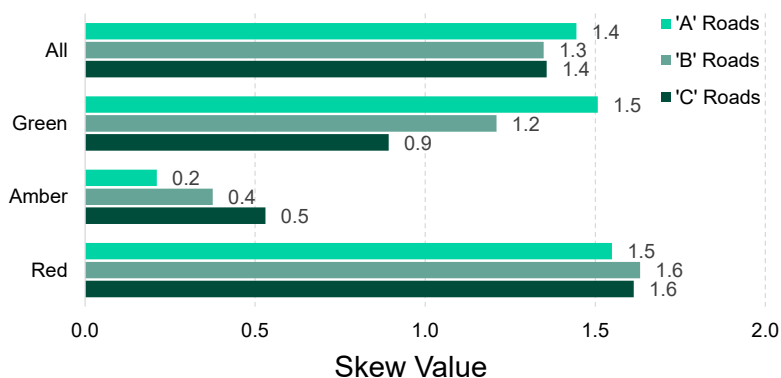
### What is the Measure of Skew

Skewness is a measure of the symmetry of a distribution around the mean, looking at the deviation from the normal distribution. A distribution is skewed if there is asymmetry, causing a tail on one side of the mean. A negative skew indicates that the tail on the left side is longer than on the right side (left-skewed), and visa versa. This measure can tell us how evenly distributed the scores are; whether there is clustering of scores at one end of the distribution and if there are a small number of extreme values causing a tail in the distribution.

- ▶ Little to no skew: skew between -0.5 and 0.5
- ▶ Moderate skew: skew between -1 and -0.5 or between 0.5 and 1
- ▶ Highly skewed: skew is less than -1 or greater than 1

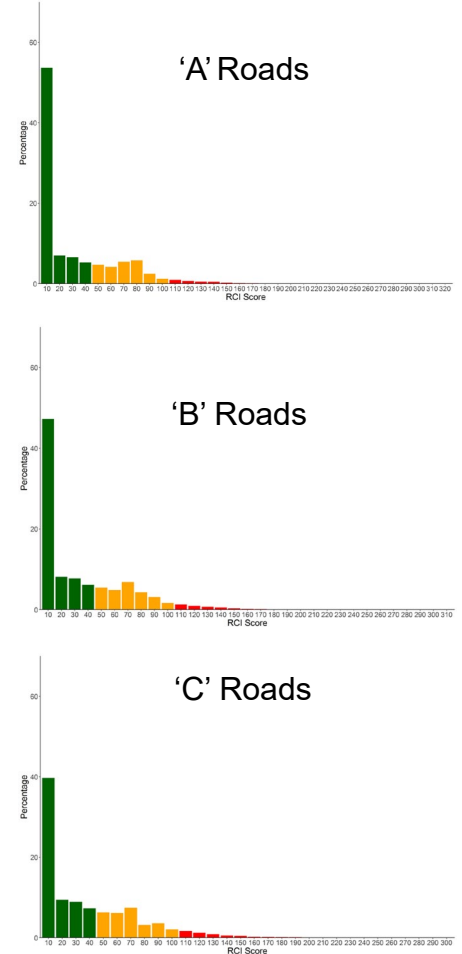
When looking at the full range of RCI scores, RCI values tend to cluster around zero (good condition) rather than towards the upper end of the distribution (poor condition). This means the data is highly skewed, with the level of skew measure at 1.3 to 1.4 (right-skewed) for each road type, as shown in chart 4. This is linked to the average RCI tending to be closer to the lower end of the distribution and the majority of roads being categorised as green.

**Chart 4: Skew of RCI Scores, by road classification and condition category, 2019-21 [RDC1001]**



For roads within the red category, skew values ranged from 1.5 to 1.6 units, indicating a high level of right-sided skew. This is because most 'red' roads have RCI scores towards the lower end of the red band, but a small minority have very high RCI scores (i.e. have very significant defects).

**Chart 3: Distribution of RCI scores, by condition category and road classification, 2019-21**



The skew within the amber category in 2019-21 was measured at 0.5 to 0.2 units, indicating that there is little skew. The fairly even distribution of roads in the amber band highlights that at a national level there was no evidence of significant clusters of amber roads building up at the upper end of the amber category which are at risk of becoming red. However, this will vary at a local level.

