

The strategic  
road network  
star rating report

**March 2022**

# Foreword

Our road safety management approach, is based on the principle that people's life and health should not be compromised by their need to travel. At the heart of this approach is a strategy that leads to safe drivers, in safe vehicles, on safe roads. How we design, build, maintain and operate safer roads is vital to helping to minimise harm.

The International Road Assessment Programme (iRAP) star rating protocols are one way we measure how safe our roads are. The star ratings are based on independently gathered road inspection data, and provide a simple and objective measure of the level of safety on a road.

We are proud that we have exceeded our target that at least 90% of travel on our network was on roads which were rated 3-star or better in 2020.

iRAP is not just about measurement though. We will use the data gathered to calculate the 2020 star rating baseline to drive our safer roads work. For example, it will inform strategic planning, investment

decisions and prioritisation. The data will also be used by road safety engineers charged with addressing safety aspects on individual routes.

National Highways contributes to the on-going development of the iRAP model. In recent years, we have worked with partners to consider how the model reflects the use of technology such as variable speed limits for managing road space.

We look forward to continuing our work with the Road Safety Foundation, iRAP and other road safety experts around the world to deliver our vision of zero harm on our roads.

Mike Wilson

Chief Engineer, National Highways

## Introduction

At National Highways, safety is our first imperative. We have some of the safest roads in the world, and we believe that no one should be harmed when travelling or working on our road network. Our vision for road safety is ambitious – for zero harm on the strategic road network. To achieve that vision, we are committed to reducing deaths and serious injuries on the strategic road network by 50% by 2025.

The star rating protocol, set out by the International Road Assessment Programme (iRAP), is a way to measure how safe our roads are. Every five years, our road network is surveyed and independently assessed to calculate star ratings. The highest risk roads are 1-star rated, while those which pose the least risk for road users are 4-star or even 5-star rated.

Our *2015-2020 Delivery plan* included a performance indicator based on this approach. It included a commitment that, by the end of 2020, 90% of travel on our network was on roads which were 3-star rated or above. Our roads have now been assessed to determine the star rating results for 2020, and we have exceeded this target. Our 2020 results show that 96% of travel on our network was on 3-star rated roads or better. We have made a range of improvements to the network since 2015 which have contributed to this success, and further improvements to the safety of roads which were already 3-star rated.

In our *2015-2020 Delivery plan* we also described an ambition to improve the majority of our 1- and 2-star rated roads to a 3-star standard or higher. Our 2020 results show that 1- and 2-star travel reduced by around a fifth between 2015 and 2020, demonstrating there is more work required to further reduce 1- and 2-star travel on our network.

We are now using iRAP star rating to help provide insights into risks present along routes to support improvements to the network. This will help us maintain our position as one of the leading road authorities in the world. The high standards of infrastructure advocated by iRAP motivate us to be even more proactive in reducing risk on our network.

We will use the 2020 baseline to help shape our thinking around route safety as we look forward to 2025 and beyond.

Using the iRAP star rating will also help us to meet the requirements of EU Directive 2019/1936 on Road Infrastructure Safety Management (RISM). This directive requires a network-wide route assessment to be carried out by 2024. This will measure the safety performance of roads targeting investment based on risk and the potential to reduce the greatest number of fatally and seriously injured casualties.

In this report, we outline the progress we are making to improve the safety of roads on our network, as measured by the iRAP star rating protocols.

## iRAP

The iRAP star rating is a tool that objectively assesses the safety standard of a road. The star ratings are based on independently-gathered 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.

Results are comparable between different road networks, as the same protocols are followed wherever in the world iRAP star rating is applied: A 3-star rated road in Britain has a similar level of safety as a 3-star rated road in any other country.

England is far from the only place in the world to have embraced iRAP star ratings: the approach has been used in over 100 countries worldwide, and 1.3 million kilometres of roads have been star rated. The World Health Organization has set global road safety targets to support the road safety Sustainable Development Goal to halve global road fatalities this decade. They mention star ratings as the means to measure the performance of new and existing roads.



The iRAP star rating approach enables road authorities to manage road safety proactively, by addressing risk factors before they contribute to serious road collisions. This is aligned with Safe System principles where action is taken proactively based on risk rather than waiting until collisions have accumulated. By addressing risk factors, rather than just collision locations, many serious collisions are prevented.

## Safe Systems

Safe System thinking guiding principles:

1. Road users will always make errors even when they are diligently observing the rules of the road and so road collisions should be viewed as inevitable.
2. Road users have limited tolerances to collision forces.

So, in implementing a Safe System we should be designing the system – the road, speeds and vehicles – to work together to prevent fatal or serious collisions.



