

Managing delay
on the strategic
road network



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Foreword



Every year our customers drive 95 billion miles on our network; a third of all vehicle miles travelled in England. Our roads help our customers get to work, and to see family and friends. And they allow the vital movement of goods to and from the four corners of our nation, and beyond.

We want everyone who uses our roads to get to their destinations safely, and in the time they expect to.

Our customers tell us they are generally satisfied with their journey times, but we know that delay affects different road users in different ways. For example, the freight sector is especially dependent on reliable journey times, and our network hosts two-thirds of all miles travelled by heavy goods vehicles (HGVs) every year.

We also know that the roads sector has a role to play in helping government achieve its net-zero carbon target; collectively we must work to reduce the environmental impacts of vehicle travel. Our analysis has shown that these impacts are worsened through journey delays, which increase the carbon footprint from burning fuel and impact air quality.

Delays also have a huge impact on the economy, with total delay on our network costing around £3 billion per year.

I'm proud of the action we've taken to address average delay over the last five years. This includes improving our signage and our other channels where we communicate about roadworks, congestion and incidents. But delay remains a complex area. External factors are largely outside of our control, and potential solutions can be challenging to implement. And traffic, setting aside the impacts of the pandemic, is steadily increasing.

In this plan, we have set out the areas that we believe will help us achieve our ambition: that average delay on our network will be no worse at the end of the second road period (2025) than it was at the end of the first road period (2020).

Delivering against this plan does not guarantee that we will achieve our ambition, but it will ensure we do everything we can to support our customers and the wider economy. Partnership work will be critical, and I look forward to working with our various customer groups and other partners to tackle this important issue together. As the country collectively works to emerge from the Covid-19 pandemic, our role in enabling positive outcomes has never been so important.

Elliot Shaw

Executive Director Strategy and Planning

Executive summary

Our ambition

Since 2015, we have helped customers make safer and more reliable journeys on our 4,300 miles of motorways and major A-roads. Everything we do, from designing our roads to clearing incidents, helps keep traffic moving on our network 24 hours a day, 365 days a year.

We know that our customers' experiences vary when it comes to journey times, and that delays, especially when unexpected, can affect day-to-day lives. Delays on our network impact the economy, costing around £3 billion per year. Delay from congestion also affects the environment, with increased carbon emissions and poorer air quality.

We have therefore worked with the Department for Transport (DfT) to set a key performance indicator (KPI) which measures average delay over the second road period, 2020-2025. This is a KPI with an ambition, not a target. This is due to the heavy influence of factors outside our control, such as traffic growth. Our ambition is that:

“Average delay on our network will be no worse at the end of the second road period (2025) than it was at the end of the first road period (2020).”

Our plan

The causes of journey delay, and potential ways to ease these, are complex. To help us achieve our ambition to manage delay, we have used research and data from our network. Our analysis of this evidence forms the foundation for this plan and our three areas of focus.

Focus area 1: Optimising our roadworks

There is a clear relationship between spend on our roads and delays, with roadworks creating around 15% of delays. Building on our work so far, we aim to improve roadworks with the highest delays. We will continue rolling out our highest safe speeds approach, where we use 60mph instead of 50mph where possible. We want to improve use of road space, including further collaboration and coordination with third parties who need to work on our road, and explore how we can safely work at different times of the day. We will also identify and use innovation to reduce the impact of our roadworks on our customers.

Focus area 2: Innovating to address congestion

While challenging for us to influence, congestion accounts for nearly half of the delays on our network. We will use *Route strategies* to reassess roads shown to have disproportionately high delays, and review options to address these issues. We plan to test techniques to manage daily and seasonal peaks. This focus will be an area of opportunity over the long term as technology evolves and as we improve integration with other transport modes and local roads.

Focus area 3: Reducing the impact of incidents

Incidents, which includes anything from road traffic collisions to debris on the road and vehicle breakdowns, cause an estimated 10% of the delays on our network. While we have opportunities to limit incidents occurring, we have more direct control over how we respond once they have happened. We will continue to learn from our data about when and where most incidents happen, to help guide our work. This will inform interventions and improve our traffic officer patrol strategies. We will carry out research into incident-related delays to further understand the differences and trends we have identified, and look at alternative data sources for monitoring A-roads, such as crowd-sourced data. As with the other focus areas, this too will benefit over the longer term from developments in technology.

Recognising future uncertainty

While this plan is grounded in research and data, we cannot predict the future with certainty. There are a range of emerging trends, some unprecedented, which have the potential to impact the services we provide. These will present both opportunities and challenges for us in achieving our ambition to manage delay. While we do not have all the answers, we will evolve our planning and horizon scanning as we consider a series of possible future scenarios. We will also gather future topics for research and development to improve our understanding of delay.



Why we manage delay

The challenge

We measure and try to reduce delay because it is important for our customers, the environment and the wider economy.

The economic and environmental impact of delay

Our roads are fundamental to the critical movement of people, goods and supplies. Our own estimates for time lost to delay on our network is around £3 billion per year.

The freight sector, in particular, is dependent on reliable journey times. Across Easter 2020, while car journeys were down to 20% of 'normal' because of Covid-19 restrictions, HGV traffic never fell below 75% of pre-pandemic levels. In autumn and winter 2020, HGV traffic was actually higher than normal, and this looks like a trend set to continue. This perfectly illustrates the importance of keeping our roads moving.

Keeping our roads moving will help us support the government achieve its net-zero carbon target. In congestion, for example, people cannot drive at the most fuel-efficient speed. An engine idling for 10 seconds also wastes more fuel than restarting, and emits more fumes into the environment.

The impact of delay on our customers

Surveys show that most customers are satisfied with our service and their journey times. We know, however, that some customers are still more affected by delay than others.

We have actively sought our customers' views and we have used this insight, together with our own analysis of delay, to inform our approach. This plan is separate from, but aligns with, our wider efforts to improve customer satisfaction, which are detailed in our *Customer service strategy*. To ensure alignment, we will include focused delay-related actions and measures in our annual customer plans.

How we listen to our customers

We have worked with Transport Focus over several years to develop the *Strategic roads user survey* (SRUS). Launched in April 2018, this survey became our official measure of customer satisfaction from April 2020. It helps us understand our customers, their experiences and their priorities. This informs our strategy and plans, including around delay. While Covid-19 prevented the face-to-face survey from happening, we have been able to use the 24 months of data already gathered. We also listen to customers through our *HighView* survey. This collects customers' opinions about their most recent journey on our network, and is made up of 22,000 respondents per year, split equally each month.

We support our surveys with a range of targeted methods and channels to listen to our customers and stakeholders. In January 2020, for example, we established our Freight Steering Group, which includes six of the largest freight and logistics businesses in the country. Groups such as these give us a vital insight into specific priorities and challenges, supporting our strategy and planning work.

What our customers tell us

Our evidence shows that customers who experience delays are less likely to be satisfied than those that do not. At the end of March 2020 (the last year before the Covid-19 pandemic meant we had to suspend in-person surveys), overall customer satisfaction with our service was 81.4% (SRUS 12-month data). This fell to 67.4% for customers who experienced roadworks, and further to 49.3% for those who experienced a delay unrelated to roadworks. Overall satisfaction also decreased with the more time perceived to have been added to journeys. However, customers who travelled through roadworks without delays were actually more satisfied than those who had not experienced any roadworks at all.

Research shows that perceptions of delay can vary, which is why information and communication are so important. Unexplained and uncertain waits feel worse than explained, finite waits, and anxiety makes delays seem longer. The 'tipping point', when delay becomes unacceptable, varies according to the customer, the purpose of the journey and how time critical it is.

How our customers feel about their journey times

Most customers are satisfied with their journey times. For the year ending March 2020 (the last year before the Covid-19 pandemic), customer satisfaction with journey times was highest in Yorkshire and the North-East, with 84% satisfaction (SRUS 12-month data). This was closely followed by the North-West with 83%. Even at its lowest in the South-West and South-East, customer satisfaction was 70% and 74% respectively.

How we communicate with our customers about delay

We use electronic and hard signage on our network and local roads to communicate about roadworks, congestion and incidents. We give travel updates through the Traffic England website and Highways England app, as well as through our social media channels and to news and travel media. We sometimes use newspaper adverts and direct mail, typically to give messages around future roadworks.

As part of our *customer service plan*, we have several initiatives that will enable us to better communicate delay-related information to our customers. This will include providing better real-time information and continuing our programme to improve the effectiveness of variable signs and signals. We are also preparing for future changes, such as in-vehicle communication through connected vehicles, and direct links with sat-nav providers.

Developing our plan

Our ambition

Our KPI for delay is set out in DfT's *Road investment strategy 2: 2020-2025* (RIS2). It defines average delay as the difference between the observed travel time and speed limit travel time in seconds per vehicle mile. It states that: "average delay on our network will be no worse at the end of the second road period (2025) than it was at the end of the first road period (2020)". It is important to note that this is a KPI with an ambition, not a target. This is due to the heavy influence of factors outside our control, such as traffic growth and extreme weather.

