highways england

The strategic road network star rating report

June 2019

ROAD SAFETY FOUNDATION

Introduction

At Highways England safety is our first imperative and we aim to have the safest roads in the world. Our road network is a vital national asset, supporting economic growth, regional development, and employment opportunity across England. It connects families, communities and businesses, enriching the lives of many citizens.

We believe no one should be harmed when travelling or working on our road network. Our work to modernise and maintain the network includes a range of safety measures: upgrading junctions, removing bottlenecks, developing higher standard A-roads, upgrading barriers and verges, and improving signage.

This report outlines progress against our commitment to ensure that, by the end of 2020 more than 90% of travel on our roads is at least 3-star rated, and that we improve the majority of 1-star and 2-star rated to 3-star rated or more. The latest data indicates that 95% of travel on our roads will be 3-star rated roads or above, meaning we have exceeded the target set in our delivery plan. We are also delivering a targeted programme to improve the star rating of 1-star and 2-star roads. However, we are not complacent, and the detail offered through the latest version of the star rating model provides us with the opportunity to re-evaluate and further improve our roads making it safer for those travelling and working on the network.

We are also committed to working closely with the International Road Assessment Programme (iRAP), the Road Safety Foundation, Transport Research Laboratory (an iRAP centre of excellence) and the Department for Transport to inform the development of a comprehensive star rating system which is better tailored to the strategic road network.

The revised model will be used to re-baseline the star rating of the network in 2020 and will continue to form part of our wider analysis of safety improvements on our network to help us make informed decisions about future investment.

Key Headlines

- We have assessed the star rating of our network to set a baseline in 2015 and to forecast results for 2020. These are based on model version 1.0 on which our target was set. Our assessment indicates we will have met our target that 90% of travel will be on 3-star rated roads or more in both 2015 and 2020.
- We are delivering £11 billion of investment to modernise and maintain the strategic road network, these investments will deliver improvements in safety and improve the star rating of our network. This investment has been informed by our star rating work and has contributed to the development of targeted investment programmes which tackle and improve 1-star and 2-star rated roads.
- We will resurvey the network in summer 2020 to assess how this investment has further improved the star rating of the strategic road network.
- We continue to work collaboratively with partners to develop an improved star rating model which better reflects the strategic road network and provides us with further details to improve the safety of our roads in the next roads period.

Safe systems and road safety management

Many countries across the world are now adopting the safe systems philosophy, based on the principles of inevitability that crashes will occur owing to humans being error-prone, and the survivability of crashes based on known tolerances of the human body to crash forces. This requires the design of a holistic system that will protect the road user from death or serious injury when crashes do occur.

The safe systems approach includes the following principles:

1. People make mistakes that can lead to road crashes.
2. The human body has a limited physical ability to tolerate crash forces before harm occurs.
3. A shared responsibility exists amongst those who design, build and manage roads, those who use roads and vehicles, and those who provide post-crash care to prevent crashes resulting in serious injury or death.
4. All parts of the system must be strengthened to multiply their effects; and to ensure that if one part fails, road users are still protected.

We have adopted a comprehensive approach based on safe systems which maximises opportunities to reduce the number of casualties. Safe systems is a holistic approach to road safety, managed so that the elements of the road transport system combine and interact to guide users to act safely and to prevent crashes – and when crashes occur, ensure that the impact forces do not exceed limits of human tolerance that, if exceeded, result in serious injury or death.

On the road, this proactive approach moves the focus away from historical crash 'cluster' data. Instead, by implementing road infrastructure treatments we seek to reduce risk before people are harmed. This is not to say that crash data should not be used: historical crash data can be helpful in identifying and prioritising treatments on high risk routes, for example, because larger numbers of crashes over a longer length of road are less likely to come about by chance. This is called 'risk mapping' and presents colour-coded maps which indicate the relative risk of different routes based on historical crash data.

