Project paper

Highways England's provision of information to road users

Final report

Prepared for Office of Rail and Road and Highways England
by IBI Group (UK) Ltd.
29 March 2019

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

1 Executive Summary

The Office of Rail and Road and Highways England have commissioned this project to review Highways England's provision of data and information to road users. This includes:

- Highways England's current traffic data and information and provision, both the types of data collected, and the channels over which it is provided;
- The standards Highways England sets itself for providing traffic data and information and how this compares to actual performance;
- Comparing Highways England against other road operators and benchmarking against examples of good practice from European operators and other modes of transport;
- Assessing the current performance to provide a baseline against which future performance can be measured;
- Recommendations on the opportunities to improve traffic data and information provision to road users in the next Road Investment Strategy (RIS2) and beyond; and advice on the metrics that can be used to assess the future provision of road user information in the future.

The traffic data and information market place has changed rapidly. Road users expect to be able to access traffic information specific to their needs, where ever they are, on a platform of their choice that is easily accessible, up-to-date and accurate. Traffic information forms part of a wider ecosystem of information and data that helps users to plan their personal and professional lives. The extent to which third parties are collecting, analysing and disseminating traffic information, data and services has grown and continues to grow substantially.

Highways England's remit is set out in its Licence from the Secretary of State for Transport. It must *"…seek to minimise disruption…"* and *"…proactively and reactively provide relevant accurate and timely information about traffic and conditions on the road network…"*. Highways England's 2016 Traffic Information Strategy sets out objectives and commitments for the collection, creation and provision of traffic data and information and includes the aspiration to provide good quality door-to-door planning for all customers.

Highways England collects and provides a wide range of data on both expected and unplanned conditions across its network, and makes them available over a range of channels, from on road signals and signs, through email, websites and social media and via external data feeds (e.g. syndicated data such as DATEX II feeds).

The current Highways England internal performance measurement regime has many measures for data gathering, geographical and temporal accuracy. Highways England broadly meets its own creation standards, with most of these metrics being at or just below target. There are two notable exceptions, firstly signal settings, where only 78% of events have signals set within the target 3 minutes for initial settings and 2 minutes for updates. This is part of a measure for which 93% performance is expected. The second is roadworks data, where only 85% of complete closures go ahead as reported at 1pm the night before and the roadworks data that is currently shown on Traffic England and other related NTIS channels, including the data feeds, has lower quality than the statistics reflected by this measure. There is variable quality in terms of timely updates once the works are live.

These metrics should continue to form part of the overall assessment of Highways England's performance and should be used by ORR, in the short-term, to monitor and assess how Highways England can improve the creation and the quality of traffic data and information delivered to customers.

However, there are few measures of the customers' experience of the quality of traffic data and information and how accurately reflected this experience is to reality. It is difficult for Highways

England to assess their success in delivering traffic data and information to customers and take action to address shortcomings. There are a lack of measurements that allow the Company to assess the success in delivering the Travel Information Strategy objectives and aspirations. This has made baselining current performance difficult, however, within this study we have partially addressed this with extensive stakeholder engagement, comparison with other agencies and benchmarking against areas of existing good practice in other transport organisations.

Highways England is considered by many to be a leading road operator in terms of traffic data and information collection and provision in the UK and internationally, and to have good processes to assure and improve quality of information. However, there are areas of divergence in emphasis and delivery between Highways England and other comparators, particularly:

- the broader offering of traffic data and information from Highways England;
- the greater emphasis placed by road operators in Europe on the syndication of traffic data rather than provision of owned services; and
- other road authorities are increasingly seeking data from third party sources.

Operators are re-evaluating how best to deliver services and data to customers, and this is focussed on the role of third-party service providers and reaching customers through their channels.

Stakeholder liaison has shown that customers and consumers of traffic data and information have a requirement for end-to-end journeys that include local and national roads. There are currently very few relationships between national operators, such as Highways England, and local road operators that result in a shared offering to customers and end road users.

There is considerable scope for improvement in the (data) interface between Highways England and local highway authorities that include the exchange of information and operational agreements. Improving these interfaces will help Highways England to achieve policy aspirations such as 'door-to-door planning' for customers. Additionally, local highway authorities are a significant user of Highways England data and should be considered as a key customer group.

There are a substantial number of users of Highways England's syndicated data feeds who use other data to enhance their service offering. Timeliness, accuracy and an understanding of data limitations heavily influences the degree to which Highways England's data is used and reaches as broad a number of customers as possible through third party traffic information services. Highways England should elevate the role that third party traffic data consumers, aggregators and traffic information providers play in delivering Highways England policy objectives.

In raising the importance of this group, Highways England should consider and better define the exact shape and format of these relationships. This should include implementing processes that better capture current and future third party traffic data requirements and viewing the Company's traffic data as a valuable product that is supported with customer service commitments to third parties. There should be acknowledgement within any future relationships with third parties of the role some play in providing traffic data to Highways England to complement their own sources.

Understanding its data and information value will help Highways England to focus their resource, and work should be undertaken to define the economic value of traffic data and information. This evaluation must consider the value that customers ascribe to different data and information, and in doing so, further help Highways England to prioritise its existing data.

Customers and users of roadworks data, in particular the freight and logistics sector, use this data to help plan their operations and journeys weeks in advance. Low levels of accuracy are leading to a lack of trust and are reducing the value of roadwork information. This means missed opportunities for Highways England to inform road users and to help organisations plan more efficient journeys.

Roadworks data was specifically highlighted by third parties as low accuracy and quality and identified as a priority area to address. Highways England are taking steps to address this, and should continue to push to adopt targets for earlier notification of works to road users. In the

interim, existing data creation standards and metrics should be used to monitor and assess the provision of roadworks data and information.

The amount of data and information presented on existing owned channels, such as the Traffic England web, site is considerable. The lack of a clear prioritisation of the information presented, or the functionality to allow users to filter it themselves, makes using the information and web site difficult for customers who have a specific goal to achieve and want to understand the scale of the impact on their journey of specific traffic events. There is a need for greater categorisation in existing data types that will allow users of data and information to better understand the impact and importance of traffic events to their journey and plan accordingly. There are also some data types that stakeholders have requested, and Highways England should consider whether these can be made available.

Although Highways England has spent considerable energy in increasing its customer focus**,** the current Traffic Information Strategy (from 2016), whilst customer-led, does not fully define who the customer or customer groups are, define different levels of customer priority or acknowledge that different approaches may be required for these different customer groups in order to meet Highways England's policy objectives. A better definition and prioritisation of customers, based on a continued assessment of their needs, will help the Company to better target the collection, creation and provision of traffic data and information and to deliver this in the most effective manner.

We have proposed twelve recommendations for improvement to Highways England's provision of traffic information and data, grouped into three themes:

Policy, organisational goals and customer requirements

1. The Traffic Information Strategy should set out Highways England's traffic data and information requirements and commitments, and should be reviewed annually.
2. Highways England should create and agree a clear definition of the most important customers for traffic data and information.
3. Highways England should develop a set of high level outcomes, in line with its strategy, that can be achieved through better traffic data and information and then measure the extent to which these outcomes are delivered.
4. Highways England's existing data creation standards and metrics should be used by ORR in the short-term to monitor and assess how Highways England currently performs in the delivery of traffic data and information.

Focussing on the core offering

5. Highways England should better understand the relative value of its existing traffic data and information, both for its own business and to customers.
6. Highways England should create a target data model that fully describes the condition of all of its traffic data and information.
7. Highways England should review its culture and processes to ensure that delivery of customer information is considered at all stages of network operation, and that incentives and KPIs reinforce this.
8. Highways England should focus on providing greater detail within existing data types and should categorise the impact of traffic events on road users.
9. Highways England should adopt targets for earlier notification of roadworks and their impacts and communicate this with road users, in particular with the freight sector.
10. Highways England should consider the provision of additional traffic data and information that are being requested by stakeholders.

Interfaces with the customer and users of data

11. Highways England should elevate the role that third party traffic data consumers, aggregators and traffic information providers play in delivering Highways England policy objectives, and consider whether formal relationships should be used to achieve this.
12. Highways England should continue to work with other highway authorities, and consider taking a leading role in delivering network operation across the UK.

Improvements to Highways England's traffic data and information provision must be an ongoing process rather than short-term fixes, although the opportunity for more immediate actions do exist. For both Highways England and ORR there should be an ambition to develop a continuous improvement culture relating to data and information that can be translated into improvement targets, measurable delivery and most importantly, meaningful output measures, such as predictability of operational delivery, engineering efficiency and improved customer satisfaction.

2 Project overview – background and objectives

2.1.1 Background to the project

The Office of Rail and Road and Highways England have commissioned a research project to review Highways England's provision of data and information to road users. The objectives of this work are to:

- Review Highways England's current traffic data and information and provision – what is currently disseminated, in what format, in what timeframes and to what level of quality;
- Review of the standards Highways England sets itself for providing traffic data and information and how this compares to actual performance;
- Compare current practice to best practice and benchmark Highways England against suitable comparators;
- Assess the current performance that will enable a baseline against which future performance can be measured;
- Provide recommendations on the opportunities to improve traffic data and information provision to road users in the next Road Investment Strategy (RIS2) and beyond; and
- Provide advice on the metrics that can be used to assess the future provision of road user information in the future.

To meet these objectives the research project has documented, assessed and benchmarked the quality of Highways England's road and traffic data and information. This includes the coverage of that data and information, its currency and completeness, gaps in the data and the value that users assign to the data. The review has considered what data and information Highways England provides to road users, what it makes available to third party traffic information providers and what is available from other sources.

2.1.2 Scope of project

The scope of the project includes:

- all traffic data and information provided across all Highways England's channels including websites, social media, signage, variable message signs, radio and television, call centre and data feeds (or data syndication) to other traffic information providers;
- traffic data and information provided before, during, and after to road users completing journeys on the strategic road network. This includes data and information available under normal operating conditions, during planned disruption and unplanned disruption;
- all types of data and information that Highways England provides directly to road users and third party providers; and
- the requirements of different road user types such as the freight and logistics sector.

Out of scope for this project are longer-term considerations of what information provision will be required to support fully autonomous vehicles using the network in the future, although the near term requirements and opportunities of connected vehicles are considered, and static information types such as road campaigns and information about major schemes.

2.1.3 Stakeholder engagement

In completing the work, the project team have engaged with a wide range of external and Highway England stakeholders to understand how they view their role, and that of Highways England, and the value that they place on Highways England data and information.

Those external stakeholders have included road operators, third party road data aggregators, traffic information service providers, road industry representatives, other government and local

authority agencies, freight sector representatives and operators, satellite navigation companies, independent experts, data and mapping providers, media, representative groups from other transport sectors, road traffic data standard authorities and international transport agencies.

Highways England stakeholders include ORR and Highways England senior staff responsible for project governance and approvals, staff responsible for the existing services and those who use traffic data and information internally, staff responsible for relationships between the organisation and third parties who own or use comparator sites and staff responsible for customer (road user) relationships.

In completing a benchmarking assessment, the project team have selected and liaised with a number of key organisations to make a meaningful comparison of the effectiveness and value of the traffic data and information outputs provided by Highways England. These organisations are Network Rail, Transport for London and ERTICO. The benchmarking approach is detailed in section 8.3 below.

2.1.4 Structure of this report

Further context to the project is provided in **section 3**, which sets out the current traffic data and information market. It then provides an approach to defining what is meant by traffic data and information and a framework for assessing the quality of traffic information.

Throughout the report we have highlighted, "key findings" in green text boxes. From section 8 onwards, where appropriate, we have also made recommendations that arise from the key findings, these are shown in blue text boxes.

Section 4 gives an overview of the role of Highways England the traffic data and information market, looking at its licence obligations and how they translate into policy, the methods by which the Company gather traffic data and information, and the dissemination channels that it uses.

Sections 5 through 7 then give more detail about the current provision of traffic data and information by Highways England. **Section 5** examines how road conditions are currently measured, and **section 6** how data and information relating to specific events on the strategic road network and the creation of diversion routes is collected. **Section 7** provides a detailed overview of the current dissemination channels.

Section 8 uses the assessment framework set out in section 3 to present a current baseline of performance by Highways England in the creation and publication of traffic data and information, and compares against the provision by other road authorities. **Section 9** provides a summary and analysis of the external stakeholder engagement. **Section 10** presents examples of good practice in the road and related transport sectors, leading to a benchmarking exercise comparing Highways England with three relevant examples.

Section 11 presents the opportunities for improvement resulting from the preceding analysis, stakeholder engagement and benchmarking work. **Section 12** summarises the recommendations for ORR and Highways England arising from the study that are made throughout the report, and groups them into three high level themes.

3 Context: traffic data and information

3.1 The current traffic data and information market

The provision of road data and information to customers has changed considerably in the past two decades. This has been driven by a number of factors including the huge increase in delivery mechanisms (e.g. connected mobile devices with location services), the ability to collate more accurate data[1], growing customer expectation and demand, and new proven business models for the delivery and monetisation of traffic information[2].

Whilst the channels and services through which customers can access traffic information have grown, relatively few have disappeared. For instance, customers continue to consume traffic information via radio and television channels, and broadcasters continue to provide daily traffic reports[3]. The way that radio and visual media is consumed has changed, with the advent of on demand services, internet channels and in-home devices such as Alexa[4] as well as new devices like the Garmin Speak[5] and the Muse taking Alexa out of the home and into cars. The level of provision of traffic information has been sustained.

Large platform suppliers such as Google, Apple and Microsoft have moved into the market place over the past decade. Providing traffic information and, importantly, the ability to plan travel as part of customer's use of these platforms, has become the norm, and more than this, providing traffic information and journey planning has become a means for these large organisations to drive customers to their platforms. As these platforms move from the desktop, to the mobile device and eventually to the car and home, the traffic information market will become even more diverse. For instance, in-car systems providing road signs and warnings co-existing with physical signage. To this complex environment should be added satellite navigation systems and providers who deliver traffic information explicitly and implicitly through a variety of channels including personal navigation devices, in car systems and via mobile devices. Latterly, large platform suppliers and car manufacturers have also moved into the satellite navigation market utilising increasingly advanced smart phones as the platform for delivery of services.

The supply of road data and information has also seen considerable change with many of the above organisations using their platforms, vehicles and users' devices to collect data and feed this back into their information provision systems. Through the course of this research project, the growing extent of this data collection by third parties has become apparent. With the advent of always connected vehicles and vehicle to infrastructure communication, this pattern of data gathering and service provision is likely to grow and will become increasingly complex.

The owners and operators of road networks, such as Highways England, also continue to provide traffic data and information services, collect and disseminate data and provide information through owned customer channels. Road operators typically provide additional channels such as on network variable message signs, traffic camera images (although these are often syndicated), customer care lines and, increasingly, updates on social media. The availability of traffic information has become ubiquitous across many media channels, platforms and in almost any environment delivered by a host of different organisations.

Key finding: The number and extent to which third parties are collecting, analysing and disseminating traffic information, data and services has grown and continues to grow substantially with Highways England, and other road operators, playing an increasingly smaller role in traffic information services delivered to customers.

[1] https://medium.com/goodvision/report-on-the-size-of-traffic-management-market-317284d5189e
[2] Traffic Information Services - Global Strategic Business Report, Global Industry Analysts, Inc , March 2018.
[3] https://www.linkedin.com/pulse/death-radio-traffic-reports-fortold-prematurely-roger-c-lanctot
[4] http://www.aftvnews.com/amazons-alexa-can-now-give-you-traffic-information-for-local-businesses-and-landmarks/
[5] http://www.aftvnews.com/amazon-and-garmin-teamed-up-to-make-a-tiny-echo-dot-for-your-car-with-alexa-navigation/

3.2 Traffic data and information for the customer

The concept of what road (traffic) information *is* has also changed considerably in recent years. To better define what is meant by road (traffic) data and information, it is useful to consider what the customer might understand by this phrase. The environment for customers is highly complex as outlined above. The way in which customers consume traffic information has changed, driven in part by these changes. Availability of channels from the home, to mobile device to vehicle, means that consumers have different needs and expectations at different stages of their day-to-day journey.

How, and what, traffic information customers are consuming is increasingly defined by where they are, what they are trying to achieve and what channel is available to them at that point. This is vital to the overall concept of the quality of information and this locational and contextual relevance increasingly forms one of the key measurements of value to the end user and the network operator. The customer has a variety of choice and will compare and contrast different sources and channels to satisfy their needs and requirements. For instance, radio reports might lead to checking on an information channel, leading to planning a journey on a navigation device, or perhaps even on two different navigation devices to compare routes.

For the customer, road (traffic) data and information is diverse in extent, channel, definition and context. Customers and the market might then consider road (traffic) data and information to take all manner of forms across many channels. It may be perhaps most useful to see the definition, from their perspective, as anything that affects or has the potential to affect their journey and the metrics (e.g. journey time) and advice that accompanies this.

The manner in which customers choose to consume this data and information varies, as does the way in which network operators provide road traffic information. For example, a network operator may wish to push messages in the event of a traffic incident to inform and potentially divert drivers away from the incident, whereas the driver, prior to their journey may not wish to pull the existence of any such incidents affecting their routes, but rather have it pushed to them during their journey. In this context, each party applies a different value and subtly different definition to that data and information.

It has been traditional with traffic data and information services to consider the pre-trip, during trip and post trip scenarios based on the premise that road users check before they depart, consume information during their journey and *might* assess their journey upon its completion.[6] Dividing traffic information in this manner may have helped inform service providers where the channels of delivery were less mobile or transferable between different physical situations. However, the pre-trip, on-trip and post-trip information can all now be delivered and consumed by the road user on one device (e.g. mobile, smart phone) and is increasingly compatible between environments from the home/office to in-car displays.

This traditional view also trivialises the complexity with which consumers of traffic information act and what their expectation is for traffic information services. Research shows that customers are not typically checking before regular or familiar journeys[7] in favour of use of in-car navigation systems and devices and variable message signs to inform them on route. There is an expectation that traffic and route conditions will change and devices and navigation systems will update to reflect the best available choices for the driver.

[6] Strategic Review of Travel Information Research, Glenn Lyons, Erel Avineri, Sendy Farag, Reg Harman, September 2007
[7] Glenn Lyons, Erel Avineri and Sendy Farag, ASSESSING THE DEMAND FOR TRAVEL INFORMATION: DO WE REALLY WANT TO KNOW? Centre for Transport & Society, University of the West of England Bristol, UK

The usefulness of considering traffic information in the well-defined categories of pre, during and post journey should now be superseded by the situational state of the traffic conditions, impact on journeys and choice of route. For the operator and creator of traffic data and information, it is of much greater value to concentrate on the delivery of content and services that address the condition of the network/journey, planned and unplanned disruption and their consequences on those conditions regardless of the stage of the journey.

Key finding: Road users expect to be able to access traffic information where ever they are, on a platform of their choice, for it to be specific to their current needs, easily accessible, up-to-date and accurate. Traffic information forms part of a wider ecosystem of information/data (similar to weather) which help consumers plan their personal and professional lives.

3.3 The difference between (traffic) data and information – does it matter?

Data is traditionally considered to be simple facts or figures, bits of information, but not information itself. When data are processed, interpreted, organised, structured or presented to make them meaningful or useful, we can call them information. Information provides context for data.

Applying this to the traffic environment, we might consider the current average speed of vehicles on a stretch of road to be data, but the average speed, with some interpretation of the normal speed and how the current speed relates to this, to be information. When that data is then used to provide advice, such as a different route or expectation of delays for a period, we might consider this further enhanced information, or extending into a service category; something upon which a customer can better base a journey decision.

The delineation between traffic data and information is not always so clear-cut. A collection of data, organised in a coherent way (e.g. spatially and temporally), given context and made meaningful through display on a map on a web site, could quite easily be considered information or data.

Within the context of this study, precisely defining and considering data and information separately does not appear to add any value. It is acceptable to acknowledge the existence of both, the interdependencies between them and the current environment where Highways England provide both in a variety of contexts and channels.

3.4 Assessing the quality of traffic data and information

It is useful to assess the quality of traffic data and information against a framework. This allows a baseline to be established and gaps in quality to be identified, so that improvements can be targeted and measured.

In the on-line and data/information sectors, the value attributed to services is increasingly defined by the value as seen by the end-user. However, in the traffic data and information sector, traffic and network management are also goals. The value of the data can also be assessed by the contribution that it makes to achieving these operational and safety goals.

From existing research, it is clear that different parties define good quality traffic information in different ways. This has led to a variety of assessment models depending on the particular view and importance given to each part of the traffic data and information value chain, whether that is the collection of quality data or the delivery of quality products to the consumer.[8]

To explore this further, figure 1 below illustrates a simple representation of the value chain for traffic data and information.

[8] Quality Management Methods for Real-Time Traffic Information, K. Bogenberger, S. Weikl

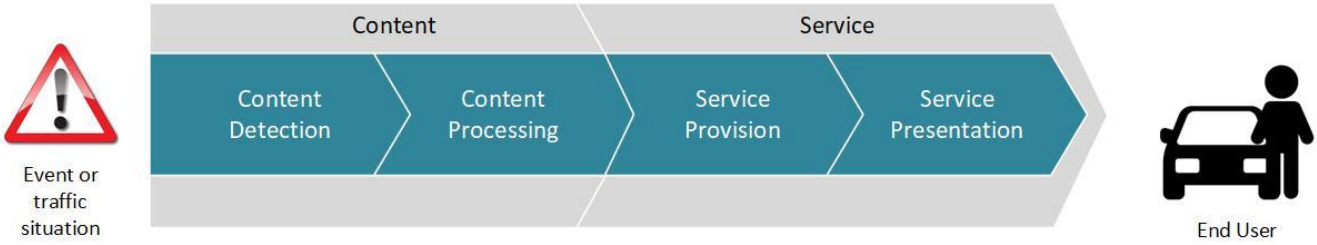


Figure 1 Value chain for traffic

It is possible to define the elements of this value chain further:

- **An event** - typically a traffic situation (e.g. the traffic flowing normally on a given road) or an unusual incident (e.g. an accident) or a planned occurrence (e.g. roadworks).
- **Content detection** - The observation of an event with the help of measurement equipment, or alternatively as observed or planned by humans (e.g. an accident as seen by a witness and reported to the police).
- **Content processing** - The accumulation of information or events in a content management system, where all information is processed and evaluated. This stage often involves validation/plausibility checks and quality control.
- **Service provision** - The processed content is enriched with content from other sources, reformatted and prepared for transmission to the end-user, then transmitted as a service to the end-user by means of wireless communication (e.g. radio, mobile cellular transmissions) or wired communication (e.g. internet via physical, cabled connections).
- **Service presentation** - The Service is received via an appropriate device, such as radio, mobile phone, navigation device or a personal computer. After reception, relevant messages are extracted from the service and rendered into the form most appropriate for presentation to the end-user (e.g. icons on a navigation device's map display, or message lists on a mobile phone, or audio output).

This demonstrates that the quality of road traffic data and information must be considered through a number of different lenses. The *Traveller Information Services Association* provides a useful statement on their considered view on what the dependent elements are for quality traffic information:

"…Quality of Traffic Information is dependent on four core components which should be consistent through the value chain. These four components are: Road Coverage; Content Accuracy & Completeness; Delivery channel and reception coverage; User Interface. The degree of alignment of these four components across the value chain for traffic information determines the level of benefits enjoyed by the user."

TISA Position Paper on Quality of Traffic Information, 2016.

3.5 Framework for quality assessment

We therefore propose an overarching framework for the assessment of quality of traffic data and information which includes four specific areas:

a) Achieving the creation standards - The level of quality of any data and information can be assessed by the organisational standards that have been set. These might be (internal) key performance indicators relating to the capture, publishing and update of data. For instance, the time between the detection of incident and its appearance on an information channel may have a minimum time. With what degree of regularity is this achieved? What are the variances?

Equally, standards will define the completeness of the data and its minimum content requirement. For instance, whether the roadwork information includes location, time/date, status, impact etc. Any assessment of quality starts with a baseline of how these performance criteria are met. It may also include measurement against an external agreed industry standard.

b) Geography and time accuracy - Traffic information typically has two geographic states: a point (on the network) and network space. For instance, an incident can typically be defined with an X and Y co-ordinate, whilst the delay caused by that incident will cover a section of the road network. The degree to which these reported geographical measurements are accurate heavily influences the quality of that information, especially given the relevance (to both consumer and operator) that geography creates.

Similarly, temporal components of traffic data and information, often in terms of start and (estimated) completion date, dramatically impact quality and usefulness.

c) Data and information 'truthfulness' – (Ground) truthfulness relates to how accurate data and information is to reality. How closely does this data reflect what is actually happening on the road network? How true or accurate any traffic data and information are, is typically dependent upon a number of characteristics:

- *Content accuracy* – the description of the event.
- *Completeness* – within a defined data model, are all data available?
- *Impactfulness* – what is the impact and effect of the event, how will it affect the experience of the customer?
- *Timeliness and latency* – how soon after any change of state is the event status, and impact updated, how quickly does this manifest itself to the user as an update? How current is the data and information?
- *Degree of variation* – what is the variation of the data and information from reality? Is it an acceptable level?

d) The customer experience of quality - Quality of traffic data and information mean different things to different users at different times. However, whilst this is a highly complex measurement of quality, with subjective as well as objective measurement, it is perhaps the most important. Some of the key measures of quality are outlined below:

- What is the reach of the data and information? Are enough customers able to consume the data and information?
- How relevant is the data and information to the consumer?
- Does the data and information reflect the actual experience? At this moment in time, during their journey or after they have completed their journey?
- How clear and useful is the data and information (and advice)?
- Does the customer trust the information?

Both the creation standards "a)" and geography and time accuracy "b)" of traffic data and information are inputs to quality that are predominantly within the control of the creator of the content, data and information.

How closely traffic data and information reflects actual reality "c)" and customer experience "d)" both manifest as outputs and are much more dependent on external factors. These include how traffic information and services are delivered, the customer experience and real-world conditions.

Section 4 now gives an overview of the role of Highways England in terms of creating and providing traffic information and data. It sets out Highways England's obligations under its Licence from the Secretary of State, and how they translate into policy. It also gives an overview of the methods by which the Company gather traffic data and information, and the dissemination channels that it uses. This overview is then expanded in Sections 5 through 7.

Section 8 then uses the quality assessment framework set out above to create a baseline for Highways England's traffic data and information provision.

4 Overview of Highways England and traffic data and information provision

4.1 Highways England's commitments for provision of traffic data and information

The **Highways England licence**[9] sets out the obligations of the Company as the highway authority, traffic authority and street authority for the Strategic Road Network (SRN).

In undertaking the relevant statutory duties, including the general duties relating to network management, and specifically relevant to traffic data and information provision, the licence states that Highways England should:

a) *Seek to minimise disruption to road users that might reasonably be expected to occur as a result of:*

   i. *Planned disruption to the network (including from road works);*

   ii. *Unplanned disruption to the network (including from incidents on the network and the short-term effects of extreme weather conditions)*

b) *Proactively and reactively provide relevant, accurate and timely information about traffic and conditions on the network to road users, including when there is disruption.*

There is no specific reference in the licence to how Highways England should provide the relevant, accurate and timely information, be it owned digital channels, on road infrastructure or through third parties. Equally there is no explicit definition of the quality of traffic information or where and what a quality assessment should be.

Key finding: How Highways England chooses to deliver relevant, accurate and timely information and channels through which this must be done is not specified in the Licence. Equally there is no definition of quality for information. Accordingly, the Company, through the Delivery Plan and supporting strategies, can propose how this outcome for traffic information is best achieved, be that through owned or syndicated channels.

