Highways England's Performance in Road Period 2

Defects Management Performance Review Final Report

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Contents

Project acronyms

A to I			K to Z	
ACS	Asset Class Strategies		KPI	Key Performance Indicator
AD	Asset Delivery		M&R	Maintenance and Response
ADAMR	Asset Delivery Asset Maintenance Requirements (GM 701)		MP	Major Projects Directorate
ADAIR	Asset Delivery Asset Inspection Requirements (GS 801)		MRP	Maintenance Requirement Plan
AM	Asset Management		NM	Network Management
ADMM	Asset Data Management Manual		Ops	Operations Directorate
AMOR	Asset Maintenance and Operational Requirements		PI	Performance Indicator
AMTP	Asset Management Transformation Programme		RIP	Regional Investment Programme
APTR	All-Purpose Trunk Roads		RIS	Road Investment Strategy
ASC	Asset Support Contract (predecessor to AD)		ROC	Regional Operating Centre
DCGN	Defect Categories Guidance Note		RP1 (2,3)	Road Period (1:2015-20, 2:2020-25, 3: 2025-30)
DMRB	Design Manual for Roads and Bridges		SRN	Strategic Road Network
IAM IS	Integrated Asset Management Information System			
IAMP	Informed Asset Management Plan			
ILPM	Intelligence-Led Predictive Maintenance			
IP5	Investment Plan Statement for Maintenance Delivery covering defects (part of Annual Performance Monitoring Statement)			

Executive Summary

This report was commissioned by ORR and is a summary of how Highways England carries out defects management, to assess the appropriateness of its current approach and to identify additional monitoring areas for ORR during Road Period 2 (RP2).

The review has focussed on two key areas to assess how Highways England is meeting its [obligations] during RP2:

- (i) the operational processes that assure Highways England's defect identification, risk assessment and rectification; and
- (ii) the overarching asset management approach including the implementation of risk-based asset group strategies and the extent to which this minimises the occurrence of defects on the network.

This **Executive Summary** section includes our summary findings against a series of scope questions and monitoring recommendations for ORR. These have been developed through engagement with ORR and Highways England and through review and analysis of documentation and data, including a comparator survey, related to defects management on the Trunk Road and Motorway network. The recommendations have been grouped into process themes:

- [**A**] Overarching defects management
- [**B**] Defect identification
- [**C**] Defect assessment
- [**D**] Defect rectification
- [**E**] Defect data and performance management
- [**F**] Claims.

Chapter 1 expands on our findings and conclusions under the following elements of Highways England's approach:

- [**1.1**] Highways England's legal and licence requirements
- [**1.2**] Highways England's operational processes to manage defects
- [**1.3**] The use of defects knowledge as part of risk-based asset management
- [**1.4**] Opportunities for ORR to monitor defects management.

Chapter 2 provides further context for the project and our findings in the following subject areas:

- [**2.1**] Defects management performance
- [**2.2**] Defect identification
- [**2.3**] Defect assessment
- [**2.4**] Defect rectification
- [**2.5**] Defect data management.

Appendix A provides a project glossary of terms.

Appendix B sets out the results of our comparator survey with other road organisations.

Project findings and recommendations

Table 1 – Project findings and recommendations for ORR, including target delivery timescales

Notes on Table 1:

- *Orange shaded cells are monitoring recommendations for ORR to consider within six defects management themes, together with a suggested timeframe for implementation (1-2 years, 3-5 years).*

- *Blue shaded cells summarise the findings for the 16 questions posed by ORR in the project brief, grouped under the same defects management themes.*

Defects management theme			Defects management findings [1 to 16] and strength of evidence
ORR Monitoring area	**1-2yrs**	**3-5yrs**	**Monitoring recommendations for ORR [A.x to F.x etc]**
[A] Overarching defects management	Y		**[A.1**] ORR should ensure that Highways England's operational guidance for defects management continues to be aligned with the document referencing and version control in its DMRB standards. This will maintain a robust and consistent defects management process.
		Y	**[A.2]** ORR should ensure that Highways England continues to trial, implement, and evaluate defects management performance improvements from its asset management improvement roadmap and transformation programme (AMTP).
		Y	**[A.3]** ORR should continue to monitor the development of Highways England's defects management improvements from its operational transformation programmes, in particular from the 'Intelligence Led Predictive Maintenance' theme.
[1] Defect identification – Are methods of inspection suitable in type and frequency for all types of road and asset?			**Strong evidence** – Highways England uses a risk-based approach to determine the risk categories across its network links (sections) and from these it uses the approach set out in its Asset Delivery Asset Inspection Requirements (GS801) to determine the frequency of safety patrols and safety inspections. Factors that are used to assess the level of risk include a combination of traffic flow data, percentage of HGVs, accident data, occurrence of significant reactive defects and local knowledge of area specific issues. Minimum frequencies are:

Link risk	Safety patrol	Safety inspection	Notes
High	Daily	Weekly	Safety patrols are not required on days
Medium	Weekly	Fortnightly	

Defects management theme	Defects management findings [1 to 16] and strength of evidence		
ORR Monitoring area	1-2yrs	3-5yrs	**Monitoring recommendations for ORR [A.x to F.x etc]**

	Low	Fortnightly	Four weekly	when safety inspections are carried out.

Inspection frequencies are therefore established based on national guidance but tailored to a regional basis and reflect relative regional priorities. There may be merit in Highways England moving to a national level network priority classification to inform inspection frequencies and to ensure a nationally consistent approach and for consistent reporting of defect performance data.

Highways England reported that the inspection of APTR and motorways where hard shoulders are not available for inspections from a vehicle can present challenges. Inspectors can sometimes walk behind barriers and supplement inspections with high-definition dash-cam footage.

Note that not all assets are capable of being inspected from a driven patrol or inspection, such as structures, and these assets have other inspection regimes in place in accordance with DMRB asset specific standards.

Also note that the focus for this project is with safety-related defects and inspections to proactively identify these, and not asset condition inspections which are used to assess overall asset condition, including defects which do not present a safety risk, but which are used to determine planned defect maintenance and inform renewal scheme planning, although it is noted that condition inspections may be used to indicate a higher risk of defects occurring and to trigger more frequent safety inspection as a result.

[2] Defect identification – Are inspections undertaken consistently across the SRN?	**Strong evidence** – Highways England has improved its consistency of defect identification through the adoption of a new (2020) Defect Repair process and detailed inspector guidance across its operational regions.
	The national group of regional heads of service delivery appears to be working well and is a driver for national consistency. Highways England reported that as new AD contracts start there is a bedding in period, with some initial inconsistency of defect identification, but this improves as staff adjust to the risk-based regime.
	All Highways Inspectors receive formal accredited training which in conjunction with standard training materials/manuals and quality checks by inspection supervisors helps to promote consistency.

Defects management theme	Defects management findings [1 to 16] and strength of evidence		
ORR Monitoring area	1-2yrs	3-5yrs	**Monitoring recommendations for ORR [A.x to F.x etc]**
[3] Defect identification – How does Highways England monitor compliance that inspections are completed as required?			**Some evidence** – Although Highways England does not currently report on its completion of safety inspections and patrols against frequency targets, we understand that this data is available and is regularly tracked in regional databases. **It is recommended that a measure is developed to monitor inspection performance against target frequencies (daily, weekly, fortnightly etc) for safety inspections and patrols.**
[4] Defect identification – Are the methods Highways England uses to collect reports of defects from the public, and key stakeholders, suitably robust and accessible for all users?			**Some evidence** – Highways England operates a central process to capture and pass on customer queries including defects to its regions. Regional control centres notify Inspectors when they receive a customer query with all queries followed up by Inspectors to identify their priority. Highways England reported that a new customer reporting channel is being trialled which uses the commercially operated 'Fix my Street' platform linked to Highways England's regional databases. This is an online process that is initiated through Highways England's Customer Contact Centre and is being trialled in the East Midlands region. When rolled out, the process will provide a 360-degree response to customers including an independent check and challenge by regional inspection managers.
			Other highways authorities follow a similar process to record and respond to customer queries including the increasing use of 'Fix my Street' and some have adopted alternative approaches to defect identification such as using control centre staff to 'triage' defects by selecting the most appropriate response.
			The extent to which customer reporting is accessible to all road users on various communication platforms has not been fully explored in this project, and there is the potential for ORR to carry out a deeper dive review of the customer reporting process and its relative accessibility. This could include notification mechanisms, follow up process, timescales, types of users, ease of navigation etc. It would be useful to engage with Transport Focus as part of this review.
[5] Defect identification – Is the approach to inspections sustainable? E.g. Are inspections adequately funded?			**Strong evidence** – Highways England prioritises safety inspections in its regions and reported that these generally achieve their target inspection frequencies, although **more formal and granular performance monitoring of inspections at a regional level is recommended**. (See response to Reference 3 – Defect Identification). Mitigation of safety risk appears to be the primary driver for inspections. Consideration of whether the frequency of inspections provides value for money, i.e., to support the balance between planned vs reactive maintenance (see below), was not evidenced in this project and could be a useful study by Highways England.
			Highways England reported that the introduction of single person inspection crews in response to Covid-19 has not affected achieving the target frequency of safety inspections, however whether the loss of a 2nd pair of eyes in an inspection vehicle has impacted the quality of defect identification is not yet clear. The

Defects management theme	Defects management findings [1 to 16] and strength of evidence		
ORR Monitoring area	**1-2yrs**	**3-5yrs**	**Monitoring recommendations for ORR [A.x to F.x etc]**
			introduction of new AI and image-based technology to provide additional defect identification views may reduce costs in the longer term.
[B] Defect identification	Y		**[B.1]** ORR should monitor Highways England's consideration of the establishment of a national network hierarchy classification system across all road types to develop more consistent setting of inspection frequencies and reporting of defect performance data.
	Y		**[B.2]** ORR should monitor Highways England's development of its performance reporting metrics including the performance of completed safety inspections to target frequencies. This could be based on data that Highways England already captures for inspection management and audit purposes, and for example, take the form of percentage inspections completed in time.
	Y		**[B.3]** ORR should monitor Highways England's consideration of how technology such as AI and image analysis could be used to provide an alternative to walked inspections to manage the risk of inspecting routes that have access restrictions such as APTR and motorways with no hard shoulders.
	Y		**[B.4]** ORR should monitor Highways England's development of defect identification improvements to improve its reporting, consistency and analysis of defects management performance.
[6] Defect assessment – Are the definitions of defects used by Highways England correct and consistently applied within and across contract areas? How well are they understood both internally and externally by key stakeholders and users?	**Some evidence** – The project has focussed on defect assessment within AD regional contracts which is Highways England's main operating model. Evidence shows that Highways England is developing a more consistent approach. Reporting of performance data still indicates some regional variance such as the percentages of 24-hour defects recorded and defects per lane km. There have been positive initiatives to achieve national consistency, and Highways England reported that it intends to investigate regional variation when they are confident that the data is consistently reported. The definitions of defects used by Highways England are complete and comprehensive, and are consistent with practice in other highway authorities. Defect definitions appear to be well understood internally within Highways England's operational teams. This includes the use of DMRB and internal technical documents such as the Inspectors guide.		
[7] Defect assessment – Is the balance of risk and customer service suitable across all road and asset types? Is safety	**Some evidence** – Highways England operates a risk-based approach which considers network safety to road users. The risk-based approach is mindful of high-risk situations (Immediate and 24-hour response)		