Risk mapping and star rating are different, but can be used together to prioritise routes that require further investigation and investment.

iRAP star rating

iRAP star rating is a tool that assesses the safety standard of a road against safe system principles. The star ratings are based on road inspection data and provide a simple and objective measure of the level of safety which is 'built-in' to the road. The higher the star rating, the safer the road. The iRAP star rating model used today is the result of 20 years of development work, which began

with EuroRAP (http://www.eurorap.org) in 1999. The model is adjusted as new knowledge, new ideas, and better understanding come to light. These changes keep the model relevant, as we have seen in other sectors such as vehicle safety with EuroNCAP for example. The iRAP Global Technical Committee (GTC) oversees any changes.

In the last ten years, the most significant change has been to move from a 4-star model that only dealt with crash severity to a 5-star model that includes both crash severity and likelihood. The star rating assessment of our network is based on the original version of the model, version 1.0 (v1.0) on which our 2015-2020 target was established.

We have also reviewed and used the current version of the model, version 3.02 (v3.02), identifying a range of areas where it can be enhanced. For example, we have commissioned the development of a shunt module which will feed into future model development and will have a global impact. Star rating not only provides a good and easily understood safety performance indicator, but also provides a rich data source for practitioners. The data collected provides a road safety inventory every 100m along the surveyed network, allowing a better appreciation of the safety condition of the network; for example, with just a click, a practitioner can see how much of the network has unprotected roadside obstacles, or how much of the network has shoulder rumble strips (known as raised rib edge lines). The survey data also assists with the planning, appraisal and prioritisation of safety countermeasures. New designs can also be star rated, and star rating performance requirements, minimum 3-star, can be built into contracts to challenge design teams.

The star rating of a road depends on a variety of factors relating to the nature of the road. As a result, motorways, with fewer merging junctions and more roadside barrier, normally have higher star ratings than non-motorways. Similarly, dual carriageways, with opposing flows of traffic being physically separated, tend to have higher star ratings than single carriageways. These differences in star ratings reflect the real differences in crash risk: on our network in 2017, motorways have an average of 12 fatal and serious crashes per billion vehicle miles travelled, dual carriageway A-roads have 24 fatal and serious crashes per billion vehicle miles, and single carriageways have 77 fatal and serious crashes per billion vehicle miles.

Part of a global programme

England is far from the only place in the world to have embraced iRAP star ratings. For example, the World Health Organisation has said that, by 2030, all new roads should achieve technical standards for all road users that take road safety into account, or meet a 3-star or better. The following countries / states are amongst those to have adopted targets based on star ratings:

- The Netherlands: No 1-star or 2-star national roads by 2020. This target was set around a decade ago. It should be noted that the network of national roads has only limited sections of single carriageway.
- Sweden: 75% of travel on 3-star or better by 2020 and approaching 100% by 2025. This analysis is being done by modelling rather than re-surveying, based on the policy of introducing wire-rope barriers on all medians.
- New Zealand: Roads of national significance to be 4-star. This is based on a locally adopted version of the model.
- Australia (Tasmania & Queensland): Minimum 3-star related targets for national highways.
- Malaysia: 3-star or better by 2020 for 75% of travel on high volume networks.

Star rating our road network

To undertake iRAP surveys, our roads were videoed. The images were then used to record road features known to influence crash severity every 100m along the network. The star ratings are produced in the programme by assigning a roadside, central reservation and junction score to each 100-metre section of road. The scores are based on detailed inspections and decades of research into the relative risk associated with different road infrastructure features. This data, along with traffic flows and speeds, were combined with information about pedestrian and bicyclist road use, and calibrated using crash data. The data was then uploaded into the iRAP analysis tools (vida.irap.org).