A 4- or 5-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 collision 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 that provided by a central barrier.

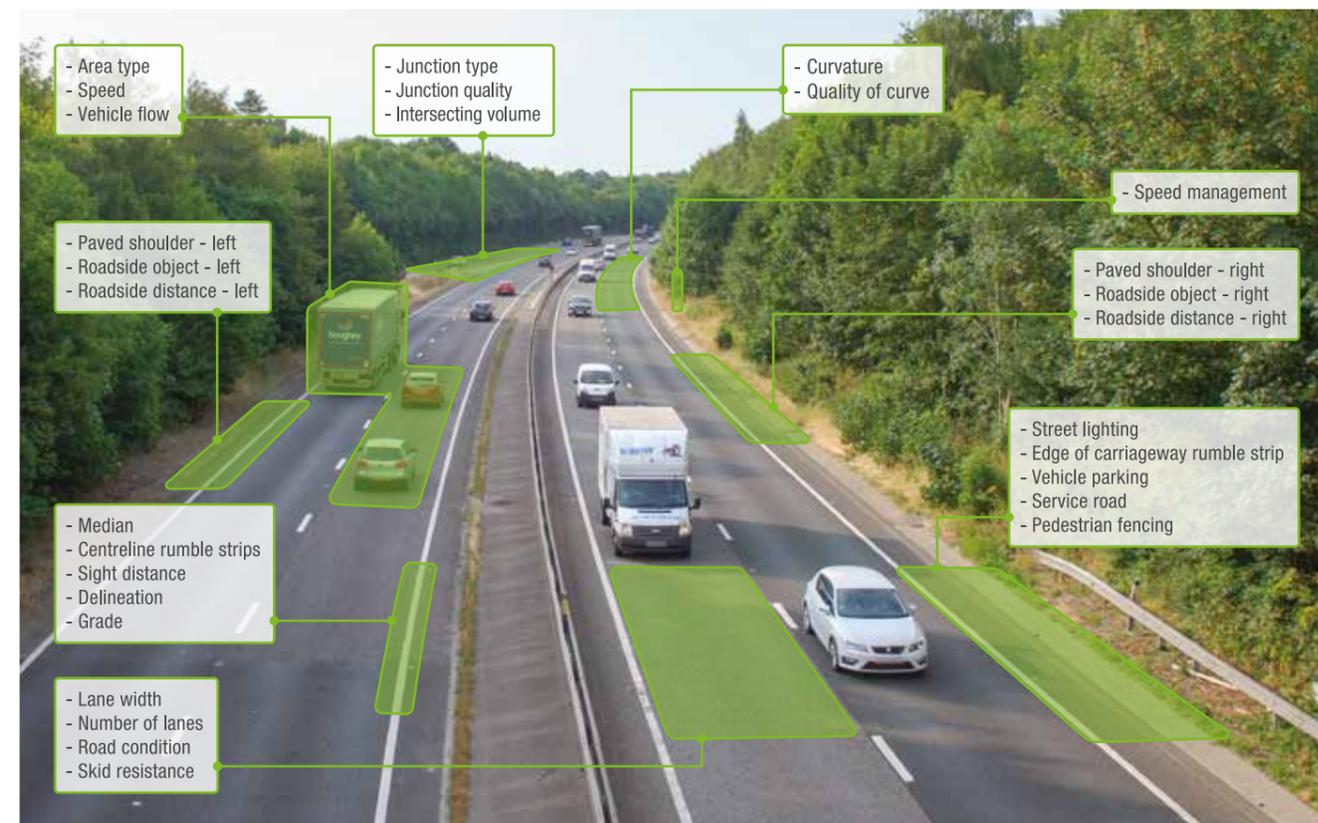
Star ratings not only provide a robust and easily understood safety performance indicator, but also provide a rich data source for practitioners. The data collected provides a road safety inventory every 100m along the surveyed network, allowing a better appreciation of the safety condition of the network.

The star rating model estimates where collisions are likely to occur in the future, given a location's risk factors. It suggests treatments known to address the collision risk identified, and which are most likely to be cost-effective in reducing that risk. These are combined into the Safer Roads Investment Plan (SRIP). At a network level, the SRIP information can help with planning the level of investment needed

The iRAP star rating model used today is the result of more than 20 years of development work, which began with EuroRAP in 1999. The model has been adjusted as new knowledge, new ideas, and better understanding come to light and changes are overseen by iRAP's Global Technical Committee (GTC).

In the last ten years, the most significant change has been to move from a 4-star model (version 1), that only dealt with collision severity, to a 5-star model (version 3.02) that includes both collision severity and likelihood.