### What is the Standard Deviation?

The standard deviation measures the variation of the values of a data set relative to the mean.

A higher standard deviation in this case would indicate that there were more RCI values further from the mean and/or more extreme values at the upper end of the distribution.

**Chart 5: Standard Deviation of the RCI scores, by road classification in 2019-21** [\[RDC1001\]](#)

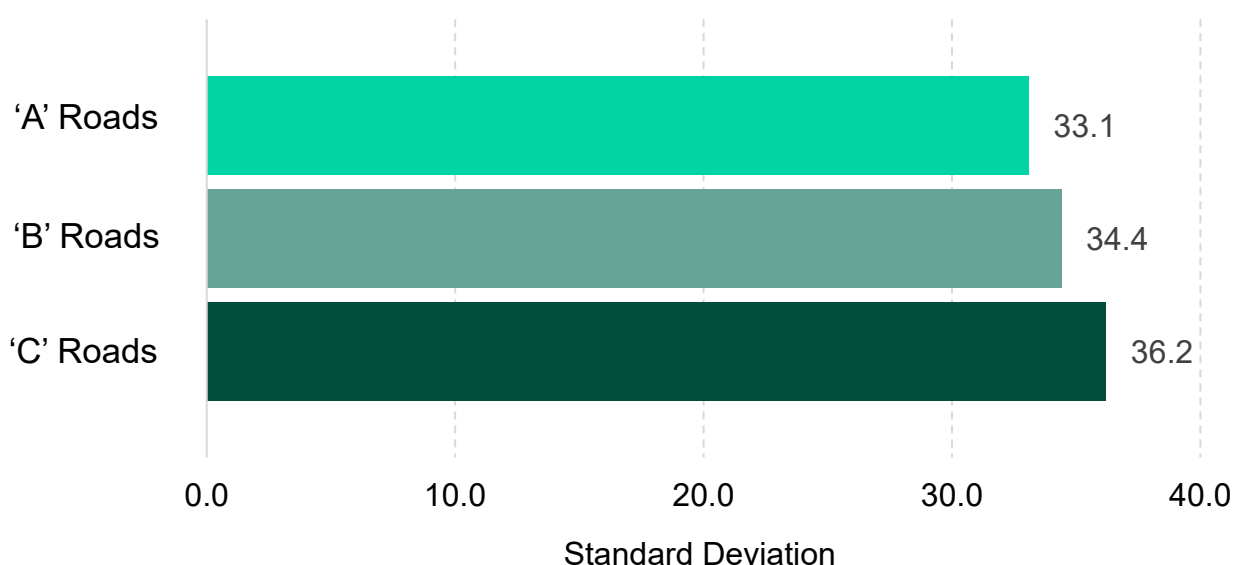


Chart 5 shows the standard deviation scores for classified ('A', 'B' and 'C') roads in England. Across the road classifications, the standard deviation scores ranged from 33.1 to 36.2 in 2019-21.

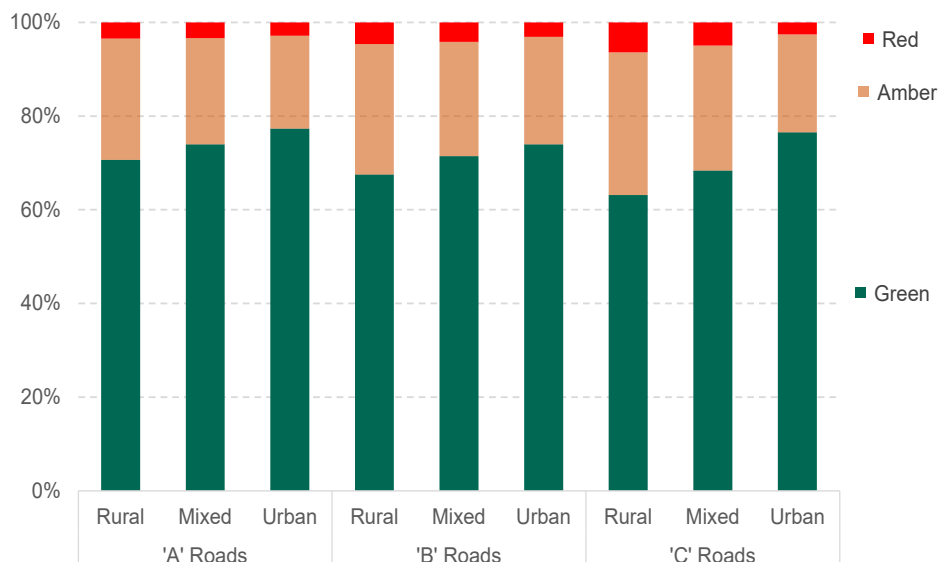
In 2019-21 for 'C' roads the standard deviation score was highest at 36.2, it highlights that the RCI scores of these roads are more varied, with more scores at the upper end (poor condition), compared to either 'A' roads at 33.1 or 'B' roads at 34.4. This pattern was also seen in 2017-19.