In response to the licence, Highways England has published a **5-year delivery plan**[10]. This plan sets out how Highways England will improve its traffic information, specifically by:

- publishing a Traffic Information Strategy;
- providing customers with better information on network conditions;
- promoting Traffic England, developing it further;
- exploring use and sharing data and traffic information from the National Traffic Operations Centre; and
- trialling wireless internet.

An update to the 2015-2020 delivery plan, the most recent of which is the **2018 – 2019 plan**[11]:

- emphasises the importance of traffic information;
- set outs aspirations for improving customer communication by:
  - enhancing the service offering by increasing the availability of relevant traffic information to customers when and where they need it; and

[9] Department for Transport, Highways England: Licence, April 2015
[10] Highways England Delivery Plan 2015-2020
[11] Highways England Delivery Plan Update 2018-2019

- ensuring that customers can receive the traffic information they want in the format they want it.

To achieve this there is a commitment to:

- review the Traffic Information Strategy;
- enhance online services to deliver better real-time messaging about unplanned incidents;
- improve the accuracy of roadworks information communicated to customers;
- enhance the messages used on the VMS; and
- develop a Customer Contact Strategy to better understand customers' needs.

The **Traffic Information Strategy**[12]**,** as referenced by the delivery plans, set out in 2016 a framework for the collection and use of traffic data, how traffic information is made available to customers and how traffic data and information is made available to third parties.

The key aspiration is for *"all our customers to have access to the quality door-to-door journey information they need to make the right travel choices."*

Key finding: The Traffic Information Strategy sets out an aspiration for quality door-to-door planning for customers. In meeting this aspiration there is a need for Highways England to consider the whole customer journey, not that just on its network, and how information can be delivered for sections of the journey that commence and terminate off the Strategic Road Network.

A clear theme emerging from the strategy is the need to better and fully understand what customers need from traffic information, whether that is delivered via Highways England owned channels or services provided by other parties. Reference to the customer within this document is assumed to mean users of the road network.

A number of specific further points on the approach to delivering the strategy are noteworthy:

- A commitment to not compete, but work with the established traffic information market;
- Focus on areas where Highways England can make a unique contribution;
- Striking a balance between data collection, information provision and increased collaboration;
- Focussing on the areas of personalised services, end-to-end journey planning and journey time information through collaboration with traffic data providers (like local authorities) and information service providers;
- Collaborate with information providers to reach as wide a customer base as possible, creating a reputation as a reliable data provider; and
- Be transparent about the quality of traffic data and information.

Reference is made to an ongoing process of better understanding customers' needs – a process that will continue to evolve as these needs change.

Highways England have also a Customer Service Strategy and Customer Service Plans. The Customer Service Plan for 18/19 includes an Improvement Theme on "improving the traffic information our customers receive", and specifically a target to "Improve the accuracy of roadworks scheduling (95% at 1pm on the day of works and 60% 5 days before)."

The rest of this section gives an overview of the methods by which Highways England gathers traffic data and information, and the dissemination channels that it uses, both of which are then described in greater detail in sections 5 through 7.

[12] Highways England Traffic Information Strategy 2016

4.2 Road information and data collection overview

4.2.1 RCC and ROCs

Traffic information from the roadside is collected by the RCCs (Regional Control Centres) who are responsible for tactical management of incidents and for the signalling associated with roadworks on motorways and parts of the trunk road network.

They are the point of contact with the police and with maintenance service providers, and they despatch Traffic Officers to assist with incidents on the road. In the South West and East Midlands regions, RCCs have become ROCS (Regional Operations Centres), providing the RCC functions, but also some of the maintenance functions which have been taken in-house by Highways England staff. The other regions will move to this model over the next 3 to 4 years.

RCCs/ROCs have access to CCTV across the network, though the coverage varies from complete coverage for parts of smart motorway sections, to little or no coverage of much of the All Purpose Trunk Roads (APTR). Hence for incidents that Traffic Officers attend, or which are visible from CCTV, the RCCs/ROCs have the most up to date information about conditions "*at the head of the queue*". RCCs/ROCs pass this information onto the National Traffic Operations Centre (NTOC), by phone, for inclusion into the National Traffic Information Service (NTIS). RCCs/ROCs make some information available directly to the public via Twitter feeds.

RCC/ROC incident logs are entered into a system called ControlWorks. Highways England staff with access to ControlWorks are able to view this in real time, and the information is also exported as a batch daily for interrogation. Information about the settings on signs and signals is also available via a system called HALOGEN.

4.2.2 NTIS

The NTIS is provided by Highways England, with the majority of the services being procured via a contract with Network Information Services (NIS) Ltd, a joint venture between WSP and Thales. Highways England's Operational Planning team provide an interface between Highways England and NTIS and other services providing information to the customer.

A key role of the NTIS is to monitor the status of the network 24 hours a day, 365 days a year, collecting speed, flow and travel times. NTIS connects to the various subsystems of the Highways England Traffic Management Systems (HATMS) at the RCCs/ROCs. These interfaces provide access to unplanned incidents, loop-based traffic data, CCTV images and the ability to set and receive Variable Message Sign and Matrix Signal settings.

They also collect ANPR data, roadside sensors and data from in-vehicle sensors, as well as information about key major events and weather that may affect traffic conditions. This information is shown on the Traffic England website and app, disseminated in near real time via data feeds available to third parties, and used to create a historic record of network conditions for performance monitoring and similar uses.

ANPR and sensor is also used in real time by the NTIS control room to detect possible incidents or other disruptions, and the NTIS control room use this and information from the RCCs/ROCs, police and other approved sources to populate details of "unplanned events" (accidents and other traffic related incidents) as they occur, and "planned events" (roadworks and major events) in advance, and updated in real time if conditions warrant. Again, this information is published in real time and collated to form a historic record. The NIS contract includes 28 performance measures, monitoring the range of services that the contract provides[13].

The NTIS contract is due to expire in May 2021, and the Highways England Chief Data Officer has commissioned work to propose options for the future of NTIS, looking at what services it provides, whether it is currently delivering what it aims to achieve, and whether it is value for money. The project will address the question of what services Highways England should continue

[13] NIS PLN QUAL 006 Performance Monitoring Approach.doc

to invest in when the current contract expires, and an options appraisal paper is being prepared for the end of March 2019.

4.2.3 NILO

National Incident Liaison Officers (NILO) take data from both NIS and RCC systems, and generate information about a subset of "critical" incidents, defined by a list of 17 attributes. They add useful detail that would not otherwise be able to be disseminated via the NTIS. This information is circulated via email to a large number of interested parties both internal and external to Highways England. The circulation list for a specific report depends on location of the event and the sensitivity of the report. NILO also provide information via twitter and the breaking news section of the Highways England and Traffic England websites.

4.2.4 Roadworks

Information about works is collected in the NOMS (Network Occupancy Management System). A representative of the region's Area Team or Maintenance Service Provider (depending on the contractual arrangements) populates the NOMS with details of roadworks dates and layouts. Every three minutes, a data file is sent from the NOMS system to the NTIS system. The NTIS system processes this file, and creates roadworks events within the NTIS system as necessary.

Most roadworks are disseminated on Traffic England without manual intervention, but a subset of the most impacting works, including full closures, are handled manually. Full closures are managed using a manual spreadsheet, maintained by the Operational Planning Team, but populated by information provided by Area Teams and Maintenance Service Providers in the regions. This is prepared weekly and updated daily and is used to provide roadworks information to the Customer Contact Centre and to freight operators to facilitate their logistical planning. This information is not currently used to populate the Traffic England website.

In addition to the information on Traffic England, major roadworks schemes are signed on VMS, have their own dedicated webpages and sometimes other information outlets such as a Twitter feed and/or Facebook page. For more details about roadworks data see section 6.2.

4.3 Information and data channels

Highways England currently provide information across a range of customer facing channels that include digital, on road network and through syndicated data interfaces. A number of these channels are not open access but can be used by authenticated parties. The exact market share owned by Highways England, or indeed any road operator, is virtually impossible to determine given the complexities in measuring the use of a many of these channels and, more importantly, the lack of any available data from the burgeoning third party market.

Web site statistics provide the most readily accessible evidence of use of traffic information services by customers, and table 1 below shows a comparison of Highways England's web site use and data subscribers compared with the Traffic Scotland service in 2018.

MEASUREMENT	TRAFFIC ENGLAND WEB SITE	TRAFFIC SCOTLAND WEB SITE
Web site user sessions/visits (2018)	6.9 million	Circa 6.9 million
Third party data subscribers	Circa 160	Circa 84

Table 1 Comparison of Traffic England metrics with Traffic Scotland

In comparison with another road operator and traffic information provider, use of Highway England's web site and data syndication are very similar, albeit that the comparator has a significantly smaller number of road users. Data syndication is a process of making data available to third party subscribers via a published and well defined data interface, such as a data feed,

and often makes use of standards such as DATEX II (a standard for the exchange of traffic related data).

With around 4 million users of the Strategic Road Network every day[14], the figure of only 6 million user sessions or visits over the course of an entire year is put into context and equates to a very low level of use by the potential market. More interesting is perhaps a comparison with a service in another transport sector. National Rail Enquiries saw over 17 million users (with the number of visits likely to be many multiple times more) last year despite the volume train travel being substantially less than road[15].

Key finding: Whilst the volume of use of Highways England's owned services and channels appears substantial (*millions of visits*) the number of customer visits is relatively small when compared with other transport operator services and the fact that 4 million customers use the network every day. It is likely that comparisons with large third party providers would show that this number is a tiny percentage of the volumes that third parties achieve, and reinforces the fact that the Company are a relatively small traffic information service provider.

Equally the Company, through its strategy and delivery plan, remains committed to '*providing a trusted source of information',* and supporting road users to plan and completed journeys on the road network. This is achieved through both the provision of dedicated data and information channels and sharing and syndication of data to third parties.

As indicated by statements in the Delivery Plan, data and information provision continues to be a major objective for Highways England. Consequently, this research has been completed in the context of this continued provision and focuses on how improvements in quality can be made, the gaps and opportunities in improving delivery and how these can be assessed and measured.

Sections 5 through 7 now go on to give more detail about how road conditions are currently measured (section 5), and how data and information relating to specific events on the strategic road network and the creation of diversion routes is collected (section 6). Section 7 provides a detailed overview of the current dissemination channels.

[14]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/396487/141209_Strategic_Business_Plan_Final.pdf
[15] http://www.nationalrail.co.uk/46383.aspx

5 Road condition measurements

5.1 Overview

NTIS monitor road traffic conditions using data from both fixed and in-vehicle sensors. They use this data to identify incidents and give information in real time, and to derive a historic database of network conditions. Highways England and NTIS collect traffic flows, speed and travel times for the whole SRN, however this is at different levels of granularity across the network (see Section 5.2.3 below).

5.2 Traffic flow

5.2.1 Overview

Highways England regards traffic flow as the total number of vehicles passing a set point within a specific timeframe.

5.2.2 Process by which data is created, maintained and updated

Traffic flow data is measured at dedicated traffic measurement sites or is extracted from the detector sites that form part of the Motorway Incident Detection and Signalling (MIDAS) system. The latter is installed on all busy stretches of standard motorway and smart motorways. The equipment installed at the traffic measurement sites, referred to as Traffic Monitoring Units (TMU), uses magnetic induction loops in each lane to measure classified traffic flows, spot speeds and headways every minute. Data is reported to the central database every 5 minutes.

MIDAS detection sites are installed every 500m on standard motorways and every 400m on smart motorways. MIDAS collects the same data as TMUs and also detects queues by monitoring the "detector occupancy".

In the majority of locations on standard motorways, MIDAS detection sites use magnetic induction loops but some locations now use "side fire" radar devices instead. These measure the same quantities as magnetic loops by using "virtual detectors" in the radar beam.

On smart motorways, side fire radars have replaced all magnetic loops except for a small number of locations. All new smart motorways install these radars by default. Data is reported to the RCC/ROC and to a central database every minute. All TMU and MIDAS equipment is maintained by Highways England Regional Technology Maintenance Contractors (RTMC).

5.2.3 Geographic coverage

TMUs are located between all major junctions on the trunk road network and on the more rural, less busy motorways (e.g. M6 in Cumbria). MIDAS detection sites are installed every 500m on standard motorways and every 400m on smart motorways. The locations can be viewed on a public website[16] with colour coding to differentiate between TMU and MIDAS sites. A range of aggregated, historic data can be downloaded by from an individual TMU or MIDAS site.

More detailed, lane by lane by 1-minute data can be obtained by subscribing to MIDAS[17] although this does not provide real-time data. Real-time data is available from TMUs and MIDAS via the DATEX II data stream (see section 7.9). In addition to the data from measurement sites, NTIS also creates "fused" data. This combines data from sites (TMU, TAME, MIDAS and ANPR) on a *per link* basis where links are defined in the NTIS network model.

[16] http://webtris.highwaysengland.co.uk/
[17] https://www.midas-data.org.uk/

5.2.4 Performance monitoring requirements

The following NTIS Performance Monitoring requirements relate to Traffic Flow data:

- PM (performance measure) 1.1: The percentage of Traffic Data from connected fixed on-network equipment which is published within 1 minute (target 99%, threshold 98%);
- PM1.2: The percentage of Traffic Data from connected fixed on-network equipment which is published within 5 minutes (target 99.5%, threshold 98.5%);
- PM2: Percentage delivery of Daily Raw Traffic Data within limit on day 1 (target 100%, threshold 98%);
- PM10.1: Percentage of Traffic Data outputs published within 1 minute (target 99.7%, threshold 99.5%);
- PM10.2: Percentage of Traffic Data outputs published within 5 minutes (target 99.9%, threshold 99.5%);
- PM13.1: Percentage validation of Traffic Data – flow outputs (target 99%, threshold 97%);
- PM14.1: Availability of Virtual Patrol Network – overall availability of Fused Traffic Data as a proportion of minutes over the reporting month (target 99.5%, threshold 99%); and,
- PM14.2: Availability of Virtual Patrol Network – availability of Fused Traffic Data with respect to significant gaps (target 99.9%, threshold 99.5%).

5.2.5 Discussion and key sensitivities

Flow is a metric that is predominantly used for engineering, performance metric and analysis purposes and not for dissemination to road users. NTIS use flow data to calculate the likely impact of capacity-restricting events (e.g. lanes closed by incidents or roadworks) and to evaluate whether there is a benefit to suggesting "strategic" diversions to road users, that is, wide area diversions which remain on the Strategic Road Network. Flow data is also used to create a historic record of flows across the network.

5.3 Traffic Speed

5.3.1 Overview

Highways England regards traffic speed as the average speed of vehicles within a link between two access points to the network and timeframe.

5.3.2 Process by which data is created, maintained and updated

Speed data is collected from the monitoring units described in section 5.2. It is additionally populated by GPS data from INRIX.

5.3.3 Geographic coverage

More detailed, lane by lane by 1-minute data can be obtained by subscribing to MIDAS[18] although this does not provide real-time data. Real-time data is available from TMUs and MIDAS via the DATEX II data stream (see section 7.9). In addition to the data from measurement sites, NTIS also creates "fused" data. This combines data from sites (TMU, TAME, MIDAS and ANPR) and floating vehicle data from an external source to report speeds and journey times on a *per link* basis where links are defined in the NTIS network model.

[18] https://www.midas-data.org.uk/

5.3.4 Performance monitoring requirements

The NTIS Performance Monitoring requirements listed in section 5.2.4 for flow also apply to speed, with the exception of PM13.1 and the addition of PM11:

- PM11: Average age of Floating Vehicle Data within fused traffic batch (target 5 minutes, threshold 6 minutes).

5.3.5 Discussion and key sensitivities

If there is no congestion on a motorway, the average speed recorded may be in excess of the 70mph National Speed Limit. Highways England cap the speed shown on services such as Traffic England at the maximum legally allowed speed limit.

5.4 Travel time (junction to junction) & delay

5.4.1 Overview

Highways England regards travel time as the average time taken to traverse between two defined points at a specified time. Delay is a calculated field, where the current travel time is compared with the "expected" travel time.

5.4.2 Process by which data is created, maintained and updated

Current travel time data is collected using the same process described in section 5.3.2.

NTIS also measures journey times on "journey time routes" using automatic number plate reading (ANPR) cameras and matching the encrypted registration plates at consecutive locations. Journey time routes comprise the links between cameras.

Lists of encrypted plates are uploaded every 5 minutes to the central matching system located in the NTIS building and journey time data is processed and stored in the NTIS database. The cameras are maintained by the RTMCs.

Normal travel time & delay

Normal travel time can be expressed in two ways, the simplest of which is the time taken to travel along a link at the legal speed limit(s) for that link.

However, there are many parts of the SRN where it is not "normal" to be able to travel at the speed limit at particular times of day. In order to understand what a "normal" travel time is, NTIS have a database of expected travel times across the day in 15 minute segments. Each day of the year is grouped into one of 13 day types. When a travel time is within the expected range, it is disseminated and added to the historic record. When a travel time rises above the expected threshold, this indicates that delay is present.

Delays against this profile are then calculated by comparing the current travel time with the typical average travel time for the link. The process is done continually as new data is received each minute.

When the delay is over 15 minutes, the system will alert operators, who can investigate whether there is an obvious cause. They may declare an incident, in which can they can manually attribute delay as an attribute of the incident. They may declare a congestion event if there is no other obvious cause (see section 6.1 on incidents and events).

The Performance Analysis Unit also generate different profile journey times and propagate traffic flows across the NTIS for the purposes of metrics and analysis.

5.4.3 Geographic coverage

There are approximately 1100 ANPR camera sites that give rise to around 1400 journey time routes covering the entire SRN. The length of routes varies depending on the network topology

and the traffic volumes. More highly trafficked routes have more cameras and hence journey time routes are shorter.

5.4.4 Performance monitoring requirements

The following NTIS Performance Monitoring requirements relate to travel time data (in addition to the flow and speed requirements mentioned in the previous two sections, which also have some relevance):

- PM13.2: Percentage validation of Traffic Data – journey time outputs (target 97%, threshold 95%); and,
- PM15: Percentage of validated profiles (target 99%, threshold 95%, where the minimum journey time discrepancy to constitute a failure is 15 seconds).

5.4.5 Discussion and key sensitivities

The inherent issue with collecting travel time using fixed sensors, such as ANPR cameras, is that the travel time is not measured until the vehicle passes the second camera, meaning that as soon as there is a delay to the vehicle reaching the second camera, there is also a delay in detecting this. However, NTIS address this by using data from in-vehicle sensors; if a number of vehicles in a similar area experience a drop in speed, this can also act as a trigger.

Delay, unlike speed or flow, can be calculated in different ways and is somewhat subjective in that different drivers have a different idea of what "normal" conditions are, and so measure delay differently. It is also important to measure both the percentage of active (e.g. reporting for at least 80% of month) sensors that are reporting accurate data and sensor coverage - the number of links with reporting devices

Finally, in the same way that published speeds are capped at the speed limit, the current travel time displayed (particularly when displayed on VMS) is capped to the travel time that can be achieved at the legal speed limit for the travel time route.

6 Data related to specific events

6.1 Unplanned events – accidents, incidents, congestion

6.1.1 Overview

Highways England regards incidents as any unplanned event on the network. The NTIS outputs only deal with unplanned events that are likely to cause more than 15 minutes delay on the network.

6.1.2 Process by which data is created, maintained and updated

Incident/Accident

The first notification of an incident may be when it is called through to an RCC/ROC, by a member of the public. If so, the RCC/ROC operator validates the details using CCTV if it is available at that location. Incidents may also be called in via "approved" sources, such as a Traffic Officer or the police, in which case the source provides the validation. The NTIS monitoring network may also give the first notification of an incident; if the monitoring network alerts NTIC operators, they will liaise with the relevant RCC/ROC.

A RCC/ROC operator creates an incident log (using ControlWorks software) and sets appropriate signs and signals as necessary, and has a target to do this within 2 minutes. If the incident is likely to affect traffic, creating delays of more than 15 minutes, they will notify/update NIS operators. They have a target to make this notification within 5 minutes. The NIS operator will then also create an incident in the NTOC system if one does not yet exist. If the event meets the criteria to be a NILO event, the NILO will generate a report and disseminate it to the appropriate parties.

As the incident evolves, ControlWorks, the NTOC system and NILO database will be updated as appropriate. ControlWorks logs will be closed once the work at the incident site has completed, whereas the NTOC log will stay open until all residual congestion has cleared.

Congestion Event

If NTOC observe delay but cannot attribute it to a specific other cause, they will generate an event with the reason "congestion".

6.1.3 Geographic coverage

Incidents are shown for the whole SRN but this is mostly restricted to RCC/ROC regions where incident response/management is in place.

6.1.4 Performance monitoring requirements

As noted above, the RCC/ROC has a target to set signs and signals within 2 minutes of notification of an event, and to notify NTOC operators within 5 minutes.

The following NTIS Performance Monitoring requirements relate to the publication times of unplanned incident data:

- PM7: Average publication time of current events (target 2 minutes, threshold 5 minutes);
- PM8a: Percentage of events updates within 2 minutes (target 99%, threshold 98%);
- PM8b: Percentage of events updates within 5 minutes (target 99.7%, threshold 99.5%);
- PM17: Average error on estimated time to return to profile (target 35%, threshold 50%); and,
- PM19: Average time between current event update and publication of strategic response (target 5 minutes, threshold 7 minutes).

6.1.5 Discussion and key sensitivities

There are significant sensitivities in relation to reporting specific aspects of an incident, in particular anything that might jeopardise the anonymity of those involved, or any specific circumstances of incidents which may be distressing and are not relevant to the actual impact of the incident on the flow of traffic itself. This is particularly relevant to NILO reports and tweets, where there is more ability to add such details.

6.2 Roadworks

6.2.1 Overview

Highways England regards roadworks as any planned activity requiring a change to be made to the road operation. This would typically involve one or more of the following:

- The planned closure of all or part of one or more carriageways and/or the hard shoulder or verge;
- The implementation of narrow lanes; and
- The implementation of reduced speed limits along a section of carriageway.

6.2.2 Process by which data is created, maintained and updated

Roadworks data is supplied and updated as necessary by each contractor working on the SRN and entered into the NOMS portal. The data is maintained by the maintenance service provider, or by Highways England staff in regions with a ROC, who can check for potential clashes, for example, between two sets of roadworks within 5km on the same road, or roadworks on parallel or nearby routes on the SRN.

The scale of roadworks determines when and how data should be initially created. Major schemes require at least an indicative roadworks schedule from the contractor 6 months in advance, which is then refined and finalised closer to the date. Data is continually submitted to and updated on NOMS as and when contractors determine timescales for future works.

All works, except for emergency works, should have schedules entered into the NOMS portal at least 3 weeks in advance (3 months in advance if a Temporary Traffic Regulation Order is required), which are to be approved by Highways England a week prior to going live. Finalised bookings are required to be made before 1pm on the day for overnight works (exceptions are made for emergency works). However, the requirements of booking space on the network mean that contractors may book more time for roadworks that they will actually use. This means that published roadworks do not go ahead on all the days specified.

Every three minutes, the NOMS system pushes its latest dataset to NTIS automatically. The NTIS data system has algorithms to process this data and create or amend the entries in its roadworks event datasets.

The contractor at the roadside should call the relevant Highways England RCC/ROC when the works go live, i.e. when temporary traffic management is about to be installed. This information should be passed onto NTIS by the RCC/ROC. NTIS will then flag the works as "confirmed" and show them as such on Traffic England and sign for them on VMS if relevant. If a confirmation call from the RCC/ROC is not received at NTIS they are shown as "unconfirmed" on Traffic England even during the periods when they are scheduled to be active. If roadworks are called through but are not visible in the NOMS database feed, operators in the NTOC can add them manually to the NTIS database.

There is a level of incompatibility between NOMS and NTIS due to the two systems having different network models, with no one-to-one mapping. This means that sometimes parts of the feed of information from NOMS are rejected by the automated transfer to NTIS, resulting in information on roadworks not being published to customers. Also the automated transfer and the

way that NOMS is populated for road space booking means that one NOMS record can generate multiple records in NTOC.

Once the works are live, contractors on site are required to notify Highways England (via NOMS) within 5 minutes of any significant change in Temporary Traffic Management, such as lanes being closed or re-opened. They must also call the RCC/ROC, particularly when signs or signals are needed to be set or cleared down. Contractors must also notify via NOMS if they expect to overrun. This must be done in advance of the end of their "Authorised Closure Time", enabling NTIS services to advise road users that roads will continue to be affected later than planned.

Once roadworks have been completed the contractor updates NOMS with the details of the completion time and date. This is included in the automated feed from NOMS to NTIS and the associated entry is removed from the NTIS system. If the roadworks require additional time to be completed the contractor will have had to amend the roadspace booking in NOMS, or possibly create a new booking; this will also be included in the automated feed and NTIS will update accordingly.

Closures

Because of the complexity of the above process, and known issues with the accuracy of the roadworks information that is presented on via Traffic England, the operational planning team run an additional manual process to collate details of roadworks that will cause a complete closure of the carriageway. The objective of this initiative is to understand the issues that cause inaccuracy of roadworks information and streamline the processes so that the knowledge gained can be translated to roadworks information for other non-closure works, and also so that the time by which finalised bookings are required (currently 1pm on the day of the works) can be extended to 7 days, and out to 21 days and beyond. This information is made available via the Customer Contact Centre and directly to some large customer organisations.

Major works

In addition to the information collected via NOMS and NTIS, many of the Major Schemes have their own dedicated webpages which give generic scheme information and more detailed information about the specific phase of the works over the next few days. See section 7.3 for more details.

6.2.3 Geographic coverage

Roadworks are shown for the whole SRN.

6.2.4 Performance monitoring requirements

The following NTIS Performance Monitoring requirements relate to roadworks data:

- PM4: Percentage of forecast events published within the agreed time (target 96%, threshold 90%);
- PM5: Average time inconsistent information is published on forecast events (target 2 minutes, threshold 7 minutes);
- PM7: Average publication time of current events (target 2 minutes, threshold 5 minutes);
- PM8a: Percentage of events updates within 2 minutes (target 99%, threshold 98%); and,
- PM8b: Percentage of events updates within 5 minutes (target 99.7%, threshold 99.5%).

Service providers under ASC contracts have performance metrics around the speed with which they update NOMS with information about when works commence and finish, as mentioned above. In regions where this function is performed in house by Highways England staff the speed is also monitored, and reported on in the same way, but without the contractual imperatives for accuracy.

6.2.5 Discussion and key sensitivities

The key issue with roadworks data is the (low) accuracy of the data being supplied to the public in advance, making it difficult for customers to plan to avoid works. Highways England are aware of this and have various initiatives underway to improve the accuracy of data. Besides the data loss between NOMS and the NTIS, there are also issues arising from:

- Planning rigour – often works, particularly larger and more complex schemes, are subject to provisional advance bookings where the precise nature and timing of traffic management may not be known. This results in spurious and excessive bookings that are not updated as the planning of the scheme matures, resulting in inaccurate information in NOMS.
- Scheduling – major roadwork schemes can have many separate bookings for different schedules of traffic management. This makes the customer information difficult to assimilate, and many of the schedules are then cancelled.
- Capability – staff inputting bookings into NOMS are remote from the design / planning staff, resulting in a lack of understanding on both sides of each other's pressures.

Therefore there are frequent complaints when particularly commercial users (the freight industry) make arrangements to divert in order to avoid a set of roadworks which do not actually take place.