The star rating of a road depends on a variety of risk factors relating to the road. As a result, motorways, with fewer merging junctions and more roadside barriers, 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 collision risk.



and strategic approach. For example, many of the cost-effective countermeasures can be delivered via maintenance and renewals.

At the individual route level, the data and countermeasure recommendations can provide road safety engineers with ideas to help with planning, appraisal and prioritisation of safety countermeasures. The approach also enables road safety engineers to model the road safety impact of

different treatment scenarios. New designs can also be star rated in advance, and star rating performance requirements, such as setting a minimum star rating standard, can be built into contracts to challenge design teams. For more detail about the current version of the model, version 3.02, please refer to the technical specifications area of [www.irap.org](http://www.irap.org).

## Safer Roads Investment Plans (SRIPs)

The Safer Roads Investment Plan (SRIP) identifies road safety engineering measures that would be likely to reduce risk at each location, based on:

- the type of risk present (for example run-off road collision risk or head-on collision risk) and the measure's known effectiveness at reducing that risk, given the conditions at the location
- the likely cost-effectiveness of the measure at a given location, taking account of the estimated monetary benefits versus the cost

The SRIP presents suggested measures by location, their estimated costs and benefits. This is a useful starting point for road engineers to develop detailed plans for improving the safety of a road. It empowers them to systematically address the risks present, while using their expertise and local knowledge, prioritising measures that are likely to reduce the number of fatalities and serious injuries most substantially. Many local authorities used the SRIP in this way to develop their submissions for the Department for Transport's Safer Roads Fund.



## Method

To undertake iRAP surveys, we collected imagery of the whole strategic road network (except for the M6 toll and roads where long-term roadworks were present at the time of the survey). We then used the images to record 52 road features known to influence collision likelihood or severity every 100m along the network. This dataset, along with traffic flow and speed data and information about pedestrian and bicyclist road use, was uploaded into the iRAP analysis tools (vida.irap.org). In 2020, traffic flows were lower because of Covid and the associated lockdowns and travel restrictions; subsequently, traffic speeds were higher. As we could not have predicted this, 2019 traffic flows and speeds were adjusted to reflect a non-Covid 2020 scenario.

The iRAP system then calculated scores for the roadside, central reservation, and junction risk for each 100-metre section of road. This was based on decades of research into the relative risk associated with different road infrastructure features. The system combined scores for each part of the road to form an overall score and star rating and then estimated future fatal and serious injuries.

The iRAP protocols stipulate a thorough quality assurance process. As well as quality controls within the organisation which conducts the coding from the imagery, the coding for at least a 10% representative sample of the network is quality checked by our partner organisation. Once the coding was completed to a suitably high standard, the overall results were then checked and reviewed by the Road Safety Foundation prior to being shared with National Highways. For more detail about the model, please refer to the technical specifications area of [www.irap.org](http://www.irap.org).

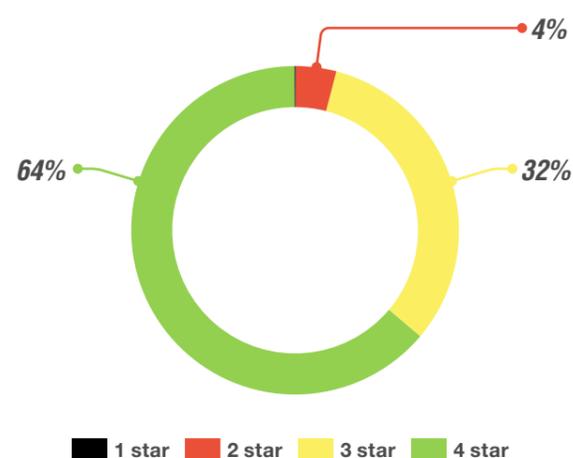
## Exceeding our 2020 performance indicator

We committed to ensure that, by the end of 2020, 90% of travel on our network was on roads which were rated 3-star or better. This commitment was based on version 1.0 of the model, and this has been exceeded.