# Surface Condition of Urban vs Rural Local Authorities

## Urban, rural, mixed LAs

LAs have been categorised as Urban, Rural or Mixed based on the proportion of their road network that is urban or rural. If more than 66% of the entire LA managed road network length is urban or rural, then the network is defined as the corresponding category (i.e. 66% urban = urban). LAs that don't reach this 66% threshold for either urban or rural are classed as mixed.

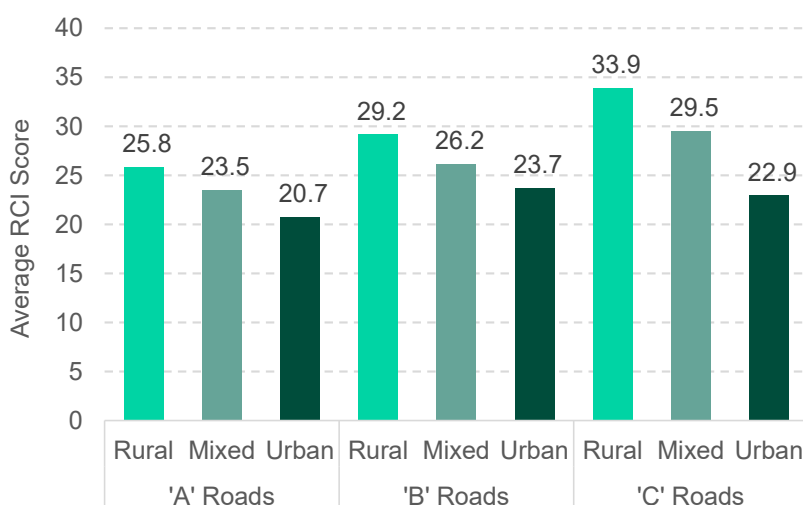
**Chart 6: Percentage of roads categorised as red, amber or green, by LA urban/rural/mixed classification and road classification, 2019-21 [RDC1002]**



In 2019-21, roads in rural LAs had the highest proportions of amber roads and red roads and this was across each road classification. This was broadly consistent in 2017-19 as well.

Urban LAs in 2019-21 had the lowest proportion of amber roads and red roads across all road classifications. It should be noted however figures exclude the London region, which is likely to affect the scores for urban LAs (all London LAs are classed as urban).