A good example of a factor outside our control having a significant influence on the delay KPI is the Covid-19 pandemic. In this case delay reduced, but equally another event might increase delay. For our ambition, we will be careful not to compare performance to a time that was affected by the Covid-19 national lockdown in March 2020. For this reason, we will use the 12-month data from March 2019 to February 2020 as the baseline for our performance.

Grounding our assessment

Principles

We used four principles to guide our work:

- 1. Take an evidence-based approach:** we have been methodical and guided by the available evidence and data
- 2. Reflect top-down and bottom-up perspectives:** we have considered both strategic and tactical perspectives in identifying possible ways to improve journey times
- 3. Focus on our customers:** we have considered aspects of journey times, such as reliability, which we know are important to our customers
- 4. Recognise the unknowns:** we have identified the areas of delay that we do not completely understand, which we will consider in future research work

Types and causes of delay

The two types of delay

Figure 1 shows a breakdown of the travel time on our network. It takes on average 62.1 seconds to travel a mile, but if every vehicle were able to travel at the speed limit, this would reduce to 52.6 seconds. Our average delay KPI is the difference between the two, giving an average delay of 9.5 seconds per vehicle per mile.

We can break delay down into two types by looking at typical travel times for each section of road, time of day and day of the week. 'Recurrent' delays are expected and typical for a journey, based on when and where the journey takes place. These are shown in Figure 1 as 6.6 seconds. 'Non-recurrent' delays are unexpected, shown in Figure 1 as 2.9 seconds.



Figure 1: Breakdown of average travel time (March 2019 – February 2020)

While some of our customers may come to expect and to some extent plan for recurrent delays, (specifically if they are regular users of a particular road at a certain time of day), this type of delay accounts for two thirds of delay. They therefore represent a large opportunity to improve journey times and customer experience. While unexpected (non-recurrent) delays only account for a third of the total, we know that these can have a big impact on individual journeys. Customers often remember, for example, when a collision meant they were stuck in a queue and were late for work. We have therefore incorporated a journey time reliability performance indicator in the RIS2 performance specification for the second road period. This measures the average non-recurrent delay.

The six causes of delay

In Figure 2, we show the six causes of delay and estimate their relative impact on our average delay measure. In this section we address each of these causes in turn.

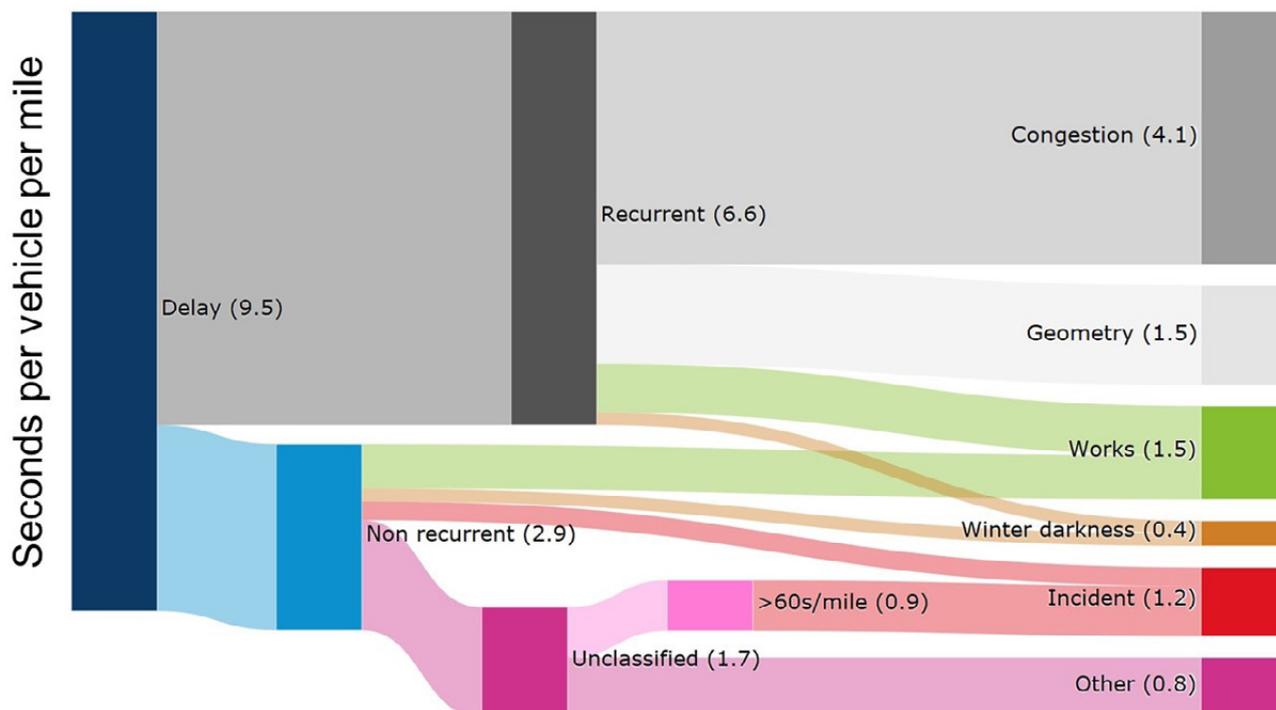


Figure 2 : Breakdown of delay (March 2019 – February 2020)

1. Congestion

The largest cause of delay, congestion occurs when levels of demand approach and exceed capacity on our roads. This causes slower speeds and sometimes queuing. Addressing congestion is a challenge, with known causes such as rising traffic levels mainly out of our control. Adding additional capacity through our enhancement programme is one way we address congestion. As technology advances and innovative solutions are developed, there may be opportunities to influence this area, particularly in collaboration with other transport providers.

2. Geometry

'Geometry' refers to areas of our network where it is not possible to travel at the speed limit and therefore, according to the definition of our average delay KPI, delays occur. This type of delay is typically caused by junction features, such as roundabouts. By taking geometric delay into account, we can assess how much recurrent delay is the minimum level expected for each section of road. This delay is most prevalent on single carriageway A-roads, which often have junctions where drivers must slow down then speed up to negotiate.

Although geometric delay is similar in size to delay from roadworks, we have not included it as a strategic focus area for this plan. We already have an established process for identifying interventions that address geometric delay through our *Route strategies*, and for delivering solutions through our enhancement programme.

3. Roadworks

If it takes longer to drive through roadworks than it did to travel on the same stretch of road previously, we capture this as 'delay from roadworks'. Some of this delay becomes recurrent, usually in long-term roadworks when drivers might start to expect these delays. The amount of delay from roadworks is determined by the amount of works we do as well as how well we do them. While the amount of work we do on our roads is determined by our RIS2 investment, which is on a greater scale than ever before, we have control over how we deliver the roadworks. We also have a variety of ways to minimise impact on our customers. We discuss these in our 'Optimising our roadworks' chapter.

4. Winter darkness

Delays are worse during winter peak hours, even with similar traffic levels to summer. This is because people typically drive slower in the dark, or when the sun is low. Winter darkness delay, however, only represents a small portion of total delay. As solutions are closely aligned to reducing congestion, we discuss these in our 'Innovating to address congestion' chapter.

5. Incidents

Incidents on our network cause delays, though the total amount of delay is moderate to low. We have options to intervene proactively and reactively to reduce incidents that cause delay. By understanding the nature of the most common incidents we can help educate and encourage motorists to prevent them (for example our tyre check campaign). We can also improve motorists' response to incidents (for example our 'Go left' campaign), and improve our own responses in managing incidents. Our traffic officers, for example, help clear incidents safely and quickly, and we also work collaboratively with the emergency services. While we have improved our incident response in recent years, we are continuing to work hard to identify what more we can do. Incidents can include many different types of event, from debris and vehicle breakdowns to road traffic collisions, and many other things in between. For our estimate of delay impacts in Figure 2, we included any unexplained non-recurrent delays longer than 60 seconds per vehicle per mile in the 'incident' delay category. This is in addition to capturing delays during times when our control rooms had a firm record of an incident occurring. We are planning more research to understand these unexplained delays further.

6. Other

The 'other' category refers to unexpected delays where we do not know the reason. For example, while it could be likely that severe weather caused a delay, it might be impossible to make a direct link. Other examples could be when one-off events such as festivals or sporting events affect our roads, or when our method of estimating delay from roadworks or incidents misses out some of the residual impacts. We will investigate whether further research into this category would be valuable.

Our three strategic focus areas

Each of the six causes of delay offer different scales of opportunity, and we have varying ability to influence possible solutions. We have therefore focused on the three strategic areas where we believe we can make the most impact: roadworks, congestion and incidents.

Focus 1: Optimising our roadworks

Context

Our 4,300 miles of motorways and major A-roads help our customers travel from Berwick-upon-Tweed to Penzance, and from Carlisle to Dover. We need to keep our network in good condition to support these journeys. We also need to invest in improvements where they are most needed, regionally and nationally. We know, however, that there is a clear relationship between spend on our roads and delays, with roadworks creating around 15% of delays. We have an ambitious programme of work ahead of us, and optimising our roadworks, without compromising on safety, will be essential.