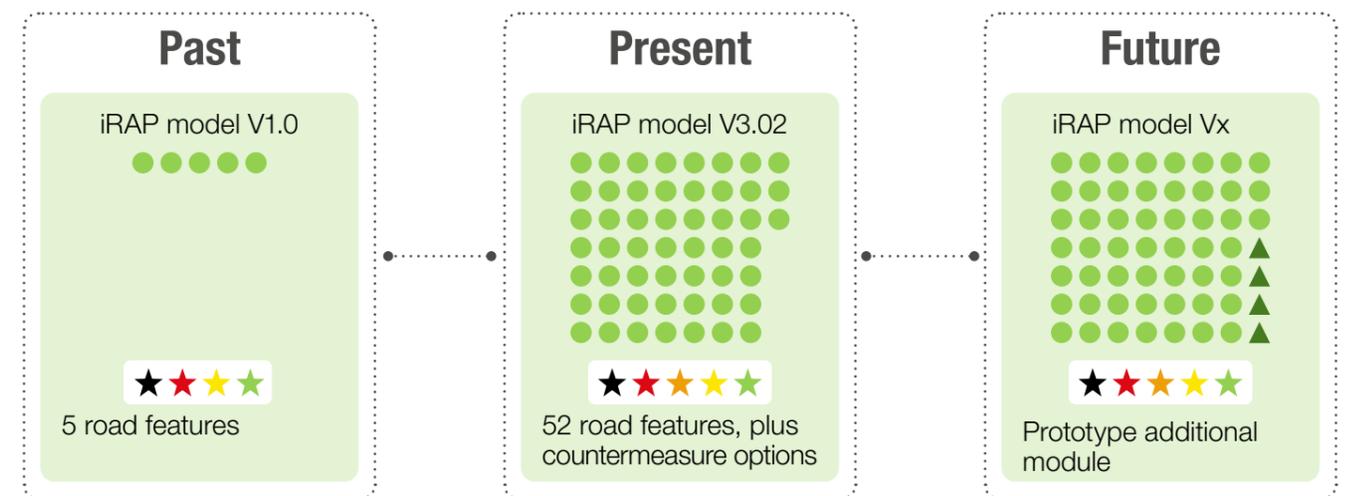
**96% of travel on our network was on roads which were rated 3-star or better in 2020.**

These results are better than those we forecast when we published our 2015 results. Almost two-thirds of travel on our network is now on roads which have the highest possible star rating achievable when assessed by version 1.0 of the model.

Percentage of travel in 2020 by star rating



## Model versions



The iRAP model has evolved over time and continues to do so based on the best available evidence. As road infrastructure risk research is published, and as roads and road use develop over time, the iRAP Global Technical Committee considers evidence and, if robust, will adopt changes to the model.

Our target for 2020 was established based on the original version of the model (version 1.0) which considered the impact of five road features on the severity of road collisions, awarding a possible 4-stars. The model has evolved greatly since version 1.0 and the most recent version of the model (version 3.02) takes account of how each of 52 different road features affect both the likelihood and the severity of road collisions, with a possible 5-stars. Version 3.02 therefore provides a much more accurate assessment of risk at each location than it was possible to obtain using version 1.0 of the model.

Version 1.0 and version 3.02 give very different results for the same road at the same point in time, and so the results should not be compared directly. Version 3.02 is more stringent than version 1.0, so it is now harder to achieve higher star ratings. Therefore a reduced star rating does not necessarily mean a deterioration in the standard of safety.

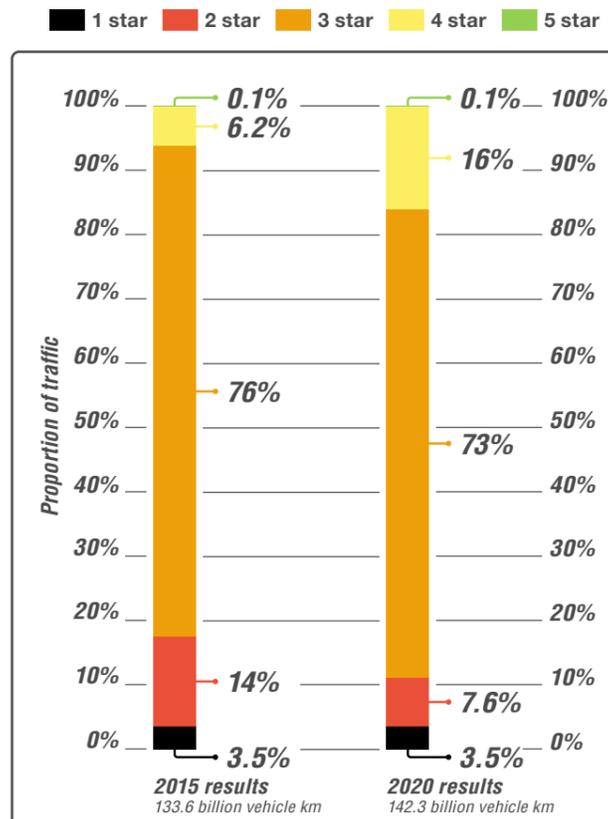
Version 3.02 also produces a Safer Roads Investment Plan (SRIP), allowing the impact of different countermeasure options to be modelled. Therefore, the updated version of the model enables

better prioritisation of future activity to improve safety on the network. By using the latest model, we will improve our practices and hence accelerate towards our vision of zero harm on the network.