Defects management theme	Defects management findings [1 to 16] and strength of evidence		
ORR Monitoring area	**1-2yrs**	**3-5yrs**	**Monitoring recommendations for ORR [A.x to F.x etc]**
criticality and consideration of the whole-life of the asset adequately balanced?			and Inspectors can escalate responses as necessary. The approach also balances risks to road users with road workers (Inspector and response contractor). Evidence from this project shows that Highways England prioritises safety over whole life cost, which is appropriate given the priority given to safety and the nature and use of the strategic network. Consideration of safety vs whole life cost also depends on asset type – Highways England reported examples of carrying out regional 'small scale' renewals using revenue funding as a more expeditious approach than developing a scheme using capital funding. Highways England also reported that when evidence of defects indicate a more rapid rate of deterioration, this process can be beneficial for some asset types including carriageway pavements.
[8] Defect assessment – Are systems for storing, assessing and processing inspection and defect data quality suitably robust? What/where are the gaps in data and asset knowledge?			**Some evidence** – Highways England records all safety defects in its regional databases and this data can be extracted centrally for reporting purposes. The associated systems and processes to record data quality appear to be robust from the limited evidence as part of this review. Highways England reported that data capture, assessment and reporting has improved and is now more consistent across regions. The central performance team has started to assess each region's performance data to identify variations that require further investigation. Defects data is used differently to identify and justify renewals depending on the asset type. This approach is set out in the Asset Strategies which the regions are adopting. If gaps are identified in asset knowledge there are other inspection regimes open to regional teams to use such as machine surveys and targeted inspections. Highways England reported that data is generally complete for defects management but there is scope for more extensive use of defects data, e.g., in supporting scheme identification and assessment.
[9] Defect assessment – How does HE assure that the data collected through its defects monitoring process is appropriate, reliable, timely, and accurate?			**Strong evidence** – The improvement journey described in theme [2] above has been mainly informal through Highways England's regional teams working together with challenge by the Central Performance team. This has identified data consistency issues which have now been addressed. As well as the standards GS801/GM701 there is the ADMM which sets out how asset condition is recorded and assessed, and which provides data quality provisions. Any safety defects identified from asset condition inspections and surveys are subject to the same risk assessment and defects management process. Highways England reported that Inspectors work is assured through ad hoc supervision but that this approach varies across the regions, e.g. carrying out joint inspections and swapping inspection routes between Inspectors.

Defects management theme	Defects management findings [1 to 16] and strength of evidence		
ORR Monitoring area	**1-2yrs**	**3-5yrs**	**Monitoring recommendations for ORR [A.x to F.x etc]**
[C] Defect assessment	Y		**[C.1]** ORR should engage with Highways England with a view to monitoring regional differences in defects management performance and prompt the setting of more challenging internal targets to further improve performance. Monitoring could include for example, the numbers of defects per lane km for different asset types and defect categories, the percentage of 24-hour defects as a proportion of total defects, or the distribution of defects in different response categories.
	Y		**[C.2]** To provide more transparency to road users ORR should engage with Highways England and suggest publishing guidance that communicates its defects management process and service level expectations. This could include customer guidance around how to report defects, the service that customers should expect from Highways England and how Highways England monitors and is improving its performance. This is similar to guidance published by local authorities.
		Y	**[C.3]** ORR should continue to work with Highways England and with Transport Focus to better communicate Highways England's defect management approach to road users including customer expectations and how to report defects.
[10] Defect rectification – Are processes for works ordering and the scheduling / programming of repairs robust and consistent across all contract areas?	**Some evidence** – The new Defect Repair process which includes rectification steps is being adopted in all AD regions. Aspects of this process appear to be determined by the requirements and capabilities of the Confirm database steps rather than by process design although these satisfy Highways England's purpose to provide a timely risk-based response. Time extensions (departures from the standard defect response time) for permanent repairs are used where there are issues with spare parts and materials availability, and accessibility of the network. These are considered in conjunction with other risk mitigation measures. The extensions process includes an independent sign-off step by the regional Head of Service Delivery. It is understood that such time extensions are exceptional rather than normal practice. "Find and fix" is used by Inspectors where they can rectify minor defects at the time defects are recorded. This is seen as a positive and proactive initiative with benefits in both speed of response and reduced cost. However, at present the use of 'find and fix' bypasses the standard works ordering process, which Highways England is in the process of rectifying. This arises because 'find and fix' defects are reported as 24-hour even though they may not need a high-risk response.		

Defects management theme	Defects management findings [1 to 16] and strength of evidence		
ORR Monitoring area	1-2yrs	3-5yrs	**Monitoring recommendations for ORR [A.x to F.x etc]**
[11] Defect rectification – How does Highways England assure itself that defect repairs are completed to required timescales and against required quality standards?			**Some evidence** – Highways England's defect repair process records key milestones to assure and monitor rectification vs allocated risk-based target times. Refer to response to theme [10] above. The defect repair process includes mechanisms for assurance and sign off of defects as they are processed and rectified on site and recorded as complete in the Confirm system. Note that the physical quality of defect repairs and the proportion of 'right first time' and repeat defect repairs was not covered as part of this project and would be useful to investigate further.
[12] Defect rectification – Is the approach to defect mitigation sustainable? E.g., Is funding for defect resolution adequate?			**Some evidence** – Highways England's approach to defect mitigation and repair appears to be sustainable in the regions that we engaged with, with safety being the primary driver. Highways England reported that funding to repair safety defects is not an issue. It is worth noting that the numbers of safety defects in each region will depend on the condition and age of the network and asset stock. In the longer term, the sustainability of the chosen defect mitigation regime in each region will depend on there being a fully funded (sufficient and sustainable) planned renewals regime with appropriate and timely asset interventions.
[13] Defect rectification – How does Highways England prioritise defects activities, what tools are available to decision makers to support whole life cost decision making?			**Some evidence** – Safety inspections are required as part of Highways England's proactive maintenance regime and all evidence points to safety being the predominant factor in decisions to rectify defects rather than a drive to minimise whole life cost. For non-safety defects, Highways England has a suite of asset standards that include condition inspections to collect information to make whole life cost decisions. Highways England reported that the defect repair procedure supports the whole life process. Some asset types have tools that take account of defects in the context of whole life cost and renewals planning. For example, for pavement assets Highways England uses the SWEEP lifecycle investment tool and Programme Investment Tool (PIT) to make use of asset data to support investment decisions. Some other asset types use defects data manually as part of a whole life process, but it is not clear if this applies, and is probably not relevant, to all assets. Highways England reported that the appearance of defects is not necessarily indicative of an asset nearing the end of its service life or is necessarily related to the lifecycle of the asset. For example, Vehicle Restraint System (VRS) defects may be the result of collisions and technology assets may near the end of their life through obsolescence. HGVs driving over footways may be a further cause of defects but not as part of a normal lifecycle. The development of Asset Class Strategies (ACS) for the main asset classes from

Defects management theme	Defects management findings [1 to 16] and strength of evidence		
ORR Monitoring area	**1-2yrs**	**3-5yrs**	**Monitoring recommendations for ORR [A.x to F.x etc]**
			July 2020 is a positive initiative which reflects the different approaches required to maintenance and renewals for different asset classes.
[D] Defect rectification	Y		**[D.1]** ORR should monitor Highways England's development of national guidance on the use of defect data in planning for renewals and in the evaluation and prioritisation of renewals schemes to improve the consistency of identifying asset need.
		Y	**[D.2]** ORR should continue to monitor and assess the impact of Highways England's ongoing operational transformation theme 'Intelligence led predictive maintenance' on defects management performance and in particular the efficiency of defect rectification.
		Y	**[D.3]** ORR should monitor Highways England's use of Capex vs Opex maintenance funding in regions as part of its asset management approach to rectify defects and optimise treatments as part of 'mini renewal' schemes at the most appropriate point in their asset lifecycle.
	Y		**[D.4]** ORR should work with Highways England to report on the full range of defect response timescales and not only 24-hour responses, including regional and asset category defect rectification performance.
[14] Defect data & performance management – Is there a consistent approach to storing post-rectification defect data?	**Strong evidence** – See response to theme [10] above. Highways England reported that for those AD regions that use the Confirm database a consistent structure is in place for recording defect rectification data. Note that this project did not engage with non-AD regions such as ASC and DBFOs, which are in the minority and are becoming a diminishing proportion of the network length as they transition to AD.		
[15] Defect data & performance management – Does HE embed defect intelligence in a whole-life asset management approach? E.g. How is defect data used to support the development of asset maintenance and renewals programmes?	**Some evidence** – Whilst defect data is available and used by those regions we engaged with to develop planned renewals, this does not appear to be comprehensively embedded. See response to theme [13]. Highways England acknowledges that it could better use defect data from inter-related asset groups to improve an asset's whole life regime and identify multi-asset interventions. For example, using drainage and geotechnical defects to identify the causes of pavement deterioration. Highways England will be using one of its OE2025 themes 'Intelligence led predictive maintenance' to look at more condition-based monitoring to link up asset interventions into a single programme and improve efficiency. It is noted that Highways England is improving its configuration of the pavement PIT decision support tool which will allow		

Defects management theme	Defects management findings [1 to 16] and strength of evidence		
ORR Monitoring area	**1-2yrs**	**3-5yrs**	**Monitoring recommendations for ORR [A.x to F.x etc]**
			it to build on current capabilities in assessing pavement condition survey data and asset age to better support decision making across regions. This project has not looked at the balance of the cost of defect repairs vs maintenance to understand the optimum balance of a predictive or proactive maintenance regime vs reactive maintenance, but this is likely to be different for each asset type and defect type. OE2025 will provide Highways England with an opportunity to better understand these factors and how it can embed defect intelligence in its whole life asset management approach.
[E] Defect data & performance management			See also **[B.2]**, **[B.4]**, **[C.1]**, **[C.2]**, **[D.4]** and **[D.5]** above which refer to defect data and performance management.
		Y	**[E.1]** To improve Highways England's maintenance operations, ORR could consider proposing leading as well as lagging defects management performance indicators, for example using analytical tools to predict where defects are likely to occur and guidance on the most appropriate maintenance response.
	Y		**[E.2]** ORR should engage with Highways England to improve the visibility and reporting of regional operational performance data – for example, the sub-division of performance data into response time categories as well as the use of regional stretch targets and the use of sub-measures such as contractor rectification response times and defect quality rates. Reporting the ratio of the number of defects reported vs fixed, and those defects repaired 'right first time' i.e. not needing a repeat repair, could also be beneficial. Note that current performance reporting of defect rectification vs risk-based response times uses a 90% threshold, with greater than 90% categorised as "green" or good performance and less than 90% categorised as "red". This threshold is low when compared to typical local authority practice (typically 95%+), and now that this measure is being reported consistently within Highways England, a higher threshold could be adopted.
	Y		**[E.3]** ORR should ensure that Highways England continues to review the performance and reporting of 'find and fix' defects by safety inspectors to ensure that they do not skew general defects management performance reporting.