Our improvements to date

Over recent years, we have worked to reduce the impact of roadworks on our customers. We have delivered various initiatives, including:

Implementing highest safe speeds

We have historically set speed limits of 50mph or lower through our roadworks. We have now provided our supply chain a standard through the *Design manual for roads and bridges* (DMRB) to design roadworks to the highest safe speed. After extensive research, trials across eight major schemes began in January 2019. As of July 2021, we have introduced the 60mph limit to another two major schemes using the updated DMRB standard, with further uptake planned for future schemes.

Making the most of our time on the road

We have worked to combine schemes and maximise what work takes place on each shift. We have also scheduled our work to take place at the least disruptive times for our customers, where possible.

Monitoring supply chain performance

We have introduced supply chain performance monitoring, embedding incentives and penalties to drive improvements in our roadworks. This includes introducing monitoring to improve the roadworks with the highest delays.

Using innovative techniques

We have researched and adopted innovative techniques, such as offline construction, to reduce safety risks and minimise disruption for our customers.

Improving communication

We have embedded key principles across our organisation, and our supply chain, which cover how to set up and communicate roadworks information to our customers.

What the data tells us

We have focused on three areas of roadworks delay: our programme of works, roadworks with the longest delays and roadwork timings.

Figure 3 shows an example of how we measure the delay from roadworks across our different operating regions. This is part of a suite of tools we have developed for our delay from roadworks performance indicator, which was introduced into the performance specification for the second road period. We now use this data to monitor our major enhancement schemes, and our supply chain are penalised or rewarded according to their delay performance.

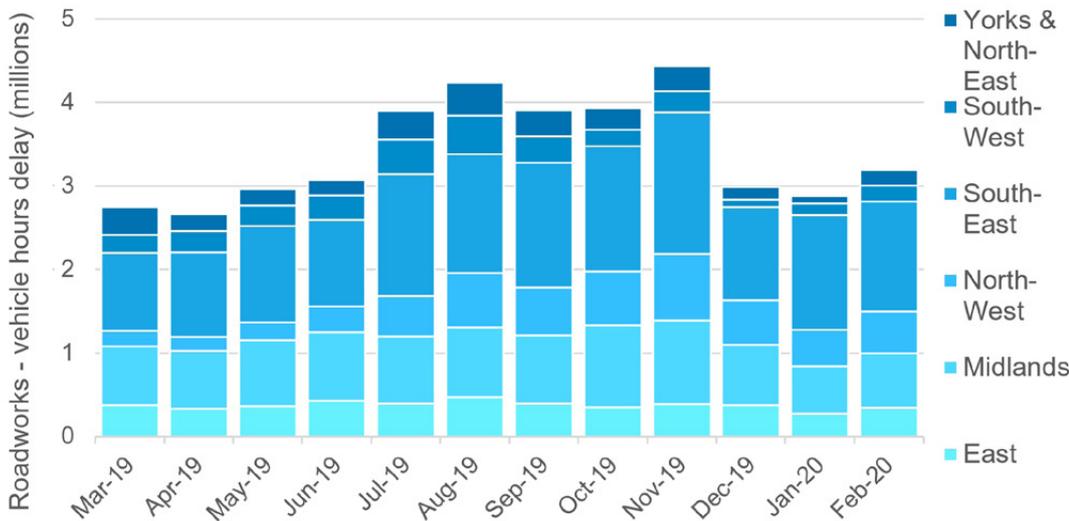


Figure 3: Delay from roadworks from March 2019 to February 2020, shown as vehicle hours delay divided by month and by operating region. Total vehicle hours delay depends on two main factors: the volume of traffic and the amount of roadworks in place. Because the South-East is the highest trafficked region it normally has higher roadworks delay, but this varies depending on the scale of the programme of works in each region.

Our programme of works

There is a clear relationship between the number of schemes we deliver and roadworks-related delay. As we are now delivering on a greater scale than ever before, we recognise the need to limit the impact of our roadworks. There are various techniques we can use, for example constructing a bridge away from the road before moving it into place.

Roadworks with the longest delays

To assess the performance of journeys through roadworks, we examine the additional time it takes to travel a mile when compared to the usual journey time. If up to 30 seconds per mile is added, vehicles are likely to be travelling around the speed limit of the roadworks. If over 120 seconds per mile is added, vehicles are likely to be travelling slower than 20mph.

In Figure 4, we show that most vehicles travelled smoothly through our roadworks. Very few journeys, 0.1 billion out of 22.9 billion vehicle miles, had over 120 seconds per mile added.

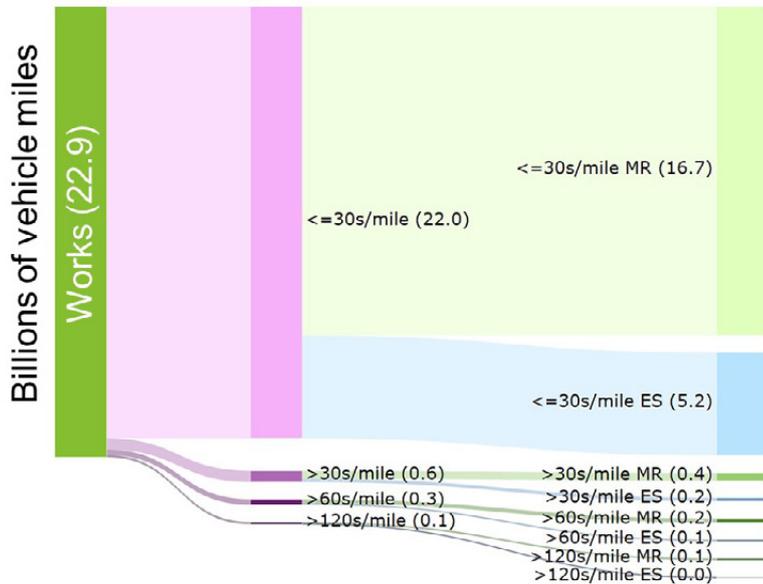


Figure 4: Billion vehicle miles travelled through roadworks, categorised by delay impact in seconds per mile and type of work: enhancement schemes (ES), or our maintenance and renewals (MR) including third parties, such as utilities firms.

It is also important to consider the impact of the delayed journeys on our average delay metric. In Figure 5, we show that, while small in number, the most disrupted journeys (with over 120 seconds added) actually contributed significantly to total roadworks delay. Some of these delays can be attributed to works completed by third parties, such as utilities firms. As also shown in Figure 5, although the majority of journeys through roadworks were delayed by less than 30 seconds per mile, with vehicles likely travelling over 45mph, these journeys collectively still caused notable delay.

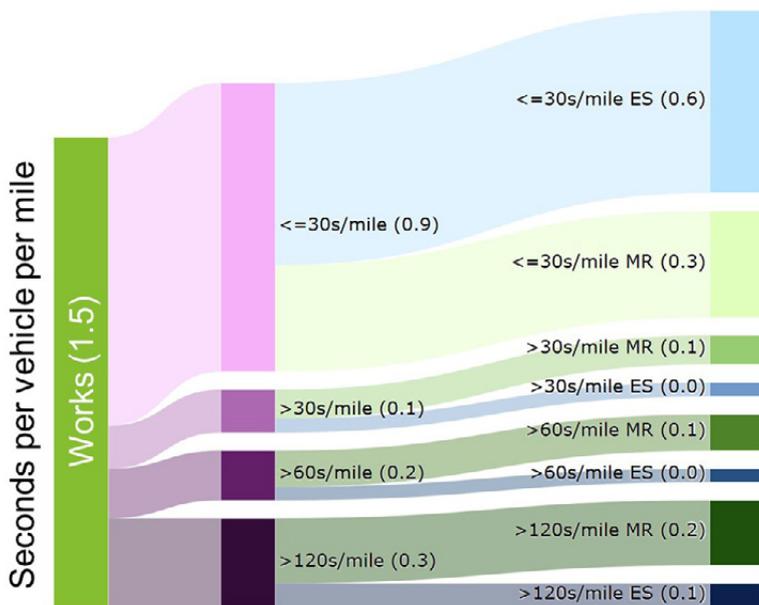


Figure 5: Average delay from roadworks, categorised by seconds per mile and type of work: enhancement schemes (ES), or our maintenance and renewals (MR) including third parties, such as utilities firms.

Roadwork timings

We know that there are times when many customers want to use our network, and times when fewer do so. As shown in Figure 6, we have tended to remove most roadworks by 6am and add them again from 7:45pm. We have also typically removed them over weekends, Christmas, bank holidays and similar occasions, when we traditionally have roadworks embargos.