We are currently limited in how star ratings can assist with assessments of smart motorways beyond the use of the standard iRAP criteria. Like many road authorities which use the star rating model to improve the safety of the roads for which they are responsible, National Highways contributes to the on-going development of the model. In recent years, National Highways has been the driving force behind the development of a prototype additional module which, if used, would consider the use of technology such as variable speed limits for managing road space. If adopted this could benefit not just National Highways to better assess smart motorways, but also other road authorities around the world, particularly those embracing new technologies.



## How has performance changed between 2015 and 2020 (using version 3.02)?



In 2020, 89% of travel on the network was on roads rated 3-star or better using the more demanding version 3.02 of the model, an increase from 82% in 2015. The proportion of travel on 4-star rated roads was more than doubled between 2015 and 2020, and travel on 1-star and 2-star rated roads was reduced from 18% to 11%. Each of these outcomes represent reductions in collision risk to those travelling on our network.

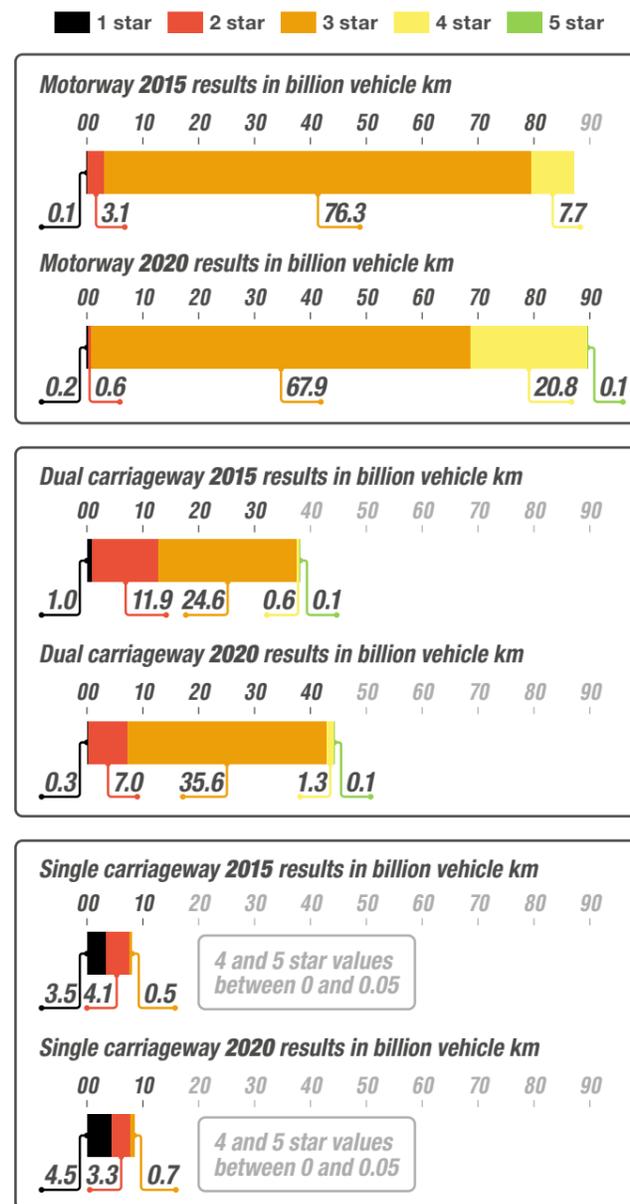
The star rating results above indicate that motorways have the highest star ratings, so are our lowest risk roads. The improvements on both motorways and dual carriageway A-roads are consistent with the improvement across all roads: in both cases, the proportion of travel on 3-star rated roads or better increased, with the proportion of travel on 4-star rated roads more than doubling. Additional positive changes:

- 2-star rated motorways and 1-star rated dual carriageways have now been almost eliminated.
- The proportion of travel on dual carriageway 1-star and 2-star rated roads has been approximately halved since 2015.

Subsequently, almost all travel on motorways, and the majority of traffic on dual carriageway A-roads (that together account for 94% of travel on our network), is now on roads rated 3-star or better. For single carriageway roads, that account for 6% of travel on the strategic road network, travel is primarily on 1- or 2-star rated roads.

During the 2015-2020 period, we used the star ratings primarily as a means of measuring safety, rather than as a means of directly driving safety improvements. These results therefore show that we are making improvements to the safety of our network through activities that are now built into our everyday work.