Key finding: Customers and users of roadworks use planned roadwork information to help plan their operations and journeys many weeks (and sometimes longer) in advance. Low levels of accuracy of data is leading to a lack of trust and value users have for roadwork information.

6.3 Secondary data

6.3.1 Overview

This section covers information regarding abnormal loads, major events, weather and diversion routes. These are occurrences that may affect traffic but are either transitory (abnormal loads weather and diversion routes) or where Highways England have little influence on them (weather and major events). Highways England are a consumer of this data rather than a creator of it (though they create and agree diversion routes in partnership with local authorities), and provide it through owned channels, where it exists. The data is therefore not comprehensive.

6.3.2 Abnormal Loads

Highways England regards abnormal loads as any item being transported on the SRN where the weight, width or length exceeds the thresholds defined in The Road Vehicles (Construction and Use) Regulations 1986.

Businesses looking to transport Abnormal Loads submit Electronic Service Delivery for Abnormal Loads (ESDAL) notifications, which are received by the Police, Highways England and those responsible for bridges under which the loads must pass.

Highways England has a team responsible for managing Abnormal Loads, who maintain a list of loads being transported on the Highways England network and details, and liaise with the other parties involved. These are passed to NIS operators and can be shown on the Traffic England website and signed on VMS although this does not happen frequently, as there are few loads that would cause significant delay on the SRN.

As abnormal loads, by definition, move, and any traffic disturbance is only temporary, Highways England's role is to ensure that routes are suitable, rather than specifically to notify road users. Also some abnormal loads may relate to highly-sensitive equipment, used in the defence, communications or power industries for example. Therefore it is not prudent to reveal the nature

of the abnormal loads themselves (and often may not be possible to reveal the presence of an abnormal load on the network, in the event its route may enable prediction to be made as to the cargo itself).

6.3.3 Major organised events

Highways England regards a major event as any single planned activity (such as a professional football match or a major exhibition) likely to result in a substantial number of additional journeys on one or more set days and which is therefore likely to result in additional congestion. Major events will not normally result in any loss of capacity on the SRN, unlike incidents.

Events from across England are shown on Traffic England and may be signed on VMS; the locations of these events do not have to be directly on the SRN itself.

There are sensitivities in terms of the provision of information which may be perceived as advertising these specific events. Therefore Highways England might state "Sports Event on Saturday".

6.3.4 Adverse weather (driving conditions)

Highways England regards adverse weather as any irregular weather conditions, such as fog, ice or high winds, liable to make road travel significantly more dangerous than normal for some or all vehicle types. Adverse weather conditions may require certain actions to be taken on the network, for example, the closure of certain bridges to high-sided vehicles in strong winds.

Highways England has a network of weather stations across the SRN, which report their status (temperature, humidity, wind direction and speed etc.) every 10 minutes via the Severe Weather Information Service (SWIS). There is also a representative from the met office in the NTOC control room, to advise Highways England about likely weather conditions. In the event that particular inclement conditions are identified, one or more specific alerts for rain, ice or snow may be raised. If the met office raise an alert, this may also trigger a Highways England weather alert, which is more specific to the road network. If a Highways England weather alert is triggered, the NILO will report on it via email, twitter and breaking news.

6.3.5 Diversion Routes

Highways England regards a diversion route as a specific route to be advised to road users in the event of one or more SRN links being shut due to an incident or roadworks.

Tactical diversion routes are (where possible) agreed with local authorities for every link on the SRN for use when incidents occur. They are signed using manually operated fixed plate signs and symbols (such as a circle, square or triangle). When a link is closed by an incident, the attending Incident Support Unit should open up the diversion sign, indicating to road users that they should "follow the O" or similar, once the ISU has driven the diversion route to check that it is clear, and that the signs are visible. Some diversion routes can also be signed using VMS using the route symbols, and NILO can add them to their reports and can refer to them using twitter.

Strategic diversions are signed by the NTIS, using instructions on VSS. They are only used for wider area diversions, and only using the SRN itself. Strategic diversions do not direct road users off the SRN because NTIS do not have information on the status of routes on the rest of the road network.

Diversions may also be agreed with Local Authorities for specific schemes on an ad hoc basis, these are signed with temporary fixed plate signs but are not recorded in any system or published.

7 Dissemination Channels

7.1 Variable Signs and Signals

7.1.1 Overview

Variable signs and signals (VSS) give Highways England the ability to issue instructions and give information at the roadside. Their use is governed by a VSS policy[19], and by work instructions which dictate what is set and under what conditions, based on customer insight and human factors best practice. VSS include variable message signs (VMS) of varying sizes and matrix signals showing speed limits, and other symbols. They are used for planned and unplanned incidents and are set by both RCC/ROC and NTIS staff with detailed system logic determining the priority of settings, and the need for other supporting settings.

7.1.2 Data types, attributes

Signs and signals display a variety of advisory and mandatory information in relation to road conditions ahead. This can include:

- Advisory or mandatory speed limits and lane usage information, which may arise due to congestion or incidents downstream;
- Unplanned event details, such as the type (e.g. accident, closure), and length of delay;
- Planned event details, to warn traffic of future or ongoing major events and roadworks, which may have an impact on this or subsequent journey times;
- Warnings to take extra care due to the presence of abnormal loads on the specific route;
- Automated settings, including travel times and weather warnings (e.g. "FOG"); and
- Campaign messages, such as advising drivers not to drive whilst tired.

The RCC set tactical signs within the link, whilst NTIS set strategic signs over a wider area. The area over which signs are repeated will depending on the likely delay caused by an incident.

7.1.3 Data currency

When VSS are set, the requested setting appears on the roadside in near real time. The timeliness of manual settings depends on the workload in the RCC, but targets are for messages to be displayed within 2 minutes of being informed of the change in situation.

The following NTIS Performance Monitoring requirement relates to NTIS's ability to set VMS:

- PM23.3: The availability of the HATMS gateway which allows NIS to use VMS (target 99.9%, threshold 99%). This is measured using an Oracle BI report.

The NTIS Performance Monitoring requirements related to unplanned events already mentioned in section 6.1 are also relevant here, as the creation of events drives the setting of VMS signs by NIS operators.

- PM7: Average publication time of current events (target 2 minutes, threshold 5 minutes);
- PM8a: Percentage of events updates within 2 minutes (target 99%, threshold 98%);
- PM8b: Percentage of events updates within 5 minutes (target 99.7%, threshold 99.5%);
- PM17: Average error on estimated time to return to profile (target 35%, threshold 50%);
- PM19: Average time between current event update and publication of strategic response (target 5 minutes, threshold 7 minutes).

[19] Highways England Policy for the use of Variable Signs and Signals (VSS) June 2018 version 3.0

7.2 Traffic England (Desktop version)

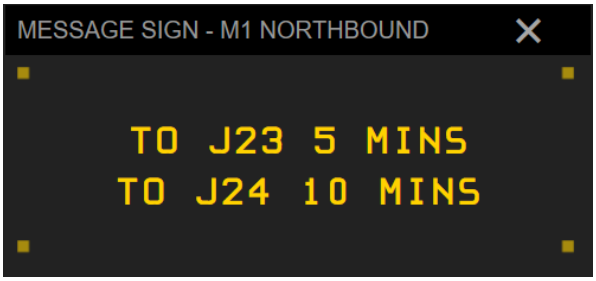
7.2.1 Overview

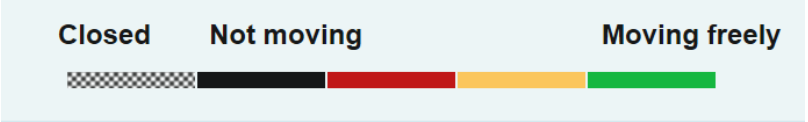
Traffic England is the main website channel used by Highways England for providing traffic and travel information to road users. It is linked directly to the main Highways England webpage. In the 12 months from 1st December 2017 to 30th November 2018, there were approximately 3 million different users of Traffic England and over 10 million page views. Traffic England is run by NIS and NIS operators update the website with details of current and future events (such as collisions or roadworks) likely to impact on people's journeys.

7.2.2 Data types, attributes

Measurement data

Traffic England displays a large quantity of measurement data, including speeds across the whole SRN, as well as operational data such as signal settings, which show how the network is being managed. CCTV images are shown to display live conditions, although these are blanked if the camera is moved from its home position, to avoid displaying distressing images.

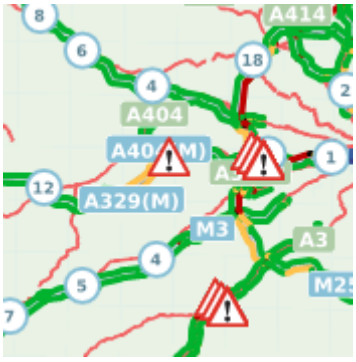




Events

When looking at the overview map, icons for events that appear at similar locations are clustered with an exclamation mark icon. As the user clicks on this cluster icon, the map zooms in until the detail of each event can be seen.

Event-specific information is provided for various types of event:

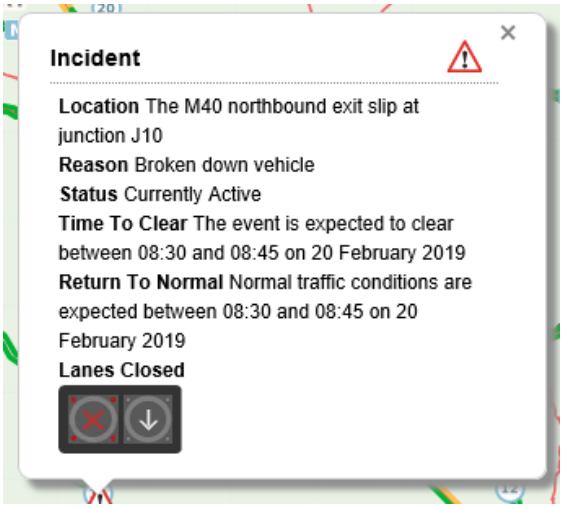


Unplanned Events: Incidents

Highways England disseminate the following information for each incident via Traffic England:

- Location (link within the SRN);
- Reason (whether this is a collision, breakdown, spillage etc.);
- Status ("Currently Active" by default for incidents);

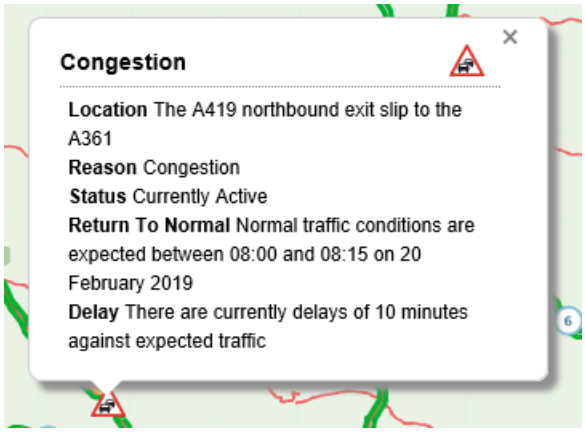
- Time to Clear (estimated time for the incident to clear and all lanes to become available based on the type of incident and vehicles involved);
- Return To Normal (estimated time for the road network to return to normal conditions);
- Delay (the amount of extra time it is expected to take to traverse this link compared to normal conditions); and
- Lanes Closed (a schematic showing which lanes are open, with arrows, and which are closed, with Xs).



Unplanned Events: Congestion

Highways England disseminate the following information for (non-incident-related) congestion events via Traffic England, in addition to colour scales describing current average speeds on each link (discussed in more depth within the Traffic Speeds section):

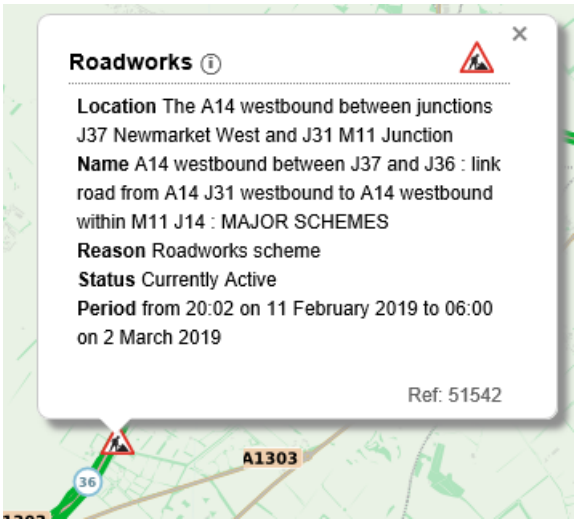
- Location (link within the SRN);
- Reason ("Congestion" by default);
- Status ("Currently Active" by default);
- Return To Normal (estimated time by which the congestion is expected to be alleviated); and
- Delay (amount of extra time it is expected to take to traverse this link – field not always present on Traffic England, as this field is set manually by NTOC operators).



Planned Events: Roadworks

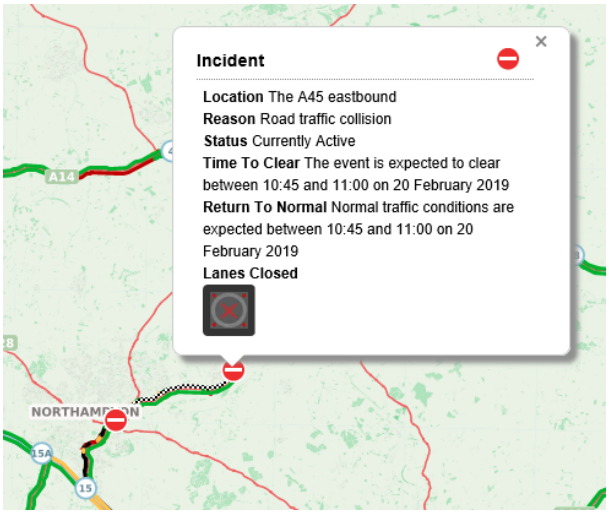
Highways England disseminate the following information for each set of roadworks via Traffic England:

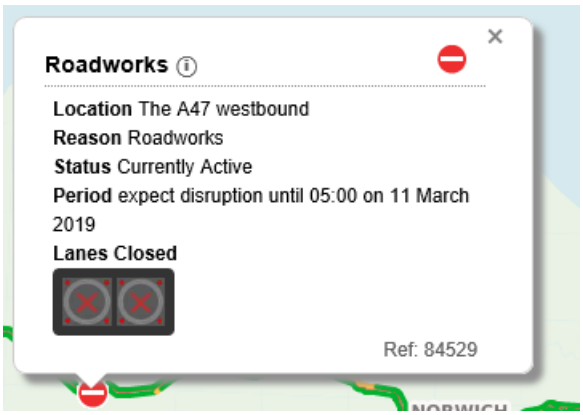
- Location (link within the SRN);
- Name (specific description of the project, e.g. "smart motorways" plus junction numbers);
- Reason (type of works, e.g. barrier or road repairs);
- Status ("Pending" for future works, "Currently Active" for current works);
- Period/Schedule (time during which you may experience disruption due to these works, period for current works, schedule for future works); and
- Lanes Closed (a schematic showing which lanes are open, with arrows, and which are closed, with X's).



Closures

On Traffic England, unplanned events or roadworks that close the carriageway completely will be shown as a closure, denoted by a "no entry" sign. Users can filter for these events specifically. The information then given is the same as for any other unplanned event or roadworks. Users may find this confusing as the details for events marked as closures use the phrase "lanes closed", and it may not be obvious this (or the no entry sign) refers to a complete closure.





Planned Events: Major events

Highways England disseminate the following information for events via Traffic England:

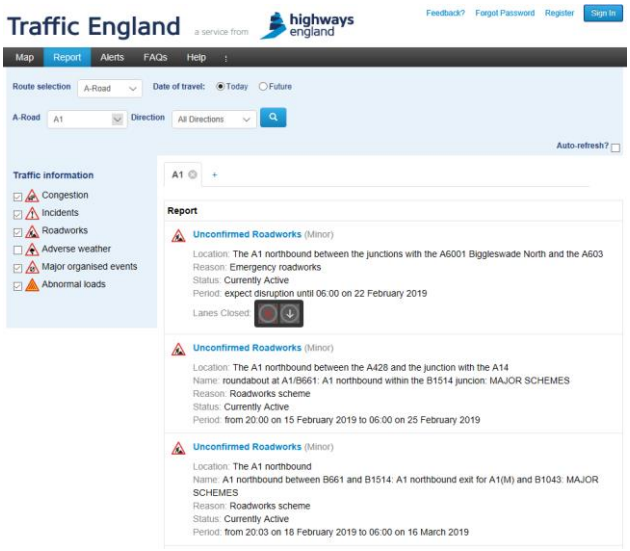
- Name (a description of the event, which should also include its location);
- Reason (type of event taking place);
- Status ("Pending" for future events, "Currently Active" for current events); and
- Period/Schedule (time during which you may experience disruption due to these events).

Other views: "Report" and "Alerts"

The default view offered by Traffic England is of a nationwide map, enabling the user to scroll view information related to their journey. However, Traffic England also offers a route-based "Report" view, enabling the user to select any motorway or APTR route and view all the incidents or roadworks taking place (or due to occur in the future).

The report presentation differs depending upon whether a motorway or A-road is selected. For motorways there are bi-directional schematics of the whole route length (or a shortened section, if selected); this includes average speeds and VMS legends for each link, as well as hyperlinks to each incident or roadworks reported, and CCTV views (these must be clicked on to give full details). For A-roads there is simply a list of incidents or roadworks along the whole length of the

route. In some cases there can be many roadworks listed within the same link, which can be difficult to review.



In addition to the Report view, Traffic England has an "Alerts" page, which lists network events, either by road or severity, and which can be filtered by unplanned (e.g. incidents) or all events (thus including roadworks too).

There is also a "breaking news" section, which is updated by the NILO with textual information about appropriate critical events, which can include "free text" details that are not able to be included within the event details described above.

Key finding: The amount of data and information presented on the Traffic England web site is considerable. The lack of a clear prioritisation of the information presented, or the functionality to allow users to achieve this, makes using the information and web site difficult for customers who have a specific goal to achieve (what is impacting my journey) and want to understand the scale of the impact allowing them to determine, for instance, whether they should consider a different route for their journey.

7.2.3 Data currency

According to the Performance Monitoring requirements, measurement data (traffic flow and speed) from MIDAS should be updated every minute, and appear near instantaneously on Traffic England. The average age of Floating Vehicle Data should not exceed 5 minutes.

Unplanned events data should be uploaded as an event within 5 minutes once confirmed in the NTIS database, whilst timescales for planned events are reliant on the NOMS data chain and depend on how far out they are:

- Event start time greater than 30 days; publication in less than 2 hours.
- Event start time between 2 and 30 days; publication in less than 15 minutes.
- Event start time less than 2 days; publication in less than 5 minutes.

The following NTIS Performance Monitoring requirements relate to availability of Traffic England data:

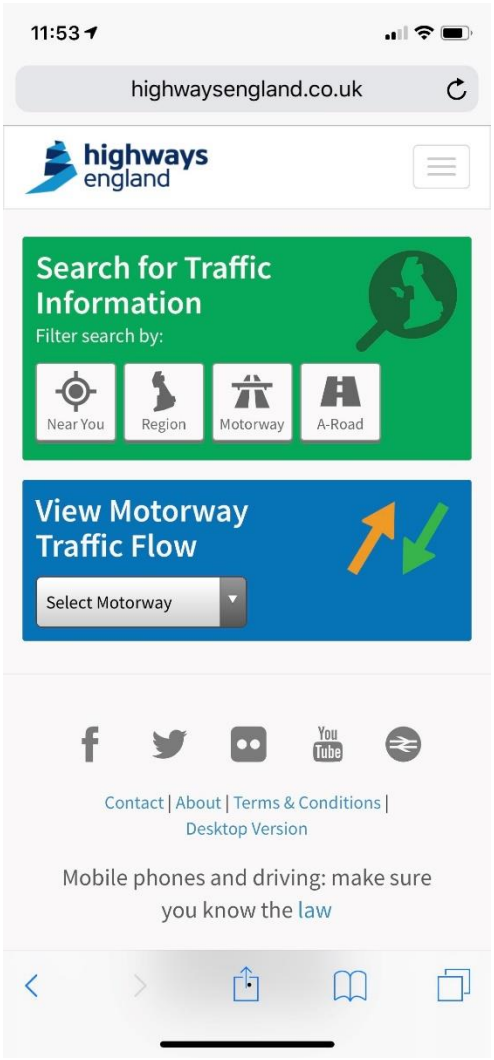
- PM23.1a: Availability of Traffic England website to present information at all times the NIS system is available (target 99.9%, threshold 99%); and,
- PM23.1b: Instances of events/VMS not updating on Traffic England (target 5 occurrences, threshold 10 occurrences).

7.3 Traffic England (mobile version)

7.3.1 Overview

Most of the data available on the desktop Traffic England website is also available in a version optimised for smart phone users. The figure to the right shows the home screen. If there is current "breaking news", this appears above the "search for traffic information box, and links to the breaking news as set by the NILO.

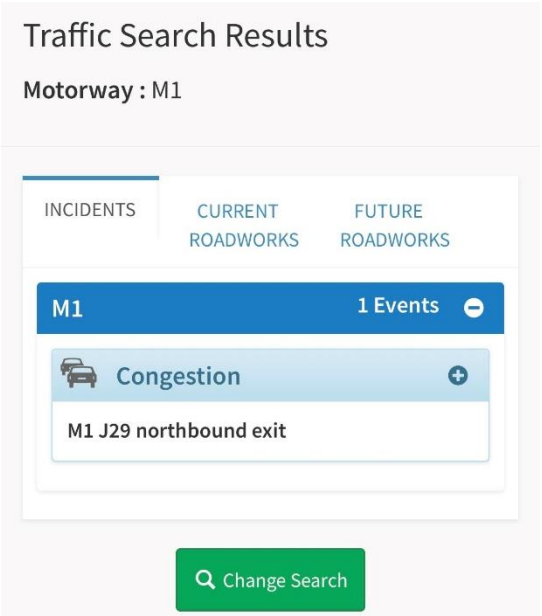
The data currency is the same as for the main website.



7.3.2 Data types, attributes

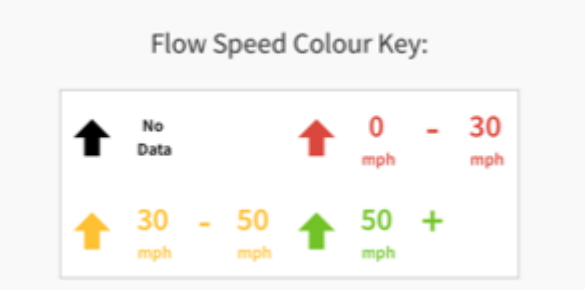
Search for Traffic Information

This section allows the user to filter traffic information that is "near you", or to select a region, motorway and a-road, and then to see incidents, current roadworks or future roadworks for that selection, as shown below.

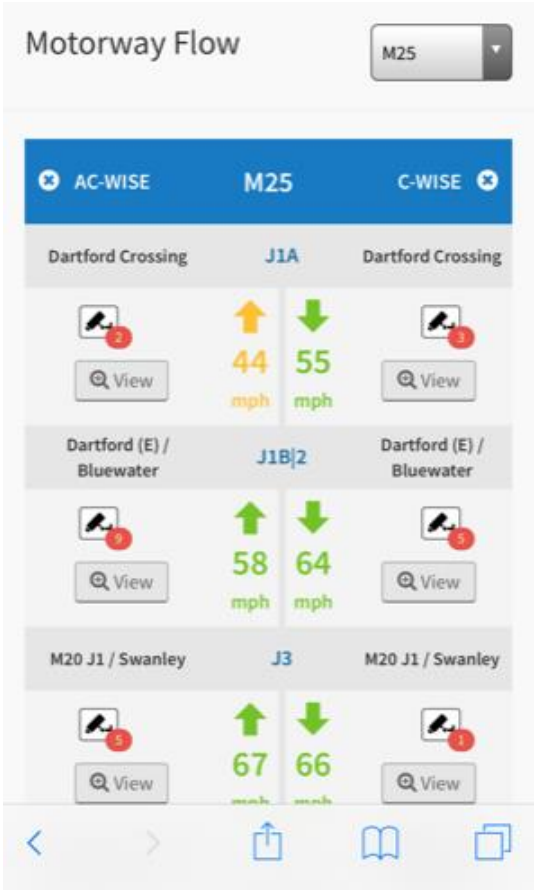


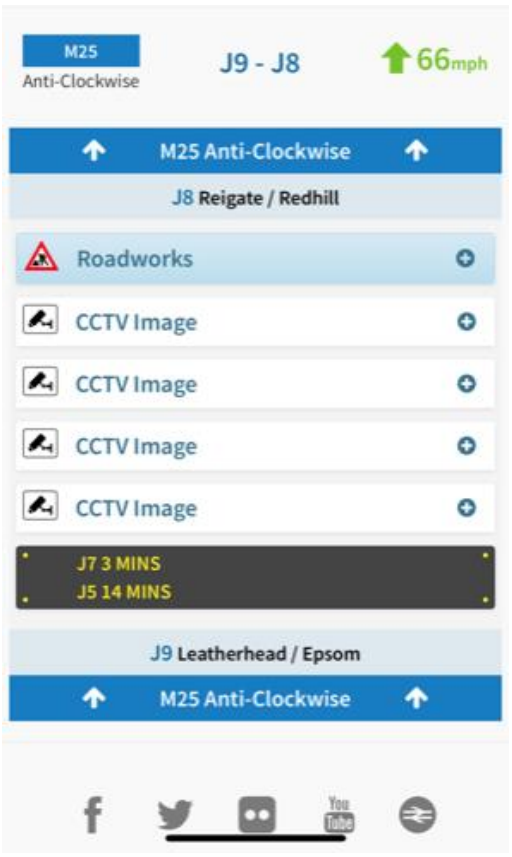
View Motorway Traffic Flow

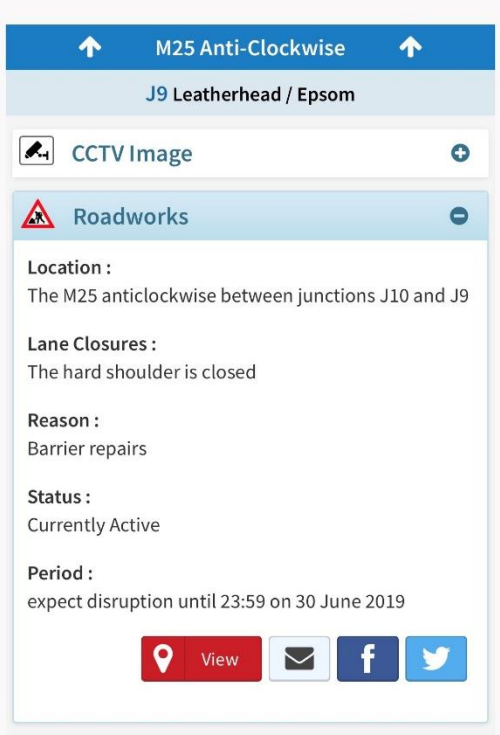
This section allows the user to choose a motorway, and then be presented with a graphical representation of the motorway, showing the colour coded average speed for each link along the motorway, and allowing the user to click through to expand the information for a particular direction and/or link.