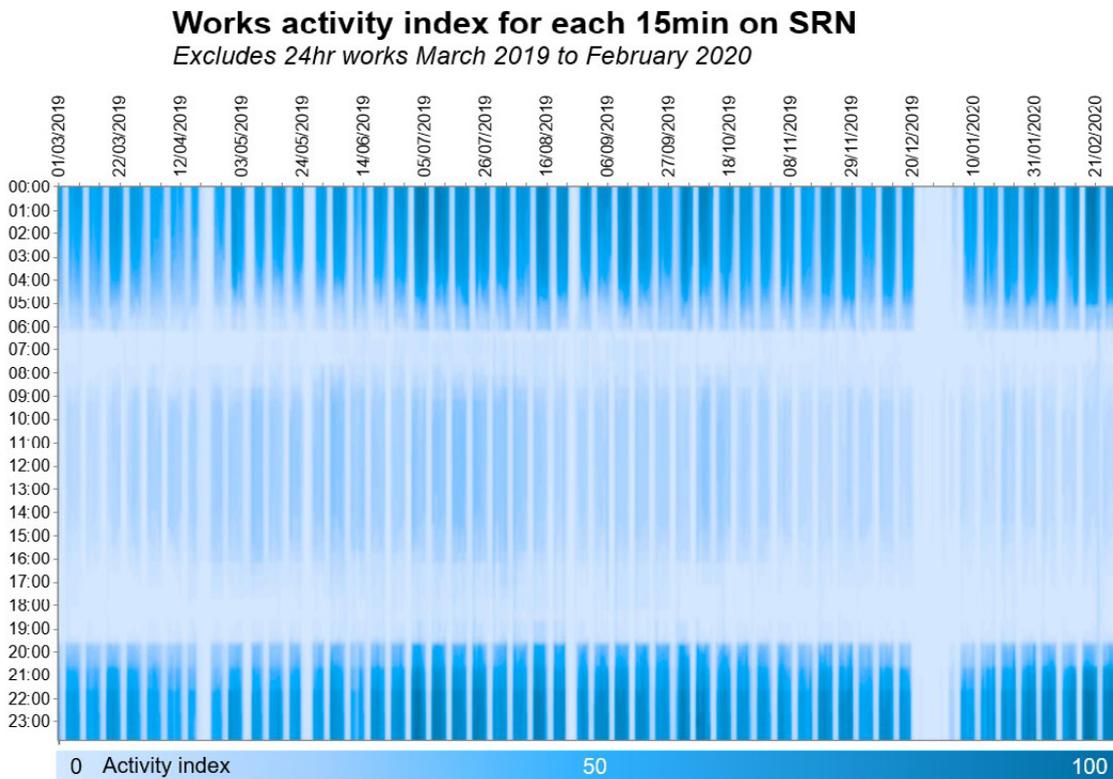


Figure 6: Heatmap of roadworks for each 15 minutes on our network (excluding 24hr works, March 2019 to February 2020), with darker areas showing when more works were active

We have examined whether we could safely and effectively extend this working window, when traffic flows were low. These opportunities in 2019-20 were often before and after night shifts, as well as on typically embargoed days. This kind of information is what we will regularly assess when we look to widen working windows.



Next steps

We have identified several potential opportunities to improve our approach to roadworks to help minimise delays. We will explore these areas, building on our work and achievements to-date, where possible. Some of these may lead to initiatives that we will incorporate into our annual *Customer service plans*.

Addressing the roadworks with the highest delays

Our aim is to continue addressing the roadworks with the highest delays through supply chain performance management, embedding financial incentives and penalties for roadworks delays, integrating this into our business-as-usual activities. We use insight from customer audits on major road projects to listen to our customers' views. We aim to continue with this to identify and make improvements. Doing these things should also allow us to identify and share best practice from well-performing roadworks.

Rolling out highest safe speeds

We have already trialled our highest safe speed approach on some of our major schemes. Building on these trials, we will look to roll out this approach to include some of our maintenance work and smaller schemes. This should help roadworks that are already free flowing to benefit from traffic moving at higher, but still safe, speeds.

Undertaking internal improvement programmes

Our *Operational Excellence 2025* programme is currently underway. This programme already sets out ways to improve our overall capability, drive better decision making and improve the cost and impact of our operational and maintenance activities. This should improve the way we schedule major enhancements alongside maintenance and other activities, and how we collaborate with our supply chain.

Strengthening our road booking procedures

We aim to strengthen our road booking procedures to help us evaluate access to road space on our network and build on relationships with regional stakeholders. This could include new initiatives, such as permitting access to our network by third parties such as utilities companies.

Widening the working window

We will explore how we can safely widen our working window and challenge current working assumptions around weekends, bank holiday and other embargos, using the best information we have on a case-by-case basis.

Improving communication

We will also consider projects to improve the quality and accuracy of the roadworks information we provide to our customers. This aligns with our KPI for timeliness and accuracy of roadworks information and helps customers make informed decisions about their journey choice.

Exploring innovative techniques and digital roads

We are already testing the use of travel demand management within roadworks, to mitigate the impact of roadworks and influence travel behaviour. If successful, we will roll this out further. Techniques could include encouraging people to travel at less busy times of the day or to consider alternative routes. We will also explore innovative ways to set up and take down traffic management arrangements, to minimise disruption to traffic.

Technological opportunities from our *Digital roads strategy* will enable us to explore innovations such as automated traffic management, and to effectively plan the interaction between multiple planned roadworks.



Focus 2: Innovating to address congestion

Context

Traffic has steadily risen over recent years, and our network now carries over three times more people than the UK rail network. Our roads carry 34% of all traffic and 68% of all freight. The most recent DfT forecast, as shown in Figure 7, indicates that traffic will further increase by the end of the second road period, and beyond. While Covid-19 travel restrictions have reduced traffic, our current assumption is that demand will return and grow in the medium to long-term. As congestion from recurring levels of traffic is the biggest cause of delay on our roads, we know we need to innovate to tackle this often-challenging area.

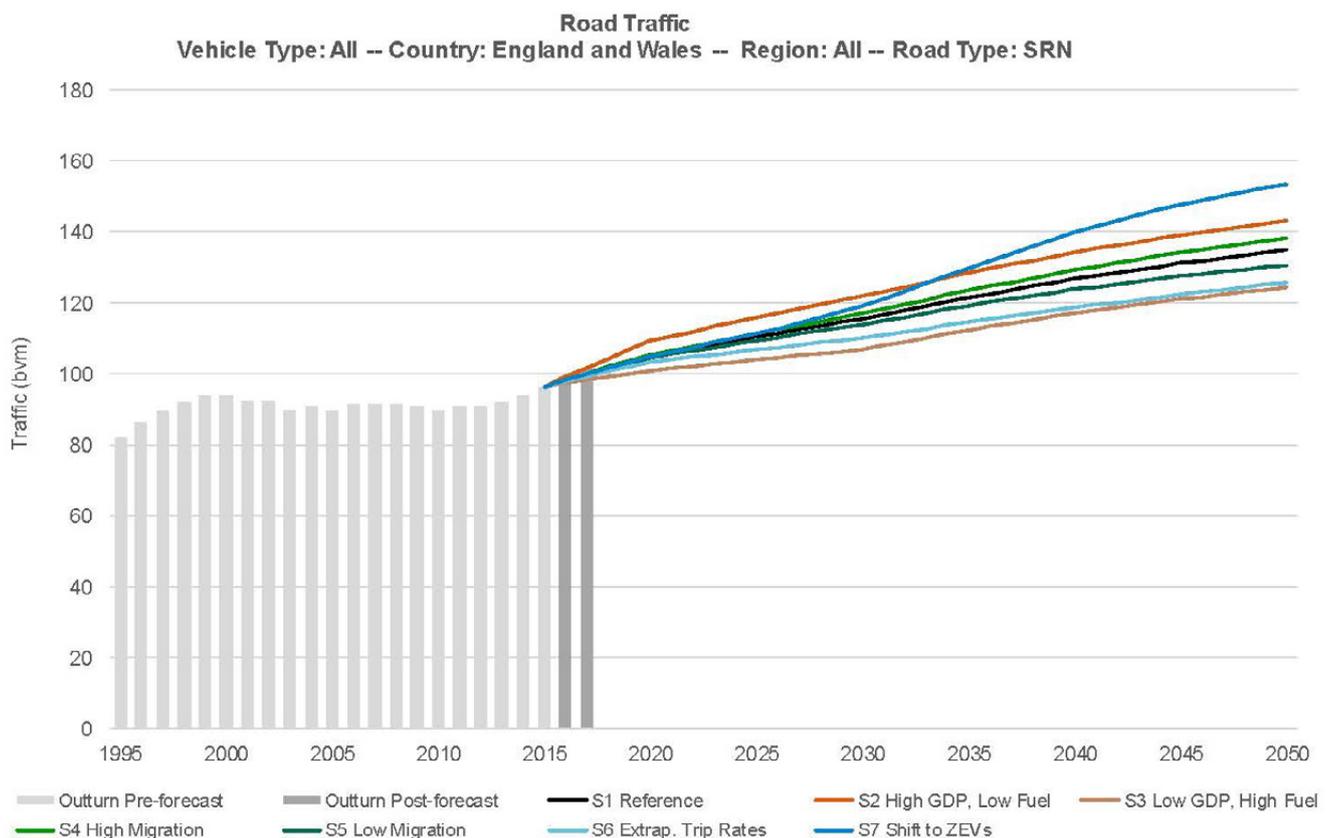


Figure 7: DfT's Road traffic forecast 2018, showing that all modelled scenarios are set to result in increased traffic on our network (Vehicle type: all; Country: England and Wales). Note: Forecast is due to be updated, and does not reflect the impact of Covid-19. Traffic (bvm) = billion vehicle miles.