The following chart shows the travel volumes by star rating for each road type in both 2015 and 2020.



## Strategic road network vehicle occupant star ratings (version 3.02) 2020

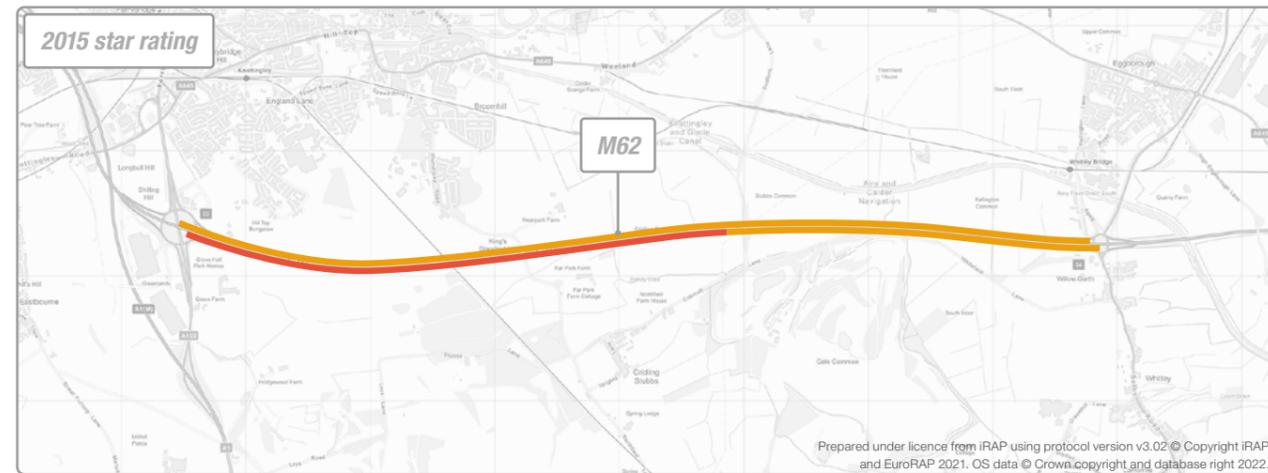


**Examples of roads on which star ratings were improved between 2015 and 2020 include:**

**The M62 between junctions 33 and 34 (installing safety barriers)**

This scheme involved the installation of metal safety barriers on the passenger-side of a section of the M62, as well as replacing the metal barrier in the central reservation with concrete barrier. In 2015, one carriageway of this section of motorway was rated 3-star and one was partly rated 2-star. In 2020, both carriageways of the M62 between junctions 33 and 34 are rated 4-star.

The most common hazard present on the passenger-side of the road in 2015 was a slope; this is hazardous because of the risk of vehicles overturning if they leave the carriageway. However, in 2020, 92% of the carriageway had a metal safety barrier present on the passenger-side, greatly reducing the risk of vehicles leaving the road should they lose control or be involved in a collision.



1 star 2 star 3 star 4 star 5 star



1 star 2 star 3 star 4 star 5 star

**A556 between the M56 and M6 (replacing a single carriageway through settlements with a dual carriageway bypass)**

The A556 between the M56 and the M6 serves as the main southern access to Manchester. Before 2017, it was mostly a 4 lane single carriageway with opposing traffic flows only separated by a double white centre line.

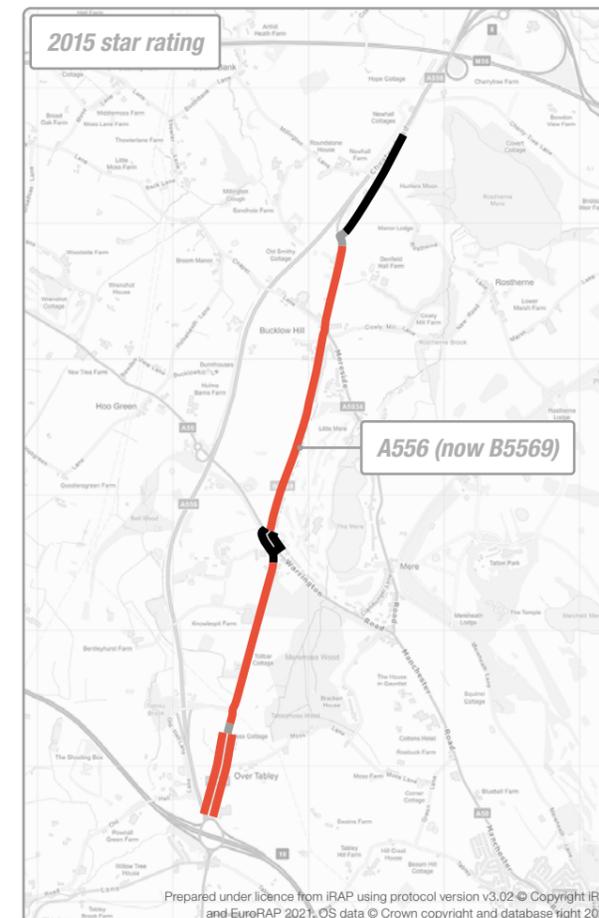
star rating is because dual carriageways have considerably lower head-on collision risk than single carriageway roads as a barrier in the central reservation prevents most vehicles travelling in opposite directions from colliding.