**Chart 7: Average RCI Score, by LA urban/rural/mixed classification and road classification, 2019-21 [RDC1002]**



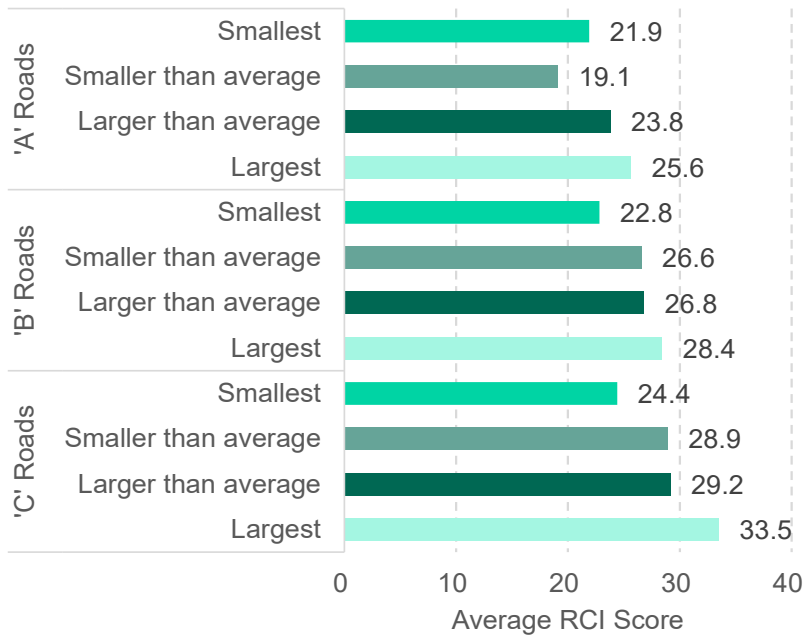
In 2019-21 each road classification showed the same trend; the average RCI was highest for rural LAs, followed by mixed and then Urban. This suggests that urban roads are in a better condition, on average, than rural or mixed LAs. This correlates with rural roads having a higher level of red and amber roads.

The pattern was most notable for 'C' roads, where the average RCI in 2019-21 was 33.9 for rural LAs, compared to 29.5 for mixed and 22.9 for urban.

Despite the variation between urban and rural LAs, all average scores were relatively low and within the range of green roads (RCI of 0 to less than 40).

# Surface Condition of Classified Roads by Length of LA Road Network

Chart 8: Average scores, by length of LA road network and road classification, 2019-21 [\[RDC1003\]](#)



## LA size

For the purpose of this analysis LAs have been grouped by size into four quartiles. The length of the each LA managed network has been ordered smallest to largest and grouped as follows:

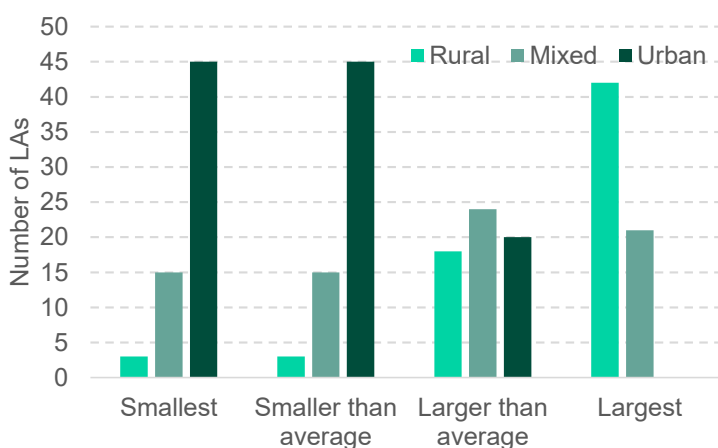
- ▶ Smallest: 0%-25%
- ▶ Smaller than average: 25%-50%
- ▶ Larger than average: 50%-75%
- ▶ Largest: 75%-100%

In 2019-21 the largest LAs had the highest average RCI scores, this was seen in all road classifications and suggests large networks tend to be in worse condition compared to smaller LAs.

The average RCI of the 'largest' LAs 'A' roads was 25.6, compared to 19.1 for 'smaller than average' LAs (the group with the lowest average RCI for 'A' roads) in 2019-21. For 'B' roads and 'C' roads the average RCI was lowest for the 'smallest' LAs, at 22.8 and 24.4 respectively, compared to that of the 'largest' LAs at 28.4 and 33.5 respectively.

Despite differences in the average RCI by LA size, all averages are fairly low and within the thresholds of roads categorised as green (RCI of 0 to 40). This suggests that overall the quality of roads is fairly good.

Chart 9: Rurality vs Size - LA Managed Roads in 2019-21 [\[RDC1006\]](#)



## Rurality vs Size

There is a known relationship between the size of LA, in terms of road network length, and whether it is urban or rural. 'Smallest' and 'smaller than average' LAs are predominately urban while largest LAs are mostly rural or mixed. Given the relationship between rurality and LA size, it is important to explore both of these factors, but also note that we cannot determine whether the trends seen are due to the size of LAs, the rurality of roads or another unmeasured factor. For more detail please see the [methodology note](#).