Defects management theme	Defects management findings [1 to 16] and strength of evidence		
ORR Monitoring area	**1-2yrs**	**3-5yrs**	**Monitoring recommendations for ORR [A.x to F.x etc]**
		Y	**[E.4]** ORR should work with Highways England to better understand the cost of defect maintenance vs planned maintenance. This should use performance data and operational guidance to understand if optimum whole life interventions are being implemented.
[16] Claims – Does Highways England use the data from 3rd party damage and claims to review its defect management practices?	**Limited evidence** was made available to assess whether such data is used to inform defect management practices, and this project did not look at the relationship between claims and defects. It is however noted as a general principle that improvements in the quality and reporting of defects data should help to identify patterns and trends between asset condition and red claims i.e. those made against Highways England. The recommendation for producing customer expectation guidance **[C.2]** is also relevant. The relationship between red claims and undertaking safety inspections and patrols to time, as well as responding to defects within a target time, are important areas that should be considered by Highways England to support its asset management approach.		
[F] Claims		Y	**[F.1]** ORR should work with Highways England to monitor how the incidence of red claims (claims against Highways England) relates to asset and defect management and what operational guidance could be developed for Highways England's regions.

1   Project findings and conclusions

This section describes the operational processes that Highways England uses to identify, assess, and rectify defects to provide assurance that it is meeting its obligations under the Highways Act 1980 and its Licence.

1.1   Highways England's legal and licence requirements

Highways England defines defects as either causing an unintended hazard, nuisance, or danger to the users of the highway, or representing a deterioration from the normal condition. Asset defects also include preventing the asset from acting in its intended manner, a damaged asset or where it is likely to increase the rate of deterioration of another asset.

Highways England is very conscious of the requirement to maintain the Strategic Road Network (SRN) and to and to meet its obligations through its inspection and defects management approach. This is reflected in its published processes, manuals and guidance. Through our engagement with Highways England we have seen evidence of a continual review of network performance and specifically defects management.

The terms of the Licence underpin Highways England's operational delivery functions and defects management. These influence the requirements for road user and inspector safety, asset management, maintenance, renewal, and replacement, efficiency and value for money, standards, specifications and guidance, and the collection, provision and publication of data and information.

The Highways Act also places a series of general and specific duties on highway authorities including where it is applicable to Highways England as a highway authority for the SRN. Its duties under the Act were confirmed through the 2015 Infrastructure Act. The two duties in the Highways Act relevant to defects management are section 41 and section 58:

> ***Section 41 Duty to maintain highways maintainable at public expense*** *- The authority who are for the time being the highway authority for a highway maintainable at the public expense are under a duty…to maintain the highway.*

> ***Section 58 Special defence in action against a highway authority for damages for non-repair of highway -*** *In an action against a highway authority in respect of damage resulting from their failure to maintain a highway maintainable at the public expense it is a defence (without prejudice to any other defence or the application of the law relating to contributory negligence) to prove that the authority had taken such care as in all the circumstances was reasonably required to secure that the part of the highway to which the action relates was not dangerous for traffic.*

A further specific duty was inserted into the Highways Act at section 41(1A) by the Railways and Transport Safety Act 2003 to *"…ensure, so far as is reasonably practicable, that safe passage along a highway is not endangered by snow or ice."*

The Highways Act defines maintenance as "*…where "maintenance" includes repair, and "maintain" and "maintainable" are to be construed accordingly*." There is no further provision for the interpretation of 'maintenance'.

The results of the comparator survey undertaken in this project (see **Appendix B** for further details) indicate that Highways England's risk-based inspection regime is consistent with the approach taken by other highway authorities.

1.2 Highways England's operational processes to manage defects

To meet its obligations as far as possible, Highways England uses a set of national standards and a risk-based approach to plan its safety inspections and to identify, assess and rectify defects. These are designed to achieve a nationally consistent standard for defects management performance. The comparator survey indicated that Highways England's operational defects management regime is consistent with that of other UK highway authorities. Note that Highways England has recently reviewed and updated its standards for highway inspections and defects management in parallel with its ongoing transition to Asset Delivery operations across its regions. The key objective of this process has been to firstly improve the consistency of defects management and from this baseline identify where performance can be improved.

The key documents that Highways England uses to deliver its defects management approach are GS801 Asset delivery asset inspection requirements, GM701 Asset delivery asset maintenance requirements and GG104 Requirements for safety risk assessment. These are published as part of the DMRB standards suite. Supporting documents that provide further guidance to Asset Delivery regional teams include a Defect Repair Process and accompanying guidance including Defect Categories Guidance (DCG) and a Defect Categories Guidance Note (DCGN). The documents in this paragraph are summarised below:

- GS801 Asset delivery asset inspection requirements – this standard contains the inspection and assessment requirements for motorways and APTR which provide network safety and network condition:

    1) Network safety – safety patrols and safety inspections that are predominantly focused on ensuring the network is safe and serviceable to deliver a service customers can trust, including lighting and technology operational inspections; and

    2) Network condition – inspections that look at the longer-term condition of all asset items.

  The standard defines the process for determining the frequency of safety patrols and safety inspections by firstly categorising the risk of the particular network link, using factors including '…a combination of traffic flow data, percentage HGVs, accident data, occurrence of significant reactive defects and local knowledge of area specific issues'. Once a network section has been categorised either high, medium or low, the standard defines the minimum safety patrol and safety inspection frequencies:

  1) high risk links:
  a) safety patrol: daily (but not on days that a safety inspection is undertaken)
  b) safety inspection: weekly
  2) medium risk links:
  a) safety patrol: weekly (but not on weeks when a safety inspection is undertaken)
  b) safety inspection: fortnightly
  3) low risk links:
  a) safety patrol: fortnightly (but not on fortnights that a safety inspection is undertaken)
  b) safety inspection: four weekly.

  The standard further notes that all defects, including roadside technology defects, that have the potential for deterioration and could cause a risk to the achievement of the outcomes or cause a danger to the users of motorways and all-purpose trunk roads shall be monitored.

- GM701 Asset delivery asset maintenance requirements – this is the primary standard for defect maintenance and sets out the maintenance requirements for various asset and activity categories to achieve four outcomes:
  1) Improve safety risk for all exposed populations who are either using, working on or affected by motorways and all-purpose trunk roads
  2) Improve customer experience
  3) Stabilise maintenance and renewal costs through the use of emerging methods
  4) Inform delivery of capital improvements to the affected property.

  The standard also defines what are asset defects (see glossary) and includes a section on an "intelligence-led approach to defect prioritisation" which effectively introduces Highways England's risk-based approach to defect interventions and associated timescales based on safety, customer service and availability. The standard also identifies four possible sources for the identification of defects: Inspections, Incidents, 3rd party reports and Collaborative custodianship.

- GG 104 Requirements for Safety Risk Assessment - sets out the approach and provides a framework for the identification, assessment and management of risk, specifically safety risk, for Highways England activities, and of such is key to defect management and maintenance and inspections. It is a generic framework that can be applied to any type of activity; the specifics of how it is applied to Defects and Inspections are documented elsewhere, particularly in the Asset Delivery Inspections and Maintenance requirements (GS801 and GM 701) and in Defect Categories guidance.

- Defect Repair Process – sets out the process for defect repair, specifically for use with the Confirm system. It describes the categorisation of defects into the required response time from 1 hour through to 6 months or longer, the process for issuing works for rectification and creating variations to response times where they are not achievable, and the approval of completed works for payment.

- Defect Categories Guidance (DCG) – this provides guidance on the identification and classification of defects to assets for those undertaking inspections on Highways England's network. The use of this guidance by Inspectors and other Highways England staff contributes to ensuring assets are as safe as reasonably practicable and not dangerous to passing traffic and capable of supporting the section 58 special defence.

- Defect Categories Guidance Note (DCGN) – this provides additional guidance on what are safety and non-safety defects for all asset types. The information is not deemed to be an exhaustive list of what is deemed to be a safety or non-safety defect and where timescales for repair are indicated, the guidance states that these are taken as a guide and individual site and defect risks shall be taken into account when considering the timescales for repair. For defects that are not covered in the guidance the definition for a safety defect should be referred to i.e. a defect that causes "…an unintended hazard, nuisance or danger to users of the highway."

Note that the comparator survey confirmed that the approach set out in GS 801 aligns with other English local authority risk-based practice (based on UKRLG Well Managed Highways) i.e. based on the assessment of risk likelihood and severity from which the Inspector makes an assessment, and which determines a timed response.

Highways England has defined the methods of response open to its regional maintenance operations for categorising and rectifying safety and non-safety defects. These are:

- Safety defects – addressed by an individual action or combination of Urgent Mitigation, Permanent Repair, Temporary Repair and/or Hazard Mitigation, within the following timescales:

- ▪ Immediate – the risk is such that immediate injury is almost certain to occur. Action must be taken as soon as the resources to mitigate in a safe manner can get to the defect location.
      - ▪ 24-hours – all Safety Defects should have the risk reduced to an acceptable level within 24 hours of reporting.
- Non-Safety Defects – timescales are set by the identifier i.e. Inspector or other authorized person but within the following timescales for permanent repair, although the guidance does allow latitude taking account of the defect type, likelihood of deterioration location, ability to provide resources to effectively and safely facilitate the permanent repair.
      - ▪ 7-days – for defects which result in an increased safety hazard to users, but no immediate risk i.e. is not a Safety Defect
      - ▪ 14-days – for defects which result in safety hazard to users
      - ▪ 28-days – for defects which are not currently a hazard to users, but are highly likely to become so
      - ▪ 6-months – for defects which are not currently a hazard to users and not currently likely to become so, but where a repair is still required.