Our improvements to date

We are already using a variety of schemes, initiatives and tools to influence and reduce congestion on our network. These include:

Enhancement schemes

We have already started delivering against our £14.2 billion investment programme for enhancement schemes across the second road period. We plan to open 25 schemes started in the first road period, begin construction on 12 new schemes, and develop over 30 pipeline schemes. Many of these will tackle areas of our network which experience high congestion, for example by increasing capacity or improving junctions. We routinely monitor the impacts of our major enhancements to evaluate whether intended benefits (including for customer journeys) are on track to be realised. We will be using this evidence to learn lessons for RIS 3 investment planning.

Motorway improvements

Additional motorway lanes and innovations such as variable speed limits are already helping us add capacity and smooth traffic flow. They are also laying the foundations for further technological advances. We set up a variable speed limit improvement programme that has already resulted in thousands of hours of journey time savings per day for our customers.

Designated funds

Our safety and congestion designated fund, introduced in 2020, follows on from similar initiatives during the first road period. Through these we delivered 111 schemes which reduced delays and improved safety in areas identified as traffic 'bottlenecks' on our network. Through the second road period we will seek more opportunities to address areas of congestion through this funding stream.

Information provision

Our roadside signs provide vital journey information for customers, and we answer customer queries through our Customer Contact Centre and through Twitter. We have also made advances in the accuracy of roadworks information we provide, and are targeting further improvements during the second road period.

Partnership working

Collaborating with others in the transport sector is fundamental to minimising the scale and impact of congestion, both on our network as well as on local roads. We are, for example, working with local authorities to review and improve diversion routes, which is important for when we have to direct traffic off our strategic road network in emergencies.

What the data tells us

We have analysed the research and data to understand how we can innovate to address congestion. We have focused on the most congested sections of our network, peak hours and seasonal impact.

Most congested sections of our network

From our analysis, we can see that there are certain areas and roads where delays are disproportionately high, considering the amount of traffic present.



In the map in Figure 8, we illustrate the variation in average delay across our network. This shows that average delay is often highest on our lower capacity A-roads, which we know can have a significant impact on our customers' journeys. In our analysis we have therefore looked at both average delay and total delay, balancing individual customer experience with total impact.

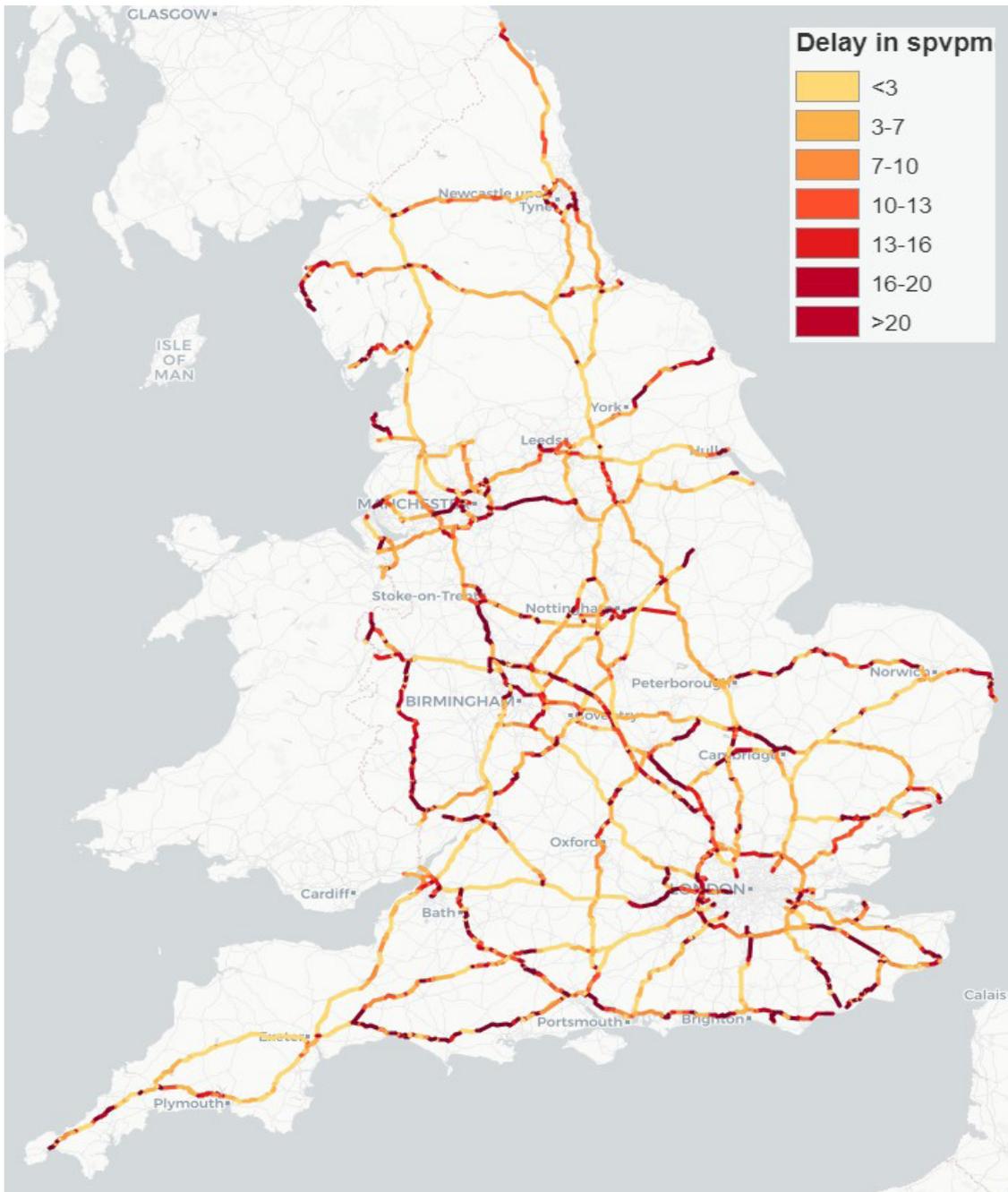


Figure 8: Map of average delay by road link across our network, in seconds per vehicle per mile (spvpm), March 2019 to February 2020

In Figure 9, we show how our South-East region accounts for 32% of delays for just 25% of total miles travelled. When we look at this area in more detail, the M25 accounts for 11% of delays nationally, for 7% of the miles travelled. This makes it the busiest and most densely trafficked road on our network. The M25 is also one of four stretches of motorway which create a quarter of all delays on our network, along with the M6 in the Midlands, the M4 in the South-East and M1 in the East.

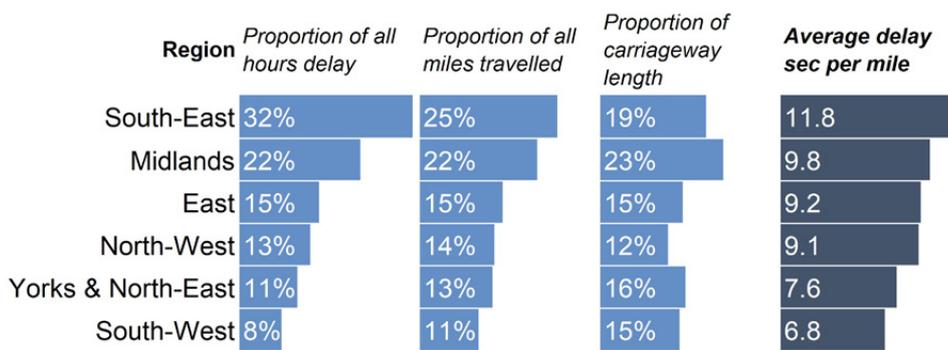


Figure 9: Delay by region, showing the South-East as having the greatest proportion of hours delay and miles travelled, but only the second highest proportion of carriageway length.

Peak hours

On certain hours on certain days there is significantly more traffic on our roads than others. In Figure 10, we show that our network is busiest from 7am-9am and from 4pm-6pm, times which also have the greatest associated proportion of delay.