## How Condition Varies by LA

Road condition varies considerably by LA, with average RCIs in 2019-21 ranging from 10.1 to 45.1 for 'A' roads, 13.0 to 43.3 for 'B' roads and 14.3 to 54.5 for 'C' roads. Local factors will impact where LAs will plan maintenance, with certain parameters which contribute to the RCI being of greater or lesser importance. This will mean that some roads may always have a relatively high RCI, for example; they score highly on a parameter such as rutting which gives an RCI in the red category, but rutting is not a priority for the LA and therefore the road is not treated.

Year on year there are variations in the average RCI scores of LAs. In 2017-19 the average RCI of 'A' roads varied from 7.5 to 46.4, compared to 10.1 to 45.1 in 2019-21. SCANNER machines are accredited for accuracy and readings must fall within the accepted boundaries, but there is still room for variation between machines. This means that year on year changes should be viewed with caution (especially at this level).

## Surface Condition by Region

**Chart 10: Highest and lowest regional average scores, by condition category, 2019-21**  
[\[RDC1004\]](#)

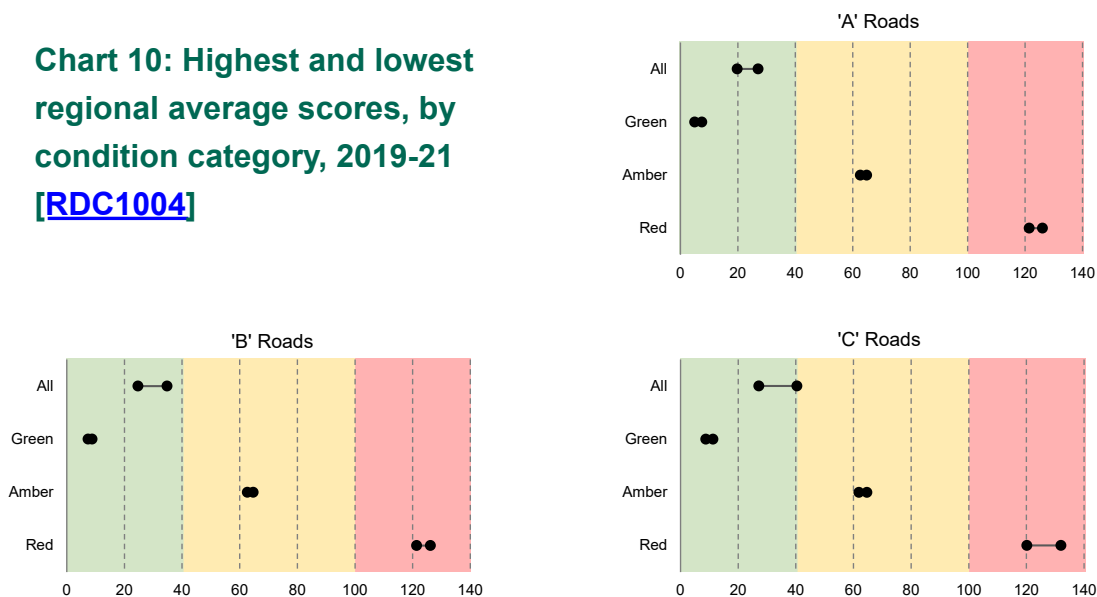


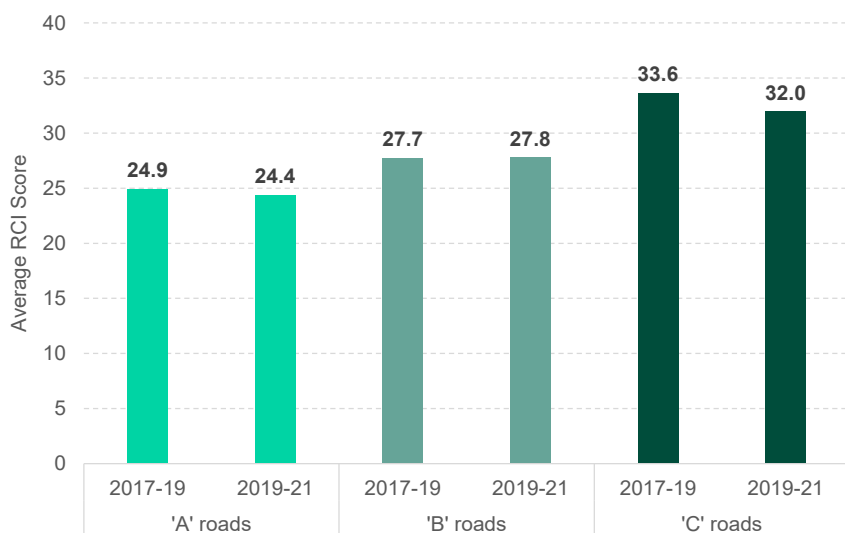
Chart 10 shows the highest and lowest the average RCI by region for each road classification. The percentage of roads categorised as red, amber or green and the average RCI varied by region. The region with the lowest average RCI on 'C' roads was the North East at 27.2, compared to the South West with the highest at 40.4 in 2019-21. This would suggest that 'C' roads in the North East are in better condition compared to other regions. It is important to note that the RCI is a tool to help LAs identify planned maintenance but ultimately the LA decides whether maintenance is required, according to local priorities.

When looking at the average RCI in 2019-21, those with the highest proportion of green roads tended to have the lowest average RCI. The South East had the highest percentage red 'A' roads at 4.7%, it was also the region with the highest average RCI at 27.1 compared to the North East with the lowest at 19.8.

# Change in Surface Condition Over Time

## National change in surface condition

Chart 11: Average RCI scores by road classification, 2017-19 and 2019-21 [[RDC1001](#)]



## Limitations - Year on year comparison

Not all LAs are included in this analysis, and the LAs included vary between the two time-periods. Therefore, caution should be taken when making comparisons over time, especially when looking at geographies below national level.