Highways England told us that although safety inspections and response times are nationally consistent, its risk-based approach means that the overall defects management process can vary by region according to its local network categorisation and types of motorways and APTRs, traffic levels and the different asset stock.

1.2.1 Defects management improvements

Highways England is trialling several initiatives that could improve its defects management processes and performance, including through its operational excellence transformation in RIS2, OE2025. The initiatives which were shared with us include:

- The development of 'Intelligence Led Predictive Maintenance' (ILPM) and digital inspection strategy to improve the efficiency of cyclical maintenance and a move from routine to proactive maintenance. This will reduce the risk of asset and service failures, reduce disruption to customers, reduce safety risk to inspectors and reduce asset maintenance and inspection costs.
- The development of key metrics to support ILPM including the unit cost of maintenance, ratio of planned to reactive maintenance, current and forecast asset condition including high risk hotspots, the quantity of unexpected asset events and the quality of asset data.
- The use of 'find and fix' by Inspectors where it is possible to rectify defects immediately rather than waiting for this to be ordered to a maintenance crew.
- A trial of a service based on 'Fix my Street' which offers customers the opportunity to notify Highways England of a defect and to be kept in communication with its progress.
- The automation of regional performance data from its IAM IS asset inventory and defects database into its national reporting software.
- Highways England's AD regions, comprising the 7 regional Heads of Service Delivery meet monthly to understand defect management (DM) performance and improve consistency in the DM process.

1.2.2 Defects management performance

Highways England currently reports defect response performance in its annual Performance Monitoring Statements (IP5 reports). This data is provided quarterly to ORR to be able to monitor in-year performance. Through our engagement we have ascertained that the reporting of defects performance data has evolved over the last two years and the current data set represents a

significant improvement on previous reports. It is also clear from what Highways England told us that they see the increasing importance of this report and underlying data as a tool to monitor and drive improvement in the regions to improve defects management performance and develop national consistency.

IP5 data is reported cumulatively through the year to ORR which builds towards an annual statement of performance. Highways England is more confident in its validation and reporting of IP5 defect data since the implementation of its refreshed Defect Repair process (June 2020) and the ability to automatically pull regional defect data from IAM IS into national reports (from October 2020). Note that specific asset defects such as operational technology will continue to be reported through separate databases and combined into national reports.

IP5 data is based on lagging indicators of 24hr and total defect response. This includes 'find and fix' i.e. defects which are rectified by the Inspectors at the time they are identified. A Red-Green status is applied with a current threshold of 90% across all response categories (i.e. if greater than 90% defects are rectified within their allocated responses time, such as 24 hours, they are identified as "Green" implying an acceptable level of performance). As part of its business transformation OE2025, Highways England may consider the development of leading indicators.

Figures 1.1 to 1.3 below are based on the performance data provided to us for this project and have been used to inform our engagement with Highways England. It is noted that some of this data was issued to us with the caveat that there were some historic issues with data consistency between the regions. Since October 2020 and following a review of data consistency by Highways England there is now greater confidence in regional data. This improvement has been driven by the regional AD Service Delivery teams in conjunction with the performance team.

Using the defects data provided to us and a DfT route lengths data set we have calculated the averages per 100 lane km for all defects and 24-hour defects respectively for the years 2019/20 and 2020/21. This is shown in **Figures 1.1 and 1.2.** The 2020/21 figures are an extrapolation to a full year based on the first two quarters' data. **Figure 1.3** shows numbers of 24-hour defects as a percentage of total numbers defects in each region. **Figures 1.4 and 1.5** describe percentage performance in rectifying defects within allocated target times for all defects and for 24-hour defects respectively.

These graphs highlight the following features in performance data:

- The relatively high level of defects (both 24-hour and total) in the North West region.
- The variation between percentages of 24-hour defects, e.g. between South West and Midland regions.
- The significant reduction in total average defect levels in the first half of 2020/21 in the South West, South East and to a lesser extent East region. Note that for the East this is not reflected in the 24-hour defects, which shows a small increase in the annual equivalent 100km defect rate which would merit discussion.
- The significant reduction in both 24-hour average defect levels in the first half of 2020/21 and in the percentage of 24-hour defects recorded in the Midlands region. Note this is not reflected in the total figures which remain consistent.
- All regions have made improvements in the percentage of total defects rectified within time in the first half of 2020/21 compared to 2019/20 and all but one has improved performance for 24-hour defects.

Given that the recent improvements to data quality that have been described above have yet to work their way through into this reported data it is difficult to assess whether regional and year-on-year differences are a function of these or whether they represent actual differences. Further analysis when successive quarters of consistent data are available would be beneficial. Note that the

impact of Covid-19 on inspection practices and performance data has not been evaluated as part of this project.

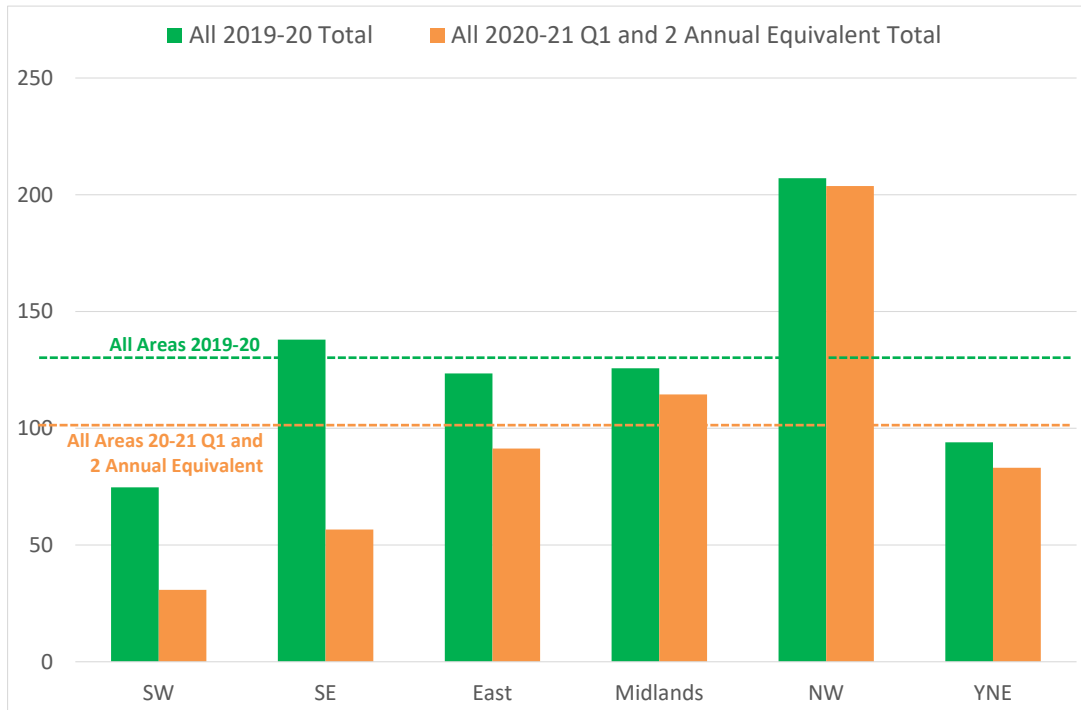*Figure 1.1: Average Total Defects per 100km by Region and Year*

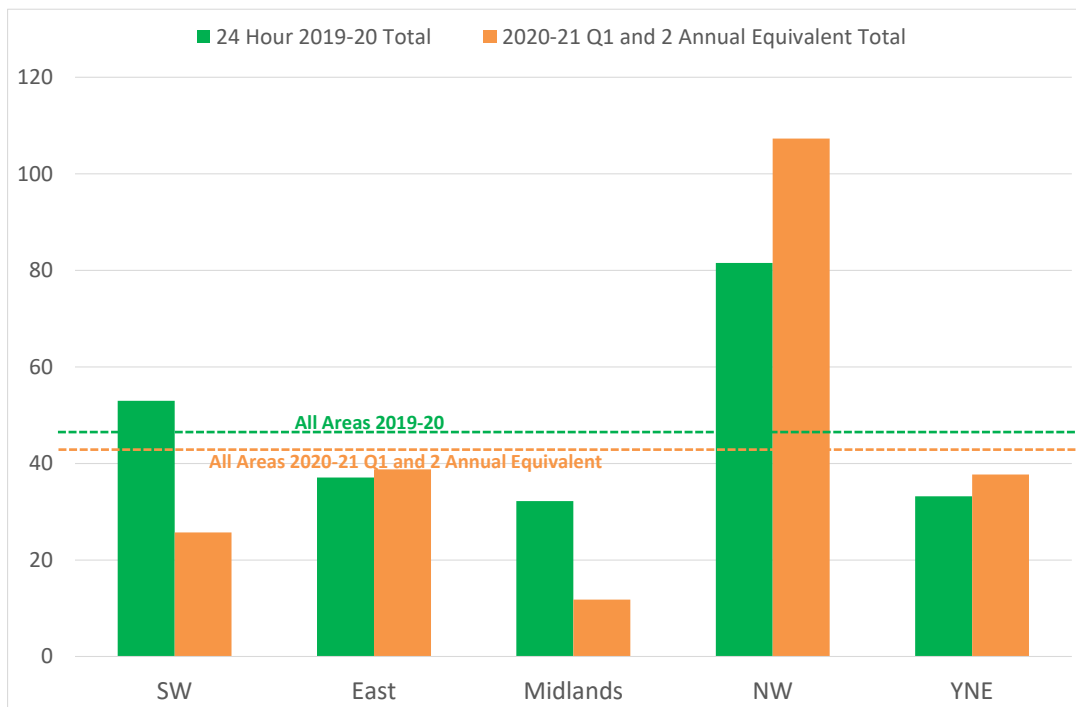*Figure 1.2: Average 24-hour Defects per 100km by Region and Year (excluding South East)*

Figure 1.3: Percentage of no of 24-hour Defects to total no of defects by Region and Year (excluding South East)