Having assigned a score for each part of the road, they are then combined to form an overall score and star rating. A 4-star road is likely to have safety barriers at the side of the road and in the central reservation, and to have junctions with motorway-style slip roads. On this type of road, road users are significantly less likely to be killed or seriously injured in the event of a crash than if they were travelling on a 1-star road. Low scoring sections have hazardous fixed objects close to the road, frequent junctions and no head-on protection from oncoming traffic, such as a central barrier.

For more detail about the model, please refer to the technical specifications area of irap.org.

Our road safety performance

In 2017, there were 1,542 crashes on our road network which resulted in someone being killed or seriously injured; 619 of these crashes were on motorways, 605 were on A-road dual carriageways and 318 were on A-road single carriageways. Overall, these figures represented a reduction of around 9% in the number of such crashes compared with the 2016 figures, and around 11% in the fatal and serious crash rate.

EuroRAP risk mapping

Risk mapping presents colour-coded maps that indicate the relative risk of different roads given their traffic volumes. The risk map for our network, covering the 2014-16 period, is presented overleaf, displaying the fatal and serious crash rate in coloured bands according to a standardised EuroRAP scale. Most of the strategic road network is in EuroRAP's 'low risk' or 'low-medium risk' bands.

There are, however, some 'medium risk' and 'medium-high risk' roads on this network; the longest sections of these are around Hastings and, according to the Star Rating results, these also contain 1-star or 2-star rated road sections. The risk of a road alongside its star rating are important factors in identifying those locations where investment is required. For example, locations which are high risk and low star rating should be prioritised.

Risk rating of England's strategic road network

This map shows the statistical risk of death or serious injury occurring on England's strategic road network for 2014-2016. These risk ratings inform our investment plans, along with analysis of the star rating data. The risk is calculated by comparing the frequency of road crashes resulting in death and serious injury on every stretch of road with how much traffic each road is carrying. For example, the risk on a road carrying 10,000 vehicles a day with 20 crashes is ten times the risk on a road that has the same number of crashes but which carries 100,000 vehicles. For more information on the Road Safety Foundation go to **www.roadsafetyfoundation.org**. For more information on the statistical background to this research, visit the EuroRAP website at **www.eurorap.org**