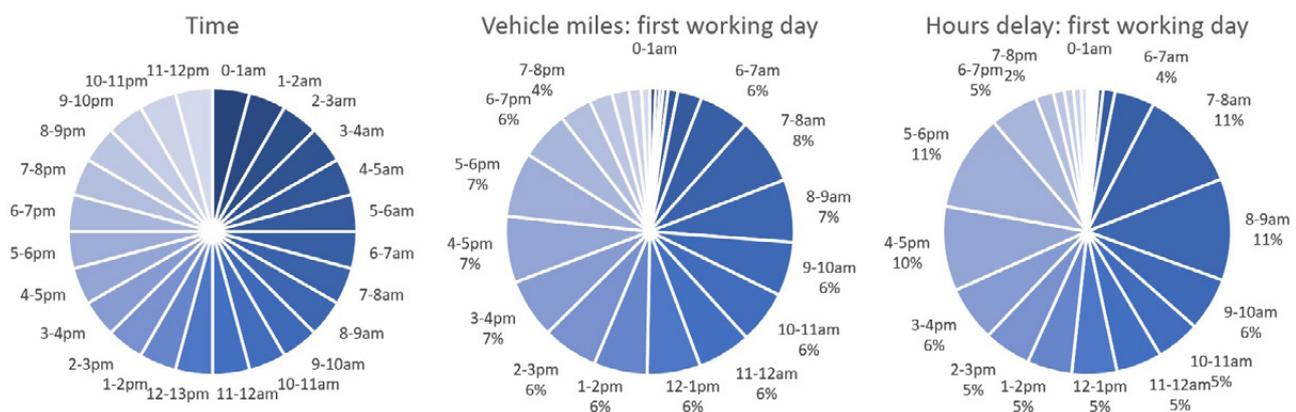


Figure 10: Clock diagrams illustrating the relative importance of peak hours compared to night-time. The left chart shows the time of day, which is spread evenly. The middle chart shows the vehicle miles travelled each hour on the first working day of a week (Mondays, except after bank holidays). The right chart shows the delay hours for the same day.

Tipping points and driver behaviour

The majority of vehicles, most of the time, are travelling in free-flowing conditions - close to the speed limit for their vehicle. However, when the number of vehicles on a road reaches a critical point, there can be a dramatic reduction in speeds. Drivers can no longer choose their speed because they are constrained by the volume of traffic around them, or by other drivers' behaviour. Minor interactions, such as one person driving too close to the vehicle ahead and having to brake sharply, can result in vehicles behind them having to brake. This can sometimes start a ripple effect which eventually leads to vehicles becoming stationary further upstream. This is the extreme example of this type of effect, but more broadly if we can avoid reaching the tipping points for congestion, we will avoid these much slower journeys and reduce delay.

Seasonal impact

We have examined the impact of seasons on delay. A similar number of vehicles, for example, travel on our network during peak hours in June and November. However, people tend to drive slower in November when the conditions are darker or the sun is lower in the sky, causing greater delays. Our network therefore typically experiences a peak amount of delay across November, as shown in Figure 11. There are, however, regional exceptions to this. In 2019, the South-East experienced its peak in July and the South-West in August, because of the impact of increased tourism.

In Figure 11, we also show that specific days of the year experience higher delays. Fridays in August, for example, are typically the busiest. Weekends are much less congested than weekdays, apart from some Saturdays in summer. Our network typically experiences the lowest delays from the Christmas holidays through to the first week of the new year when people are travelling less.

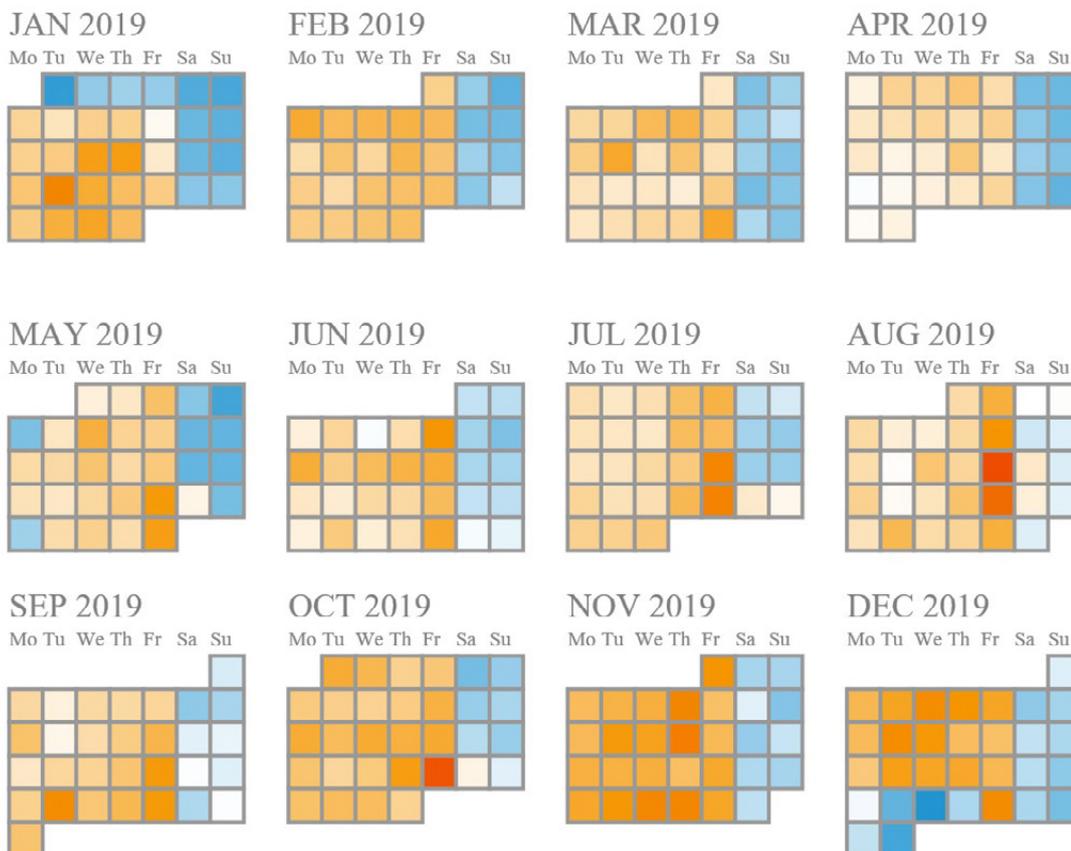


Figure 11: Delay calendar by day of the year. White is neutral and represents the average overall. Darkest orange represents the days with the highest average delay. Darkest blue represents the days with the lowest delay.

In 2019, the busiest day was Friday 16 August, with 4-5pm being the busiest hour when tourism trips coincided with regular commuting peak traffic. Average delay across our network at this time was at its highest. More locally though, the rural roads towards and around the coasts, which tend to be the seasonal holiday routes, were generally more affected than our motorways.

Next steps

We have identified several potential opportunities where innovation could help address congestion and help minimise delays. We will explore these areas, building on our work and achievements to-date, where possible. Some of these may lead to initiatives that we will incorporate into our annual *Customer service plans*.

Reassessing areas with high levels of delay

We will use our next round of *Route strategies* to reassess the roads with the highest delay, and understand whether there is more we can do to improve congestion.

Using innovative techniques to address peak hours and seasonal impact

We will continue with our variable speed limit improvement programme to improve the use of this technology to help smooth the flow of traffic. We will bring multiple systems into a single platform, to enable better management of on-road operational technology. We want to see which techniques, such as travel demand management, could be used to reduce the number of vehicles on our network at peak hours and during busy seasons. This could help avoid reaching tipping points and improve journey times. Over the long term, we will support the introduction of connected and autonomous vehicles to enable more efficient travel.

Collaborating with other transport providers

We will collaborate with other transport providers as we work towards improved integration with other transport modes and local roads. This should reduce pressure on our roads and balance transport provision. Our continued engagement in forums such as the Joint Liaison Group with Network Rail, the Sustainable Development Steering Group with ports trade bodies and Sub National Transport Bodies will be important in progressing these conversations. There are new opportunities for us all to explore concepts such as 'mobility as a service'. If successfully adopted, this will make alternative modes of transport more accessible.