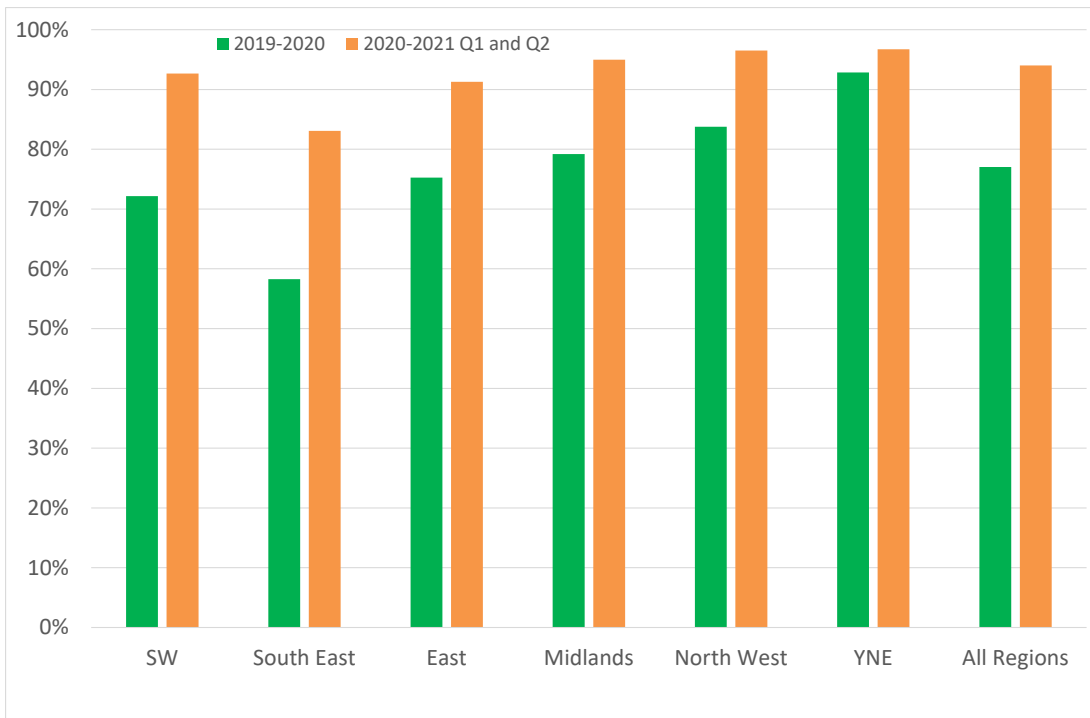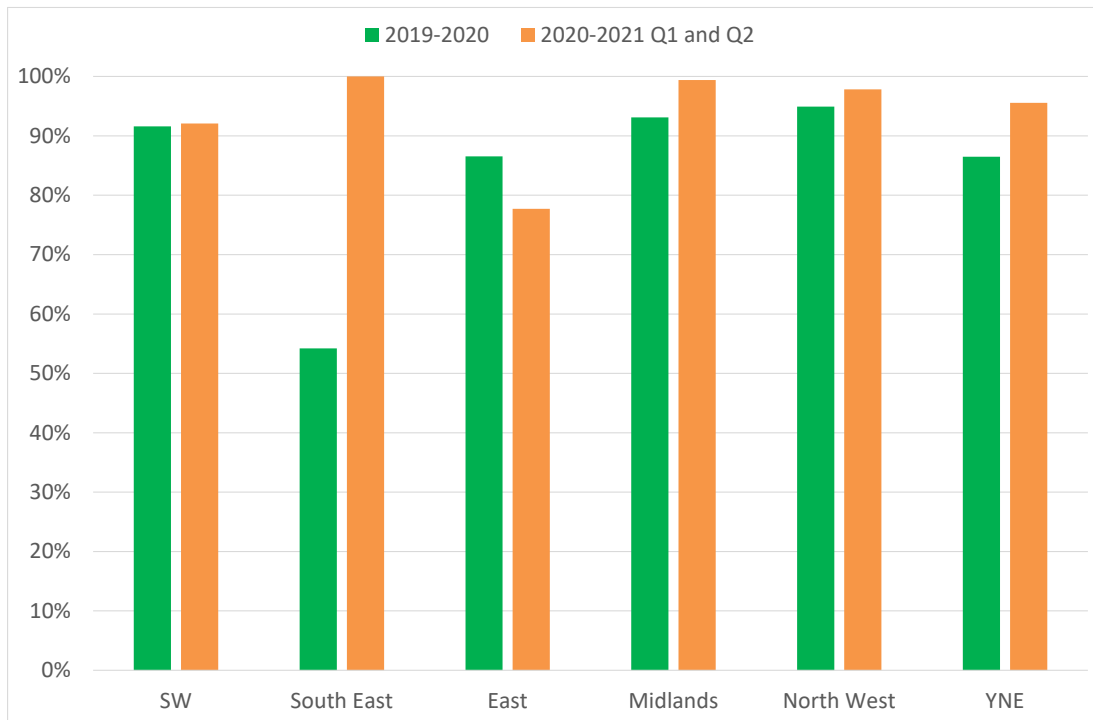*Figure 1.4: Percentages of Defects Rectified within Timescale (All Defects)*

Figure 1.5: Percentages of Defects Rectified within Timescale (24 Hour Defects)

1.2.3 Inspector competencies and inspection process

Highways England told us that there can be challenges between Inspectors categorising a defect response time within the required contract requirement and the practicalities of network access and traffic management to rectify a defect as well as, on occasion, the supply of some materials/parts. Highways England manages these situations with a formalised and auditable process to approve extensions to the risk-assessed response time where these cannot be carried out. In these circumstances and where required, Highways England will first mitigate any safety risk such as providing close-coning for barrier defects or deploying flood boards for flooding defects.

GS801 states that all personnel undertaking network safety and condition inspections shall be responsible and competent for the task undertaken, have received suitable training and be fully conversant with the relevant guidance.

Highways England told us that all Inspectors have LANTRA City & Guilds 603 qualifications which provides them with the awareness to make risk assessments within the limits of Highways England's defined defects management process. This is equivalent to other UK local highway authorities.

Highways England told us that in the first year of some AD contracts there were challenges with Inspectors miscategorising defects in accordance with the risk-based regime. This produced an unexpected increase in the volume of defects identified for rectification and an increase in maintenance costs during this initial contract period. Following analysis of the data and retraining of the Inspectors, defect levels returned to more expected levels.

Highways England's Inspectors have had to adjust to Covid-19 and deploy single crew inspections in accordance with published guidance. This means dual crews (driver/observer) is not possible. Highways England told us that there is no evidence that this has impacted inspection frequency or data quality.

Findings: Defects management legal and Licence requirements and operational process

- Highways England's need to meet its legal and Licence obligations through inspection and defects management is reflected in published process, manuals and guidance.
- Highways England has provided evidence of the development of processes to achieve regional consistency and the continual review of network performance and defects management.
- Highways England uses a set of national standards and a risk-based approach to plan its safety inspections and to identify, assess and rectify defects. These are designed to achieve a nationally consistent standard for defects management performance.
- Highways England has recently reviewed and updated its standards for highway inspections and defects management in parallel with its transition to Asset Delivery operations across its regions.
- Highways England's approach to defect management set out in GS 801 aligns with other English local authority risk-based practice.
- Highways England reported that although safety inspections and response times are nationally consistent, its risk-based approach means that the overall defects management process can vary by region according to its local network categorisation.
- Highways England is trialling several initiatives that could improve its defects management processes and performance.
- Highways England requires formal qualifications for its Inspectors equivalent to other UK highway authorities. There have been some initial challenges with the reporting of defects in the initial AD contract period which has required the retraining of Inspectors to the new risk-based regime.
- Highways England publishes annual IP5 reports (Maintenance Delivery Reporting) with national performance data as well as quarterly regional performance data to ORR. ORR reported that the level of reporting in terms of visibility and usefulness has improved significantly over the last 12 months.
- Analysis of 2020-21 IP5 data against 2019-20 shows improvement across all regions. It is too early to tell if this is the result of data quality improvements or a real change in performance, but this is an area that Highways England reported that it is actively monitoring.
- There have been issues with the quality and consistency of reported performance data related to defects management which have recently been addressed and Highways England expect to be able to make more informed regional comparisons using this data going forward.
- The recently established group of Heads of Service Delivery within AD contracts appears to be a positive development which is working to establish a consistent approach to defects management. It is providing a level of assurance that processes for defects management are being operated correctly.

1.3 The use of defects knowledge as part of risk-based asset management

1.3.1 Highways England's asset management approach

In accordance with its Licence requirement, Highways England is developing its asset management approach to be consistent with ISO 55001 principles including the adoption of risk-based asset management. In 2020 it published its asset management policy and strategy which sets out the

landscape and future commitments. During RIS1 and continuing in RIS2, Highways England has embarked on several asset management improvement programmes including its Asset Management Transformation Programme (AMTP), Informed AM Plan (IAMP) and Asset Group strategies. These will run in parallel and interface with the Operations transformation programme OE2025. The asset team has also developed Asset Class Strategies for nine key asset classes and uses these to provide guidance to the regions to develop their asset maintenance strategies including condition inspections and planned and reactive maintenance response. Table 1.1 shows the asset management themes, key aspects and activities referenced in the asset management strategy that can influence defects management. These activities are due to be completed by 2025.

Table 1.1 – HE's Asset Management Strategy themes, aspects and activities relevant to defects management to be completed by 2025

Theme	Key aspect	Proposed activities
Using asset knowledge to manage risk	Collecting asset data to produce the information needed to make informed decisions. This includes an understanding of asset risk and together with knowledge of asset performance and cost, making balanced intervention decisions.	Establishing clear requirements for asset data, now and in the future. Understanding the requirements for asset information systems that enable consistent storage, management and access to data in a controlled manner. Developing asset inventory and condition capture tools to obtain information more quickly and efficiently. Implementing a risk-based approach to prioritising and justifying interventions, based on their impact on road users.
Right intervention at the right time	Using the tools and information to understand the existing needs of the asset, together with predicted future need, to identify programmes of work to maintain asset condition and performance.	To deliver the most from investment choices, identify efficient and timely asset interventions. Further developing decision support tools to allow complex decisions about asset interventions, optimising cost, risk and performance.
Empowering and connecting Highways England's people	Providing clarity on the asset management approach and expectations and enabling training and development so that all Highways England employees have the skills and tools they need to deliver their role at all levels of the company.	Consulting with stakeholders. Defining the roles, responsibilities, skills and capabilities for key asset management positions. Developing a supporting training programme to increase the capability of staff and improve maturity as an asset management organisation.

1.3.2   Highways England's Asset Management Transformation Programme (AMTP)

Highways England's AMTP describes several activities that are likely to have an indirect impact on defects management through improved knowledge and planning. These are (and their proposed year of implementation):

- Asset management training needs and skills framework (2021-22)
- Structured asset management skills improvement programme (2022-23)
- Inspection metric in place (2020-21)
- Asset class strategies published (2020-21)

- Risk management of asset performance (2020-21)
- Asset data strategy (2020-21)
- Develop maintenance intervention reduction tools with innovation and Intelligence, improving planning and delivery (2022-23)
- Risk appetite implemented for service and all asset classes (2021-22).