This was replaced by a new route to the west of the old one; the new road is a grade-separated dual carriageway bypassing Mere and other small settlements. The old A556 became part of the local road network and is now a single carriageway two lane road with parallel pedestrian and cycle facilities.

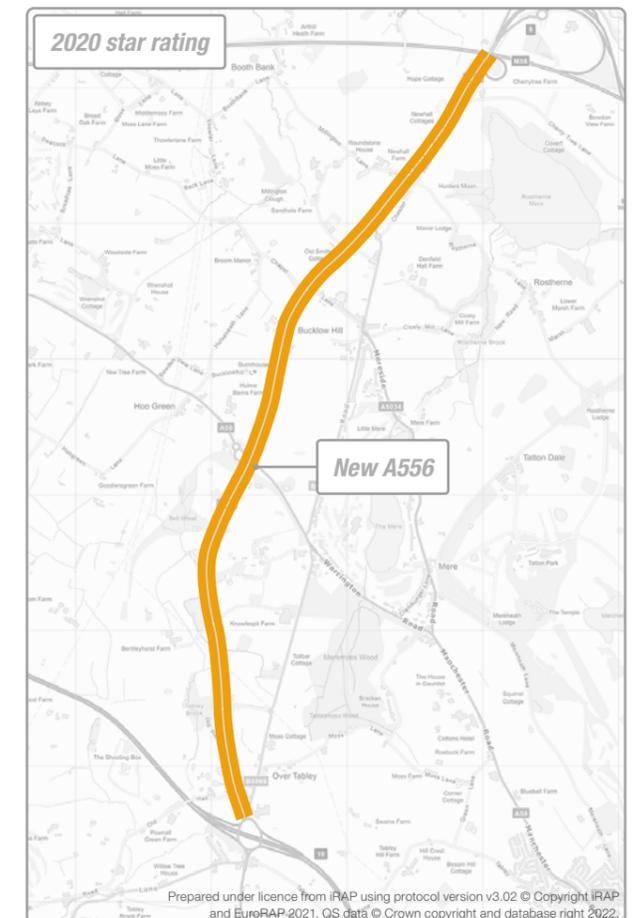
In addition, the old A556 had multiple T-junctions along the route whereas the new A556 has fewer junctions, which all have slip roads.

Before the scheme was implemented, the A556 was primarily 2-star with some 1-star sections. Following the upgrade, the A556 is completely 3-star. One of the key reasons for the higher

The new A556 section also has a safer roadside environment, with gentle upward slopes or metal safety barrier next to the road for the majority of the route instead of the frequent large trees and lampposts which were present on the roadside for a large proportion of the old road. This reduces the risk of serious injury were a vehicle to leave the road.