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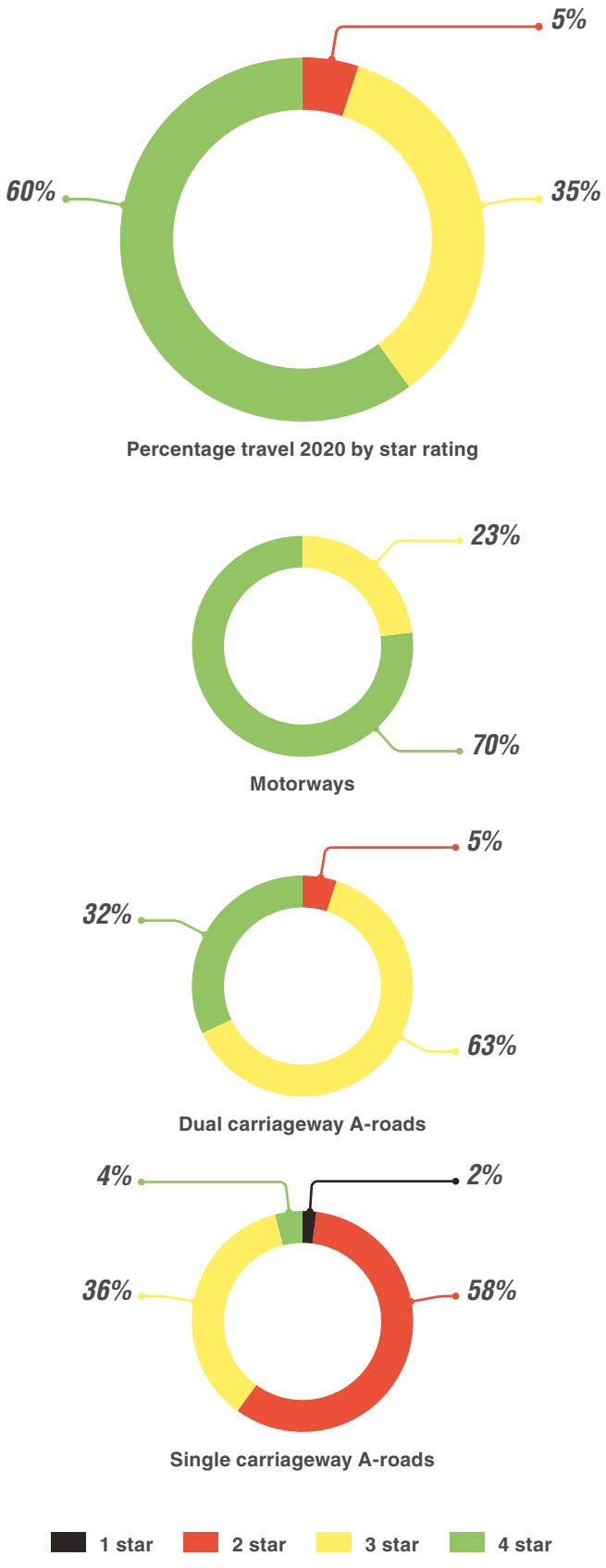
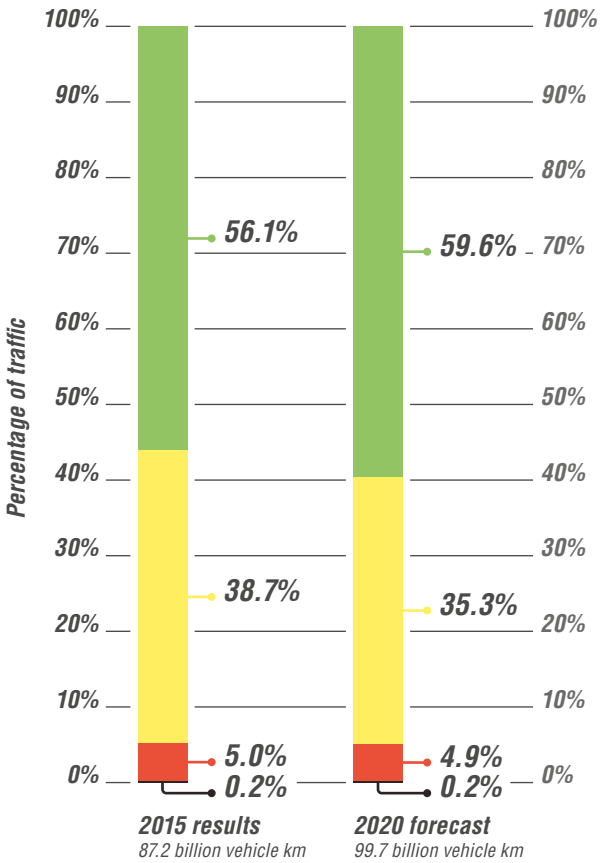
EuroRAP

Star rating performance

We have assessed our network based on the iRAP model (version 1.0) on which the target was established. This indicates that by 2020 95% of travel on our network will be on roads rated 3-star or 4-star and that we will have exceeded the 90% target by 2020, using version 1.0 of the model.