Note that progress towards delivery of the above actions has not been assessed in this project.

1.3.3   Highways England is using its Informed Asset Management Plan (IAMP)

Highways England is using its IAMP (dated 2018) to improve three themes: data, information and knowledge. The outcomes of this work are:

- DATA - We know our assets and how they perform.
- INFORMATION - We know how to safeguard asset integrity.
- KNOWLEDGE - We have confidence in the decisions we make.

Each theme has accompanying action statements, products and outputs and timelines. Of relevance to defects management are the themes aspects and activities shown in **Table 1.2**.

Table 1.2 – Informed Asset Management Plan themes, aspects and activities relevant to defects management (note that these activities were scheduled to be completed by 2020)

Theme	Key aspect	Proposed activities
Good asset data	Filling gaps in asset data adopting a risk-based approach to data collection, focusing on business need, from asset creation and improvement to maintenance and operations:	Inventory - Identify the company's asset data / information needs and fill associated critical gaps. Condition - Define condition data needs to support Asset Delivery.
Asset Strategies	Defining how we maintain all asset classes based on evidence and management of risks, to provide consistency and value for money throughout the assets' lifecycle.	Asset Strategies for all asset classes embedded across the Company. A National Infrastructure Plan bringing together Strategies for all asset classes and aligning with RIS2 business case published.

1.3.4   Highways England's Asset Class Strategies

Highways England's nine Asset Class Strategies define the overarching approach to asset maintenance and renewals including for defect maintenance. These align with existing guidance and standards (referred to above), both general (e.g. GM701) and asset class specific (e.g. from DMRB).

The nine asset classes are:

1. Ancillary assets, including:

   - Road Markings
   - Road Studs
   - Traffic Signs (non-electronic)
   - Footways and cycleways
   - Pedestrian guard rails
   - Fences, barriers and walls

2. Drainage
3. Geotechnical Assets
4. Lighting
5. Pavements (Carriageways)
6. Structures
7. Traffic Signals and Roadside Technology
8. Tunnels
9. Vehicle Restraint Systems

These recently introduced Asset Class Strategies have yet to impact defects management on the network.

Highways England told us that the primary data source used to identify asset need and develop renewal schemes to keep the network safe and serviceable is asset condition inspection and survey data. Defect data from safety inspections and the cost of maintaining defects is used as secondary information to support the identification and development of asset renewals. The use of defect data also varies depending on the asset type and the degree that defects provide an indication of asset deterioration and end of service life. For example, Highways England told us that pavement defects identified from safety inspections can provide an indication of surface deterioration and some factors related to end of life, but this requires further machine survey defect data. Highways England advised us that technology assets behave differently and end of life can be indicated by analysing defect patterns to avoid sudden equipment failure, or equipment may become obsolete prior to end of life.

Highways England also told us that evidence from repeat defects and regional factors such as climatic conditions are used to plan their renewals programmes and to share learning across regional forums. Defect data from safety inspections is also used quantitatively in some asset lifecycle processes such as the pavement whole life cost optimisation tool.

Findings: The use of defects knowledge as part of risk-based asset management

- Highways England reported that the primary data source used to identify asset need and develop renewal schemes to keep the network safe and serviceable is asset condition inspection and survey data. Defects data from safety inspections and the cost of maintaining defects is used as secondary information to support the identification and development of asset renewals.

- The use of defects data to support risk-based asset management varies depending on the asset type and the degree that defects provide an indication of asset deterioration and end of service life.

- Defects data from safety inspections is used quantitatively in some asset lifecycle processes such as the pavement whole life cost optimisation tool.

- The recently introduced Asset Class Strategies are seen as useful standardisation guidance to support a risk-based asset management approach in AD regions but there is not yet demonstrable evidence that these have impacted defects management on the network.

1.4 Opportunities for ORR to monitor defects management

From the evidence and engagement in this project, it is apparent that Highways England has made significant progress to achieve a nationally consistent and improved level of defects management performance reporting. A historic lack of consistency in data capture and reporting has limited the scope to improve performance in this area. Highways England have stated that the initiatives to improve consistency now mean they are in a position to assess performance and have meaningful discussions on how to improve this. These include increasing the 90% threshold of defects rectified within target time to a higher level to drive regional performance improvements (i.e. those reported as "green" rather than "red"). Note that UK local authorities have implemented similar risk-based regimes and have performance thresholds between 95% to 98% for both 24-hour and other defect response times.

Based on evidence there are a few areas of monitoring and challenge by ORR that may help Highways England improve its defects management performance. These are:

- Performance framework and metrics – Moving to a more framed performance regime with leading indicators and a more granular review of the appropriateness of the current 90% threshold could help to improve defects management consistency and performance. Highways England could consider other monitoring measures which are used by comparator authorities such as stretch targets and sub-measures including contractor rectification and quality rates, the ratio of number of defects reported v fixed and 'right first time'. It may also be useful to break down defect performance data into response time categories.
- Defects management performance – Current performance reporting focuses on the numbers of defects and the performance in rectifying defects within target response times. It may be useful if Highways England also reported on actual performance of inspection frequency undertaken against target frequencies.
- The use of 'Find and Fix' – This approach has been adopted nationally by AD regions and Inspectors are able to rectify some defects at the time of inspection. This is acknowledged by Highways England to deliver cost efficiencies. Find and fix defects are classified and reported as 24-hour defects, but this is usually a reflection of the fact that they can be fixed immediately (i.e. within 24 hours) rather than a true reflection of the level of risk they present. They will usually be raised as a job in IAM IS then included and closed out. This has been identified by Highways England as a possible data consistency issue that needs to be addressed as current reporting of 24-hour defects will include a proportion of those that would otherwise not be of sufficient severity to be included were they to be issued to a contractor for rectification.
- The use of defect data in renewal schemes – Highways England acknowledges that it could use defect data from inter-related asset groups to improve an asset's whole life regime and identify multi-asset interventions. For example, using drainage and geotechnical defects to identify the causes of pavement deterioration. Highways England will be using one of its OE2025 themes 'Intelligence led predictive maintenance' to look at more condition-based monitoring to link up asset interventions in single programmes and improve efficiency.

- Capex v Opex – Highways England told us that where assets can have rapid deterioration such as pavements, bridge expansion joints and MIDAS loops, these require capital renewal, but the process of agreeing these renewals takes time and therefore sometimes these items have to be addressed through Opex. Often this then removes the need to do the Capital Renewal. The availability of Capital funding can therefore constrain the delivery of a programme of work that aims to achieve whole life outcomes. This can also occur when defects are not repaired at the optimum time because of cost or access/customer constraints. This could be addressed through OE2025.
- AM Roadmap and AMTP actions – Highways England's asset management improvement roadmap and transformation programme (AMTP) have several actions that can positively influence defects management. Progress of these should be monitored. We can confirm through our evidence that one of these actions, the development of asset strategies for the nine key asset classes, has been closed out and have been adopted by AD regions.

There are other improvements that, whilst not directly relevant to ORR monitoring of Highways England performance for defects management could nonetheless be beneficial:

- Document control – The naming and version control of defects management documents could be more consistent, in referencing to recently revised DMRB standards.
- Process transparency – The level of transparency of Highways England's defects management approach to customers could be better and in line with its objectives for customer engagement. For example, it could publish a guide – 'what should our customers expect' or similar – to describe how it works to keep the network as safe as possible and how it identifies and responds to defects and will communicate with customers. There are many examples from UK local authorities that set out similar customer expectations.
- Process definitions – the DMRB standards include helpful terms and definitions (some of which are included in the glossary in this report). We note that although specialist Inspectors such as for structures assets are defined, the highway safety Inspector is not defined in GS801, although there is a description of the level of competency required to carry out safety inspections. A review of all relevant defined terms would provide clarification to customers and industry.
- Network priority classification – Inspection frequencies are established based on national standards but tailored to regions and reflect the relative network priorities within a region. There may be value in a national level network priority classification to inform more consistent setting of inspection frequencies and reporting of defect performance data.
- Motorway inspections – Highways England told us that motorways with no hard shoulders can be a challenge to inspect although Inspectors can walk behind barriers and supplement inspections with high-definition dash-cam footage.
- Inspection and Defects Management Documentation – Although the framework within which inspections and defect maintenance takes place is described in GS 801 Asset Delivery Asset Inspection Requirements and GM 701 Asset delivery asset maintenance requirements, the detailed guidance for those involved in the process is given elsewhere, particularly in the Defect Categories Guidance Note and in the Defect Repair Procedure. There may well be scope to streamline these documents in the interests of consistency of guidance and transparency to customers and industry.

Findings: Opportunities for ORR to monitor defects management

- Highways England has made significant progress to achieve a nationally consistent and improved level of defects management performance reporting.
- There are several areas of monitoring of Highways England's asset management and defects management approach that ORR could consider:
    - Delivery of asset management transformation actions and their impact on defects management improvement.
    - Review of current performance reporting data and measures to provide more granular national and regional performance data and evidence of defects management improvements.
    - How defects data is used to support whole life asset investment planning.
    - How 'find and fix' could be extended as a proactive maintenance approach.
    - The rules around using revenue funding to carry out minor capital renewals as part of a proactive maintenance approach.
    - The use of defects data to monitor the incidence of claims as a result of poor asset condition.

2 Defects Management Context

This chapter describes the primary documents that mandate and support Highways England's defects management performance and their approach to identification, assessment, rectification and data management.

2.1 Defects management performance

2.1.1 Highways England Performance Monitoring Statements

The primary source of information on the reporting of performance on the network are the annual Performance Monitoring statements reported to ORR by Highways England; the most recently published of these is for the year end 2019-20 which is provided as an Excel workbook. The workbook contains:

- 8 Performance Specification Statements (PS1 – PS8)
- 5 Investment Plan Statements (IP1 – IP5)
- 16 Financial Performance Statements (F1-F6)

For the purposes of defects and associated inspections, 'IP5 Maintenance Delivery' is the key performance statement, reporting, for a range of defect and activity types, the percentage of 24-hour priority defects completed within the required timescale and the percentage of all defects completed within the required timescale (including 24-hour defects).

Our assessment has looked at how these defect performance measures are calculated to understand:

- The total numbers of defects represented for each type.
- The breakdown by region/contract.
- Variation between APTR and Motorway and other relevant factors.
- The standards applied in each region/contract for determining 24-Hour Prioritisation and other defects; and
- Total numbers normalised by network length or other factors.