Information provision

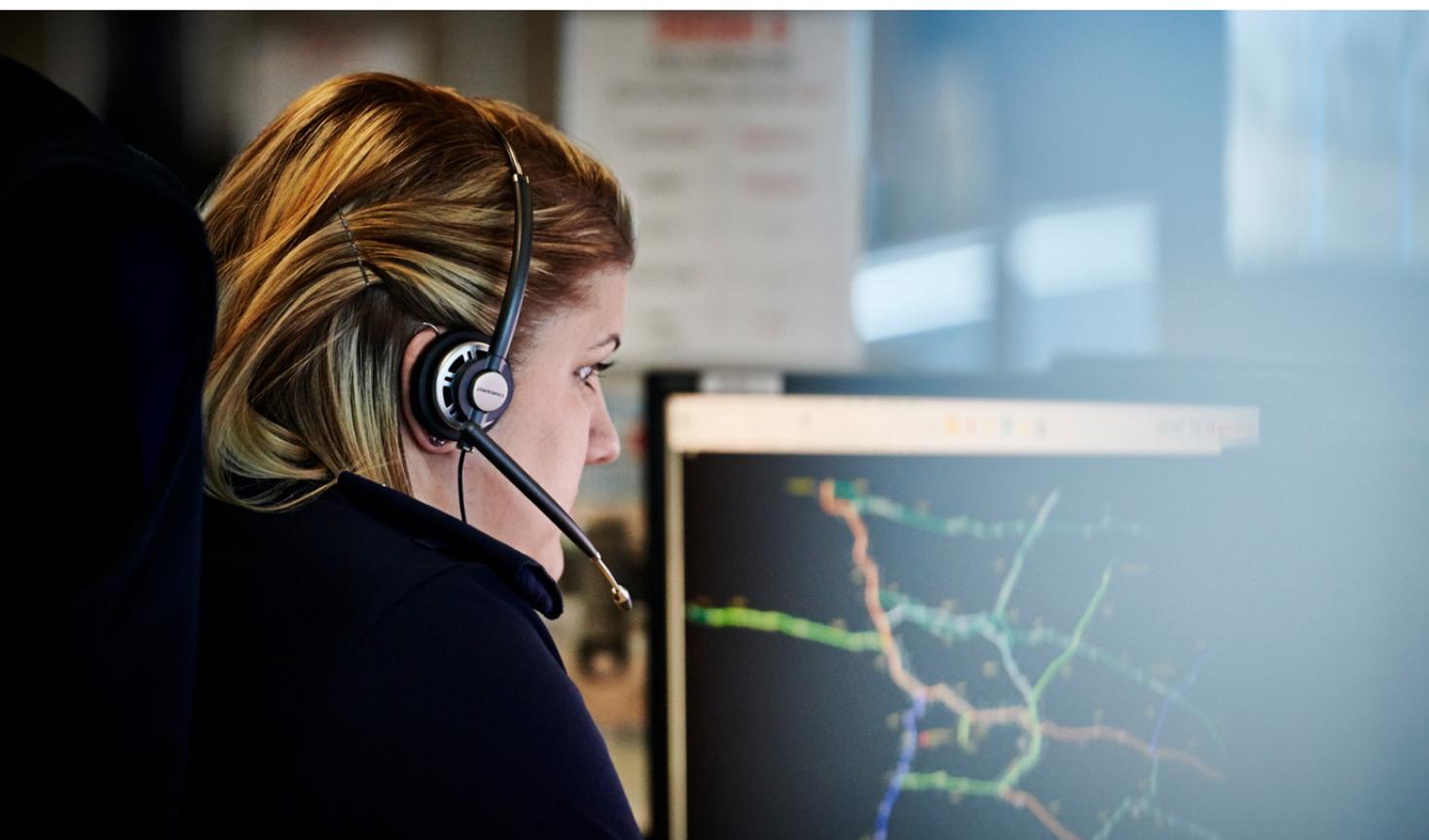
We have an ambition to provide information to our customers that reflects network performance as close to real-time as possible, and to improve the information on our most-used A-roads so it is more consistent with the level of information provided on our motorways. This might include working with third-parties to provide in-vehicle information about disruption and alternative routes.

Reviewing our diversion routes

Diversion routes are activated when a section of our network is unavailable, for example because of an incident or roadworks. We continue to work with local highways authorities to improve our diversion routes, for example with better information and signing. We will undertake trials to reduce the impact of major works on users and communities.

Undertaking further research and analysis

Further research may highlight activity that could reduce congestion-related delay. Potential focus areas include: research into road capacity and peak hours to help us better understand and avoid the tipping points; further analysis into the characteristics and trends of different road types (such as A-roads compared to motorways); and analysis to increase our insight into how the seasons impact congestion. We will also continue to pursue opportunities to collaborate with other international road operators, sharing knowledge and best practice.



Focus 3: Reducing the impact of incidents

Context

We know that the level of traffic and the number of incidents on our network are linked. If traffic on our network increases as forecast, we expect the number of incidents to also increase. As incidents cause an estimated 10% of delays on our network, this is a critical area of focus. When we refer to incidents it can cover many different events that impact the traffic on the road - from serious collisions to reports of minor debris. But all incidents have the potential to impact on journeys. In our 10% estimate we also included any non-recurrent delays that are unexplained, and which cause more than 60 seconds delay per vehicle per mile. This was our estimate of the impact of incidents where we do not have a record in our control rooms. Many of these events will be on A-roads, which we do not routinely patrol. We are planning more research into this area.

We are investigating new performance indicators on delay from incidents during the second road period.

Our improvements to date

We need to keep our customers, people and suppliers safe, above all else. We have worked to reduce the occurrence and impact of incidents, with approaches including:

Communications campaigns We have run communications campaigns to influence driver behaviour. In recent years, for example, our 'Space invaders' campaign has helped reduce the number of shunt collisions and the 'Go left' campaign aims to minimize the impact of breakdowns. Our tyre checks campaign helps to make drivers aware of the most common reason for an unplanned vehicle stop and how to avoid it.

Incident response strategies We have continuously reviewed our incident response strategies. This has helped us correctly resource, equip and position our traffic officers to attend incidents efficiently and effectively. We have been developing tools to support these strategies, allowing us to assess live operational choices. We have improved collaboration across regions, so when an incident occurs near the operational border we can use the bordering regions' resources if they are able to get there quicker.

Incident debriefs

We have held thorough debriefs after incidents, helping us learn from incidents and continue improving our service. This resulted in exceptional performance against our KPIs to clear motorway incidents within one hour.

Collaboration with first responders

Effective collaboration with other emergency services is vital. We have updated and signed the *Strategic road responders' agreement* and committed to objectives for our carriageway clearance initiative: Collision, Lead, Evaluate, Act and Reopen (CLEAR).

Innovation

We have used innovation and new technologies to increase our effectiveness at detecting and responding to incidents. For example, we use our fatal incident database - the largest of its kind in Europe - to help us understand the nature of incidents and what we can do to prevent them, including incidents that follow unplanned events, such as breakdowns.



What the data tells us

We can work to prevent incidents happening, and reduce the impact when they do occur. As we have more direct control over the latter area, we have focused our analysis on the biggest impacting incident types and incident rates.

The biggest impacting incident types

The types of incidents which lead to delays are wide and varied. In Figure 12, we show that, of the three most common incident types, road traffic collisions are the most likely to cause long delays. Most of these caused delays of over 2 minutes per mile, which broadly equates to speeds of less than 20mph. While road obstructions are in the top three most common incidents, they have a very small impact on delays. Over the same time period, the majority of these incidents caused less than 30 seconds per mile of delays.

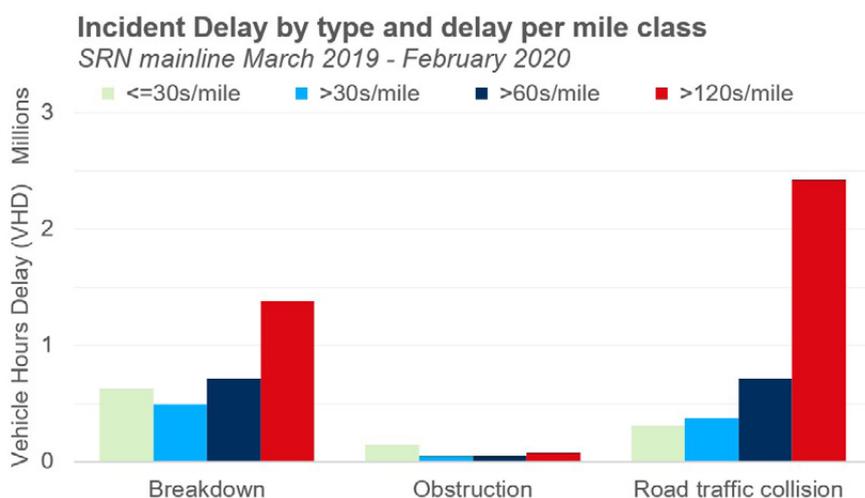


Figure 12: Impact of our three main incident types, road traffic collisions (RTC), breakdowns and obstructions, on vehicle hours delay (SRN mainline, March 2019-February 2020).

We currently only estimate impact when we know an incident occurred. Some incidents, for example, occur on roads where our traffic officers do not patrol, such as the majority of the strategic A-roads. This means we are not immediately aware of such incidents and the response is led by a recovery operator or the emergency services. We plan to do more research into incidents on these roads.

Incident peaks and rates

Our traffic officers are often the first responders to incidents on England's motorways and some sections of A-road. We have a wealth of intelligence which we can use to send traffic officers to the highest demand areas at the right times.

While an incident can occur at any time, there are typically peaks when more incidents happen. There is, for example, a peak in incidents at around 3pm to 7pm, particularly on weekdays. Figure 13 shows that, similar to the congestion analysis in our second focus area, the spread of incidents across the day broadly follows the distribution of traffic across the day. However, the impact of those incidents is much more focused on the peak hours, when delays relating to incidents are exacerbated by the higher volume of traffic.