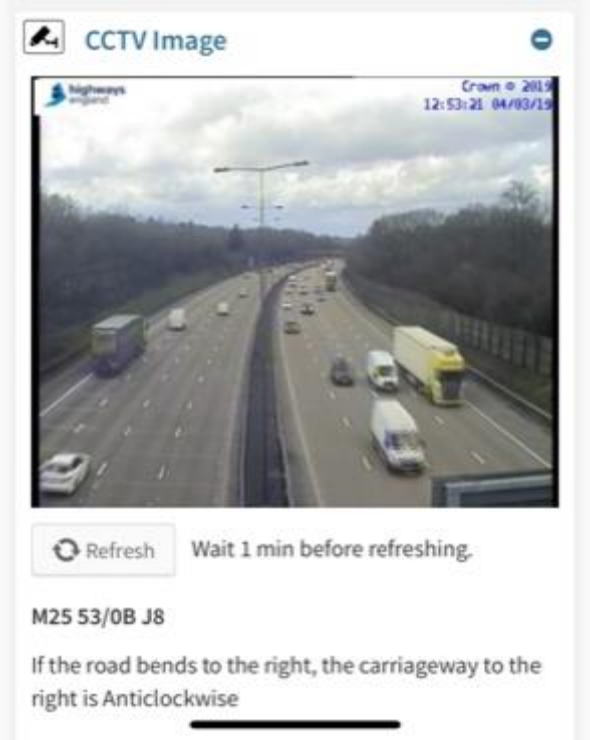


The screen shots below and overleaf illustrate the motorway flow presentation, and the information that the user can see if they expand details that they are interested in.









7.4 Highways England App

7.4.1 Overview

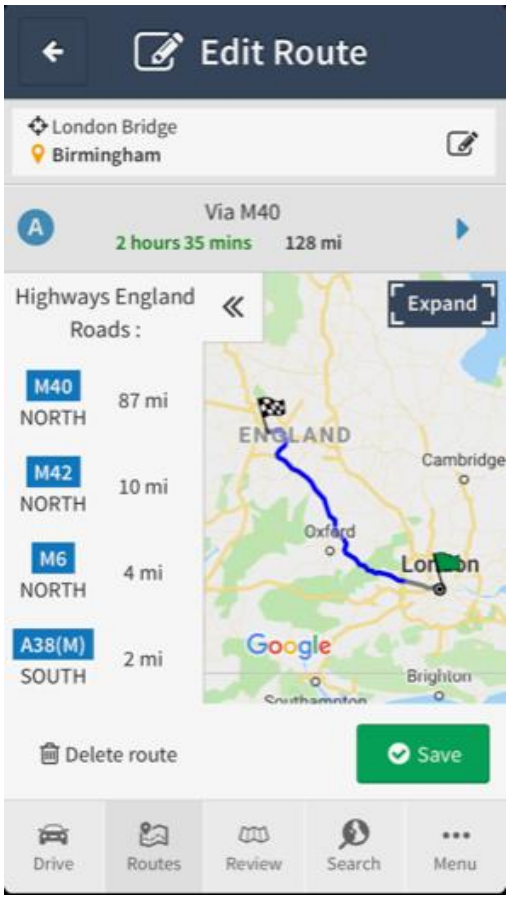
The Highways England "Live Traffic Information" app is designed to provide relevant information to road users concerning incidents, roadworks and congestion. It enables users to search for incidents local to the user (or anywhere on the motorway or APTR network), with largely the same interface as the mobile website. It serves a similar role to the Traffic England mobile version – it is not a navigation application.

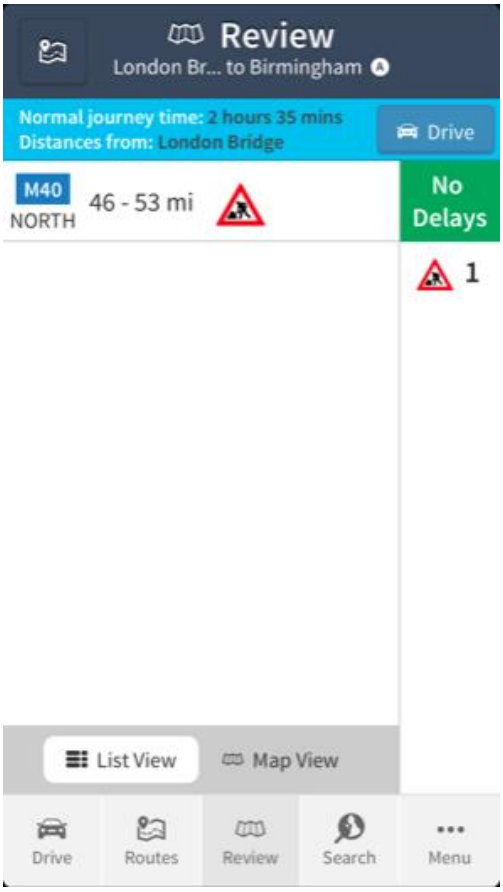
During 2018, approximately 440,000 different users of the Live Traffic Information app undertook about 3.7 million sessions on the app, resulting in approximately 23 million page views. The average session time was 3 minutes and over 90% of these sessions came from returning users.

7.4.2 Data types, attributes

Live Traffic Information uses the NTIS feed and by default receives an update of Event Data every 10 minutes (this frequency can be increased to 5 minutes if desired). As such it contains largely the same information seen on the Traffic England mobile version (described in the previous section).

However, it does allow the user to save regular "routes", and to see traffic information for that specific route (rather than being restricted to a single motorway or A road). It also allows push notifications to advise the user of the status of these routes at set desired times.

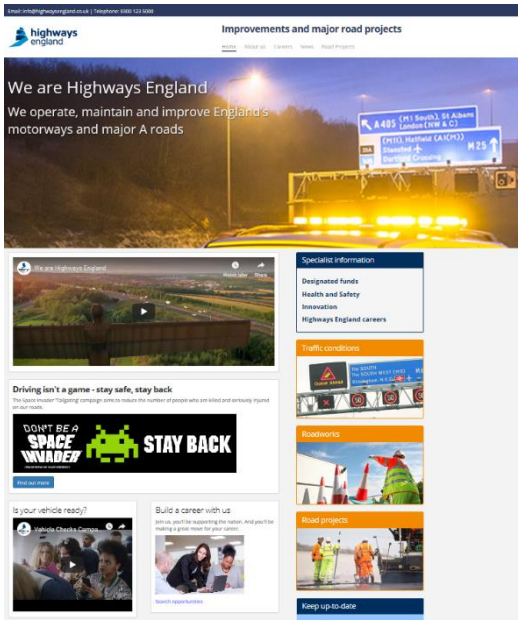




7.4.3 Data currency

The data currency is the same as for the main website. Data is updated every 10 minutes by default; however the refresh frequency can be increased to a maximum of every 1 minute.

7.5 Highways England website



7.5.1 Overview

Highways England's website caters for a variety of different information needs, such as:

- Traffic enquiries (these users are linked directly to Traffic England);
- Major scheme works and related route diversions;
- Planned investments;
- Ongoing campaigns (e.g. Space Invaders); and
- Careers enquiries.

7.5.2 Data types, attributes

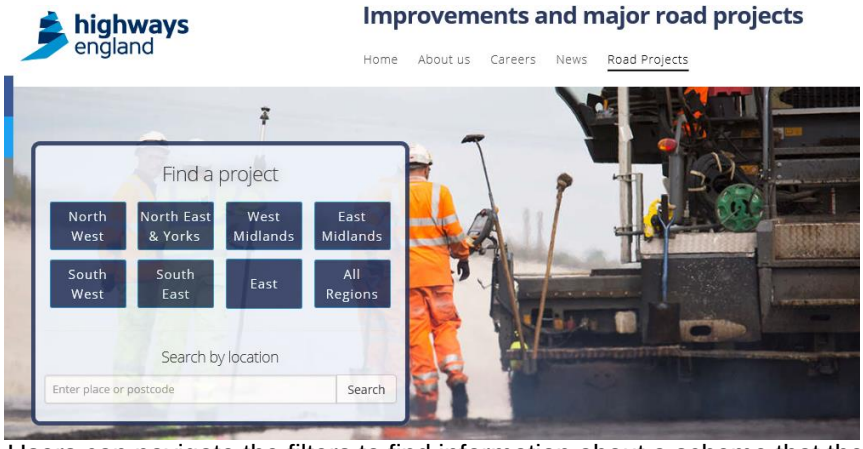
Highways England's website information is largely qualitative, relating to the above categories, and therefore does not have specific frequencies of updates, because the traffic and travel information is largely provided directly by the links to

Traffic England. There is a "breaking news" section on the home page when there is such news, which mirrors the breaking news section on traffic England, and is set by the NILO.

Major schemes have specific dedicated pages including:

- Justification for the scheme;
- Progress reports;
- Timescales;
- Consultation documents;
- Roadworks associated with the scheme (linking to data from NTIS); and
- Diversion routes.

These can be found via a search function on the "Road Projects" tab, illustrated below.



Users can navigate the filters to find information about a scheme that they are interested in. For some current schemes, diversions are indicated for specific sets of traffic management that are planned. The image below shows a diversion for an A14 closure. For other smaller schemes, the user is redirected (seamlessly) to the traffic england website.

A14 westbound J29 (Bar Hill) to J28 (Swavesey)

From: March 4, 2019 **To:** March 11, 2019

Seven night closure (9pm to 6am) Monday through Sunday

A14 eastbound J28 (Swavesey) to J29 (Bar Hill)

From: March 4, 2019 **To:** March 11, 2019

Seven night closure (9pm to 6am) Monday through Sunday

A1 northbound Buckden to Alconbury

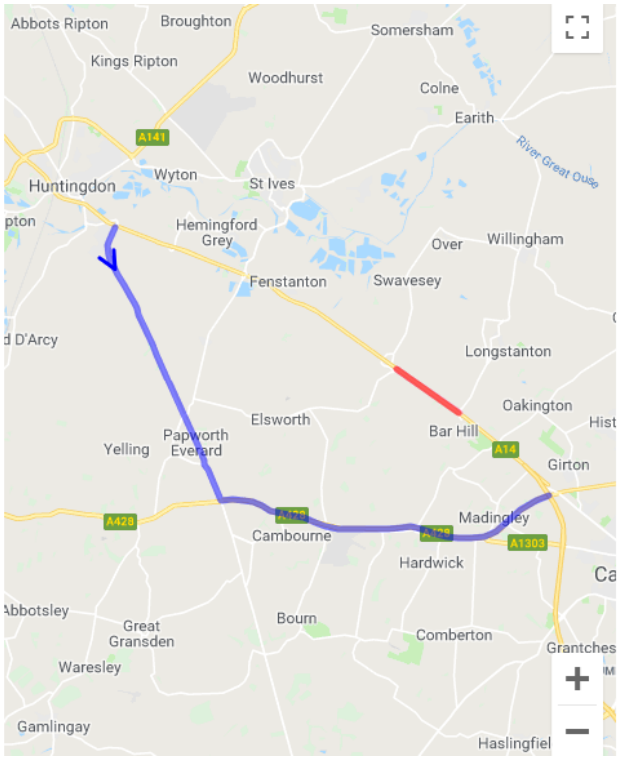
From: March 4, 2019 **To:** March 9, 2019

Five night closure (9pm to 6am) Monday through Friday

A1 southbound Alconbury to Buckden

From: March 4, 2019 **To:** March 9, 2019

Five night closure (9pm to 6am) Monday through Friday



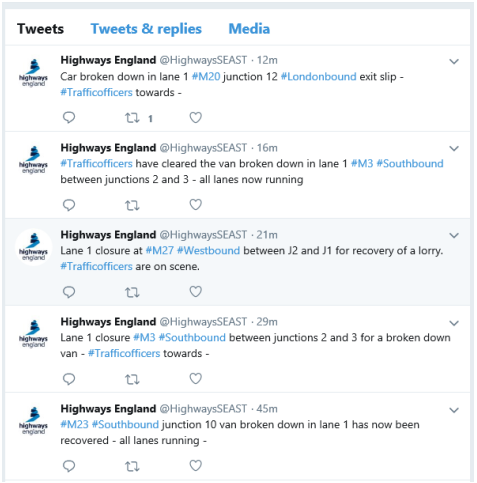
7.6 Twitter (social media)

7.6.1 Overview

Twitter has been adopted by the RCC/ROCSs in order to give incident details to the public. There are eight regional operational feeds plus a national feed used by the NILO and each is regularly updated in near-real time in order to keep people informed as to the changing nature of incidents.

7.6.2 Data types, attributes

RCC/ROCs and NILO make good use of the particular attributes of Twitter, with the short character limit encouraging the use of other ways to get the message across. This includes the use of VMS "mock-ups" to show the type of message being displayed on the road itself (e.g. "Roadworks Ahead"), CCTV images of breakdowns on the network and photographs from the scene of the incidents themselves. This makes the incidents being discussed more relatable.



The text portions of the messages are designed to be read like normal sentences, albeit with large numbers of hashtags in order for people to find messages relevant to them quickly. References to junctions alone are discouraged, with messages typically stating the name of a place associated with that junction.

Twitter messages are not limited to any particular category and will depend on what is deemed relevant to road users at a particular time. This can includes collisions, breakdowns, congestion, diversion routes, adverse weather, abnormal loads, roadworks, major events and so on.

7.6.3 Data currency

As the information submitted on Twitter is interpreted, prioritised and issued by RCC/ROC Operators (a human interface), there is no consistent duration in which messages are received at the RCC/ROC and passed on via Tweets.

7.7 NILO reports

7.7.1 Overview

NILO reports are generated by the NILO for each event that meets the definition of a NILO critical event. The main sources that NILO use are RCC logs and information from the NTIS. They combine these sources to generate event reports which are then emailed using distribution lists to a wide range of stakeholders, both internal and external. These include haulage companies, press and media organisations, and local councils. This information is also used to generate twitter and breaking news content.

7.7.2 Data types, attributes & currency

Information contained within the NILO reports is based on data within the RCC/ROC ControlWorks logs and NTIS system. Besides the time and location details, it will include other information that may add interest, for the media, for example, or that will give users more information about the cause and likely duration of the event.

7.8 Customer Contact Centre

7.8.1 Overview

The Customer Contact Centre provides road users with another means to find out about major incidents or roadworks which may affect their journey. Road users also contact the centre before their journeys for information and after them, in particular if they wish to make a complaint after incurring some form of delay. There are additional enquiries from those who live close to the SRN who may raise concerns about current or future schemes which may be impacting on their lives (e.g. via noise).

Road users can use phone or email to make their enquiries to the Customer Contact Centre.

7.8.2 Data types, attributes & currency

Information given by the Customer Contact Centre is not limited to a specific data type and will depend on the query being asked.

7.9 Syndicated data

7.9.1 Overview

A series of data fields are provided by Highways England in DATEX II format, to enable third-party providers to develop apps for road users.

7.9.2 Data types, attributes

The following forms of data are currently provided via DATEX II:

- Traffic speed and flow (via MIDAS and TMU loop-based data);
- Travel time between junctions (via ANPR);
- Network link model;
- Traffic incidents;
- Roadworks (both current and planned) – including full and partial closures;
- Abnormal loads details;
- Other congestion events not attributed to any specific incident or roadworks;
- Major organised events;
- Adverse weather warnings; and,
- Variable Message Signs and Matrix Signals locations and settings.

Full details of how to subscribe and the data available is published online and in user guides[20].

NTIS Daily Aggregated Traffic Data

All of the data that is published via the NTIS DATEX II service in real-time including incidents, VMS and Matrix Signal settings, and speeds, flows and journey times and any data not received in real-time is also made available for collection historically. Each day, the data is made available by 4am available as a compressed file from both a website or programmatically from a web service.

[20] http://www.trafficengland.com/services-info, http://www.trafficengland.com/resources/cms-docs/overview.pdf, http://www.trafficengland.com/resources/cms-docs/user-guide.pdf.

For each day, NTIS publish 3 files (Day 1, Day 5 and Day 8) each containing more complete data than the previous one, as data that was not received after Day 1 is received at a later date and amalgamated.

7.9.3 Data currency

The data fields above are updated at 1 minute frequency, with the exception of ANPR travel times and TMU Loop-based Traffic Data, which are each updated every 5 minutes, and the network link model, updated fortnightly.

7.9.4 Discussion and sensitivities

Whilst Highways England offer advice to anyone looking to use the syndicated feeds, and apply certain caveats regarding the accuracy and timeliness of all information being supplied via these feeds, there are still reputational risks present if the information sent via the syndicated feeds is erroneous, or if it is subsequently misinterpreted by such third-party information providers.

Key finding: There are a substantial number of users of Highways England's syndicated data feeds who use data to enhance their service offering to their customers. Timeliness, accuracy and an understanding of this data (including limitations) heavily influence the degree to which data is used and the extent to which the Company's important traffic information gets to as broad a number of customers as possible through third party services.

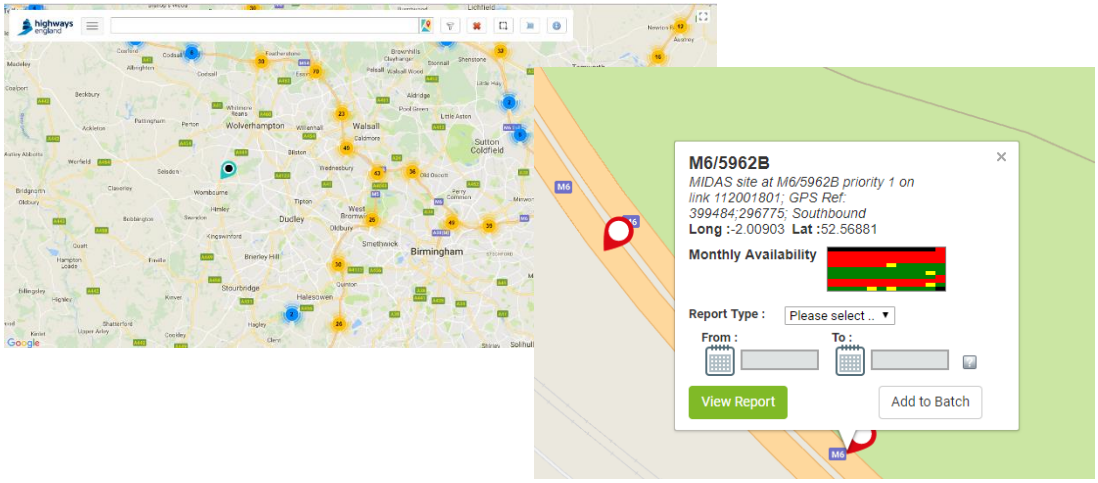
7.10 Other channels of note

7.10.1 Highway England Journey Time Database

A website[21] that allows annual stats to be downloaded by road section.

7.10.2 WebTRIS[22]

The Web Traffic Information Service allows users to extract traffic data from roadside traffic counting devices. The website indicates the availability of the devices and clearly shows the amount of missing data.



[21] http://tris.highwaysengland.co.uk/detail/journeytimedata
[22] http://webtris.highwaysengland.co.uk/

7.10.3 Highways England Trip Information System (TIS)

The system provides a database of trip records derived from mobile phone data. The database has been built by Telefónica UK (O2) and relates to all motorised road and rail trips throughout Great Britain (the UK mainland) during 2016.

The data is available for use on Highways England and Department for Transport projects via this web interface which allows users to obtain anonymised and aggregated origin/destination data for those projects.

7.10.4 HALOGEN Online[23]

HALOGEN is the central source for Highways England traffic management systems logged data.

The database logs real-time and historic data from roadside equipment across the strategic road network. Data sets include matrix and variable message sign settings, emergency roadside telephone and equipment faults, and equipment locations.

7.10.5 MIDAS Data

MIDAS traffic data is available via the MIDAS data website[24] for users with accredited access, and also via "one minute traffic data" – a viewer commissioned by the RAC Foundation[25].

7.10.6 Traffic Cameras HETC[26]

Highways England Traffic Cameras System is a national system designed to deliver live still CCTV images and video direct to the user's desktop, with access restricted to Highways England operational staff and stakeholders.

7.10.7 Direct data request

Team such as the Performance Analysis Unit and Regional Intelligence Units frequently provide information as part of FOIs, PQs and Ministerial requests as well as information to support suppliers.

[23] https://halogenonline.dft.gov.uk/halogenweb/jsp/Secure/welcome.jsp, https://sitedatatools.co.uk/Account/Login?ReturnUrl=%2F
[24] https://www.midas-data.org.uk/
[25] https://www.racfoundation.org/research/mobility/one-minute-traffic-data
[26] https://www.highwaystrafficcameras.co.uk/HETCOperational/login.jsp

8 Current baseline of traffic data and information

8.1 Summary of Highways England existing metrics and performance

In section 3, we proposed a framework for the assessment of quality of traffic data and information which includes four specific areas:

a) achieving creation standards;

b) geography and time accuracy;

c) data and information 'truthfulness'; and

d) the customer experience of quality.

Sections 5, 6 and 7 set out the current processes for the collection, creation and delivery of traffic data and information by Highways England, and the associated internal metrics.

In assessing and baselining Highways England's quality of traffic data and information we have been able to capture the current relevant internal data creation standards and, to a lesser degree, the geography and accuracy of provision. The data below shows how the company currently performs against the creation standards, and geography and time accuracy it sets itself. These performance metric relate to:

- *Network conditions* – the constant measurement of traffic flow and speed and travel times across the network, to check for abnormalities that might indicate an event is occurring;
- *Event data* – the creation and dissemination of data and information about any unplanned event that occurs on the network such as accidents, incidents or congestion, and,
- Roadwork data – the creation and dissemination of data and information about works that are planned to take place on the network, both in advance of the works taking place and during the period that they are active.

All NTIS performance measures are a monthly average from July to December 2018. The method of calculating some of the performance measures changed in July 2018.

8.1.1 Network conditions measurement

Availability of Traffic Monitoring units – The availability and performance of the roadside technology that is used to collect flow, speed and travel time data is recorded annually within Highways England's year-end Performance Monitoring Statements.

For the most recent year (2017-18) a figure of 98.4% was achieved; this is below the previous year's baseline figure, which is used as a target, of 98.79% derived from the Performance Specification.

Availability of the "virtual patrol network" – this is the NTIS data created by fusing data from Highways England's traffic monitoring units and from in-vehicle sensors:

- NTIS Performance Measure 14.1: overall availability of data – 98.50% achieved, which is below both target and threshold for penalties to the contractor (target 99.5%, threshold 99.0%); and
- NTIS performance measure 14.2: measures gaps in availability of more than 10 minutes, i.e. outages that will impact customers more. As such this sub-measure has a more stringent target than PM14.1 – 98.4% achieved, again below target (target 99.9%, threshold 99.5%).

Validation of Journey time data – this compares processed journey times against actual route times taken from ANPR cameras, to a specific agreed methodology[27]. The measure calculates the number of outputs passing validation as a percentage of the number of outputs published:

[27] TDN Percentage of published outputs passing validation (WA 119-08-007-002-08-51)

- NTIS Performance measure 13.2 – 96.97% validated, which is below the 97% target, but ahead of the 95% threshold for penalties to the contractor.

8.1.2 Event data

Highways England monitors the time taken by their RCC/ROC Operators to set, update and remove signs and signals following notification. They have targets of 3 minutes to set initial signals, and 2 minutes to update or remove signals respectively, following notification.

The following percentages of signs and signals were set within these target times, for each RCC/ROC, during the month of January 2019:

SOUTH WEST	SOUTH EAST	EAST	EAST MIDLANDS	WEST MIDLANDS	NORTH EAST	NORTH WEST	NATIONAL
82%	76%	78%	79%	81%	80%	68%	78%

Table 2 Percentages of signs and signals set within target times

Average publication time of current events: NTIS are monitored to measure the average time it takes an operator from first opening the dialogue box in their system to the time when the event is published to users, and for the time from updated information being received to it being published in the Event report:

- NTIS performance measure 7: time to create the event - 1.14 minutes achieved, faster than the 2 minute target
- NTIS performance measure 8 – the percentage of events updated within 2 minutes: 98.02% over the 98% threshold for penalty, but behind the 99% target.

Average error on estimated time to return to profile: NTIS are measured on the quality of the data that they give out about the likely delay associated with an event using an agreed process. This looks at events lasting over 1 hour which have a return to normal time published at the mid-way point of the event, and calculates the percentage error on the return to normal times

- NTIS performance measure 17 – 35.49% achieved, just below 35% target, but ahead of 50% threshold.

Average time between current event update and publication of strategic response - NTIS are measured on the time that it takes for an operator to set a strategic response (to choose whether to sign for a diversion on VMS, or whether to give information on events only, for example) from when the information is first received.

- NTIS performance measure 19 – average time to set a strategic response - 2.49 minutes achieved, against 5 minute target.

8.1.3 Roadworks data

Accuracy of advance information: Highways England has been monitoring the percentage of complete closures due to roadworks which are reported by 1pm on the day and go ahead as planned, for the past 9 months. These results are presented by Region and are as follows:

	SOUTH WEST	SOUTH EAST	EAST	EAST MIDLANDS	WEST MIDLANDS	NORTH EAST	NORTH WEST	NATIONAL
Jun-18	91%	86%	59%	74%	90%	82%	89%	84%
Jul-18	95%	78%	81%	85%	92%	91%	83%	85%

	SOUTH WEST	SOUTH EAST	EAST	EAST MIDLANDS	WEST MIDLANDS	NORTH EAST	NORTH WEST	NATIONAL
Aug-18	93%	88%	91%	75%	89%	84%	85%	86%
Sep-18	87%	67%	78%	67%	86%	74%	57%	79%
Oct-18	94%	84%	85%	73%	95%	73%	67%	75%
Nov-18	88%	80%	89%	68%	86%	70%	77%	78%
Dec-18	85%	79%	93%	79%	84%	79%	87%	83%
Jan-19	84%	85%	96%	79%	86%	83%	76%	83%
Feb-19	83%	82%	95%	84%	87%	85%	85%	85%

Table 3 Percentage of complete closures due to roadworks reported by 1pm

Highways England has set itself a target of 90% accuracy by this measure. The national accuracy for February 2019 was 85%.

However, the roadworks data that is currently shown on Traffic England and other related NTIS channels, including the DATEX II feeds, has lower quality than the statistics reflected by this measure, because it covers all roadworks types (not just closures) and as mentioned in section 6.2, it is subject to loss of data quality due to the difficulty in translation between the NOMS and NTIS network models.

Timely update of details: Any change in status relating to a set of 'live' roadworks should be updated in NOMS (the Network Event Management (NEM) module), within 5 minutes of it occurring. NOMS has 6 internal KPIs associated with the timeliness of each type of data entry in relation to roadworks. These are measured on a per Area basis. The table below covers the year from March 2018 to February 2019.

	UPDATING NEM FOR STARTS (KPI1)	UPDATING NEM FOR STOPS (KPI2)	OVERRUNS (KPI3)	POSTPONEMENTS (KPI4)	CANCELLATIONS (KPI5)	NEM NOT UPDATED (KPI6)
Area 1	88%	89%	76%	100%	67%	94%
Area 2	89%	89%	67%	100%	53%	88%
Area 3	96%	98%	77%	94%	90%	93%
Area 4	84%	86%	88%	91%	81%	90%
Area 5	92%	95%	40%	96%	82%	97%
Area 6	95%	95%	73%	96%	84%	100%
Area 7	85%	88%	71%	73%	32%	92%
Area 8	95%	95%	61%	96%	78%	100%

	UPDATING NEM FOR STARTS (KPI1)	UPDATING NEM FOR STOPS (KPI2)	OVERRUNS (KPI3)	POSTPONEMENTS (KPI4)	CANCELLATIONS (KPI5)	NEM NOT UPDATED (KPI6)
Area 9	98%	94%	79%	92%	80%	100%
Area 10	92%	88%	86%	94%	56%	100%
Area 12	97%	97%	86%	99%	89%	99%
Area 13	96%	95%	81%	98%	76%	100%
Area 14	94%	93%	89%	94%	88%	87%

Table 4 NOMS internal KPIs

8.1.4 Summary of metrics

The table below gives a summary of the above metrics, targets and the actual achieved values. The red text indicates measures where the actual performance is well below target.