The associated commentary notes against the IP5 reports state that there is ongoing activity to improve data quality, and this was confirmed and discussed in further detail in the engagement interviews.

Another relevant measure to the management of defects in IP5 (Maintenance Delivery) is for Reactive Maintenance (AD areas only) which reports the Percentage of Reactive <24hr works that are completed within the required timescales.

Information on numbers of received and settled Red and Green claims is also reported to ORR in IP5; this is useful contextual information as it may be able to be used to relate to the condition state of the network asset, as well as other factors.

Additional defects management performance reports provided by Highways England to ORR (we assume these are non-public), for the first two quarters of 2020-21 provide more detail.

- **IP5 Q2 2020-21 Final Submission to ORR** – this provides another more detailed reporting of the metrics in IP5 in the Performance Monitoring Statements for a single quarter. It includes total numbers of defects (both 24-hour and other) received and responded to within timescale as well as percentages.
- **IP5 Q2 2020-21 Regional Summary** – this workbook gives a breakdown of the percentages reported in IP5 for defects by six regions; the total numbers used to derive

the percentages are not given. For the South East many of the metrics are not available (Not AD). The percentages of reactive maintenance works completed within required 24-hour timescales are also given.

- **24-Hour Defect quantities for 2018-19 and Q2 2020-21 by regions (excluding South East)** – this spreadsheet provides the 2019-20 24-hour defect quantities and the Q1 2020-21 defect quantities across five regions. Note that the south-east is excluded because it is not currently an AD region. The information shows defect rectification performance for each asset category as quantity 'on time', out of 'total' and '% completed on time'.
- **Total Defect quantities for 2019-29 and Q2 2020-21 by region** – this spreadsheet provides the total defect quantities across all six regions for the full year 2019-20 and Q1 2020-21. The information shows 'No of defects', 'No rectified within required timescale' and '% rectified within required timescale'. For 2019-20 out of 38415 defects, 29590 or 77.0% were completed within the required timescale. This ranged from 92.8% in Yorkshire and the North East to 58.3% in the South East region (note that this is a non-AD region).

2.2   Defect identification

2.2.1   GS 801 Asset delivery asset inspection requirements

GS 801 addresses the identification of defects specifically from inspections. The introduction summarises the purpose of inspections as follows:

> *Inspections are carried out to identify and report on defect(s). The output from the inspections will be used to inform asset management decisions by risk assessing the defect(s) to determine its mitigation. This should take into account the assets life-cycle and be a positive benefit to reduce the progressive deterioration of safety, reliability and quality of highway assets. In turn inspections will prolong asset life, deliver sustained performance and keep assets safe for customers.*

There are a number of key points in this paragraph:

- Inspections are about identifying defects;
- Defects are risk-assessed to determine mitigation;
- They also inform asset management decisions; and
- They promote safety, asset performance and asset life.

Four types of inspections are identified as shown in **Figure 2.1**;

- Safety Patrols;
- Safety Inspections;
- Condition Inspections; and
- Targeted Inspection (*ad-hoc inspections carried out where required to address specific local risks.*)

Figure 2.1: Highways England's defined inspection types and purpose
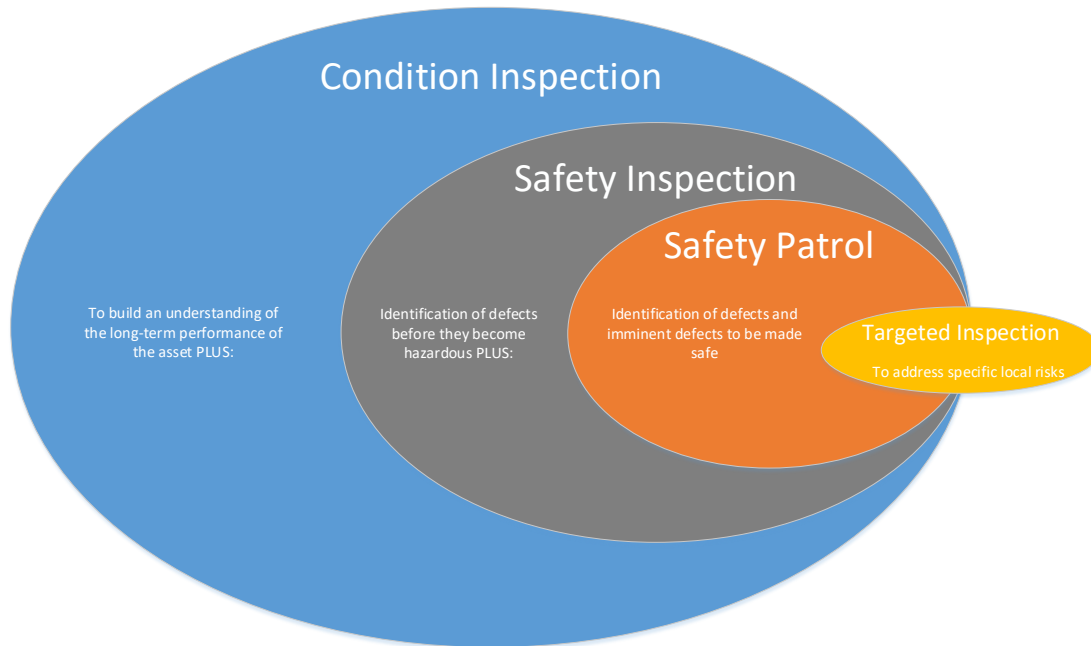
The importance of inspections in defending claims is detailed in the following statement in GS 801:

> *The inspection regime shall provide an important means by which claims relating to loss or damage caused by defects can be defended and repudiated by proving:*
>
> *1) acceptable policies and procedures are in place to maintain the highway;*
>
> *2) the policies and procedures were being performed; and*
>
> *3) there was no prior knowledge of a defect before the incident date.*

The document acknowledges that some assets and defects may be the responsibility of 3rd parties and that there is a need for a mechanism for reporting and requiring action from these 3rd parties.

The importance of inspector training and competency is also stated:

> *"All personnel undertaking network safety and condition inspections shall be responsible and competent for the task undertaken, have received suitable training and be fully conversant with the relevant inspection requirements, customer service imperative and guidance documents."*

Section E, **Inspections for network safety** covers the development of an inspection regime, with a risk assessment and categorisation based on the character of the part of the network, including traffic and condition used to determine the types and frequency of inspections that are applied.

The standard requires the following factors to be taken into account in determining the risk category:

- Traffic flow data;
- Percentage HGVs;
- Accident data;
- Occurrence of significant reactive defects; and
- Local knowledge of area specific issues.

The following types of inspections for network safety are identified:

1. Safety Patrols – which "*shall be carried out using a suitable method to ensure the network is safe, serviceable and meets our customers' needs and expectations by ensuring, as far as possible, that defects and imminent defects are identified to be made safe.*"
2. Safety inspections include all of the provisions of the Safety Patrol but are also intended to identify defects before they become hazardous

The minimum inspection frequencies are set out below:

Link Risk Category	Safety Patrol Frequency	Safety Inspection Frequency
High	daily (but not on days that a safety inspection is undertaken)	weekly
Medium	weekly (but not on days that a safety inspection is undertaken)	fortnightly
Low	fortnightly (but not on days that a safety inspection is undertaken)	four weekly

Section E/3 "Inspections for network condition" covers the inspections to assess and grade condition of asset to understand long-term performance. Whilst they aren't primarily focussed on the identification of "defects" per se according to the definition of defects in GM 701 defects they will result in the identification of defects that will require risk assessment and rectification. The following specific provisions apply:

1. A condition inspection shall include all the duties and outcomes of a safety inspection;
2. Any safety defects identified during condition inspections shall be addressed in the same way as they would be if they had been identified during safety patrols or safety inspections; and
3. Unplanned asset condition inspections shall be undertaken as required to address urgent safety needs e.g. following an incident or report of a damaged asset.

2.2.2   Asset Class Strategies

The nine asset class strategies each include in Section 2 "Understanding the asset" information on inspection and monitoring, which include inspections to identify defects. These are both the general safety related network inspections described in GS 801 and asset-specific inspections to determine condition and maintenance need.

With the ACSs reference is made to various response times the shortest being "immediate".

2.2.3   COVID-19 - Consideration for Temporary Changes to Safety Patrols, Safety Inspections and Asset Inspection Frequencies

This note, issued in April 2020 gives guidance to regional operations teams on dealing with reduced resources and prioritising those resources for safety patrols, safety inspections and asset inspections as a result of the COVID-19 pandemic. It states that:

All inspections and patrols should continue as per existing requirements and the guidance in this note should only be considered if resource levels do not make it safe or feasible to meet the requirements during the COVID-19 pandemic.

The note states that any temporary changes should be based on risk assessment and that *Section 58 defence should be maintained at all times.*

At the time of issue of this note (April 2020) traffic levels on the network were considerably reduced; the guidance states that *As a result of reduced traffic volumes and reported traffic incidents, regions can re-evaluate risk categorisation to reduce the inspection frequencies.* It will be useful to understand whether changes to frequencies were made in response to this guidance and whether frequencies have reverted to normal in response to the recovery of traffic levels since April 2020.

In relation to safety patrols and inspections:

Three stages are identified to assist with undertaking safety patrols and safety inspections

Stage 1 - reducing the frequency of safety patrols/ inspections in line with a reassessed risk profile
Stage 2 - increasing the number of trained staff.
Stage 3 – targeted patrols
It is noted that assigning a lower risk category to a link results in significant reduction in resource requirements.

If the resource levels become even more critical and the inspection frequencies from the lower risk frequencies can't be achieved, absolute minimum level targeted inspections using the available resource can be considered on a risk-assessed basis. These targeted inspections should be based on the region's knowledge of their area, historical defect information, accident statistics and any known issues that the relevant asset owners are aware of.

2.3   Defect assessment

2.3.1   GG 104 Requirements for safety risk assessment

GG104 sets out the approach and provides a framework for the identification, assessment and management of risk, specifically safety risk, for Highways England activities, and as such is key to defect management and maintenance and inspections. It is a generic framework that can be applied to any type of activity; the specifics of how it is applied to Defects and Inspections are documented elsewhere, particularly in GS801, GM 701 and in regionally specific documentation.

The framework and approach is "to be applied when undertaking any activity that does or can have an impact on safety on Highways England's motorway and all-purpose trunk roads, either directly or indirectly."