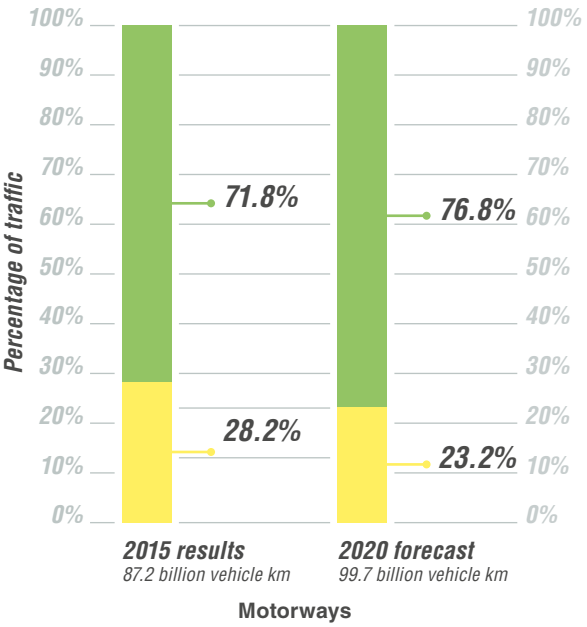
Our assessment of star ratings in 2020 is based on the programme of major projects which will be completed by March 2020. These estimates are, by their nature, conservative as they do not reflect the impacts or include the result of designated funds targeting single carriageways, the safety and congestion fund, and other improvements and enhancements which cannot be accurately represented and forecast within the model given the nature of improvements. The full effect on the star rating performance resulting from these improvements will only be fully understood when the network is re-surveyed in 2020. These conservative estimates have been compared with the 2015 Star Ratings below.

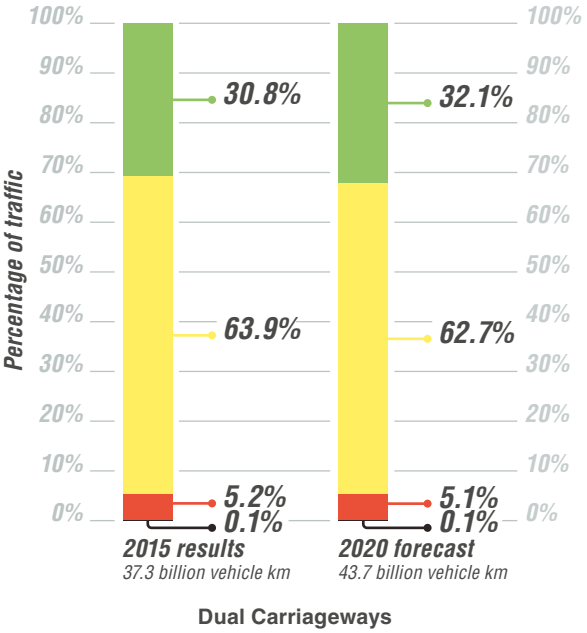


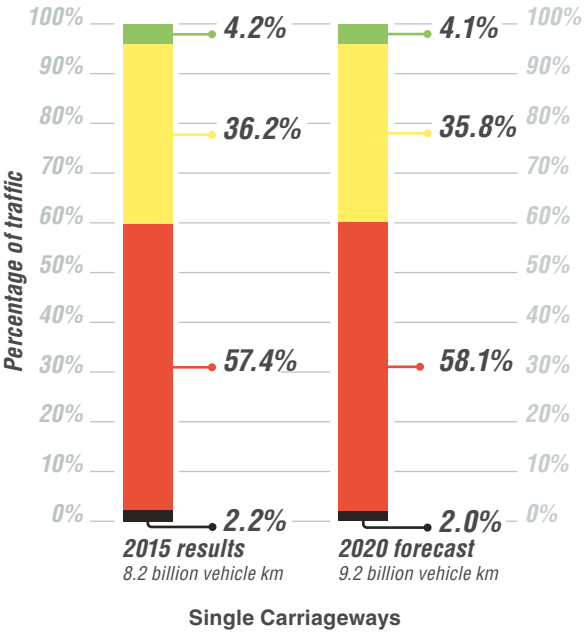
The percentage of traffic on our network travelling on roads that is forecast to be rated 3-star or above in 2020 is expected to increase only slightly between 2015 and 2020. However, projections suggest there will be a shift upwards in the star ratings above the 3-star threshold: the percentage of travel which is on 4-star roads is expected to go up from 56.1% to 59.6% and the percentage on 3-star roads is expected to fall from 38.7% to 35.3%.