AREA	MEASURE SUMMARY	TARGET	ACTUAL
Network conditions measurement	Availability of traffic monitoring units	>98.79%	98.4% (2017-18)
	Availability of the "virtual patrol network" data	>99.5%	98.50%
	Availability of the "virtual patrol network" gaps in data	>99.9%	98.4%
	Validation of journey time data	>97%	96.97%
Event data	Percentages of signs and signals set within timescales	>93%	78%
	Average publication time of current events time to create the event	< 2 minutes	1.14 minutes
	Average publication time of current events updated within 2 minutes	>99%	98.02%
	Average error on estimated time to return to profile	<35%	35.49%
	Average time between current event update and publication of strategic response	<5 minute	2.49 minutes
Roadworks data	Percentage of complete closures (accuracy)	>90%	85%
	NOMS internal KPIs	*100%*	Range from 32% to 100%[28]

Table 5 Summary of metrics, targets and actual achieved values

[28] Dependent on KPI and Area

Highways England broadly meets its own creation standards, with most of these metrics being at, or just below, target. There are two notable exceptions. Firstly signal settings, where only 78% of events have signals set within the target 3 minutes for initial settings and 2 minutes for updates. This is part of a measure for which 93% performance is expected.

The second is roadworks data, where only 85% of complete closures go ahead as reported at 1pm the night before, using the new metric (the accuracy reported via Traffic England is lower) and there is variable quality in terms of timely updates to the NOMS system.

These metrics are an important measurement for the creation standards and the geography and accuracy of traffic data and information provision. They represent a means by which the company can continue to assess performance and provide a current baseline in the delivery of traffic information and data.

The remainder of this section goes on to review gaps in the way that Highways England measure the quality of its traffic information and data provision, and to provide a comparison of Highways England's performance against other road operators.

8.2 Highways England – quality measurement coverage and gaps

As mentioned in the previous section, the measures available cover data creation standards and, to a lesser degree, the geography and accuracy of provision. It is much harder to make an assessment of the customer's experience of quality. Highways England measure customer satisfaction, but this is a coarse measure, and cannot be tied to any specific aspects of traffic information, and may be influenced by journeys that are not on the SRN.

The Traffic Information Strategy was written in 2016 and, as noted in the 2018/19 Delivery Plan, will be subject to further updates. Whilst the policy, commitments and approach to the delivery of traffic data and information at a strategic level are clear, it is less clear from the Strategy how these will be enacted, delivered and measured, especially in relation to the customer.

Key finding: The Traffic Information Strategy provides a high level statement of commitments but limited definition of how these commitments will be delivered to the customer.

Recommendation 1: The Traffic Information Strategy should set out Highways England's traffic data and information requirements and commitments, and should be reviewed annually.

There is a gap in being able to demonstrate how the processes set out in sections 4 to 7 deliver on the above commitments. For instance:

- Whether customers have access to the door-to-door journey information they need;
- Understanding whether customer needs are being fully met;
- Determining whether the correct balance between data collection and information provision has been established; and
- Whether collaboration with information providers is reaching as wide a customer base as possible.

Equally, there is an absence of the metrics for Highways England to assess the extent to which these commitments are being met. For instance, whether increased collaboration with third party data providers has resulted in delivering relevant traffic information to a wider customer base. It is therefore difficult to create a baseline of Highways England's current position against delivery of the strategy.

Key finding: There is no current defined mechanism for how Highways England should measure its commitments and outcomes for customers as set out in the Traffic Information Strategy.

Recommendation 3: Highways England should develop a set of high level outcomes, in line with its strategy, that can be achieved through better traffic data and information and then measure the extent to which these outcomes are delivered.

Whilst the Traffic Information Strategy is customer-led, the definition of exactly who the customer is not fully clear. This matters as the strategy, objectives, resulting approach and delivery will be very different for different customer types. For example, an existing information provider may value planned data and information over incident or current travel time. This may be a result of scarcity of that data, with the information provider able to acquire their own real time information but not the planned disruption traffic data and information held by Highways England. The reverse is almost certainly true for the atypical commuter whose interest is very much about their current journey and so values much higher current travel time or delay information.

Key finding: There is an absence of a definition of the customer or customer groups in the Traffic Information Strategy, the priority of these customers to Highways England and an acknowledgement that different approaches may be required for these different customer groups to meet policy objectives.

Recommendation 2: Highways England should create and agree a clear definition of the most important customers for traffic data and information.

Whilst reference is made to the value of Highways England's data and information, no distinction is made to which data and information is most valuable to whom and at what point. As a result of this, all data and information is given equal weighting and this impacts on the delivery of information to customers who will value certain data over other data depending on circumstance. Equally, it is not clear what data and information is of the greatest value to Highways England (in achieving the objectives set out in the Licence, for instance) and which should therefore receive the largest focus, attention and promotion.

Key finding: A better understanding of data and information value data can help Highways England to decide where to focus resource. This evaluation should consider the value that customers ascribe to different data and in doing so help prioritise importance.

Recommendation 5: Highways England should better understand the relative value of its existing traffic data and information, both for its own business and to customers.

The value of data can take a variety of forms, but there is evidence from other transport agencies of the considerable economic and social value of transport data[29]. This has led, in the case of TfL for example, to better understanding the positive outcomes that can be delivered to customers, road users, businesses and the organisation itself. In quantifying the value of transport data, TfL have been able to focus on further areas of improvement, provided economic justifications for undertaking these improvements and developed closer working relationships with the consumers of their data. The strategy does not clearly define the line between the delivery of data and information on Highways England's owned channels (e.g. web site, app) and provision of this data to traffic information providers.

As outlined above, one key measure of the quality is how the customer experiences data and information and this is influenced by where and in what context they consume this. For instance, whether that is pre or during a journey. It is, however, a critical measure of success, especially when the Traffic Information Strategy is customer-led. Moving toward a model where the customer experience can be better understood and responded to requires considerable change in organisational processes that can be shaped by overarching customer information strategies, similar to those implemented by other organisations[30].

To address this further a *Study of road users' perceptions of traffic information*, let jointly by Transport Focus, Highways England and the Office of Rail and Road, was commissioned in late 2018 and will more closely address customer experience and expectation of traffic information. There are also a number of initiatives within Highways England that are seeking to address some of the points we have raised in this section.

Key finding: The customers' experience of information affects the quality of traffic information. Whilst this is complex outcome to achieve and measure with many influencing factors, end-to-end processes that are driven by the imperative to best achieve customer satisfaction, trust and relevancy will likely better deliver higher quality information.

Recommendation 7: Highways England should review its culture and processes to ensure that delivery of customer information is considered at all stages of network operation, and that incentives and KPIs reinforce this.

Although a detailed assessment of the customer experience of quality is beyond the scope of this study, through stakeholder liaison and a parallel benchmarking against comparators, some themes have emerged and these are covered in the next section, and in section 9.

8.3 Comparing Highways England with other road operators

8.3.1 The provision of traffic data and information by other road operators

By examining the provision of traffic data and information, current quality metrics and performance of suitable comparators, it is possible to create a baseline of Highways England's current position within the (road transport operator) market. The current data and information offering of other road transport operators, including TfL, Transport Scotland, Transport for Greater Manchester and the National Transport Authority (Ireland), is presented below.

[29] Assessing the value of TfL's open data and digital partnerships, Deloitte, 2017, http://content.tfl.gov.uk/deloitte-report-tfl-open-data.pdf

[30] TfL Customer Information Strategy http://content.tfl.gov.uk/sasp-20160310-p1-item13-customer-information-strategy.pdf

Through a benchmarking exercise we have reviewed a number of specific but key functions of Highways England in the creation of traffic data and information against industry good practice and processes that are viewed as having achieved successful outcomes.

In completing stakeholder liaison, especially with UK road operators, there was a clear view that Highways England are considered to be a leading road operator in the field of road traffic data and information provision, the quality of this information and in processes to assure and improve quality. We have therefore looked to make specific comparisons with two organisations in the public transport/rail industry.

Key finding: Highways England is considered by many organisations and third parties to be a leader in traffic data and information and the adoption of processes to assure quality and improve quality of information.

Tables in Appendix 2 and 3 present the digital traffic data and information currently provided by a number of road transport operators and the owned channels that are used for dissemination of this data and information. We have focussed on the type of data and information that is the subject of this investigation as outlined in section 2.1.2.

These road transport operators are:

- **Transport Scotland** - the national transport agency for Scotland providing data through their Traffic Scotland service.
- **Transport for London** – the local government body responsible for the transport system in Greater London and providing traffic information on sections of the road network in the capital.
- **Welsh Government** – delivering a traffic information service for the motorway and trunk road network through the Traffic Wales service.
- **Rijkswaterstaat** - ministry of infrastructure and water management providing traffic information on the Dutch road network.
- The **Association of French Motorway Companies (ASFA)** - professional association operation and traffic information on the French motorway concessions.

There are some noteworthy points that result from this comparison:

- The extent of the Highways England offering, both in terms of traffic data and information and the number of (digital) channels, compares favourably is broader than other road operator comparators;
- Highways England provide more syndicated data than other comparators and greater levels of completeness and network coverage. The exception is Rijkswaterstaat who provide a similar level of syndicated data; and
- The focus for Rijkswaterstaat appears to be on the syndication of data rather than on a broad extent of traffic data and information and provision across multiple channels. Indeed, the Dutch and French examples provide few owned channels.

Across the EU, there are multiple examples where countries have developed National Access Points, and are now using these to collect and distribute safety related traffic information (SRTI) and real-time traffic information (RTTI) services via DATEX II.

Key finding: Evidence from the EU suggests that there is more emphasis placed by road operators on the syndication of traffic data rather than the provision of owned traffic information services.

The Netherlands has the National Data Warehouse for Traffic Information (NDW), whilst Austria, Denmark, Finland, Germany, Portugal and Sweden (as well as Norway) have also delivered National Access Points in relation to these information types. The existence of these National Access Points results from a number of EU traffic information initiatives that are discussed further in section 10.2.

Key finding: Highways England current offering of traffic data and information is broader than other road operator comparators.

8.3.2 Traffic data and information quality assurance in other transport operators

In general there is an absence of specific metrics and measurements (and performance indicators) relating to the delivery of traffic data and information amongst the other road operators in the UK. Policy and strategy documents provide statements and commitments in relation to the quality of traffic information such as:

"*Providing the information travellers require to plan their journey, mode of travel and timing to maximise the efficiency of the road network*." Future Intelligent Transport Systems Strategy, Transport Scotland.

For other organisations the provision of traffic information is a commitment to customers articulated in customer information strategies and commitments to address customer need and improve levels of customer satisfaction. [31] In this case, traffic (travel) information forms part of a much wider service provided by the transport operator to their customers.

Key finding: Transport information is increasingly viewed by transport system operators as part of the much wider *customer strategy* which is leading to greater emphasis on delivering information to better meet customer needs and address customer pain points.

For most road transport operators, the accuracy of traffic information and data (such as incidents) is primarily assured through a number of operational processes focussing on the creation of this content (e.g. the input). These include:

- Operational control room validation and verifications processes and procedures;
- Validation of events from detected from network infrastructure sources (e.g. through traffic/incident management system) with traffic cameras and CCTV where available; and
- Levels of agreed control room activity to validate information from other sources such as police and traffic information officers.

For road network condition data such as travel time, flows and speed, there is evidence that the accuracy is assessed at different times and across different geographies:

- For travel time data, some organisations undertake drive validation exercises to measure the accuracy. This is often undertaken when new infrastructure is deployment allowing for the extension of network coverage or after systematic changes to algorithms used to calculate the travel times;
- Data and information quality and accuracy tests are done on an ad hoc basis and often during and after large build schemes assessing data such as queues and travel times;
- Delay data resulting from incidents and roadworks has been created by delay modelling tools although not always widely used; and
- Periodic origin and destination data assessments are completed examining the coverage and extent of traffic data and information on given routes.

[31] TfL Customer Information Strategy http://content.tfl.gov.uk/sasp-20160310-p1-item13-customer-information-strategy.pdf

Considerable effort is directed to ensuring that the processes of detection and creation of traffic data from management systems are completed. This includes verification of algorithms, validations of processes and extending the capabilities of systems to self-verify and validate data. Where there are contractual arrangements for the operation and management of the road network, an expectation and requirement exists for the contractor to complete much of the quality assessment. In the case of London, for instance, the city is divided in four monitoring areas with four dedicated monitoring teams.

Increasingly, road operators are consuming and using data from other sources to detect incidents, inform operational decisions and then publish traffic information to customers. In at least one of these cases, the creation of **all** incident information that results from these sources is validated by a secondary source (typically CCTV) prior to publication. This approach has also been extended to **all** roadworks where verification of the commencement and completion of works against scheduled times and resulting traffic conditions is undertaken and data and information updated accordingly.

Key finding: Road operators are increasingly seeking data from third party sources to help them better detect, inform decisions and provided information to customers. In some cases there external data sources are replacing and superseding existing detection systems.

Many operators have processes to receive, investigate and validate customer and road user feedback received through a variety of channels (e.g. social media, contact centres) but were not actively involved with a regular assessment of their customer's experience of traffic data and information.

8.3.3 Emerging themes and trends from road operators

There are a number of themes and trends worthy of note in relation to traffic data and information provided by road operators:

- There is an increasing focus on the relationship with customers, both end users of the network and those organisations consuming and repurposing data. This appears, in some cases, to have resulted in organisations re-assessing or re-evaluating their role in the provision of traffic information.
- There are an increasing number of relationships being established with third party traffic data providers for the road operators to obtain traffic data such as incidents, journey times and delays. This data is being used by the road operators to validate existing data, enhance the customer information or inform operational management.
- These relationships are also extending to agreements for the delivery of traffic information via third party digital platforms to road users. For instance, sending specific and relevant messages to regular road users in areas affected by major planned roadworks. In this context, some parties raised some concern about the accuracy of third party data and the level quality and accuracy especially for use in an operational control environment.

Key finding: Road transport operators are re-evaluating how best to deliver services and data to customers. Increasingly this is focussed on the role of third party service providers and reaching customer through their channels.

Recommendation 11: Highways England should elevate the role that third party traffic data consumers, aggregators and traffic information providers play in delivering Highways England policy objectives, and consider whether formal relationships should be used to achieve this.

- A greater focus on the customer and the resulting questions over the role of the road operator appears to be leading organisations to focus on their core traffic data and information offering rather than providing a breadth of other related information (e.g. weather, event information). This in part is leading to further efforts (and the freed resources) to focus on improving the quality of core data.

Key finding: Transport operators are increasingly focussing on understanding and prioritising their key offering, what they provide that is unique and what model of delivery works best for traffic data and information to most economically deliver policy objectives.

Recommendation 5: Highways England should better understand the relative value of its existing traffic data and information, both for its own business and to customers.

- The growth in channels through which traffic data and information is available, explored in section 3.1, the increasing ubiquity of these services on channels and platforms (e.g. mobile devices, in car) and budget constraints, is leading organisations to assess the variety of channels through which they deliver traffic data and information to customers. For instance, with third parties now dominating the market place for journey planning and navigation, coupled with their reach to customers and coverage of all road networks, organisations are questioning whether there is a need for travel and journey planning applications to be delivered by the road operator.
- There are very few relationships between national and large road operators and local authorities and councils to share traffic data and information.

Key finding: Customers and consumers of traffic data and information have a requirement for end-to-end journeys that include local and national roads. There are currently very few relationships between national and local road operators that result in a shared offering to these customers.

Recommendation 12: Highways England should continue to work with other highway authorities, and consider taking a leading role in delivering network operation across the UK.

Section 9 now goes on to present the findings from our discussions with the wider stakeholder group.

9 Stakeholder review and analysis

9.1 Stakeholder groups consulted

We have identified a large number of stakeholders in consultation with key contacts within ORR, Highways England and across the roads sector. These are across a number of categories:

- Policy makers and governing bodies;
- Other national road agencies;
- Local highway authorities;
- Other transport operators;
- Data re-users and road information service providers;
- Industry experts and interest groups;
- End-users of information, broadly split into:
    - Freight and logistics; and
    - Car drivers.

The following sections describe the key relevant themes and views from these groups.

9.2 Policy makers and governing bodies

Key policy drivers – these stakeholders feel that the road network is the key component of the overall UK transport network and is vital to the efficient and effective operation of the country and its economy. There is an expectation within this policy regime that there will be more, better and relevant information presented to end-users to improve their mobility and to improve the efficiency of the transport network. The overall policy framework is captured in strategic DfT policy documents and carried through to Highways England information policy, and its delivery and effectiveness is overseen by the ORR. In addition to the general economic and social aspects of the policy framework, there are other key drivers such as the *Open Data and Transparency* requirements that facilitate data sharing and the promotion of third-party information service providers.

Relationship with local highway authorities – this is seen by these stakeholders as a key aspect in the delivery of overall policy objectives for the whole road network. The SRN, although carrying large volumes of traffic, notably freight and logistics, only comprises a small proportion of the total road network in England and few, if any, journeys start and finish on the SRN. End-users do not recognise, or probably care about, the ownership of different parts of the network and therefore their satisfaction with information provided about the condition of the road network will depend on the effectiveness of the interface between all the road authorities. There are a number of current initiatives in this area including *Street Manager*, covering roadworks and traffic management orders, and the *Roads Data Repository* providing a *National Access Point* for roads data. Highways England will be expected to be a key player in each of these initiatives.

Recommendation 12: Highways England should continue to work with other highway authorities, and consider taking a leading role in delivering network operation across the UK.

Data and information obligations – in addition to the Open Data and Data Sharing obligations set out above, these stakeholders expect that the data and information produced by Highways England should conform to the appropriate national and international standards and guidelines. These are captured in a number of documents such as those covering road signs and the *Design Manual for Roads and Bridges*. The obligations and the means of adherence and measurement should be covered in the Business Plan and the Information Policy and be included in the published KPIs and the relevant Road Investment Strategy documents.

Recommendation 1: The Traffic Information Strategy should set out Highways England's traffic data and information requirements and commitments, and should be reviewed annually.

Recommendation 3: Highways England should develop a set of high level outcomes, in line with its strategy, that can be achieved through better traffic data and information and then measure the extent to which these outcomes are delivered.

Third party interactions – stakeholders feel that these should be related to the needs and the preferences of the end-users and should be prescribed in their application. There should be no preferential treatment of individual third-parties and, where possible, the same information should be provided to all recipients that wish to receive it. This interaction should apply to re-users of Highways England data who provide information services and also to data sources to supplement those already available to Highways England.

Future policy and improvements – policy makers feel that the key is to get the basics right before considering other potential areas of improvement; this would include roadworks, diversionary routes, events and contingency planning as well as effective, transparent processes. This would result in the information services (and basic roadside equipment such as signs and VMS) having very high levels of trust and believability. Increasingly, the data and information service provision should be customer-driven and should demonstrate high levels of accuracy and usefulness. As part of the overall information provision process there should be clear target levels, easy measurement metrics and the development of services should show pace and ambition.

9.3 Other national road agencies

Emerging themes and trends have already been covered in section 8.3.3 above. Stakeholders commented on Highways England's current provision of data and information:

- Highways England is generally thought to be the benchmark standard;
- The process is driven by the larger initiatives and investment;
- Highways England generally has well instrumented roads that enable high quality information;
- The other national agencies tend to compare themselves with each other rather than with Highways England; and
- The national boundaries are important and the exchange of information between the relevant Control Centres matters.

9.4 Local highway authorities (LHA)

Current Provision of Information – again much of the local highway authority stakeholder discussion revolved around the current data provision and emerging themes and trends that have been discussed in section 8.3.3. Stakeholders also commented that provision of traffic information by local highway authorities is relatively limited and that whilst there were some good exemplars within the local sphere, these do not cover all roads, all drivers and all time periods. The current publication of information is reasonable but there are large areas that could be improved, including the interfaces between Highways England and Local Authority roads.

Relationships between Highways England and LHAs – stakeholders feel that there are often good relationships between Highways England and the local control function such as between Hertfordshire and the South East RCC, but the hours of opening are different between the organisations. This leads to questions about how to handle "out of hours" and whether there should be arrangements to cover all time periods. There is also a discussion about the relationship between Highways England and LHA contractors.

Key finding: There is considerable scope improvement in the (data) interface between Highways England and local highway authorities that include the exchange of information and operational agreements. Improving these interfaces may help Highways England achieve policy aspirations such as 'door-to-door planning' for customers.

There are some regular relationships between Highways England and LHAs such as Quarterly Liaison Meetings and stakeholders suggested that the North East region provides an exemplar for such relationships. In any event there need to be structured relationships between the parties that ensure there are effective processes for the passing of information and arranging appropriate actions.

Planned and unplanned disruption – stakeholders felt that there are examples of good practice but also poor examples, and these may be most marked when related to network disruptions. In the event of a blockage of the SRN, the managing agents are prone to implement diversions without recourse to the local highway authority and this has resulted in severe congestion in the surrounding area. This may be worsened should there be issues such as roadworks on the local road network. Stakeholders reported that roadworks are generally e-mailed between Highways England and the relevant LHA immediately prior to the works and this information is also available from the ELGIN website. With regard to incidents, they report that the information provided by Highways England is generally better than that from LHAs as it is more context specific and more likely to influence driver behaviour and compliance. There is also greater validation of information by Highways England and therefore it is likely to be more accurate and complete.

Sharing of information between Highways England and LHA – local authorities see some Highways England data as very important to their operational activities, this includes:

- Flow data (MIDAS, TAME & TMU);
- Control incident data; and
- Traffic management strategy.

Key finding: Local highway authorities are a significant user of Highways England data and should be considered as a key customer group.

Some local authorities that re-use Highways England data presume the data to be of good quality because it is produced by Highways England rather than due to any measurement of quality. Information from smart motorways will be very important in the future and could have a significant impact on the adjoining local authority network. There are also future opportunities for sharing third party data such as that produced by mobile phone companies and other tracking organisations.

Future priorities – the local authority stakeholders generally considered that the focus should be on dealing with third parties rather than continuing to expand or improve owned channels, although these may continue to co-exist. There should be a focus on data quality, publication of data and collaboration between agencies and traffic information providers.

Local Highway Authorities stakeholders feel that they need to work together and with Highways England and there needs to be a total network view, perhaps led by Highways England. There also needs to be an end-user focus and the key deliverables should be to achieve driver and freight (customer) outcomes.

Key finding: Local Highway Authorities and organisations such Transport for Greater Manchester are increasingly focussing on acquiring data from third party providers. Whilst they continue to consume and value data from Highways England, this data is being merged with and used alongside other sources that cover both local and national roads.

Recommendation 12: Highways England should continue to work with other highway authorities, and consider taking a leading role in delivering network operation across the UK.

9.5 Other transport operators

The stakeholders from the rail industry and the public transport side of Transport for London were chiefly contacted as part of the benchmarking exercise into planned and unplanned disruptions to the network in the form of rail possessions and public transport incidents. This is covered in section 10.3.

In the course of the workshops however, the subject of relationships between the road sector and other modes was raised and it was felt that this was not currently a high priority but would have some use, notably with long-distance rail operators. Stakeholders felt that in metropolitan areas and within cities there was a move towards multi-modal control centres and that traffic information from all agencies was a vital part of this development.

9.6 Data re-users and road information service providers

This is a large and diverse stakeholder group that includes intermediaries, end service providers and also increasingly data providers, each of which may be members of one or more of these sub-groups. It is also a group that is assuming increasing importance in the overall process of collecting and processing data and in providing the information services that end-users consume and that influences their travel behaviour and hence experience.

Nature of digital interface with Highways England – this generally involves access to a number of Highways England data sources that may be via the Open Data arrangements on data.gov.uk or via Highways England sources directly. Although this is defined as the digital interface and the vast majority is via electronic channels (there may be telephone contact on occasions) the content of the interface may be more analogue in nature such as press office tweets that provide journalistic-type input into systems.

There was a view that the digital interface with Highways England was driven by the availability of access to existing Highways England systems and whilst this was understood and seen as a reasonable approach, it contrasted with the approach elsewhere, notably with Transport for London, where a single consolidated interface was provided, that also fed the systems provided by TfL, thereby assuring a "single version of the truth."

In contrast, re-users felt there was a need to undertake significant work to de-duplicate multiple information sources and create a definitive version. The lack of a single, definitive, trustworthy source was raised by a number of parties in relation to roadworks, major schemes and delay monitoring.

Key finding: Significant work is undertaken by third parties to de-duplicate and merge different data provided by Highways England before it is re-used within and to support third party systems and traffic information services.

Recommendation 11: Highways England should elevate the role that third party traffic data consumers, aggregators and traffic information providers play in delivering Highways England policy objectives, and consider whether formal relationships should be used to achieve this.

A number of service providers were unclear what data they receive from Highways England, either because they left that decision to a data aggregator or they took derived data from a third party source. This could commonly be via an organisation such as INRIX for traffic conditions or ELGIN for roadworks. End user service providers generally assumed that Highways England information would be of good quality but had no direct measurement with their own service provision.

Key finding: Highways England traffic data forms part of a much wider eco-system of data provision with some organisations consuming without being aware, or concerned with, the fact it may have originated from the Company.

This data re-use and aggregation is generally seen as a good model and is likely to flourish and increase in importance, however the role of Highways England as the source of some important facets of the data was stressed, including:

- Incident description and location;
- Causal information;
- Diversion routes;
- Queue lengths and potentially duration;
- Context in wider network terms;
- Alternative routeing advice;
- Customer credibility; and
- Sentiment and re-assurance.

Key finding: There are a number of data currently not published by Highways England that third party data aggregators and service providers value considerably: these include temporary speed limit data, diversionary routes, data and information on the causes and consequences of planned and unplanned disruption.

Recommendation 8: Highways England should focus on providing greater detail within existing data types and should categorise the impact of traffic events on road users.

Nature of human and organisational interface with Highways England – generally there are no formal agreements between Highways England and third parties unless a specific service is procured and provided. This mirrors the arrangements for open data and sharing of information,

however, it is probably at odds with the move towards assurance of third party information services in terms of end-user receipt of safety-related and real-time information as foreseen in the ITS Directive.

There is no single view amongst third parties regarding the desirability of more formal agreements with concerns over potential obligations and restrictions being countered by the advantages of sharing expectations and the surety of ongoing service/access provision. The principles behind Traffic Management (TM) 2.0 were raised by stakeholders with exposure to wider European markets and that this is based on collaboration and the voluntary sharing of expectations and obligations.

The issue of multiple contacts within Highways England was raised by some parties, with up to 13 different contacts being referenced by one SME, reflecting the area and divisional nature of Highways England operations, whereas others had a single point of contact, at least initially, although this could be subject to a rapid turnover of staff.

Views on current Highways England data and information provision – there is a view that Highways England have prioritised major works and information about these over the day-to-day issues that affect the network. This is most marked in roadworks and major schemes, where there is information and monitoring of major works well in advance of implementation and the effects of the works are monitored and generally fairly predictable, compared to individual roadworks that are notified almost in real-time and where little predicted delay and alternative arrangement information is available. Issues with roadworks data includes timeliness regarding planned and current works; the actual works being performed; the effect on traffic and on the overall road network; delay in the update of status of the works and effects on traffic; and the coverage of the works and their interface with the surrounding local road network. Some re-users would estimate the current accuracy level as being around 50% and that this should rise to at least 80% as a matter of priority. This is seen as having a detrimental impact on road users but also on the corporate reputation of the re-users of the data, for example the BBC, who see traffic news bulletins as an important part of their overall offering.