1 star 2 star 3 star 4 star 5 star

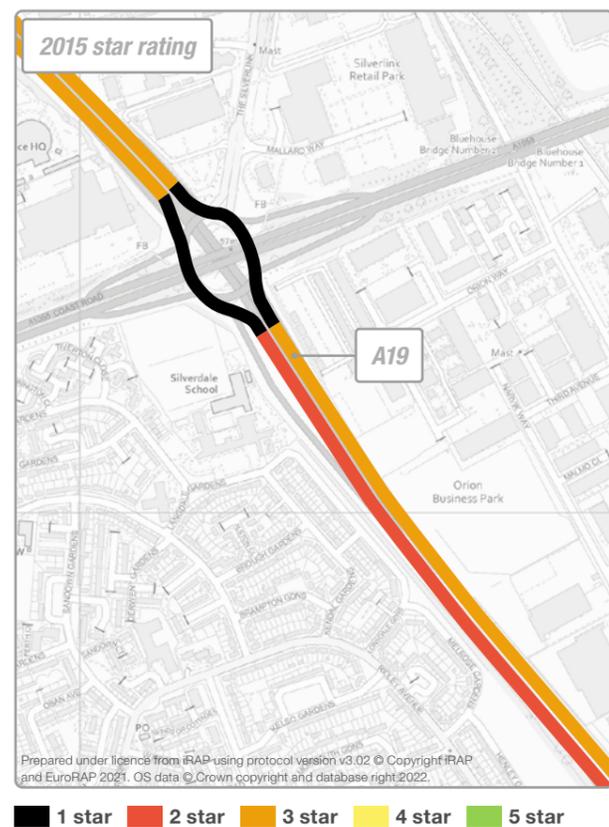


1 star 2 star 3 star 4 star 5 star

### The A19 Coast Road (junction improvement scheme on a dual carriageway A road)

This scheme converted the A19/A1058 junction from an at-grade roundabout (on the main road itself) into a grade-separated roundabout (slip roads and a separate roundabout similar to most motorway junctions) between 2015 and 2020. Before the scheme was implemented, the A19 road sections at or near the roundabout were 1-star rated. Following the scheme's

implementation, these sections were 3-star rated. The higher star rating was achieved because slip roads with grade separated roundabouts allow through traffic to effectively bypass the junction and the associated conflicts. An additional concrete safety barrier was installed as part of the scheme to reduce the severity of run-off road collisions.



### Using the 2020 iRAP baseline

Star ratings provide National Highways with the ability to inform our approach to safety treatments from a risk management perspective. This supports our journey towards our vision of zero harm on the network. We will use the 2020 baseline star rating data to:

- At a network / regional level:
  - Monitor performance going forward using the star rating metrics
  - Inform strategic planning, investment decisions and prioritisation

- At an individual route level:
  - Provide Safe System ideas to road safety engineers charged with addressing the safety provision on individual routes
  - Model different road safety countermeasure options for a route, to optimise serious casualty reduction

We are investing in our staff to support these activities, providing them with training on how to use the iRAP tools as part of their day-to-day activities. This will help to ensure that the star ratings and the data that underpin them can be used to drive activity throughout the business. National Highways' iRAP programme has

also helped in the development of a route review tool which will simplify the use of the results in developing and testing treatment scenarios. This tool will be made available across the world and will equip road safety engineers with tools to help them determine the road safety impact of their planned treatment solutions.

Baseline iRAP star rating data will be provided as a data set for consideration with the Walking Cycling Horse riding (WCH)\* scheme-specific initial assessment. In addition, we are starting to use iRAP's Star Rating for Designs tool where new roads are being designed, helping to ensure that they are built to a 3-star rated standard or higher to optimise the potential safety benefits of major projects. In 2019 the Arup design team for the A417 'missing link' undertook this approach applying it to their designs. It helped them to identify that there was high risk where an access road joined the main carriageway. Alongside other factors this prompted them to review alternative design options to understand their impact on star ratings and on expected fatal and serious injuries.

This optioneering resulted in them amending the gradient of the road allowing them to reconfigure the access road removing the need for a junction with the main carriageway. This results in a much-reduced expected number of fatal and serious injuries and an improvement in the star rating.

\*iRAP does not account for horse riders.

### Acknowledgements

National Highways worked with the Road Safety Foundation and TRL Limited to star rate the strategic road network using the iRAP model. The Road Safety Foundation, a registered charity, is the UK iRAP licence holder. As such, it oversees the technical approach and direction of the iRAP programme as the star rating approach is used to assess the safety of British roads. TRL Limited, an iRAP Centre of Excellence, worked with an iRAP-accredited coding team from the Faculty of Traffic and Transport Science at Zagreb University to complete the coding and analytics; the Road Safety Foundation and iRAP reviewed the results and provided technical advice throughout the project.

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### 2025 and beyond

We are working towards our vision that no-one should be harmed whilst working or travelling on our network and that everyone gets to their destination safely. Taking a proactive approach to road risk management is an integral part of our strategy. We have forecast how major projects planned in the next few years are likely to impact upon star ratings by 2025. This forecasting takes account of the major planned investments, rather than the smaller road safety schemes we undertake. Although we only expect a slight increase in 3-star plus travel from major schemes, the proportion of travel on 4-star roads should increase from 16% to 18%.

Star ratings are sensitive to traffic flows and speeds, and there is uncertainty about how travel patterns (for example travel purpose, patterns and vehicle mix) will change in the years following the peak of the Covid pandemic. Therefore, these forecasts should not be considered to be accurate predictions: rather, we are using the forecasts to inform how we can further improve star ratings beyond major schemes. We continuously review what our casualty targets and performance indicators should be, such as the reduction in the number of fatal and seriously injured casualties on our network. We are also developing performance indicators to support the achievement of this target, including a possible measure of infrastructure safety using the iRAP model.

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