It is also important to note that 2019-21 covers the **Covid-19 pandemic** when there was lower vehicle traffic but increased pressures on LAs.

The proportion of roads which are red, amber and green were broadly similar (i.e. less than 1pp change) between 2017-19 and 2019-21 for each road classification.

There was also little change in the average RCI between the two time points. This correlates with the percentage of red, amber and green roads remaining fairly stable. The largest changes were seen in the average RCI for roads categorised as red, with 'A' roads worsening from 123.1 in 2017-19 to 124.1 in 2019-21, which was still less than a 1% increase.

The minimal change in the average RCI and the proportion of red and amber roads suggest that overall road condition has remained fairly stable between 2017-19 and 2019-20.

Across the entire distribution of roads the largest change was across 'C' roads, with an improvement from 33.6 in 2017-19 to 32 in 2019-21.

When focusing exclusively on LAs included in both time points, there was also little change in the average RCI over time albeit the trends do differ slightly. One notable change was in the average RCI for 'C' roads which decreased slightly.

There was little change in level of skew between the two time-points for each road classifications. The right-sided skew with most scores being at the lower end of the distribution was maintained between the two time points, indicated that overall road condition was fairly consistent.

The standard deviation was also fairly stable between the two time-periods, 'C' roads had a largest change between 2017-19 and 2019-21 at -0.9 (from 37.1 to 36.2). This suggests little change in how varied the scores are.

## Change in surface condition by LA size

The average scores showed some variation between 2017-19 and 2019-21, but the overall trend for larger LAs having higher average RCI scores (i.e. poorer condition) was maintained. The 'smaller than average' LAs had the most change in the average RCI, with their 'A' roads decreasing from 21.1 to 19.1, 'B' roads increasing from 23.0 to 26.6 and 'C' roads increasing from 25.9 to 28.9. 'Smaller than average' LA 'B' roads and 'C' roads also had the largest increase in their percentage of red roads (increasing from 3.0% to 4.5% and 3.5% to 5.3%, respectively). This could indicate that these LAs had a worsening of road condition between 2017-19 and 2019-21.