Key finding: Roadwork data specifically was highlighted by third parties as low accuracy and quality and identified as a priority area to address.

Recommendation 9: Highways England should adopt targets for earlier notification of roadworks and their impacts and communicate this with road users, in particular with the freight sector.

Incident information is also seen as important, with Highways England and NTOC and RCC/ROCs playing a key role in the creation and dissemination of data and information about incidents, including definitive statements of cause, consequences and alternative routeing advice. There are however areas of concern regarding the time taken to enter incidents on to the system (generally longer than other sources) which could be a validation issue. There are also concerns over the variation in messages between channels, for example the Traffic England website driven by the central NTIS system and twitter account messages. One re-user recorded at least 20 instances of variations in a single month, which leads to questions over accuracy and verification.

Recommendation 8: Highways England should focus on providing greater detail within existing data types and should categorise the impact of traffic events on road users.

Access to and usage of various channels has also been raised with Highways England being seen as a minority provider of information (except on roads via signage and VMS) with more use of third-party services for upcoming incident awareness, alternative arrangements, routeing and even access to information about roadworks. Interesting comparative work on access to

information has been undertaken, specifically for roadworks on the M1 between junctions 23A and 26[32].

Relationship with local highway authorities – the area of interface with the 135 local highway authorities was seen as a current weakness and an area for improvement. The relationship should be seen in the context of a number of facets including the physical, digital and human interfaces as well as the relative outputs and priorities of each organisation from the end user perspective.

Out of hours relationships also causes concern, with Highways England operating 24/7/365 and local authorities more of an office hours based regime. Stakeholders suggested that Highways England could undertake intervention on adjoining roads of significance in the absence of local control arrangements and co-ordinate activity from an incident affecting both networks either directly or indirectly.

Recommendation 12: Highways England should continue to work with other highway authorities, and consider taking a leading role in delivering network operation across the UK.

Re-use and syndication of data – there are relatively few limitations on the re-use and syndication of data, as set out in the Open Government Licence (OGL), and this is one of the concerns about entering into any agreement between the parties, which is not covered in the OGL regime, that could result in new limitations. The only key limitation in the OGL is a prohibition on changing the nature or meaning of the information that is re-used. However, the need to either verify, adapt or de-duplicate incorrect incident or roadwork information by the re-user could been seen to contravene this restriction, albeit for the good of the end user. Most re-users and service providers consider that they add considerable value to the initial Highways England data source, such as journalistic meaning, additional characteristics or de-duplication and verification, thus enabling the re-user to make a charge for further syndication of the data and information.

Areas for improvement - the following areas were suggested for attention and improvement:

- Timeliness of data and publishing of initial information and changes to status;
- Coverage of the incident or planned works and the interface with the wider road network;
- Temporary speed limit information and the predicted consequential effect on traffic;
- Diversionary routes, their suitability and the effect on traffic flows and speeds;
- Single entity for Highways England information rather than regional and area variations;
- Naming conventions for incidents and planned closures/delays on the network;
- Focus on cause and consequence of planned and unplanned disruption; and
- Detection of incidents and initiation of remedial and alternative action.

Recommendation 10: Highways England should consider the provision of additional traffic data and information that are being requested by stakeholders.

Future (5-year plan) targets – the re-use and information service sector would welcome more clarity on the core role of Highways England in the data and information provision marketplace and a more collaborative approach. This needs reflect a "level playing field" and not be skewed by public funding or investment, whilst respecting the priorities of the end-user and the promotion of new business opportunities, notably among SMEs. This may also lead to a consolidation of the activities of the public sector (including Highways England) in the market around data creation, network ownership, traffic management efficiency and maintenance of assets and asset

[32] Elgin trial (M1 junction 23a to 25) - Evaluation Report, June 2018

condition, increasingly with customer service and end-user applications being provided by private sector organisations. This will become even more important as the advent of connected, co-operative and autonomous vehicles becomes a reality, with the interface between infrastructure and vehicles, between vehicles and vehicles, and between control, systems providers, vehicles and drivers becoming central to the success of any new means of operation.

9.7 Industry experts and interest groups

The discussions with industry experts and interest groups have tended to follow the key issues and concerns raised by the experts rather than an agenda set for the project, as with many of the other stakeholder groups. These discussions have therefore raised a number of questions or statements that we have summarised as follows:

- Traffic information should be seen as a number of related but separate markets that could well be serviced by different providers/applications including:
    - On journey routeing and navigation;
    - Imminent or real-time conditions and variations to planned itineraries; and
    - Next day/forward planning of travel.
- Third parties are increasingly gathering and processing data on traffic conditions and the movement/flow of vehicles;
- Road users are affected and influenced by human factors that need to be built into traffic and travel services and applications;
- Delay information and the consequences on journey times is becoming increasingly important and expected by users of the road network;
- There are important questions over roadworks information:
    - How are multiple works in close proximity dealt with?
    - Is the duration of the works and hence the consequences of the works generally over estimated?
    - Why do works frequently disappear (not happen as planned) and how should this be reduced and dealt with when it occurs?
    - Do Highways England need to have more robust processes with contractors?
- There are also questions raised over measurement:
    - How is the benchmark of current performance best assessed?
    - Should measurement be primarily built into the process or be the subject of spot checks regarding accuracy and reality?
    - Do NTIS have the capability and capacity to assess delay in a meaningful manner?
- Freight issues need special attention, notably around full closures and the consequences thereof that may fundamentally differ from those of car drivers;
- Adherence to standards and protocols is important but also raises issues:
    - Quality and accuracy is not assured by adherence (e.g. DATEX II);
    - The criteria around the standards and the underlying parameters need to be clear and understood in the gathering, processing and publishing of data and information; and
    - There are UK, European and global standards that do not always align, and also interfaces with standards from other domains such as IT and communications.

- Wider interest groups are concerned about and interested in Highways England's (and UK's) future intentions in terms of the adoption and compliance with international standards, for instance:
    - Will we continue to design services around key standards such as DATEX II;
    - If not bound by compliance with data and information obligations such as those specified within the ITS Directive, what will our attitude be to designing services and gathering data against these criteria?; and
    - As we move towards increasingly important interfaces between infrastructure and vehicles, how will we align to international design criteria in these vital areas?
- It is noted that performance and compliance against these standards and protocols is variable across European countries at the present time, however, UK and Highways England specifically are seen as amongst the most advanced and leading exponents of data and information gathering, processing and publishing and therefore future direction and the extent of conformity and/or divergence are seen as important;
- Better quality in the future may be achieved via:
    - Commonality of approach and standards (internationally and across UK national and local highway authorities);
    - Earning and maintaining trust of end-users through enhanced accuracy, reliability and relevance; and
    - Better working with third-party providers to ensure consistency of service to end-users.

9.8 Freight and logistics end-users

Key issues concerning the freight industry – the freight sector has a variety of concerns and issues with data and information regarding Highways England roads and their operation. These include:

- The location and timing of works including those on adjoining routes;
- The cost of total carriageway closures from unplanned incidents;
- Alternative routeing on unsuitable routes;
- Lorry parking at motorway service areas;
- Failed equipment, notably MIDAS loops;
- Different operational characteristics on different types of motorway;
- Extended diversionary routeing for freight vehicles over unsuitable routes;
- Effect of planned and unplanned incidents on freight operators notably:
    - Fines due to delays to customer deliveries,
    - Potential loss of contracts due to poor performance against deadlines; and
    - Inefficiency leading to the need for additional vehicles/drivers;
- Increase in investment in RIS2 may lead to an increase in delay and unreliability of journey times.

Relations between Highways England and freight – key links exist with the Strategic Partnership Team for the freight associations and some major customers and this is enhanced on some occasions by links with areas and divisions. There are groups set up looking at strategic corridors and routes such as the Kent Corridor Group and the A66 Stakeholder Working Group, these are seen as positive by the freight sector but may lack influence and funds, albeit they have a useful communications role.

Recommendation 2: Highways England should create and agree a clear definition of the most important customers for traffic data and information.

Overall the industry considers the current position to be something of a "curate's egg" with patches of good practice and areas of little liaison; the intention should be to build on the success of the existing groups and embed this in other areas.

Roadworks and Incidents – this is the key area of concern. In normal operational state, on-board systems such as Paragon and Isotrak generally enable efficient adherence to schedules but when conditions are disrupted, delivery slots may be missed and commercial penalties triggered. The freight sector report that they are often dependent on intermediaries such as INRIX to inform them about delays and transform data into a journalistic style that is easily consumed by drivers.

In the event of a delay occurring, the consequences are important, such as predicted time to clearance and delay to journey compared to normal running, these can be passed on to potential delivery agents and schedules amended. It is also important to maintain transparent records of incidents so that delays and contractual breaches can be referenced and verified by hauliers and their customers.

Currently, roadworks are notified very close to the event and previous efforts at collating these and passing them on to hauliers have been unsuccessful due to problems with the accuracy of the data around cancelled works or late notifications. This leads to a lack of trust in the information provided and decreasing take-up of the information. There is a pressing need to improve this information flow in terms of timeliness, accuracy, reality, consequences and duration of delays. Should this be improved this could prove to be a win-win for Highways England and for the freight sector.

Key finding: Problems with accuracy of roadworks, cancellations and late notifications has a detrimental impact on the long and medium term planning processes in the freight and logistics sector. These leads to a lack of trust in the information.

Recommendation 9: Highways England should adopt targets for earlier notification of roadworks and their impacts and communicate this with road users, in particular with the freight sector.

Link with local authority roads – drivers are generally unaware of the ownership of the roads and therefore information needs to be seamless across the whole journey. In particular, where alternative routes are enacted due to planned or unplanned disruption this needs to avoid any restrictions and not be subject to delay or disruption.

Bridge strikes are a major issue for the freight sector and these remain at a consistent level, therefore any instances of freight blindness need to be eradicated and there needs to be specific consideration of freight requirements in the event of any planned or unplanned disruption to the network.

Future Priorities – the sector had a number of priorities/suggestions including:

- Consistency of messaging;
- Accuracy and timeliness of information;

- Context including location, duration and length of delay;
- Consideration of SMEs and small hauliers;
- Link with type approval of vehicles and devices; and
- Information about driver facilities, notably at strategic locations and on the approach to sensitive facilities e.g. at ports and Operation Stack.

These priorities should be also seen in the context of:

- Stress reduction for drivers;
- Making journeys and schedules better;
- Traffic management efficiency and use of the infrastructure;
- Reliability for deliveries (= happy customers and hauliers);
- Overall performance improvement including clearing of incidents and minimising the effects of roadworks; and
- The contribution of freight to the overall economy and the national interest.

9.9 Car driver end-users

The main focus of work here will be by the Transport Focus led work on the needs and wants of drivers and end-users of the road network as referenced in section 8.2. However, this project has looked at the issue with the representatives of drivers, rather than the drivers themselves and a number of issues have emerged that need to be validated with the outputs from the Transport Focus research:

- Focus on planned and unplanned disruption to the network;
- Questions to be asked are:
    - Who is interested?
    - Who is affected?
    - Who needs to know?
    - What do they need to know?
- Need to consider the formal obligations on Highways England but also the actual delivery of information services to road users, both directly and via third parties and to specify the roles of those involved and the relationships between them, from the lens of the end-user's needs;
- Information need to be assessed in terms of whether it is:
    - Timely;
    - Accurate;
    - Reliable;
    - Understandable;
    - Comprehensible; and
    - Useful.
- Concentrate on easy wins in the first instance, such as:
    - Journey times;
    - Travel times;
    - Description of location (rather than junction or road numbers);

  - Use of VMS;
  - Role of web services; and
  - Relation with third-party services.

- Measure and improve inputs to drive up quality but measure overall effectiveness and usefulness by means of end-user and traffic management outcomes, together with the level of locational and contextual relevance.

Recommendation 8: Highways England should focus on providing greater detail within existing data types and should categorise the impact of traffic events on road users.

Section 10 now sets out the results of benchmarking Highways England practice against examples of good practice for collecting data inputs and providing data outputs.

10 Benchmarking of traffic data and information provision

10.1 Benchmarking approach

The benchmarking approach outlined below considers a series of good practice examples. These include operational examples during normal network conditions and where planned and unplanned disruption occurs on a transport network. We have proposed a set of key actions for consideration which have arisen from the examples.

To prioritise these actions, we have consulted experts and strategists in Highways England. These steps and outcomes are set out in the following sections.

10.1.1 Benchmarking of inputs

In the meetings with external stakeholders, especially other road transport operators, it emerged that Highways England is considered by most UK road data and information providers as the source of best practice for road traffic data and information and assessing the quality of this. Consequently, comparisons with other UK providers such as Transport for London (roads) or Transport Scotland would probably not lead to meaningful conclusions.

In order to facilitate conclusions about future direction and improvements, we have drawn comparisons against other European Road agencies, for roads standards and data collection and coverage, and with other non-road UK transport operators, for incidents and events. This includes:

- **Current EU Data Standards relating to traffic information** – as published in a series of documents including EU EIP SA 4-1 Practical guidelines 2018-02-26 Quality of Safety-Related and Real-Time Traffic Information Services: Practical Guidelines (2018). Many of these documents relate to the EU ITS Directive that covers motorways and major routes across all member states. Exemplars can be found in Holland, Germany and Austria.
- **Other transport modes** – Network Rail and Transport for London (public transport)

10.1.2 Benchmarking of outputs

To make a meaningful comparison of the effectiveness and value of the data and information outputs provided by Highways England, we have selected two areas to assess the impact and usefulness of the services; these are roadworks and incidents/events. We have therefore completed the benchmarking against the following comparators:

- **Roadworks** – possession and engineering management as provided by the rail industry, based on the Great Western route that has a mixture of major project work and intensive maintenance work; and
- **Incidents and events** – comparison made with Transport for London (public transport) and the management and publishing of data and information for incidents on London Underground and Overground/TfL Rail and Docklands Light Railway.

10.1.3 Identifying a prioritised list

Having identified actions that might be considered good practice in the areas set out above, we have discussed the following questions with stakeholders in Highways England:

- Are the identified actions relevant in considering Highways England current processes?
- If so, how does Highways England currently compare with these actions?
- Could these areas of good practice be usefully considered for adoption by Highways England?
- Should they form the basis of future targets and measurement?

- What are Highways England currently doing against any of these actions?
- What are the challenges for Highways England in adopting or undertaking any of these actions?
- Which of these are higher priority?

This process has identified a prioritised list of candidate actions, presented in each section below, and informs the recommendations set out in this project.

10.2 Current EU Data Standards relating to traffic data and information

10.2.1 Overview of standards

The ITS Directive, enacted in 2013, has consolidated action and priorities across the member states and has led to a series of agreed priority actions and a number of linked initiatives. This includes reviewing the role of both the public and private sectors in the provision of traffic data and information services. Much of this has been co-ordinated via ERICO (ITS Europe) and TISA (Traveller Information Services Association), with support from the EU, resulting in a series of mandatory and advisory provisions and obligations across the traffic information sector.

Appendix 4 details the initiatives that have been considered in formulating the set of good practice that is summarised below. These documents are:

1. Quality of Safety-Related and Real-Time Traffic Information Services: Quality package (2018 Update)
2. Quality of Safety-Related and Real-Time Traffic Information Services: Practical Guidelines (2018)
3. Intelligent transport systems - Integrated transport information, management and control - Data quality in ITS systems (2008)
4. Quality of SRTI-messages in the Netherlands (2016)
5. Commission Delegated Regulation (EU) 2015/962 of 18 December 2014
6. Commission Delegated Regulation (EU) No 886/2013 of 15 May 2013

10.2.2 Summary and implications of these documents

The Directives in the regulations outlined above define the requirements for "road safety-related minimum universal traffic information" and provision of EU-wide real-time traffic information services. These may have been to some extent inspired by the earlier ISO Standards report and significantly influenced the Dutch "Quality of SRTI-messages" report [ref 4 above] in particular that adopts the approach from the "road safety-related minimum universal traffic information" Directive. The Dutch report gives a fully worked through example as to how to evaluate existing traffic information in a format consistent with the EC Directive.

In order to convert the basic principles outlined in the Directives into a more substantial set of processes that can be applied consistently across the EU, the European ITS Platform (EIP) undertook research and liaison in order to determine how to identify and measure the various parameters involved.

This process resulted in Quality Guidelines [ref 2 above], which is an in-depth description of how to do such evaluation for any particular parameter. However, whilst these Quality Guidelines are excellent for explaining suitable methodologies to undertake from an academic perspective, actually following them would appear to be outside the scope of this project and they do not explain much about why such processes are undertaken. This area is covered by the Practical Guidelines [ref 3 above], which is the most relevant document to this report.

10.2.3 EU Traffic Data Standards and Quality – identified good practice

The following summarises some of the key points arising from the existing EU documentation and standards relating to traffic data and information. These formed the basis for discussions with Highways England staff to allow us to define the prioritised list given in section 10.2.4.

1. Member States shall designate a competent national body to assess whether requirements are being fulfilled by information providers and notify the European Commission. The information providers shall provide the designated national bodies with their identification details, a description of the information service provided, and submit a declaration of compliance with the requirements. The designated national bodies shall randomly inspect the correctness of the declarations of a number of information providers, and request proof of compliance with the requirements.
2. The relevant standards and quality levels set out are intended to be minimum levels, with an aspiration to move to a banded quality level measurement regime with quality bands set as non-compliant, basic, enhanced and advanced (e.g. Dutch self-measurement).
3. The safety-related information delegated regulation to the ITS Directive sets out the key information areas that are prioritised and these could be further enhanced or potentially reduced to reflect local circumstances such as high winds on the Severn Bridge or issues with ice in notorious locations. This is a very useful means of identifying what matters most, and a similar approach could be made to traffic management issues, again perhaps adapted by location and circumstances (e.g. near Old Trafford when a football match is taking place).
4. Our understanding of the requirements for measuring the effectiveness of service provision is that some form of relationship needs to exist between national road authorities, major service providers (perhaps with a threshold of greater customer usage than the Traffic England website), digital mapmakers and broadcasters to agree and enact measurement of service compliance.
5. The quality frameworks proposed assume a syndication model from transport agencies, focusing on the inputs and creation of data. An emerging standard exists for the assessment of real-time traffic information (RTTI). The focus is on the information service value chain, i.e. content detection and content processing. Content detection starts at the occurrence of an event or change in traffic-related condition and content processing ends at the provision of the information at a content access point.
6. The criteria for assessing traffic data are defined separately for event information and status-oriented information, because of the inherent differences between the natures of data related to these information types.
7. Quality and success measurements exist for data quality and are applicable to interfaces between any data supplier and the data consumer on open interfaces. The assessment includes the quality of the service as a whole or any component part of the service that a supplying or publishing system can provide. For instance, this may give a measure of the availability and reliability of the data service in terms of uptime/downtime and the responsiveness of the service, or it may give a measure of the precision and accuracy of individual attributes in the published data.
8. Data quality metadata includes a range of parameters normally associated with the measurement of quality such as veracity, precision, service completeness, availability and timeliness of the data.
9. Research in the Netherlands has considered the latency between registration times for the notification of a broken down vehicle in two different systems and the timeliness of this information (both for initial reports and incident updates/conclusion) when compared with speed data on the affected road section.

10.2.4 Prioritised list of proposed actions – data standards & quality

Having reviewed and benchmarked against EU Traffic Data Standards and Quality, and discussed this with Highways England stakeholders, we have identified the following proposed actions for Highways England:

1. A comprehensive data and information model should be created covering all aspects from physical occurrence through to end-user consumption. This should cover the actions of all parties including Highways England and third-parties and the relevant interfaces, standards and protocols that underpin the model.

Key finding: EU Data standards for traffic data and information are leading some road operators towards the creation of a data model for traffic data and information that considers the detection through to publication.

Recommendation 6: Highways England should create a target data model that fully describes the condition of all of its traffic data and information.

2. As part of an overall traffic information strategy and in the creation of a data model, there should be a clear definition of the priority data and information categories, notably in the spheres of safety-related and real-time information, why these have been prioritised and data is managed with and their key parameters.

Recommendation 8: Highways England should focus on providing greater detail within existing data types and should categorise the impact of traffic events on road users.

3. Given the importance of third-parties in information service provision (an increasingly in data collection) there should be documented relationships between Highways England and key third-parties. These should set out the key organisational relationships, the obligations and expectations of each party and how these will be assessed and measured.

Recommendation 11: Highways England should elevate the role that third party traffic data consumers, aggregators and traffic information providers play in delivering Highways England policy objectives, and consider whether formal relationships should be used to achieve this.

4. A series of key metrics and measurement should be set out, including with third-parties and Highways England should consider adopting a graduated assessment regime, rather than compliance, with categories such as basic, enhanced and advanced. This could form the basis of service development over the RIS2 period and beyond.

Recommendation 3: Highways England should develop a set of high level outcomes, in line with its strategy, that can be achieved through better traffic data and information and then measure the extent to which these outcomes are delivered.

Recommendation 7: Highways England should review its culture and processes to ensure that delivery of customer information is considered at all stages of network operation, and that incentives and KPIs reinforce this.

10.3 Planned Network Disruption - Network Rail/Great Western Possessions Management

10.3.1 Network Rail/Great Western possessions management

Network Rail needs to restrict access to the network to carry out many of its maintenance and renewals activities. These restrictions of access are referred to as possessions. Possessions are considered disruptive if they affect the running of passenger or freight operators' normal timetabled services. A key requirement of railway operational analysis is the ability to analyse and assess possession management, to ensure the successful completion of planned engineering projects whilst reducing levels of both planned and unplanned disruption to train services. Like many railways, Network Rail faces numerous challenges when planning and managing possessions including:

- ensuring that there are applicable safety systems and processes involved in the planning of work-flows and possessions;
- the need to increasingly move towards a 24-hour a day, 365 days a year operation, whilst simultaneously maintaining the infrastructure throughout the year to ensure the safety and reliability of the network;
- the possible need to plan and agree engineering projects with the train and freight-operating bodies many months, and sometimes years, in advance of any possession;
- works may form parts of bigger and more complex programs of work so if one part of a project plan changes, it could affect other stages of development; and
- potential demands on maintenance and engineering staff with work needing to be carried out at all times of day and night.

The rail industry has been subject to regulation and scrutiny for over 20 years from ORR and the Strategic Railway Authority (SRA - *now part of DfT*), Network Rail is now approaching its sixth five-year funding process, and this regime has developed over that period, rather than because of customer-driven pressure or business prerogative.

Appendix 5 details the key findings arising from workshops, reviews and discussions on the processes of possession management that have been considered in formulating the set of good practice which is summarised below.

10.3.2 Possessions management – identified good practice

The following summarises some of the key points arising from this process and relating to traffic data and information. These formed the basis for discussions with Highways England staff to allow us to define the prioritised list given in section 10.3.3.

1. Rail possessions are based on both a customer focused commitment e.g. Time minus 12 (weeks) and an overarching business process (5-year control period funding). To achieve this, a Business Plan is produced by route covering a 5-year period than includes the proposed engineering requirements. A detailed planning process starts at T minus 90 (weeks).
2. The whole supply chain is back-to-back with this process. The supply process and chain has all the assumptions of timescales embedded within their processes that largely results in timescales being met.
3. As these processes and timescales are now well embedded the amount of non-used possessions, other than those resulting from weather, is now very low.
4. There is a financial imperative on network rail to pay Train and Freight Operating Companies, TOCS and FOCS, for taking possessions outside of the agreed timescales. A penalty for work outside of the agreed planned work period (*white period*) is very high.

5. The industry adopts the approach of booking periods of significant extended closure to accommodate intensive large-scale work on the rail lines. These are often completed during holiday periods.
6. Schedule of the works – this is done about 6 months prior to the go live date. Freight and passenger operators on rail are informed T minus 31 weeks of the proposed engineering work and a draft period possession (DPPP) plan is created. At T minus 27, there is a confirmed planned possession programme. At this point freight, operators and TOCS bid for service plans (with replacement buses or other routes agreed as alternatives). This enables freight customers to have a very reasonable advanced warning of changes to delivery schedules.
7. There is a variety of criteria used to assess the clashing of planned works. This depends on the impact that clashes might have. On the rail network, TOC, freight and location specific rules are used about each route and the impact of closures on customers, for example container cleared routes cannot be blocked together and Cross Country do not permit engineering work within 3 hours running time.
8. The industry takes advantage of major planned closures; the more that can be done in that period the better. This allows and encourages the contractors to do as much work as possible during that period. This is then communicated to customers as a benefit, providing a clear message that the industry is looking to be as efficient as possible. For example, station works and line speed improvements have been planned simultaneously on the Barnstaple line.
9. Customers (e.g. passengers) are provided with a clear message of the route strategy and how work will benefit them in the long run. The message is that their journey will improve.
10. An access dispute resolution process exists between TOCS if there are any disputes in the bidding process. This is generally never used, but the threat of the process results in efforts not to elevate issues to this level.
11. The ORR measure of efficiency is not the process and works – they measure the outputs. For instance, asset condition target, cost per work unit done, although T-12 compliance is measured by DfT.

10.3.3 Prioritised list of proposed actions – possessions management

Having reviewed and benchmarked against Network Rail/Great Western possessions management, and discussed this with Highways England stakeholders, we have identified the following proposed actions for Highways England:

1. The rail possessions management process has developed over a fairly long period of time whereas an enhanced roadworks management process is relatively in its infancy. However, a rolling programme of setting and meeting a series of earlier targets for the notification of roadworks and their consequences would require review of the current planning process and the changes required to achieve these targets. This could be planned on an annual basis throughout RIS2 with a mature process and relevant targets in place, supported by a robust process by the start of RIS3.

   As part of this enhanced notice period plan, Highways England should set up a mechanism for communicating the roadworks plan and its consequences to road users, with emphasis on the freight sector, so that this can be built into delivery schedules and logistic chain management. Highways England should assess the economic benefit of these arrangements, in terms of the supply chain and also the logistics sector and set this against any additional costs in the roadworks management process.

Recommendation 9: Highways England should adopt targets for earlier notification of roadworks and their impacts and communicate this with road users, in particular with the freight sector.

2. Building on the experience of the rail industry, statements of "Rules of the Route" should be established on a route-by-route basis that sets out agreed arrangements for "White Periods" when lanes or road sections can be used for roadworks and the proposed number of closures outside these periods, taking into account the impact on customers. Within this process there should also be a statement of any geographical or consequential limitations (such as proximity of roadworks, cumulative delay times and limitations on adjoining routes) and the consequences of planned works such as maximum additional journey times and authorised alternative routes.

Recommendation 8: Highways England should focus on providing greater detail within existing data types and should categorise the impact of traffic events on road users.

3. Metrics and measurements should be developed reflecting these arrangements such as the adherence to the target notice period, the target and achieved percentage take-up of agreed roadworks and measured journey times on alternative routes against those set out in the "Rules of the Plan". Over the period of RIS2 and beyond the development of back-to-back arrangements with the engineering supply chain should enable RIS3 measurement to assess the efficiency of the roadworks process to which this data and information enhancement will contribute.

Recommendation 3: Highways England should develop a set of high level outcomes, in line with its strategy, that can be achieved through better traffic data and information and then measure the extent to which these outcomes are delivered.

