

Travel time reporting tool

Technical guidance note



October 2024

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The methodology used to generate the data within the tool may differ from methodologies used in different versions of the tool published at different points in time. This is due to continuous improvements of data mapping, capture, and quality. As these factors evolve over time any comparison with earlier data or data from other sources should be interpreted with caution.

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Glossary

Term	Definition
15-minute time slice (t)	The National Traffic Information Service (NTIS) that we use divides the day into 1-minute segments. These are then aggregated into 15-minute segments. This is denoted in the journey time metric equations as t .
AM peak	The period of day defined as being between 7:00 am and 10:00am.
Day Type	<p>A value is assigned to the data providing a description of the day type. The values are the following:</p> <ul style="list-style-type: none">• First working day of normal week• Normal working Tuesday• Normal working Wednesday• Normal working Thursday• Last working day of normal week• Saturday, but excluding days falling within type 14• Sunday, but excluding days falling within type 14• First day of school holidays• Middle of week - school holidays, but excluding days falling within type 12, 13 or 14• Last day of week - school holidays, but excluding days falling within type 12,13 or 14• Bank Holidays, including Good Friday, but excluding days falling within type• Christmas period holidays between Christmas Day and New Year's Day• Christmas Day/New Year's Day.
Interpeak	The period of the day defined as being between 10:00 am and 4:00 pm.
Link	A link is a section of road on the strategic road network (SRN) between entry and exit points, such as slip roads on motorway junctions or roundabouts on A-road junctions. Usually links also start and end where there is a change in the number of lanes, speed limits or other topographical changes. The length will vary depending on the location of the link. The network definition used is the published NTIS network. Note that the network model changes during the year, so all road links that exist in the financial year are displayed on the map. This means

that links that changed characteristics during the year exist as separate entities. It is possible to toggle between links that overlay each other spatially, in order to display the data for each one separately. Link length is measured in miles.

MIDAS	Motorway Incident Detection and Automatic Signalling technology uses sensors embedded in the road to monitor traffic flow.
NTIS	The National Traffic Information Service works alongside several different systems to obtain traffic data to form an historic view of traffic conditions on the strategic road network. It collates and processes the data allowing users to access journey time information.
Observed travel time	The average actual time (in seconds) that a vehicle takes to traverse a link, divided by the length of the link (in miles). This data is gathered by sensors on the road and from in-vehicle technology such as satnav.
Overnight	The period of the day defined as being between 7:00 pm and 12:00 am and 12:00 am and 7:00 am.
PM peak	The period of the day defined as being between 4:00 pm and 7:00 pm.
Profile flow	The number of vehicles expected to be detected on a link within a specific 15-minute time slice and day type based on data collected previously. Profile flow is bespoke to each individual link, with each having its own weighting.
Profile travel time	The average time (in seconds) a vehicle is expected to take to travel the length of the link for the 15-minute time slice and day type, divided by the length of the link (in miles). This is taken from historic travel times, regardless of whether any roadworks, incidents or other events were taking place.
Speed limit travel time	The time taken for a road user to travel one mile, if following the set speed limit for that link. The speed limit is the upper limit, in other words the limit for vehicles that are not subject to additional speed restrictions.

1. Travel time information

1.1. Introduction

The government's Road Investment Strategy 2 (RIS2)¹ sets out the performance measures against which we'll be monitored over the second Road Period, from 1 April 2020 to 31 March 2025.

The key performance indicators in RIS2 focus on activities or outcomes which are most important, either for road users or communities that live near our roads, or wider government objectives.

One of these outcomes is "providing fast and reliable journeys". This outcome is made up of the following metrics:

- Average delay
- Delay on smart motorways
- Delay from roadworks
- Journey time reliability
- Delay on gateway routes
- Average speed

The metrics are calculated based on the performance of our network of motorways and major A-roads, which form England's strategic road network (SRN).

We use travel time information from the SRN primarily to assess performance. We've also developed a tool to help make this information more accessible to others. The tool allows users to explore more granular historic travel time information both as annual averages and as averages per specific periods of day per financial reporting year. The specific periods of the day are categorised as 'AM peak', 'Interpeak', 'PM peak' and 'Overnight', definitions of which can be found in the glossary.

Table 1 lists the metrics which can be viewed at which level:

Table 1 Travel time reporting tool metrics

Metric	Annual average	Key times of the day
Average delay	✓	✓
Total delay	✓	✗
Journey time reliability	✓	✓
Average speed	✓	✓

The tool currently contains data from the first three financial years of reporting (1 April 2020 to 31 March 2021, 1 April 2021 to 31 March 2022 and 1 April 2022 to 31

¹ <https://www.gov.uk/government/publications/road-investment-strategy-2-ris2-2020-to-2025>

March 2023). Further information on how each metric is calculated can be found in this document.

1.2. Impact of change and variability on data

It is important to note that the granularity of the links which comprise the strategic road network changes over time. The methodology used to aggregate and spatially map this changing data will result in variation in the number of links and impact metric aggregation in different aggregation periods. Any comparison with data between aggregation periods or data from other sources should be interpreted with caution. We provide more detail where necessary below.

1.3. Average delay

By our definition, any journey that travels slower than the speed limit experiences delay. To put this into context, if you experience 10 seconds of average delay per mile, then to travel one mile on a motorway will take 61 seconds instead of the 51 seconds it would take driving at 70mph.