Although the changes over time by size categories are slightly smaller when focusing exclusively on LAs included in both time points, the overall trend of larger LAs having higher average RCI scores was still present.

The same pattern occurred with the standard deviation of RCI scores, with the two notable changes being increases in the 'B' road and 'C' road standard deviation of 'smaller than average' group of LAs. This would suggest more dispersed RCI scores in 2019-21, which would mean more roads at the higher end of the distribution of scores.

## Change in surface condition by Urban/Rural LA

In both time periods the overall average RCI scores were higher for rural LAs compared to other LA types. This trend was consistent across each road classification. Between 2017-19 and 2019-21 there were some changes in the average RCI. The average scores for urban 'A' roads fell from 24.4 to 20.7, although it is important to note there is no data for London LAs in 2019-21. The average RCI of rural 'C' roads also fell from 36.9 in 2017-19 to 33.9 in 2019-21. This suggests an improvement in the overall condition of these roads, although this would be influenced by the different subset of LAs present within each time-period.

When focusing exclusively on LAs included in both time points, there are smaller changes to the average RCI over time. The overall trend of rural LAs having higher average RCIs was still evident.

In general rural LAs had the highest proportions of amber roads and red roads in both time-periods, apart from 'A' roads in 2017-19 when urban LAs had the highest percentage of red roads. This is likely impacted by the inclusion of London in 2017-19, with all London LAs classed as urban.

## Change in surface condition by Region

The average RCI by region was more variable over the two time periods, and at this level of detail the average RCI scores will be more affected by the different subset of LAs included within the 2017-19 data versus the 2019-21 data. There were however some notable trends:

- ▶ Despite some changes in the average RCI between 2017-19 and 2019-21, the majority of scores were still fairly low (less than 40), indicating good overall road condition.
- ▶ The average RCI for each road classification in the North West increased between 2017-19 and 2019-21. The largest change was in 'B' roads, increasing from 29.0 to 34.8. These roads also had the highest increases in the percentage of road categorised as red.
- ▶ The region with the highest or lowest average RCI varied between the two time periods.

## Background Notes

### Technical information

Information about how these experimental statistics were produced, as well as information about road condition data can be found in the methodology note, guide, notes and definitions and technical note, which can all be found on the Road Condition Statistics web page: <https://www.gov.uk/government/publications/road-network-size-and-condition-statistics-guidance>

### Experimental Statistics

The statistics presented in this report are experimental. The information presented in this report differs from the main statistics published, which primarily focuses on roads categorised as red and are based on UKPMS outputs provided by LAs. The annual Official Statistics report which contains information about road condition since 2007, can be found here: <https://www.gov.uk/government/collections/road-network-size-and-condition>

Details of ministers and officials who received pre-release access to these statistics up to 24 hours before release can be found in the pre-release access list: <https://www.gov.uk/government/publications/road-network-size-and-condition-statistics-pre-release-access-list>.

### Strengths and Weaknesses

This analysis has provided additional information to help us better understand the condition of England's roads. It allows a greater understanding of road condition to help fill evidence gaps and support policies in maintaining England's roads. SCANNER does not measure the appearance of the street from the perspective of a local resident or road user.

The SCANNER (Surface Condition Assessment for the National Network of Roads) data are collected using automated road condition survey machines. Although each machine is accredited for accuracy and readings fall within the accepted boundaries of the SCANNER specification for road condition, there is still variability between the results that each machine delivers. It can lead to small changes in the figures over time that are for reasons beyond the condition of the road, and above the expected range of variability that already exists within the data. Caution should therefore be taken when comparing the figures over time. Caution should also be taken when comparing the figures over time as there are a different subset of LAs in each time point, with no London data in 2019-21. There is broadly little change in the trends over time in the average scores when looking at LAs included in both time-points.

The nature of the RCI calculation can lead to steps in the data. Due to the thresholds applied for each parameter there are instances where the maximum value is reached for a given parameter at which point it will increase no further. This can lead to certain RCI values being more commonplace across the distribution (see section 3.4 of the SCANNER specification).

Any feedback on these experimental statistics should be sent to: [roadmaintenancstats@dft.gov.uk](mailto:roadmaintenancstats@dft.gov.uk).



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