10.4 Unplanned Network Disruption – London Underground – Incident Management

10.4.1 London Underground incident management

London Underground, through their control centre and supporting processes, manage the provision of customer information to millions of travellers in London on tube and rail networks. This includes the management of unplanned events that affect the operation of the network.

Transport for London and the Underground have been in the full gaze of public scrutiny for many years and are sensitive to disruption becoming front-page news in the press as soon as it occurs. This has focussed senior management attention and staff action on rapid and helpful reaction to all significant incidents.

Appendix 6 provides a summary of key findings arising from workshops, reviews and discussions on the London Underground planned and unplanned customer information that have been considered in formulating the set of good practice that is summarised below.

10.4.2 Incident management – identified good practice

The following summarises the key points arising from this process related to traffic data and information. These formed the basis for discussions with Highways England staff to allow us to define the prioritised list given in section 10.4.3.

1. A clear process and model exists from the occurrence of an incident through to the communication and delivery of information/data to the user/customer. The customer/user can be a third party or end user of the network.
2. Transport for London staff and all other parties are clear and buy into the process from incident to information consumption, due to the risk to corporate and brand reputation.

3. Everything in the London Underground process is simple and straightforward. From this simple model, there is clarity of position and roles/responsibilities.
4. However, for each underground or rail line there are different metrics applied for the route, part of route and time (peak and off peak, days of the week). Within the end message and measurement there is a high level of context and geographical variation. This leads to a definition of the quality of information that is simply expressed in terms such as minor or severe disruption.
5. Two parallel processes exist: Operations and Customer Information. Operations do not concern themselves with customer message and vice versa. Whilst the operating team concentrate on resolution, the customer information team assess the impact on users of the system– e.g. impact of the incident, delay. The customer team are party to the incident information and interpret the message.
6. There is a clear hierarchy from line to central control. The central control team have final call on the information provision, but this is very rarely a contentious issue.
7. *Observation – many of the customer team members are from an information and customer background rather than an operational background.*
8. As much priority is given to informed opinion and experience as is given to pure to process. This results in customer digestible information on appropriate channels.
9. There exists a very simple but comprehensive form of words for each incident. There is a definition of, and compliance with, a set of agreed nomenclature and message structures.
10. The digital information channels are based around a canonical model. The same data and information created for any incident drives all the digital channels (web, third party data, on system and third party data).
11. Priority is given to different incident types at different locations, so an incident affecting the Central Line at Bank will be prioritised over a service closure at Chesham.
12. London Underground do not typically measure adherence to process. One major measurement is the time between when wheels stop (on a train) through to publication of an incident. The driver on train makes an announcement. Customer satisfaction is the basis for measuring successful outcomes rather than a measurement of adherence to the process.
13. A clear verification process exists. Reports of events and the rules surrounding how much credibility is given to the information informs the verification process.
14. There is a clear and agreed naming convention of geography in incident information.

10.4.3 Prioritised list of proposed actions – incident management

Having reviewed and benchmarked against London Underground incident management, and discussed this with Highways England stakeholders, we have identified the following proposed actions for Highways England:

1. There should be a simple process model from physical incident through to end-user consumption of information that should include all potential detection and notification sources and all potential end-user channels.

> **Recommendation 7: Highways England should review its culture and processes to ensure that delivery of customer information is considered at all stages of network operation, and that incentives and KPIs reinforce this.**

2. The current Highways England model has interfaces with a number of data sources, often operationally based, and these may have duplicate entries or gaps. Over the period of RIS2 and beyond this should move towards a Canonical model, such as that used by TfL, or at

least a rationalisation and simplification of the interfaces so that a "Single Version of the Position" can be provided.

Recommendation 6: Highways England should create a target data model that fully describes the condition of all of its traffic data and information.

3. A series of metrics and measurements should be established for incident management that are relatively simple in nature but also reflect contextual issues (such as time period, peak or night-time), location (M25 round Heathrow or A64 near Scarborough) and consequential effect (minor delays through to route closure).

Recommendation 8: Highways England should focus on providing greater detail within existing data types and should categorise the impact of traffic events on road users.

Section 11 now sets out opportunities for improvements by Highways England that we have identified from the research to date.

11 Opportunities for improvement

It is important to determine the areas of responsibility that Highways England alone have in the area of traffic data and information creation and provision. In discussions with stakeholders and Highways England we have identified the following four areas:

1. To support traffic management on the strategic road network;
2. As a source of some data and information such as the road network geometry and for network condition and status such as traffic incidents, travel times and delays and planned events such as roadworks and maintenance;
3. To provided alternative travel arrangements in the event of planned or unplanned alteration to the normal traffic status; and
4. As a source of definitive messages about the network and incidents.

As outlined in section 3.1, the environment in which traffic data and information is being collected and delivered has, and will, continue to evolve and become more complex, whilst customer expectation of traffic information services continues to grow. As the road network owner and operator, Highways England will continue play a major role in this environment albeit the relationship with the customer, and whom that customer is, is likely to change over time.

Delivering the Licence commitment to minimise disruption to road users and ensure customers have access to relevant, accurate and timely information mandates the need for Highways England to continue to strive to provide high quality traffic data and information and seek to continuously improve this provision. This commitment should be measured against the outcomes that the organisation wants to achieve and against delivering on customer need.

Recommendation 2: Highways England should create and agree a clear definition of the most important customers for traffic data and information.

Recommendation 3: Highways England should develop a set of high level outcomes, in line with its strategy, that can be achieved through better traffic data and information and then measure the extent to which these outcomes are delivered.

The following sections present opportunities for Highways England to improve traffic data and information provision to road users, and the metrics that may be used to assess the future provision of road user information.

11.1 Delivering the Licence commitment

As outlined in section 4.1, the Highways England Licence, 2015-2020 Delivery Plan response and Traffic Information Strategy provide the organisation's policy, strategy and commitment to the delivery of traffic data and information.

Updates to the Delivery Plan in 2018/2019 reference work to update the Traffic Information Strategy. In updating this specific strategy, and considering objectives and commitments beyond RIS 1, we recommend a number of areas for improvement.

The Traffic Information Strategy is "*written from a customer's perspective",* in as far as it is driven by a customer need for information. There is, however, an absence of a definition of exactly who the customer is within the context of the strategy. As customers are not a homogeneous group, they will have varying requirements across a range of data and information and any strategy accordingly needs to reflect these differences. This may result in substantially differing strategies to meet differing customer needs.

At a simple level, different customer groups might include:

- Road users (commuters) – who consume traffic information and advice provided through Highways England owned channels including the web site and signs and signals;
- Freight and logistics sectors – who consume both traffic information and advice provided through Highways England owned channels and syndicated traffic data as part of their longer, near and real time planning processes; and
- Third party traffic data aggregators who consume both historic, planned and real time data via syndication feeds using data to enhance and assess their traffic information services to customers.

Within the context of better understanding and defining customers and their requirements, there is a need to for Highways England to better understand the economic value of the traffic data it owns, uses, creates and provides to customers. This helps to achieve a number of the broad objectives set out in the policy documents:

- Provides focus on the data and information that is of most value to the Company and to customers and brings the largest aggregate benefit;
- Informs and justifies areas for future improvement in the quality and extent of traffic data creation and provision;
- Can better articulate the value of the Company to the customer and the wider industry; and
- Provides a value baseline against which Highways England's progress can be measured in the future.

Recommendation 5: Highways England should better understand the relative value of its existing traffic data and information, both for its own business and to customers.

The Traffic Information Strategy set outs a number of objectives without specific reference to exactly how these objectives will be met, specifically for the delivery of traffic data and information. There is a need for a further level of detail that addresses each of the objectives, sets out how these will be delivered and provides the metrics and measurement of achieving this, based on business and customer benefits.

Recommendation 3: Highways England should develop a set of high level outcomes, in line with its strategy, that can be achieved through better traffic data and information and then measure the extent to which these outcomes are delivered.

To assess the performance and the delivery of traffic data and information, Highways England currently use data creation standards and metrics for network conditions measurement, event data and roadworks. These include metrics for accurate reporting of road closures, timeliness of roadwork data updates, validation of journey time data, availability of TMUs, updates of signs and signals, publication of time of events and publication of strategic responses. These metrics assess the internal data creation standards and, to a lesser degree, the geography and accuracy of provision of traffic data and information, and whilst there is a need for a further level of detail to assess the objectives of the Traffic Information Strategy, they should continue to form part of the overall assessment of performance.

Recommendation 4: Highways England's existing data creation standards and metrics should be used by ORR in the short-term to monitor and assess how Highways England currently performs in the delivery of traffic data and information.

In an environment and market that has seen considerable recent change, with new methods of delivering and collecting traffic data and information by new and emerging organisations, it is reasonable to assume that there will continue to be a transformation of this market in future, especially with better connected vehicles. Accordingly, there is a need for the Traffic Information Strategy to undergo regular review and update, probably as part of the annual Business Plan process that allows for Highways England to adjust and refine how best they meet and deliver on their objectives.

Recommendation 1: The Traffic Information Strategy should set out Highways England's traffic data and information requirements and commitments, and should be reviewed annually.

11.2 Improving traffic data and information

From the stakeholder liaison, especially with UK road operators, there was a clear view that Highways England are considered to be leaders amongst road authorities in the field of traffic data and information provision, in the quality of this information and in adopting processes to assure and improve quality.

In comparison with other UK and most EU road operators, Highways England provides a greater extent of traffic data and information over more owned channels. This includes syndication of data, although there are a number of EU organisations who are expanding coverage and merging traffic data from multiple sources into single national data access points. These access points are providing consumers of data with a single, unified point of traffic data access. DfT is currently funding a programme to establish a national access point for all road authority information, with Highways England being seen as a major contributor to the success of the project.

Highways England appear to have substantially more metrics and performance indicators relating to the creation of traffic data and information than other operators, and a greater existence of processes to assess the quality of this data. Highways England's verification processes for assuring event information, like many other road operators, are robust to the point of introducing delays, as no confirmed event is published or status changed unless verified by dedicated operational teams.

There is a general trend amongst road transport operators to re-assess and re-evaluate their role in the provision of traffic information. Specifically this relates to relationships with third party information providers who are increasingly seen as the major channels to reach customers. This has extended in some cases to much more defined agreements for targeted information. In addition, the consumption of traffic data (such as incidents, journey times and delays) from third parties has increased, with some agencies using these sources as the primary data for validation, customer information and operational management. The result has been for road operators to focus on their core traffic data and information offering rather than providing a breadth of other related information (e.g. weather, event information) and limit the digital channels through which they are providing traffic data and information.

The Company's current focus for traffic data and information, and any assessment of its quality, tends to be in relation to the delivery channels owned by Highways England (e.g. web, app and signs and signals). We believe that the importance of data syndication to third parties to help meet the Company's information and customer objectives should be elevated. Measuring the quality of data and information provision should be extended to cover all major providers of traffic information services and to assess how well this data is delivered and consumed by third parties. Measurements and metrics for the creation and delivery of traffic data and information tend to focus on an assessment of the process and we suggest that metrics should also look to evaluate how well the services are achieving the desired outcome.

In the context of the above, Highways England should consider its relationship with key intermediaries and re-users of data and whether there is a need for formal agreements and obligations of use around data. They should also review their lines of contact and communications with these intermediaries where they are not clear. These parties include local highway authorities, third party data providers and, likely in the future, connected vehicle manufacturers.

Recommendation 11: Highways England should elevate the role that third party traffic data consumers, aggregators and traffic information providers play in delivering Highways England policy objectives, and consider whether formal relationships should be used to achieve this.

The Company's relationship with local highway authorities is a key aspect in the delivery of overall policy objectives for the whole road network. The provision of traffic information by local highway authorities varies markedly between individual authorities and whilst there are some good exemplars within the local sphere, these do not cover all roads, all drivers and all time periods. The current publication of information is reasonable but there are large areas that could be improved, including the interfaces between Highways England and Local Authority roads. Local Highway Authorities need to work together, and with Highways England, and there needs to be a total network view, perhaps led by Highways England. There also needs to be an end-user focus and the key deliverable should be to achieve driver and freight (customer) outcomes.

A recurring message from stakeholders was the need for Highways England to focus on its core data and information product, and the data and information that it has most (and unique) control over (e.g. network characteristics, roadworks, incidents, and travel times) rather than data it does not own or create (e.g. weather information, major events). The focus should be on making such data as understandable, complete and accurate as possible.

Recommendation 12: Highways England should continue to work with other highway authorities, and consider taking a leading role in delivering network operation across the UK.

Recommendation 6: Highways England should create a target data model that fully describes the condition of all of its traffic data and information.

In the relation to the above, the sheer volume of information provided through digital channels and the lack of priority and impactfulness assigned to the data, creates a barrier to quality. This manifests in the user's experience of those channels but also in the ability for the end user to understand what is of most importance to them and any action or change that they should sensibly take as a result of that information.

Recommendation 8: Highways England should focus on providing greater detail within existing data types and should categorise the impact of traffic events on road users.

The key for policy makers is for Highways England to focus on getting the basics right before considering other potential areas of improvement, this includes roadworks, diversionary routes, traffic events and contingency planning as well as effective, transparent processes. This, we believe, would result in the information services (including basic roadside equipment such as signs and VMS) having very high levels of trust and believability.

Increasingly, the data and information service provision needs to be customer-driven and demonstrate high levels of accuracy and usefulness. As part of the overall information provision process there should be clear target levels, easy measurement metrics and the development of services should show pace and ambition.

Recommendation 7: Highways England should review its culture and processes to ensure that delivery of customer information is considered at all stages of network operation, and that incentives and KPIs reinforce this.

Re-users of Highways England's data felt there was a need to undertake significant work to de-duplicate multiple information sources and create a definitive version whilst making it as easy as possible to interact with the company. The lack of a single, definitive, trustworthy source for roadworks, major schemes and delay monitoring is a barrier in creating trust, value and wider re-use of data that meets the Company's objective of reaching as broad a customer base as possible.

There are (known) issues with roadworks data that include: timeliness regarding planned and current works; the actual works being performed and the effect on traffic and the overall road network; delay in the update of the status of the works and effects on traffic; and the coverage of the works and their interface with the surrounding local road network. The general perception, supported by Highways England's own measurements, is that the current accuracy (and quality) of data is below where it should be and addressing this is seen as a priority by both Highways England and its stakeholders. This poor quality has a detrimental impact on road users and on the corporate reputation of the re-users of the data who see traffic information relating to roadworks as an important part of their overall offering.

Recommendation 9: Highways England should adopt targets for earlier notification of roadworks and their impacts and communicate this with road users, in particular with the freight sector.

For some third-party users there are concerns over the variation in messages across Highways England owned channels that leads to questions over accuracy and verification. Consistency of messages and data across these channels is a pre-requisite to trust and wider re-use. The challenges of ensuring consistency has perhaps led other operators to focus on fewer core channels, thereby mitigating the risk of inconsistency. An alternative approach is to adopt a *canonical model* for data (similar to that adopted by Transport for London), creating a single access point for all input and output data and assuring consistency across multiples data sources.

Recommendation 6: Highways England should create a target data model that fully describes the condition of all of its traffic data and information.

Whilst Highways England continues to publish data in standardised forms (e.g. DATEX) a continued and extended commonality of approach and the use of standards across UK and by local highway authorities is a means through which better quality traffic data can be achieved in the future.

For re-users of the Company's data and information there were a number of areas raised that required attention, specifically:

- Improvements in the timeliness of data and publishing of initial information and changes to status;
- An increased coverage of the incident or planned works and the interface with the wider (local authority) road network;
- Provision of temporary speed limit data and the predicted consequential impact on traffic;

- Publication of diversionary routes, their suitability and the impact on traffic flows and speeds;
- Improvement in naming conventions for incidents and planned closures/delays on the network; and
- Further data and information on the causes and consequences of planned and unplanned disruption.

Recommendation 10: Highways England should consider the provision of additional traffic data and information that are being requested by stakeholders.

Freight operators and logistic organisations reflected a number of the above priorities, albeit with a specific freight-focus. They also highlighted a number of areas for improvement that include greater incident and event context including location, duration and length of delay, and further information about driver facilities, notably at strategic locations and on the approach to sensitive facilities e.g. at ports and Operation Stack.

Recommendation 12: Highways England should continue to work with other highway authorities, and consider taking a leading role in delivering network operation across the UK.

Section 12 now summarises the recommendations that we have made throughout the report, and groups them into three key themes.

12 Summary of recommendations for improving traffic data and information provision

This section sets out a summary of our recommendations for the ORR and Highways England resulting from our investigation and research and the areas for improvement in section 11. We have grouped these recommendations into three themes:

- Policy, organisational goals and customer requirements;
- Focussing on the core offering; and
- Interfaces with the customer and users of data.

As we outlined earlier in the report, the market and environment in which traffic data and information is provided has undergone significant change in recent years, and this is likely to continue. Future changes will be influenced in particular by the continued emergence of connected vehicles that act as a traffic and road information data point and as a channel through which consumers will receive more traffic information.

Improvements to Highways England's traffic data and information must be viewed as an **ongoing process** rather than as short-term fixes, although the opportunity for more immediate actions do exist.

For both the Company and ORR, there should be an ambition to develop a continuous improvement culture relating to traffic data and information that can be translated into improvement targets, measurable delivery and most importantly, meaningful output measures, such as predictability of operational delivery, engineering efficiency and improved customer satisfaction.

12.1 Policy, organisational goals and customer requirements

Highways England should gather, process and disseminate traffic data and information that helps them either to deliver national or Company policies, operational and business priorities, or to satisfy the traffic information needs and wants of customers and communities. These objectives should drive the Company's data and information activity, and we feel that the following recommendations will help Highways England to better target its efforts:

1. **The Traffic Information Strategy should set out Highways England's traffic data and information requirements and commitments, and should be reviewed annually.**

   The strategy should set out the customer and organisational needs that Highways England seeks to satisfy and how this will be achieved. It should identify key metrics, set out how these will be measured and how they contribute to meeting identified needs. Given the dynamic nature of the information sector, including technology development and ever rising customer expectation, the strategy should be reviewed and amended on at least an annual basis as part of the Business Planning process.

2. **Highways England should create and agree a clear definition of the most important customers for traffic data and information**.

   This should define the most important groups, such as end/road user, freight and logistics operators and data users/consumers, rather than trying to define and ascribe a similar value to all possible types and subsets of customers. Efforts should be made to capture and define the requirements for these primary customer groups through liaison, research and via stakeholder representatives. This may result in different strategies and approaches for delivery to different customers and should be reflected in policy and the Traffic Information Strategy.

3. **Highways England should develop a set of high level outcomes, in line with its strategy, that can be achieved through better traffic data and information and then measure the extent to which these outcomes are delivered**.

Mature organisations measure the success of their information efforts by reference to the achievement of high-level outcomes or outputs. For example, the rail industry measures the efficiency of its engineering activity rather than its possession planning, and TfL measures customer satisfaction with journeys rather than its incident management process.

4. **Highways England's existing data creation standards and metrics should be used by ORR in the short-term to monitor and assess how Highways England currently performs in the delivery of traffic data and information.**

   In the interim, whilst Highways England develop a set of high level outcomes and metrics for better traffic data and information (*recommendation 3*), ORR should utilise existing data creation standards and metrics for network conditions measurement, event data and roadwork to assess the performance of Highways England. These should include metrics for accurate reporting of road closures that go ahead as planned (*for example with a target of 90%*) and the timeliness of roadwork data updates (*potentially with a target of publication 7 days in advance*), validation of journey time data (*98% target*), availability of TMUs (*for instance 99% target*), updates of signs and signals (*2 minute target*), publication of time of events (*3 minute target*) and publication of strategic responses (*5 minute target*).

12.2 Focussing on the core offering

Having set out the purpose for which data and information is gathered, processed and disseminated, Highways England should focus on the basic requirements set out in its policy and operational documents. We feel that these recommendations will help Highways England to focus on consistency of data coverage, timeliness, accuracy and usability covering normal network operations as well as planned and unplanned disruption:

5. **Highways England should better understand the relative value of its existing traffic data and information, both for its own business and to customers**.

   This should include evaluating different data types and data states so that the Company can focus efforts on the most valuable assets. Importantly this valuation (be that economic or otherwise) must include the value that customers ascribed to it (both end/road users and third party data providers).

6. **Highways England should create a target data model that fully describes the condition of all of its traffic data and information.**

   This model should include historic, current and predicted traffic data. In creating this target model, Highways England should review the existing gaps and duplication in its current creation and provision of traffic data and information, and be better able to describe the relative condition of data to consumers and users. Within the data model there may be differentiation between road types, for example smart motorways and single carriageway A roads. For each category, the model should set consistent standards and targets in terms of geographical coverage, data and information collection, and end-user information service provision. Highways England should measure delivery to these standards.

7. **Highways England should review its culture and processes to ensure that delivery of customer information is considered at all stages of network operation, and that incentives and KPIs reinforce this.**

   There are three generic states that describe the status of road and traffic data: normal operation, planned disruption and unplanned disruption. We reviewed all three in the benchmarking exercise, comparing Highways England with European Road Agencies, Rail Possessions Management and Transport for London rail incident management. Whilst Highways England is rightly considered to be a leading player among UK and European road authorities, we identified examples of good practice in each area that could strengthen this reputation and benefit end-users. These include consideration of the end-to-end process from data collection to end-user consumption, establishing a corporate culture around the

mitigation of incidents and adoption of longer-term planning horizons for planned works, where the contracts and incentives are back to back across the supply chain.

8. **Highways England should focus on providing greater detail within existing data types and should categorise the impact of traffic events on road users.**

   This specifically relates to traffic data such as roadworks. One way of achieving this change is to provide more causality, impact and consequences (e.g. alternatives) of both planned and unplanned traffic events thereby enabling consumers to better understand what is important to completing their journey and what is less so.

9. **Highways England should adopt targets for earlier notification of roadworks and their impacts and communicate this with road users, in particular with the freight sector**.

   The rail industry has committed to a target of 12 weeks in terms of disruption to services due to engineering works. This enables customers to plan journeys and buy tickets and freight operators to rearrange delivery schedules. In contrast, the road sector works on close to real-time notification and also high levels of non-take-up of closures that causes concern, notably to the freight sector. To achieve its target, the rail sector plans over a five-year period with detailed planning commencing almost two years in advance and detailed proposals being shared with train companies six months before the planned work. This also enables engineering contracts to reflect these considerations and plan accordingly.

10. **Highways England should consider the provision of additional traffic data and information that are being requested by stakeholders.**

    These are:

    a. Provision of temporary speed limit data and the predicted consequential impact on traffic;
    b. Publication of diversionary routes, their suitability and the impact on traffic flows and speeds;
    c. Improvement naming conventions for incidents and planned closures/delays on the network; and
    d. Further data and information on the causes and consequences of planned and unplanned disruption.

12.3 Interfaces with the customer and users of data

The traffic data and information sector has a number of different parties covering network ownership and operation, data gathering and service provision. Highways England should focus on the interfaces between these parties. This will help the Company to meet the needs of road-users for end-to-end journey information from diverse channels and providers with seamless, consistent service provision.

Initially Highways England should focus on local and bordering national highway authorities and major end-user service providers and data aggregators. Over the period of RIS2 and beyond this may need to expand to include infrastructure and vehicle interfaces, as connected vehicles become the norm. We feel that the following recommendations will assist Highways England to address these interfaces:

11. **Highways England should elevate the role that third party traffic data consumers, aggregators and traffic information providers play in delivering Highways England policy objectives, and consider whether formal relationships should be used to achieve this.**

    These relationships should be viewed as core to meeting Company policy, goals and objectives for end customers and road users. In raising the importance of this group, Highways England should consider and better define the exact shape and format of these relationships. This should include implementing processes that better capture current and

future third party traffic data requirements and viewing the Company's traffic data as a valuable product that is supported with customer service commitments to third parties. There should be acknowledgement within any future relationships with third parties of the role some play in providing traffic data to Highways England to complement their own sources.

12. **Highways England should continue to work with other highway authorities, and consider taking a leading role in delivering network operation across the UK.**

    Very few journeys are made solely on the SRN and drivers will rightly expect their information needs to be met across their whole journey. The relationships and interfaces between highway authorities need to appear seamless and there needs to be a focus on the road network as a single entity rather than as a myriad of different owners and operational regimes. There is a potential leadership role for Highways England, to take an overview and to consider issues such as common standards, interfaces with local roads and initiating out of office response to traffic events, although this is not part of the current remit and resourcing.