Highways England strategic road network vehicle occupant star ratings (version 1.0) 2020

Star ratings provide a simple and objective measure of the level of safety 'built in' to the road for the safety of vehicle occupants. Using iRAP v1.0, 4-star roads are the safest, and 1-star roads are the least safe. Star ratings are based on road inspection data collected through surveys and analysis. Further details at: www.irap.org







Star rating forecasts for 2020

While all travel on our motorways is already on 3-star or above sections, we expect there will be an increase in the proportion of this travel which is on 4-star sections. We predict a similar upward shift in the star ratings of travel on our dual carriageways, including a small reduction in the modest amount of travel on 2-star sections. The percentage of travel on single carriageways which are rated 3-star or above is expected to fall slightly between 2015 and 2020 due to the increased risk of head-on crashes resulting from increased projected travel levels. However, it is on these roads that we will see the effect of wider improvements which have not been captured in our current forecast. Travel on single carriageways accounts for only a small proportion of travel on our network. Overall, there is expected to be a shift upwards in the star rating on the strategic road network because of planned infrastructure investments.

Our approach – applying star rating

Targeted safety programmes - addressing 1 and 2 star roads

Our designated funds safety programme is delivering targeted route treatments for single carriageway corridors where the star ratings are generally lower, for example on the A49, A47 and A21 corridors. We are investing £77m by the end of this roads period (end of March 2020) on these corridors delivering a range of improvements. These include enhanced lining and signing, creating safer verges through removal of obstacles, improving visibility through vegetation clearance, improved vulnerable road user facilities, localised widening, overtaking bans and speed limit reviews. To date we have invested approximately £44m delivering over 90 schemes on our single carriageways.

This includes improvements on the A64 between York and Scarbourgh, where we are investing over £3m in 2019/20 introducing village 'gateways', lower speed limits as appropriate, improved pedestrian crossing routes, improved bus stop facilities, dedicated right turns and additional footways, applied consistently throughout the route. This work will alleviate inconsistencies on the A64 in relation to speed limit application, signage and enforcement, while balancing the needs of all road users.

These improvements are also supported by wider investments as outlined in our safety and congestion programme, which will invest £220m by the end of this roads period, and deliver significant safety improvements across the network; for example, improved safer junction arrangements on A64 at Barton Hill (see pictures to the right).

These programmes have been informed by our assessment of the networks star rating. We have also trained over 80 of our engineers to use the iRAP data to help them to develop proactive road safety engineering solutions which will improve safety and the star rating of our network.

Our work on star rating has also been used to inform and develop new infrastructure solutions to prevent collisions on the single carriageways. For example, the introduction of hard shoulder rumble strips (raised rib edge lines) as part of new planned investments. It is also informing the development of our new design standards to ensure that our roads will meet, if not exceed, the 3-star requirement.

Future proofing the iRAP model

Working closely with the Road Safety Foundation and iRAP we have invested in the development of the model, for example incorporating shunts and improving the coding of junctions. This makes it more sensitive to the specific needs of the strategic road network while also benefiting other iRAP users around the world.

A64 improvements

It is envisaged that these developments will form the basis of a new model to assess the network when it is re-surveyed in 2020. We are also working collaboratively with local authorities to apply iRAP in a targeted manner on their networks, and to support the development of plans for the major roads network.

Developing new performance metrics

We are committed to implementing a safe system across our network. We are working towards our vision that no-one should be harmed whilst working or travelling on our network and that everyone gets home safe and well. Taking a proactive approach to road risk management is an integral part of our strategy. We are in the process of identifying the most appropriate interim casualty targets, such as the reduction in the number of fatal and serious injured casualties by 2030. We are also developing a range of performance indicators to support the achievement of this target, which are likely to include a measure of road design safety using the most up-to-date (3.02) version of the iRAP model.

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