More specifically, average delay is calculated by comparing the actual average observed journey time of vehicles on the strategic road network (SRN). This is detected by sensors on the road (e.g. MIDAS) and by data collected from in-vehicle technology (e.g. satnav), with the minimum journey time based on travelling at the posted speed limit.

The metric shown in the tool is for a single link, aggregated from 15-minute time slices (t) across different time periods (e.g. Annual, AM peak) or day type across a whole financial year.

The calculation uses data from all vehicle types and all time slices. Where any of the 15-minute time slices are negative, i.e., the average observed travel time is faster than the posted speed limit, then zero is used in the calculation.

The average delay for a link for aggregation period is calculated using the below formula:

Average delay (seconds per vehicle per mile)

$$= \frac{\sum_t ([\text{observed travel time} - \text{speed limit travel time}] \times \text{profile flow})}{\sum(\text{profile flow})}$$

1.4. Total delay

As mentioned above, by our definition, any journey that travels slower than the speed limit experiences delay. The total delay metric adds up all the delay experienced on a road link during an aggregation period, across all vehicles, so shows the links which experience the most cumulative delay. This could show a highly trafficked road as experiencing more total delay than a lower trafficked road, even if the average delay per vehicle might be higher on the road with less traffic.

Total delay is expressed in vehicle hours delay (VHD). This metric is normalised by dividing by the length of the link to ensure values are comparable between different links. This is necessary because the road network changes during the year (for example, a junction upgrade may be completed, a speed limit may change, or a lane might be added). In some cases, a road link will be given a new link identifier in the network model we use to represent traffic (the NTIS network model), or a link might be split in two, or two links might be merged into one.

We normalise by the number of days data is available, otherwise a link that exists for only part of the year would appear to have less delay than a link that existed for the whole year, which would understate its delay performance. For these reasons, the total delay output mapped in the tool is the daily average VHD per mile, which makes this metric directly comparable across all road links.

Average VHD (vehicle hours delay per mile per day)

$$= \frac{\sum_t ([\text{observed travel time} - \text{speed limit travel time}] \times \text{profile flow})}{\text{days of data}}$$

1.5. Journey time reliability

Our journey time reliability metric describes the amount of non-recurrent, or unexpected, delay on a link. Unexpected delay is the difference between the observed travel time and the typical travel time on this section of road.

For example, of the 10 seconds of average delay per mile in the example given under 'average delay', five seconds of this could be unexpected delay and therefore contributes to our reliability performance indicator. The other five seconds would be delay that is typically experienced due to regular traffic conditions or the physical features of the road.

More specifically, the journey time reliability metric measures the delay experienced by road users compared to expected journey times based on previous data collected. It is the average difference experienced by the road user between the observed travel time and the

profile travel time for the journey. Where either $[\text{Observed travel time} - \text{profile travel time}]$ or $[\text{Observed travel time} - \text{speed limit travel time}]$ in the 15-minute time slice is negative, if the observed travel time is faster than either the posted speed limit or the profile travel time, then zero is used in the calculation. Another way of describing reliability is non-recurrent delay.

Journey time reliability (seconds per vehicle per mile)

$$= \frac{\sum_t ([\text{observed travel time} - \text{profile travel time}] \times \text{profile flow})}{\sum(\text{profile flow})}$$

1.6. Average speed

Average speed is defined simply as the average speed travelled during the financial year on a road link. The average speed metric can indicate the standard and capacity of the roads on the strategic road network. It looks at the average speed of vehicles on the network by calculating the traffic flow and speed for a link, for the financial year, and applying the below formula:

$$\begin{aligned} \text{Average speed (mph)} \\ &= \frac{3600 \times \sum_t (\text{profile flow})}{\sum (\text{profile flow} \times \text{observed travel time})} \end{aligned}$$

1.7. Average travel time

Travel time is defined as the average time taken to travel a mile on a link or selection of links. Values are normalised by the total link(s) length to enable comparison.

$$\begin{aligned} \text{Average travel time (s)} \\ &= \frac{3600 / \sum_t (\text{link length} / [\text{profile flow} \times \text{observed travel time}])}{\sum (\text{link length})} \end{aligned}$$

1.8. Comparisons to other data

The Department for Transport (DfT) supports the transport network including roads, rail, buses, shipping, and aviation. Through National Highways, they invest, maintain, and operate around 4,300 miles of the motorway and A-road network in England.

The DfT provide an annual report on their road congestion and travel time measures, based on the calendar year January to December. Although similar to our Travel Time Information Tool, some measures of the same name are calculated using different data sources and for a different time period meaning that final figures are non-comparable. The full DfT Statistical document can be located on the Department for Transport's website.²

The four measures used by the DfT to measure the performance of the SRN are:

- Average speed
- Average travel time
- Average delay

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https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/782192/background-quality-report.pdf

- Reliability

1.9. COVID-19 impact on traffic

Starting on 23 March 2020, the restrictions and lockdowns due to the COVID-19 pandemic had a notable effect on driver behaviour, suppressing traffic on the network significantly and causing a reduction in delay. However, as traffic volumes begin to return to pre-pandemic levels, we are also seeing delay return to pre-pandemic levels.

In the period 2020-2021, we reported the average delay (KPI) to be 6.7 seconds per vehicle per mile,³ compared to a delay of 9.33 seconds for the period 2019-2020.⁴ The delay ambition for the end of RIS2 is 9.5 seconds.

³ https://nationalhighways.co.uk/media/0g2mueew/highways_ar21_interactive.pdf

⁴ <https://www.orr.gov.uk/sites/default/files/2021-02/benchmarking-highways-england-2020-progress-report.pdf>

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