Appendix 1 – Bibliography and reference

1. ORR, Benchmarking Highways England – 2017 progress report, 2017, https://orr.gov.uk/__data/assets/pdf_file/0013/26320/benchmarking-highways-England-2017-progress-report.pdf
2. Cambridge Economic Policy Associates (CEPA) and Transport Research Laboratory (TRL) Ltd (for ORR), Efficiency of Highways England's operating expenditure: Analysis of productivity and unit cost change, 2017, https://orr.gov.uk/__data/assets/pdf_file/0006/26286/efficiency-of-highways-england-operating-expenditure-report-2017-03-31.pdf
3. Matt Lovering and Nick Daley (Credo, for ORR), Highways England – roadworks management, 2017, https://orr.gov.uk/__data/assets/pdf_file/0007/26287/highways-england-roadworks-management-report-2017-05-24.pdf
4. ORR, International Journey Time Benchmarking: Strategic Road Networks Summary Report, 2017, https://orr.gov.uk/__data/assets/pdf_file/0008/26288/international-journey-time-benchmarking-analysis-report-2017-11-23.pdf
5. Gerard Whelan and Alan Taggart, (KPMG, for ORR), Benchmarking Highways England, 2016, https://orr.gov.uk/__data/assets/pdf_file/0015/20805/kpmg-benchmarking-highways-england-february-2016.pdf
6. Transport Focus, Transport Focus Data Hub, 2018 onwards, https://transportfocusdatahub.org.uk/manager/login.aspx
7. Department for Transport, Bus Services Act 2017: Consultation on Bus Open Data, 2018, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/722573/bus-services-act-2017-open-data-consultation.pdf
8. Department for Transport, Open Data Strategy, 2012
9. Transport Scotland, Clear - Keeping Scotland's traffic moving, 2014, https://www.transport.gov.scot/media/31626/j320515.pdf
10. Research Resource, Exploratory research to inform Transport Scotland ITS Strategy, 2018
11. Stephen Craig (Jacobs, for Transport Scotland), Future Intelligent Transport Systems Strategy 2017 to 2022: Research and Consultation Summary Report, 2017, https://www.transport.gov.scot/media/41636/its-strategy-research-and-consultation-summary-report-july-2017.pdf
12. Deloitte (for TfL), Assessing the value of TfL's open data and digital partnerships, 2017, http://content.tfl.gov.uk/deloitte-report-tfl-open-data.pdf
13. TfL, Open Data: Powering London through free open transport data, 2016,
14. Highways England, Traffic Information Strategy, 2016, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/490540/S150634_Traffic_Information_Strategy.pdf
15. NIS, National Traffic Information Service: Performance Monitoring Approach, Revision 8.0, 2018

16. NIS, National Traffic Information Service: DATEX II Service, https://www.datex2.eu/sites/default/files/NIS%20P%20TIH%20008%20NTIS%20DATEXII%20v8.pdf
17. NIS, National Traffic Information Service: Publish Service, http://trafficengland.com/resources/cms-docs/overview.pdf
18. Maila Herrala (VTT Technical Research Centre of Finland), The value of transport information, 2007, https://www.vtt.fi/inf/pdf/tiedotteet/2007/T2394.pdf
19. Traveller Information Services Association (TISA), TISA Position On Quality of Traffic Information, 2016, http://tisa.org/wp-content/uploads/QWG16001_TISA_Position_paper_Quality_Of_Traffic_Information_v12a_final.pdf
20. K. Bogenberger and S. Weikl, Quality Management Methods for Real-Time Traffic Information, 2012, https://www.sciencedirect.com/science/article/pii/S1877042812042711
21. A.J. de Jong, Quality of Real-Time Travel Time Information: A research to travel times presented to drivers in the Netherlands, 2012, https://www.utwente.nl/en/et/vvr/education/Master/finished_graduation_projects/afstudeerders_per_jaar_2/pdf/2012_09_26_Joost_de_Jong.pdf
22. Sandra Geisler, Yuan Chen, Christoph Quix (Aachen University), Guido G. Gehlen (Ericsson), Accuracy Assessment for Traffic Information Derived From Floating Phone Data, 2009, http://publications.rwth-aachen.de/record/125434
23. T. Delissen and E. Rijnierse (National Data Warehouse for Traffic Information – NDW), DATEX II Dutch Profile, 2015, https://www.ndw.nu/pagina/en/20/brochures/
24. James Elliott (Elliott Asset Management, for ORR), Highways England and Incident Management Study: Final Report, 2018, https://orr.gov.uk/__data/assets/pdf_file/0014/40370/highways-england-and-incident-management-study-2018-12-19.pdf
25. Eric A. Gordin (Florida Department of Transportation), Evaluating the Impact and Usefulness of Highway Advisory Radio and Citizens' Band Radio Advisory Systems in Providing Traveler Information and Improving the User Experience on the Florida Turnpike Enterprise's Toll Road Network and the Florida Interstate Highway System, 2016, https://transportationops.org/publications/evaluating-impact-and-usefulness-highway-advisory-radio-har-and-citizens%E2%80%99-band-radio
26. Stacy Unholz (Atkins, for Metropolitan Transportation Commission), Traveler Information Industry Scan, 2015
27. Utah Department of Transportation, 511 Strategic Planning: Final Report, 2014
28. Risto Kulmala et al, Quality of Safety-Related and Real-Time Traffic Information Services: Quality package, 2018 Update, https://www.its-platform.eu/filedepot_download/1807/6305
29. Leif Rystrøm (Danish Road Directorate), Quality of Safety-Related and Real-Time Traffic Information Services: Practical Guidelines, 2018, https://www.its-platform.eu/filedepot_download/1807/6304
30. ISO, Intelligent transport systems — Integrated transport information, management and control — Data quality in ITS systems, 2008
31. Rijkswaterstaat, Quality of SRTI-messages in the Netherlands, 2016
32. Clas Roberg (Trafikverket), Experiences And Results From The Validation Studies In Sweden, 2015

33. EU, Commission Delegated Regulation (EU) 2015/962 of 18 December 2014, 2014, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32015R0962
34. EU, Commission Delegated Regulation (EU) No 886/2013 of 15 May 2013, 2013, https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:32013R0886
35. Glenn Lyons, Erel Avineri, Sendy Farag, Reg Harman, Strategic Review of Travel Information Research, September 2007
36. Glenn Lyons, Erel Avineri and Sendy Farag, Assessing the demand for travel information: do we really want to know? Centre for Transport & Society, University of the West of England Bristol, UK
37. Global Strategic Business Report, Traffic Information Services, Global Industry Analysts Inc , March 2018, https://medium.com/goodvision/report-on-the-size-of-traffic-management-market-317284d5189e
38. Roger C. Lanctot, The Death of Radio Traffic Reports Foretold, Prematurely, https://www.linkedin.com/pulse/death-radio-traffic-reports-fortold-prematurely-roger-c-lanctot
39. Elias Saba, Amazon's Alexa can now give you traffic information for local businesses and landmarks, 2017, http://www.aftvnews.com/amazons-alexa-can-now-give-you-traffic-information-for-local-businesses-and-landmarks/
40. Elias Saba, Amazon and Garmin teamed up to make a tiny Echo Dot for your car with Alexa navigation, 2017, http://www.aftvnews.com/amazon-and-garmin-teamed-up-to-make-a-tiny-echo-dot-for-your-car-with-alexa-navigation/
41. Louis Hendriks (Rijkswaterstaat), Ronald Jorna (Mobycon), Jacqueline Barr (IBI Group), Peter Lubrich (BASt), Dorin Dumitrescu (ITS Romania), Luis Baptista (IMT / Infraestruturas de Portugal) (for European ITS Platform), EU EIP SA46 Annual NAP report 2016, 2017, https://www.its-platform.eu/highlights/report-status-national-access-points-europe-published
42. TfL Customer Information Strategy, 2016 http://content.tfl.gov.uk/sasp-20160310-p1-item13-customer-information-strategy.pdf
43. Quality Management Methods for Real-Time Traffic Information, K. Bogenberger, S. Weikl
44. Department for Transport, Highways England: Licence, April 2015
45. Highways England Delivery Plan 2015-2020
46. Highways England Delivery Plan Update 2018-2019
47. Highways England Traffic Information Strategy 2016
48. Assessing the value of TfL's open data and digital partnerships, Deloitte, 2017, http://content.tfl.gov.uk/deloitte-report-tfl-open-data.pdf
49. NIS PLN QUAL 006 Performance Monitoring Approach.doc
50. Elgin trial (M1 junction 23a to 25) - Evaluation Report, June 2018
51. Highways England Strategic Business Plan, 2015-2020, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/396487/141209_Strategic_Business_Plan_Final.pdf
52. Highways England, Customer Service Plan, 2018-2019
53. Policy for the use of Variable Signs and Signals (VSS) June 2018 version 3.0

Appendix 2 – Comparison of traffic data and information provision by different UK and EU road operators

Organisation	Highways England		Traffic Scotland		Transport for London		Traffic Wales		Rijkswaterstaat		ASFA - France	
Source within organisation	**Website**	**Syndicated data**	**Website**	**Syndicated data**	**Website**	**Syndicated data**	**Website**	**Syndicated data**	**Website**	**Syndicated data**	**Website**	**Syndicated data**
Road network condition monitoring												
Traffic speed (*average on a link)*	Yes	Yes (multiple forms)	Partial coverage - average for routes only	Partial coverage	No	No	Colour groupings for each speed band	No	Only congested areas are highlighted	Yes	Colour groupings for each speed band	Not found
Traffic flow *(number of vehicles passing a point)*	No, unless closure	Yes (multiple forms)	No	No	No	No	No	No	No	Yes	No	Not found
Travel time *(junction to junction)*	No	Yes	Partial coverage *(selected routes)*	Partial coverage	Specific sites (*e.g. Blackwall Tunnel)*	Based on specific pre-sets only (*location, time etc.)*	No	No	No	Yes	Selected routes, shown on separate map	Not found
Delay	Yes	No (can be inferred from other data)	Yes	No (can be inferred from other data)	No	No	Only estimates due to roadworks	No	Yes	No (can be inferred from other data)	No	Not found
CCTV/traffic camera images	Yes	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Not found
Map of network/link model	Yes	Yes	Yes	No	Yes	Yes *(corridor-based)*	Yes	No	Yes	Yes	Yes	Not found
Events occurring on the network affecting travel conditions												
Traffic incidents	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Not shown separately	Yes	Yes	Not found
Roadworks *(current and planned)*	Yes	Yes	Yes	Yes	Yes	Yes	Yes (via Elgin)	Yes	Yes	Yes	Only current shown	Not found
Closures *(may be derived from roadworks list)*	Yes (within roadworks)	Yes (within roadworks)	Yes	Yes (within roadworks)	Yes	Yes (within roadworks)	Yes (via Elgin)	Yes	Yes	Yes (within roadworks)	Only current shown	Not found

Organisation	Highways England		Traffic Scotland		Transport for London		Traffic Wales		Rijkswaterstaat		ASFA - France	
Source within organisation	**Website**	**Syndicated data**	**Website**	**Syndicated data**	**Website**	**Syndicated data**	**Website**	**Syndicated data**	**Website**	**Syndicated data**	**Website**	**Syndicated data**
Abnormal loads	Yes	Yes	No	No	No	No	No	No	No	Yes	No	Not found
Congestion/queues	Yes *(for defined congestion events)*	Yes *(for defined congestion events)*	Yes	No *(can be inferred from other fields)*	Only linked to incidents	No	Yes	No	Yes (*for defined congestion events)*	Yes	Traffic speed scale only	Not found
Events occurring on and off the network affecting travel conditions												
Major organised events (current and planned)	Yes	Yes	Yes	No	No	No	Limited	No	No	Yes	No	Not found
Adverse weather (driving conditions)	Yes	Yes	Events and specific weather station measurements	Yes	No	No	Yes	No	No	Yes	Yes	Not found
Responses to events both on and off the network												
VMS locations	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No	Not found
VMS text legends	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No	Not found
Matrix signal settings	Yes	Yes	No	No	No	No	No	No	No	Yes	No	Not found
Diversion routes	No	No	No	No	No	No	Yes	No	No	Yes	No	Not found
Information relevant to specific road user types												
Freight information (geared to freight industry)	No	No	Yes	No	No	No	Icon for roads closed to HGVs	No	No	Yes	No	Not found

Key to colours
Item found in organisation's traffic information offering
Item found in organisation's traffic information offering (but limited scope)
Item not found in organisation's traffic information offering

Appendix 3 – Comparison of different delivery channels by different UK and EU road operators

Organisation	Highways England	Traffic Scotland	Transport for London	Traffic Wales	Rijkswaterstaat	ASFA - France
Channels giving travel information (directly owned by organisation)						
Website for mobile devices	Yes	Yes	Yes	Yes	Yes	Yes
Mobile App	Yes	No	No	Yes	No	No
Twitter handle	Yes (national and per region)	Yes	Yes	Yes (one each for North/South Wales)	Yes	Page not used for traffic information
Facebook page	Page not used for traffic information	Yes (page actively used for travel information)	Page not used for traffic information	Page not used for traffic information	Page not used for traffic information	Page not used for traffic information
Email alerts	Yes	No	Only covers public transport options	Yes	No	No
RSS feed	Yes (professional users only)	Yes	No	Yes	No	No
Dedicated traffic radio station	No (discontinued)	Yes (Traffic Scotland radio)	No	No	No	Yes
Dedicated customer call centre or information line	Yes	Yes (24 hour operation)	Yes	Yes	Yes	No

Key to colours

Item found in organisation's traffic information offering

Item found in organisation's traffic information offering (but limited scope)

Item not found in organisation's traffic information offering

Appendix 4 - EU standards and documentation relating to pan-European traffic data and information

The following initiatives have been considered in formulating the set of good practice in this area:

1. **Quality of Safety-Related and Real-Time Traffic Information Services: Quality package (2018 Update)**

The European ITS Platform (EIP) projects provided a recommendation on quality requirements for the European services of Safety-Related Traffic Information (SRTI) and Real-Time Traffic Information (RTTI), as well as the data content of them. EIP also provided a recommendation for the quality assessment methods to be used in evaluating the services against the evaluation criteria and requirements specified by EIP.

The document provides guidance on how to describe, manage and assess SRTI and RTTI service quality. It focuses on the first parts of the information service value chain, i.e. content detection and content processing. Content detection starts at the occurrence of an event or change in traffic-related condition and the content processing ends at the provision of the information at a content access point. The guidance for the later parts of the value chain (service provision and service presentation) are planned to be developed by the EU EIP project in 2016-2020.

2. **Quality of Safety-Related and Real-Time Traffic Information Services: Practical Guidelines (2018)**

These Guidelines give a short practical description of what to do in order to measure and document the quality of traffic information generated by a data supplier. The guidelines aim to support the staff at traffic centres, when implementing quality assessment and quality management practices for their data provision.

The Guidelines will also help to report quality levels to the users of the traffic information as well as to the European Commission (EC), as required in the Delegated Regulations/Acts concerning SRTI (Safety Related Traffic Information) (Ref 1) and RTTI (Real Time Traffic Information) (Ref 2).

The guidelines are focused on event-oriented SRTI and RTTI (e.g. accidents), as defined by the previously mentioned EC Delegated Regulations/Acts. Status-oriented SRTI/RTTI (e.g. traffic flow) is not considered. Furthermore, these Guidelines focus on the quality of the data itself. Quality of RTTI/SRTI service provision is not considered.

3. **Intelligent transport systems - Integrated transport information, management and control - Data quality in ITS systems (2008)**

This Technical Report specifies a set of standard terminology for defining the quality of data being exchanged between data suppliers and data consumers in the ITS domain. This applies to Traffic and Travel Information Services and Traffic Management and Control Systems, specifically where open interfaces exist between systems.

In the majority of ITS applications, data is routinely exchanged between disparate systems. However, transport and travel information is frequently being provided via interfaces onto open networks for use by external users and it may not always be known from where this data has originated or for what purposes it is suitable.

In these circumstances, a stated quality of the data becomes important and it is critical for users to understand the quality parameters so that accurate information can be derived from the data by itself or in combination with data from other sources.

Data quality meta-data includes the usual range of parameters normally associated with the measurement of quality such as veracity, precision, service completeness, availability and timeliness of the data. However, there are other important quality meta-data such as ownership of the data. Ownership is important in many applications, and data suppliers may wish to restrict the usage of their data to certain classes of users. Measures of data quality may also be important in determining the relative monetary value of data in a commercial situation and so it is important that there is a common understanding of these measures.

4. **Quality of SRTI-messages in the Netherlands (2016)**

This presentation is a self-assessment of the quality of safety related traffic information (SRTI) messages Rijkswaterstaat provides as a content provider. The European ITS platform (EIP) developed quality criteria and assessment methods, whilst the follow-up (EIP+) delivered testing and validation of the quality recommendations.

This document sets out the current Rijkswaterstaat architecture and process for managing responses to events. Different measurement approaches were undertaken, depending on the type of event or condition being investigated.

In order to comply with EIP definitions on road safety related 'universal traffic information', Rijkswaterstaat carried out a translation exercise to map across their previously defined national categories and compare findings with the EIP-defined quality levels. These findings were as follows:

- It is not possible to determine the Dutch quality level of latency, because the latency is below the basic level;
- For timeliness (start/end) the level in the Netherlands is mostly enhanced; and,
- The quality level of error rate for debris on the road in the Netherlands is basic.

5. COMMISSION DELEGATED REGULATION (EU) 2015/962 of 18 December 2014

This Regulation covers the provision of EU-wide real-time traffic information services. It establishes the responsibilities and specifications necessary in order to ensure the accessibility, exchange, re-use and update of road and traffic data by road authorities, road operators and service providers for the provision of EU-wide real-time traffic information services. It shall apply to the comprehensive trans-European road network, as well as motorways not included in this network, and priority zones identified by national authorities where they consider this relevant.

The Regulation defines three data categories, with different characteristics:

- Static road data;
- Dynamic road status data; and,
- Traffic data.

The Regulation states that each member state shall set up a national access point. The national access point shall constitute a single point of access for users to the road and traffic data, including data updates, provided by the road authorities, road operators and service providers and concerning the territory of a given member state.

Member states shall assess whether the requirements set out in this Regulation are being complied with by the road authorities, road operators, digital map producers and service providers and may request such data as required in order to evidence this.

6. COMMISSION DELEGATED REGULATION (EU) No 886/2013 of 15 May 2013

This Regulation states the specifications necessary to ensure compatibility, interoperability and continuity for deployment and operational use of data and procedures for the provision, where possible, of road safety-related minimum universal traffic information free of charge to users on the trans-European road network.

The events or conditions covered by the road safety-related minimum universal traffic information service shall consist of at least one of the following categories:

a) temporary slippery road;
b) animal, people, obstacles, debris on the road;
c) unprotected accident area;
d) short-term road works;
e) reduced visibility;
f) wrong-way driver;

g) unmanaged blockage of a road; and,

h) exceptional weather conditions.

Member States shall manage national access points to the data, designate sections of the trans-European road network where traffic and safety conditions require deployment of the road safety-related minimum universal traffic information service and inform the EC of these.

Public road operators, service providers and broadcasters dedicated to traffic information shall provide road safety-related minimum universal traffic information to end users prior to the provision of any other non-safety-related traffic information. The information service shall be provided in such a way as to maximum dissemination to affected end users and be made available, if possible, free of charge to end users. Information providers shall collaborate to harmonise the presentation of content to end users.

Member States shall designate a competent national body to assess if these requirements are being fulfilled by information providers and notify the EC. The information providers shall provide the designated national bodies with their identification details, a description of the information service provided, and submit a declaration of compliance with the requirements. The designated national bodies shall randomly inspect the correctness of the declarations of a number of information providers, and request proof of compliance with the requirements.

Member States must inform the EC within 12 months of the national body designated for the assessment of compliance with the requirements. They must also provide progress updates annually thereafter, advising of the progress they have made in implementing the information service, including how its quality is defined and monitored, and the results of the assessment of compliance with the requirements.

Appendix 5 - Planned Network Disruption - Network Rail/Great Western Possessions Management

Key findings arising from possessions management

Key findings arising from workshops, reviews and discussions on the processes of possession management:

- Possessions Management process originated from the process of agreeing the works necessary in each 5-year Control Period.
- The next Control Period (CP6) commences in 2019, extends to 2024, and forms the basis for Network Rail funding from Government and the Regulated Measurement Regime overseen by ORR.
- The overall Engineering Work Bank covers major schemes, renewals and maintenance as well as minor schemes.
- The Route Utilisation Strategy for the route to 2024 and beyond is published, forming the Network Rail aspirations for each route and this is published together with the CP6 Business Plan for each route.
- There is Train Operator Company (TOC) input into the Business Plan and the Route Utilisation Strategy, however these are chiefly in the form of the agreed Franchise Commitments.
- DfT has a major input into the CP6 process in the form of policy aspirations and future franchise commitments and as the source of funding for the Control Period.
- As Great Western is currently under Direct Award status, there is little new TOC-related work, however the last Control Period included the extensive work to cover Great Western Electrification and works related to the new ICE trains.
- The process of agreeing the detailed engineering work for 2019 commenced around 90 weeks in advance of the new timetable with the publication of the Engineering Access Statement (EAS); this included the new works specified in CP6, also deferred work from CP5.
- The EAS includes the periods during which engineering work is permitted including two-track timetables (in four track areas) and white periods when no services are scheduled to operate.
- This is included in the Timetable Planning Rules, against which the TOCs bid for slots to operate trains and forms the basis for point-to-point running allowances and issues such as station dwell times and junction allowances as well as engineering and temporary speed restriction allowances.
- There is no quantum of engineering work allowed to be bid for beyond the already agreed engineering access allowances.
- The engineering assessment needs to take account of the required works in the CP6 plans and utilisation strategy, including:
    - Major works;
    - Maintenance;
    - Renewals; and,
    - Minor works.
- The track renewals work bank for CP5 leads to the assumptions for CP6 including the quantum and cost of the works.
- The engineering assessment enables Network Rail to ensure that they can enable back-to-back arrangements with the supply chain for track renewals, maintenance and for major works.
- The final arrangements for engineering works also takes account of the position on adjoining routes, for example major works between Didcot and Oxford in 2020/21 precludes work on:
    - Swindon to Gloucester/Cheltenham;

  - Cross Country services can have no other works within 3 hours (nothing South of Didcot and between Oxford and York);
  - Freight requires West Coast to be open given route restrictions on other routes; and,
  - Chiltern also needs to be available.
- In the event of any conflict in arrangements, there may be last minute agreements on route priorities, but these need to be finalised in a period greater than 7 months from the commencement of the works.
- There may also be some maintenance carried out in advance of major works to ensure that the non-affected route operate at optimal performance levels, this enables the following to be achieved:
  - Temporary Speed Restrictions are avoided;
  - Performance issues are minimised; and,
  - Trains operate within the agreed allowances.
- Cancelled engineering works are not common, although there may be issues where contracts are nearing completion and/or works are delayed.
- Where works are cancelled, the revised engineering affected timetable would normally be maintained, however this is subject to a pragmatic assessment, however, the trains need to adhere to the advertised time where they are not affected by the works themselves.
- Where works overrun, or are likely to overrun:
  - If this is known in advance then the work may be curtailed;
  - Contingency Plans may already be in place;
  - For major works, pre-planned arrangements may cover periods up to 24 hours; and,
  - Train service contingency plans in place for unplanned disruption may be implemented to cover work overruns.
- Agreed process for each individual possession, except those already allowed for in the EAS and TPR arrangements:
  - Draft Period Possession Plan agreed at T-31 (weeks) and sent to Train and Freight Operating Companies;
  - At T-29 a meeting is arranged with all the key parties to review the contents of the Draft Plan;
  - At T-27 a Confirmed Period Possession Plan is published;
  - The Train and Freight Operating Companies then enter a bid and offer process for the revised train service requirements until T-14;
  - At T-12 the revised customer arrangements and any agreed White Space are put in place which includes:
    - Revised train and replacement bus arrangements;
    - Ability to buy tickets and reservations on the revised timings; and,
    - Freight customers able to identify revised routeing for traffic, including restricted container traffic that can be advised to customers.
  - T-12 is pretty much achieved for most possessions.
- As well as the minimum T-12 arrangements set out in the Informed Traveller Programme most Train Operators try to make further communication with their customers, for example:
  - Programme of works throughout a year or three months;

  - This may be linked to a major works programme such as electrification and new trains;
  - Multiple communication channels may be used as part of the programme;
  - User groups and community groups will be part of the overall programme;
  - Passenger events will also form part of the programme of communication activity; and,
  - This may be tied to the 5-year plan but needs to have relevance and context.
- Where possible, the agreed works programme should have a procurement interface beyond the major works for example, the proposed blockage on the Barnstaple route will include:
  - Minor cosmetic works at stations;
  - Works on structures e.g. bridges;
  - Line speed improvements; and,
  - Community engagement.
- The Network Code puts an obligation on Network Rail to consult with operators, this result in the production of an Overall Route Plan that on the Great Western route is referred to as the One Plan.
- Measurement of the engineering programme:
  - Day-to-day performance;
  - Efficiency of works carried out;
  - Late notice changes (outside the agreed programme) less than 20 per period;
  - Network and asset condition; and,
  - Amount and efficiency of works performed against the CP5 or CP6 Plan.
- Customer satisfaction measurement:
  - Monthly research sessions;
  - National Passenger Survey – Information at Times of Disruption; and,
  - Feedback volumes and their trends.
- Resolution of Disputes:
  - Largely internal as part of the process;
  - Any disagreement can go up the internal chain; and,
  - No general dispute resolution but the backstop would be the Access Dispute Resolution Arrangements.
- ORR Interface with Possessions and Engineering Management:
  - Efficiencies at the agreed CP5 or CP6 level of achievement;
  - Schedule 4 cost as part of Track Access (and equivalent freight access costs);
  - Cost of work done against targets;
  - Safety Performance; and,
  - T-12 process compliance (DfT responsibility).
- Key Documents include:
  - Engineering Access Statement – Paddington to Swindon;
  - Timetable Planning Rules – Great Western route;

- One Plan; and,
- Route Utilisation Strategy and Route Business Plan – Great Western.

Appendix 6 - Unplanned Network Disruption – London Underground – Incident Management

Key Findings from London Underground – Incident Management Workshop

- There is an Incident Management Rule Book covering all aspects of the subject and a number of training packages in this area.
- The maximum time from a wheel stop incident to this being relayed to London Underground Control Centre (LUCC) is 5 minutes, which would normally include the matter being reported to, and passed on by, the relevant Line Information Specialist. In reality, this is normally in the region of one minute.
- The detection of an incident would normally be from the train running system (signalling), but could also be from the train radio system.
- The driver of a stopped train is required to make an announcement to passengers within 30 seconds of coming to a stand; they may often have contacted the Line Controller within that period.
- Station staff may also be the source of information, this may be about station overcrowding or the need to clear an object from the line, again this will normally be relayed via the Line Controller.
- LUCC has access to *Tracker.net* that shows all line diagrams and the movement of services, which is a very useful tool to verify incidents affecting train services.
- For engineering work, line occupied and line clear declarations are the responsibility and domain of the Line Controller, however the Information Manager will be kept abreast of any exceptions to the planned timings.
- The view of the Network Information Manager at LUCC is that he takes the Customer View of any incident and translates the emerging information into messages that manage the flows of customers affected by the problem and manages customer expectation.
- Although much of the process is set down in the Incident Management Rule Book and various Information Flow diagrams and language guides, there is also a fair amount of human decision-making and application of experience, which is encouraged.
- Therefore, station staff may take a view on station overcrowding, the line information specialist on the current status of the train service and also on the state of any return to Business as Usual, when the operational incident may be over but the consequences are still affecting the overall service level.
- Thus, the training process involves a considerable amount of "sitting with Nellie" as well as the formal training modules, so that the individual can get a feel for events and the necessary translation of these into user-friendly language.
- The formal decision-making process involves the Network Operations Manager (NOM) and the Line Service Manager for operational issues. This is mirrored by the Network Information Manager and the Line Information Specialist for information matters.
- In the event of a difference of opinion between the line and the centre, the central view would prevail, however this is not a normal occurrence.
- London Underground does not have a formal measurement regime, given the process is generally only available to the key participants, but all complaints regarding information and any feedback from senior management is the subject of an investigation.
- The quarterly customer information survey is the key measure of performance and satisfaction; this includes a question on information at times of disruption.
- Complaints investigation is carried out by reference to historical records from the electronic service update information (ESUI) records.
- Information about lift and escalator non-availability is subject to measurement, with 90% of incidents that are reported being published on the various information sources/channels within 5 minutes of notification from station staff.

- Formal Incident Management Process:
    - Senior Operating Officer in charge of the process;
    - Declares a Category 1 incident in the event of a Service Suspension and/or a Major Station Closure;
    - Network Incident Response Manager looks after the operating incident;
    - Radio Channel for communications is specified;
    - This is the source of information for all participants;
    - The Network Information Manager uses this channel as the prime source of information, with regular liaison with the Line Information Specialist; and,
    - Generally, there is no need to disturb the operating officers as the information from the radio channel is very comprehensive but the SOO is located in the same office in the event of further information.
- Validation of reported incidents:
    - Generally from access to operating systems such as tracker.net;
    - Line controller also source of validation;
    - In the event of a reported incident such as person or obstruction on the track:
        - First question is where is the information from?
        - If it is from London Underground staff then generally accepted to be correct?
        - If it is from a member of the public, then depends on the circumstances?
        - Nearest London Underground staff member may be sent to investigate.
        - Category of disruption triggered by circumstances but person on line will be presumed to be correct.
- Incident progression:
    - Category agreed at the outset;
    - On-going status checked and increased or reduced in severity as appropriate;
    - Progress of the incident checked at agreed milestones and channels updated as appropriate;
    - At the termination of the operating incident this is an operational decision made by the SOO and the Network Incident Response Officer; and,
    - Following the end of the operational incident, the Network Information Manager and the Line Information Specialist liaise on the status of the service until the service is deemed to have returned to normal.
- It is generally considered that the management of incidents and the information that is disseminated about them is much improved in recent years.
- Information about non-London Underground TfL operations:
    - London Overground is generally good and also reports to NRCC;
    - TfL Rail is deemed to be much improved since joining the TfL family and taking over services from Liverpool Street and Paddington;
    - Docklands Light Railway is system driven and therefore generally very timely and accurate; and,
    - Tramlink can be a problem with frequent failures to inform the problems to LUCC and the impression that it operates as a separate service rather than part of the overall family.

- Key documents include:
    - Information Process Flow;
    - Performance Regime for each route;
    - Language used for Describing Disruptions; and,
    - Incident Management Rule Book.