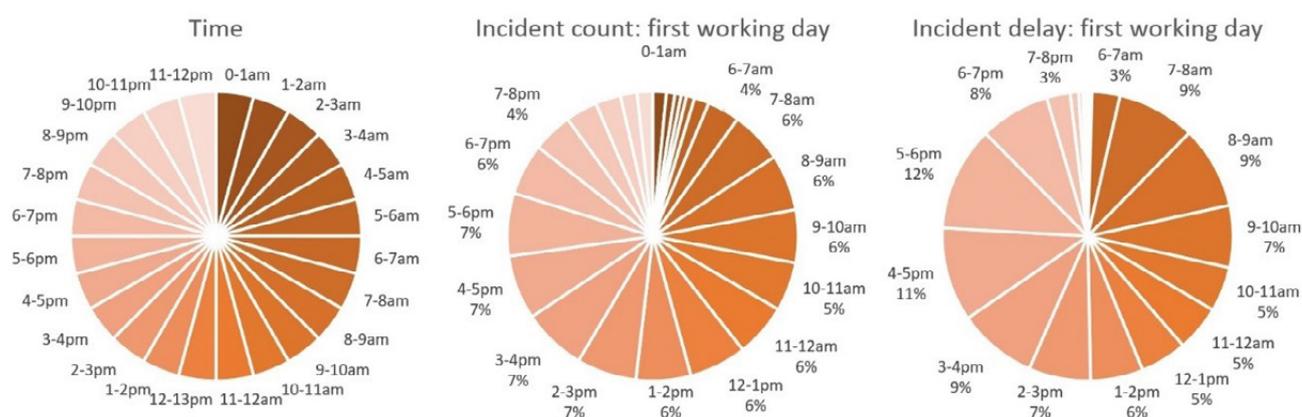


Figure 13: Clock diagrams illustrating the spread of incidents through the day and the estimated delay associated with them. The left chart shows the time of day, which is spread evenly. The middle chart shows the number of incidents logged in each hour on the first working day of a week (Mondays, except after bank holidays). The right chart shows the incident-related delay hours for the same day. Incident numbers are for the top 3 most common incidents, as per Figure 12.

As with traffic in general, the number of incidents we deal with varies across the week. The distribution of incidents follows closely the pattern of traffic across the week, with weekends experiencing much fewer incidents. However, the impacts of the associated delay are much higher when traffic is at its highest, for example on a Friday, when 16% of the week's traffic and incidents occur and 22% of the associated incident delay occurs. As with the hour of day in Figure 13, this is because the higher amount of traffic on the network makes it much more likely for delays to occur when an incident happens. The road is much closer to, or even over capacity, so even smaller incidents can have a big impact on delay.

Geographic variations

When we look at regional variations, some regions appear to have higher incident rates than others. Figure 14 shows that the East is the largest region in terms of the amount of traffic on its motorways, but it has the lowest incident rate per million vehicle miles. There are many reasons why different regions have different rates, with each region having its own unique make-up of roads with their own characteristics.

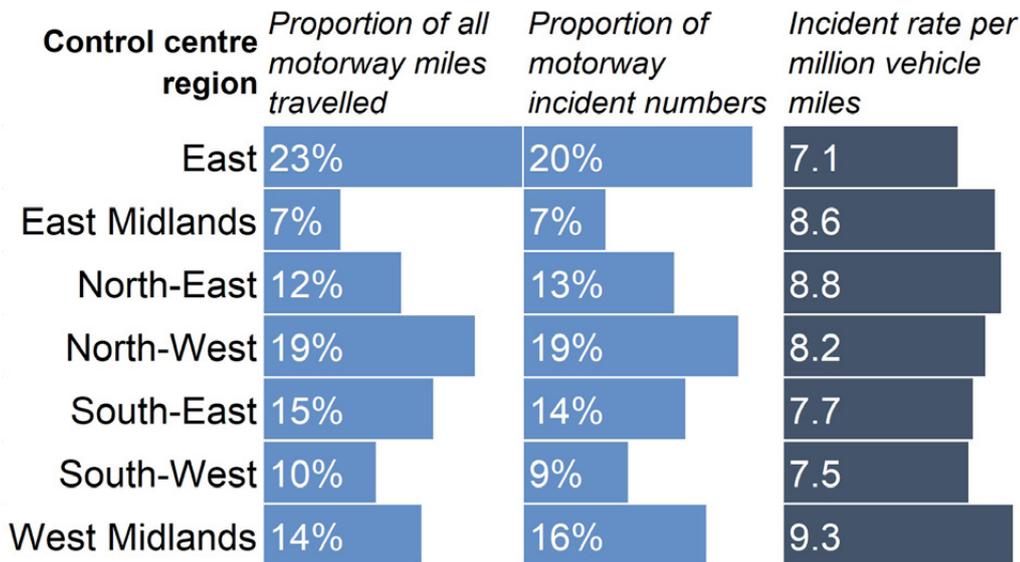


Figure 14: Incident rates by control centre region, showing the East as having the greatest proportion of miles travelled and incident numbers, but the lowest incident rate per mile travelled. To ensure a fair comparison all numbers and rates are for motorways only and exclude A-roads, which are not generally patrolled.

When we investigate more locally, certain routes appear more susceptible to certain types of incidents. We act on this type of intelligence to inform our patrol strategies and plan interventions.

Incident clearance

We have an incident clearance KPI that aims to reduce the impact of incidents on the network and to our customers by monitoring the proportion of incidents cleared within an hour.

We consistently met the KPI target for incident clearance in the first road period. We use analysis of our data to locate traffic officers closer to problematic parts of the network so that they can clear incidents more quickly. This kind of work allowed us to increase the number of incidents cleared within an hour, from 85% at the start of the first road period to 88% by the end.

We will continue to monitor incident clearance as a KPI, which has been expanded for the second roads period to cover 24 hours a day instead of just the daytime. This ensures that all incidents, no matter how many people they impact, will get treated equally.

Next steps

We have identified several potential opportunities to reduce the impact of incidents. We will explore these areas, building on our work and achievements to-date, where possible. Some of these may lead to initiatives that we will incorporate into our annual *Customer service plans*.

Optimising our patrol strategies

We will act on our intelligence about when and where most incidents happen. This will help to inform interventions, improve our patrol strategies and ensure our traffic officers are sent where they are needed. We know that continued and effective sharing of best practice can help drive improvements and consistency.

Supporting advances in vehicle technology

Advances in vehicle technology will have a significant impact on the occurrence of incidents. Connected and autonomous vehicles will enable greater potential for insight, and all vehicle manufacturers now have a legal obligation to publish safety-related data. We will look into the possibility of using this type of data to further improve our knowledge of incidents.

Monitoring of all-purpose trunk roads

We plan to undertake research into the areas of our network where we have less visibility of incidents occurring, for example on our A-roads. We will review which A-roads would benefit from additional monitoring to help us identify and inform our customers about incidents, with third-party and crowd-sourced incident-related data promising a richer picture.

Research and analysis

Further research may highlight actions we can take to reduce incident-related delay. Areas that could be explored include: conducting further research into incident delays to help improve how we operate our network; further analysis into incident types and regional performance to better understand differences and trends; reviewing potential opportunities to collaborate with the emergency services; using data to increase our insight into why incidents occur and how best to react to them.

Next steps

In this plan, we have returned to the research on, and data from, our network. Our analysis of this evidence has formed the foundation for our three areas of focus and our proposed activities. While delivering against these areas does not guarantee that we will achieve our ambition, it will ensure we do everything we can to support our customers and the wider economy. Following the publication of this document, we will integrate our proposed activities into our strategies and plans, continue our programme of research and development and monitor our progress.

Planning and uncertainty

This document identifies many potential opportunities to mitigate delay. To support both our ambition for the average delay KPI, and our *Customer service strategy*, many of these may lead to initiatives that we will incorporate into our annual *Customer service plans*.

Our *Route strategies* process provides an opportunity for us to understand pressing priorities for the network, and be clear about what we intend to do where, why and when. We are already working on the next generation of *Route strategies*, and we will incorporate average delay considerations. We will, for example, use this process to help us reassess the roads with the highest delays and understand whether there is more we can do to improve congestion.

There are several areas of uncertainty which could present both opportunities and challenges for us in achieving our ambition to manage delay. These include potential changes to the way people travel following the Covid-19 pandemic, alongside longer term technological advancement and societal change.

Research and development

We are developing an ongoing programme of research and development. We know there are some causes of delay and mitigating actions which require more time, or specialist support to understand. We have identified gaps in our current knowledge, topics outside our areas of expertise and the wider uncertainties that will benefit from greater research.

We want to strengthen our relationships with research institutions, academia and industry, to unlock new knowledge and help us find new ways to solve our current and future delay challenges. This will include collaborative working through research projects and could extend to opportunities such as supported PhDs to help us better understand the causes of delay and mitigating actions.

We will continue our collaboration with other European road authorities within the Conference of European Directors of Roads, to help us access European and international best practice.

Progress monitoring and data sharing

Our KPI for delay states that: “average delay on our network will be no worse at the end of the second road period (2025) than it was at the end of the first road period (2020)”. Our progress will be monitored by the Office of Rail and Road, as part of our performance framework commitments for the second road period.

We understand the importance of data transparency. As set out in RIS2 and our *Delivery plan: 2020-25*, we are committed to exploring ways of publicly sharing more granular delay data. To address this, we are developing a data sharing plan that will allow everyone to benefit from the richness of our data.



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Highways England creative job number BED21 0029

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Registered office Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ

Highways England Company Limited registered in England and Wales number 09346363