The standard identifies three different "populations" whose needs should be taken into account and balanced when considering safety risk. These populations include:

> *1) everyone who works for Highways England on our road network;*
> *2) everyone travelling on our road network, including people who work for someone else; and*
> *3) people who are neither working on nor using it but are affected by it, such as those who live adjacent to the road network.*

GG 104 provides a framework rather than a rigid process that allows for application to a range of activities from simple to complex.

It acknowledges that the outcome of a safety risk assessment may be to "do nothing", an important consideration for defects and inspections.

It states that *"The presumption that to do something is always necessary does not guarantee the optimal safety outcome for everyone."* The implication of this for defects and inspections would be in how the safety of the three "populations" are balanced.

"The requirements are clear on the need to document the scope of the safety risk assessment and any evidence used in it. This is to ensure that a thorough audit trail is provided and there is no

ambiguity around the decisions made" is an important provision in the context of risk assessments for defect management and inspections.

Section 4 of the standard covers the documentation and maintenance of the safety risk assessment.

For defect management and inspections these are applied to both:

1. links in the network to determine type/frequency of inspection.
2. individual defects to determine the most appropriate response/mitigation.

There are three categories of activity and assessment, the classification of which will determine the level of governance and approval that is applied to a risk assessment. Defects and Inspections would appear to fall into the "Type A" category which requires the lowest level of review and approval, we will seek to confirm this in our enquiries.

2.4   Defect rectification

The key document that Highways England uses for defect rectification is the Maintenance Requirements Plan (MRP). These are locally owned and developed within each Highways England region.

COVID-19 - Consideration for Temporary Changes to Safety Patrols, Safety Inspections and Asset Inspection Frequencies (discussed above) states that, under "Responding to defects"

In ASC and AD Areas a risk-based approach is adopted in defining response times to defects. The response and repair timescales are detailed in the Areas' Maintenance Requirements Plan for AD and within their Quality Plan for PAD and ASC…..defect repairs continue to be carried out with a risk based approach whilst considering reduced resource availability and reducing traffic flows.

2.5   Defect data management

The overall provisions and requirements for Data Management for defects and inspections are set out in the Asset Data Management Manual (ADDM).

Part 1 – Data Principles and Governance, *introduces the concept of asset data management defines how this is structured and governed within Highways England.*

Data quality is discussed including the role of validation as part of the data capture process, which are relevant for Defects and Inspections.

There are a number of sub-principles relating to reporting that are relevant for defect management and inspections:

- Frequency of reporting will be driven by the need to balance the need for regular monitoring, the costs and ease of creating reports and the time for changes to take effect;
- All external reporting of asset information is subject to senior management approval. All reporting of asset information is subject to relevant approvals; and
- Asset performance indicators are developed and reported to provide understanding and assurance of our asset lifecycle management and performance (including safety and serviceability) to the business and stakeholders.

Various categories of data are identified that are relevant to defects and inspections:

- **Operational**: Data/information regarding the effective operation of the asset, and planning for any activities to operate, maintain, or improve it, including planning and schedule of routine inspections;
- **Maintenance & Renewal**: Data/information recording history of maintenance interventions against an asset; activity to repair defects and/or restore asset condition including Work Records; and
- **Condition**: Data/information regarding the condition of an asset, including:
  - Inspection Records; e.g. details of inspection, and verdict of the asset condition, who undertook the inspection, date of inspection and details of the condition of the item; and
  - Defect Reports; and
- **Performance**: Data/information regarding the performance of an asset; e.g. is the asset performing as intended including Inspection Records e.g. details of inspection, and verdict of asset performance.

ADDM Part 1 also discusses the unique and reference identifiers for assets.

Part 2 – Requirements and Additional Information *sets out Highways England's requirements for asset data management and provides supporting guidance for each asset class.*

Reference is made to spatial referencing and a required accuracy level for locating assets to be within 3m on average, with an error of no more than 5m for individual assets.

It sets out the timescales for data to be loaded to the relevant asset systems; Network Inspections, which includes defect inspections (safety patrols/inspection, condition inspections) has 30 days allowed for loading.

In "Governance" reference is made to Asset Data Stewards and Custodians; it will be important to understand how these roles are fulfilled for defects and inspections.

Section 2.1 lists the Company's Asset Data Systems:

- Routine and Planned Maintenance System;
- Pavement Data Management System;
- Carriageway Inventory Data Management System;
- Structures Data Management System;
- Geotechnical Data Management System;
- Drainage Data Management System;
- Environmental Data Management System; and
- Technology Performance Management Service.

It would appear that the Routine and Planned Maintenance system (which is Confirm for AD regions and IAM-IS for ASC and PAD contracts) is the principal repository of defect and inspection data. It will be important to understand whether any of the other systems hold defect/inspections data and if so whether in summarised or detailed form.

The scope of the Routine and Planned Maintenance System is set out as follows:

(i) The ability to capture, store and report asset inventory and defect data for carriageway inventory assets;
(ii) Works ordering to manage routine and planned maintenance for carriageway inventory assets;
(iii) Customer enquiry management; and
(iv) The ability to import and export data.

Mobile data capture software and hardware is excluded, but it will be relevant to our enquiries, as will the grouping and routing of sections for inspection.

Section 4, "Approved Network Model" describes both *Geospatial location of assets/objects and Linear referencing in relation to the carriageway.* We will seek to establish *how* defects management and inspection data is referenced for data collection, storage and reporting.

There is a requirement for record inspections against maintenance sections or inspection routes.

A set of defect codes and associated priorities are given in **Table F-4 – Defect Priorities**, the detail of which is given in the MRP for a contract; we will seek to understand how these are applied locally and what the equivalent categorisation is in AD regions:

Defect Code	Defect Meaning
SFTY	Safety Priority
NSFH	Non-Safety High Priority
NSFM	Non-Safety Medium Priority
NSFL	Non-Safety Lower Priority

Part 4 of the ADMM suite, the **Asset Reference Catalogue** provides supporting guidance to Part 3 – the **Data Dictionary**; the data dictionary describes and gives photographs of each of the items in the dictionary.

Appendix A - Glossary of terms

The following definitions have been extracted from Highways England's published documents and those provided as evidence to this project. Acronyms are described at the beginning of the report.

Asset defect – one that either:

> 1) causes an unintended hazard, nuisance or danger to the users of the highway.
> 2) represents a deterioration from the normal condition.
> 3) prevents an asset from acting in the intended manner.
> 4) is damaged.
> 5) is likely to increase the rate of deterioration of another asset.

Asset Delivery (AD) – This approach enables us to directly manage maintenance operations and scheme delivery. Through Asset Delivery, we will improve our asset knowledge and increase our control, including over interventions, planning, and sequencing. This will improve safety and quality, as well as reducing disruption and delivering better long-term value for money.

GS801 Asset delivery asset inspection requirements – this standard contains the inspection and assessment requirements for motorways and APTR which provide network safety and network condition:

> 1) **Network safety** – safety patrols and safety inspections that are predominantly focused on ensuring the network is safe and serviceable to deliver a service customers can trust, including lighting and technology operational inspections; and
> 2) **Network condition** – inspections that look at the longer-term condition of all asset items.

Intelligence-led maintenance – The use of data and knowledge to design the optimum maintenance intervention for individual assets.

Network safety inspections – Safety patrols and safety inspections that are predominantly focused on ensuring the network is safe and serviceable to deliver a service customers can trust, including lighting operational inspections checking for outages of illuminated signs and lighting; technology operational inspections checking for outages of illuminated electronic signs and signals.

Network condition inspections – Asset condition inspections that look at the longer-term condition of all asset items.

Principal inspection – a type of maintenance inspection carried out for structures assets which are undertaken on a routine basis. Other structures inspections include safety inspections, general inspections, special inspections (in response to a specific issue).

Routine and Planned Maintenance system – This is the principal repository for defect and inspection data with the following functionality:

> (i) The ability to capture, store and report asset inventory and defect data for carriageway inventory assets.
> (ii) Works ordering to manage routine and planned maintenance for carriageway inventory assets.
> (iii) Customer enquiry management; and
> (iv) The ability to import and export data.

Section 58 special defence – the special defence under section 58 of the Highways Act, 1980 which provides a highway authority with a defence in respect of claims for damage resulting from a failure to maintain the highway if they can prove that they had taken such care as in all the circumstances

was reasonably required to ensure that the highway was not dangerous for traffic, taking into account:

- the character of the highway, and the traffic which was reasonably to be expected to use it;
- the standard of maintenance appropriate for a highway of that character and used by such traffic;
- the state of repair in which a reasonable person would have expected to find the highway;
- whether the highway authority knew, or could reasonably have been expected to know, that the condition of the part of the highway to which the action relates was likely to cause danger to users of the highway;
- where the highway authority could not reasonably have been expected to repair that part of the highway before the cause of action arose, what warning notices of its condition had been displayed.

In the context of defects a robust, risk-based inspection regime that proactively identifies and rectifies defects according to the factors above will help to establish the special defence.

Smart motorways (SM) - A type of motorway that uses variable mandatory speed limits to increase capacity and smooth the flow of traffic. There are three types of smart motorway:

a) Controlled motorway: a smart motorway where the hard shoulder is retained;

b) Dynamic Hard Shoulder (DHS) running: a smart motorway which includes the dynamic conversion of a hard shoulder to a running lane;

c) All lane running (ALR): a smart motorway which includes the permanent conversion of a hard shoulder to a running lane.

Structures Inspector – A person appointed by the supervising engineer with the competence and qualifications to inspect highway structures.

Appendix B - Defects management comparator survey

To provide context to this review a web-based survey of UK and international road organisations was undertaken, to gather information on approaches to defects management. 24 responses to this survey were received, including:

- 5 National Road Operators, including in Austria, Northern Ireland, Italy in addition to Highways England
- 1 Regional Road Operator
- 15 Local Highway Authorities, including TfL
- 2 Devolved National Road Authorities (Scotland and Northern Ireland)
- 1 Other (DBFO)
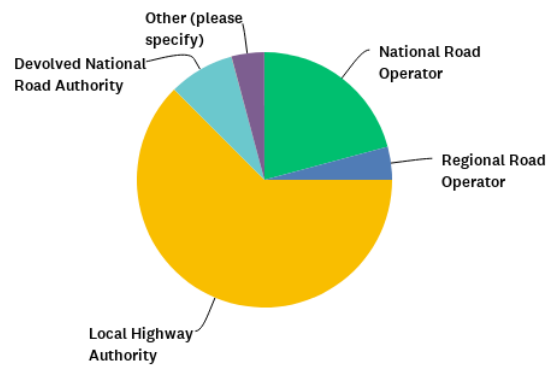
These organisations are involved in managing a full range of road types, from motorways to local roads:
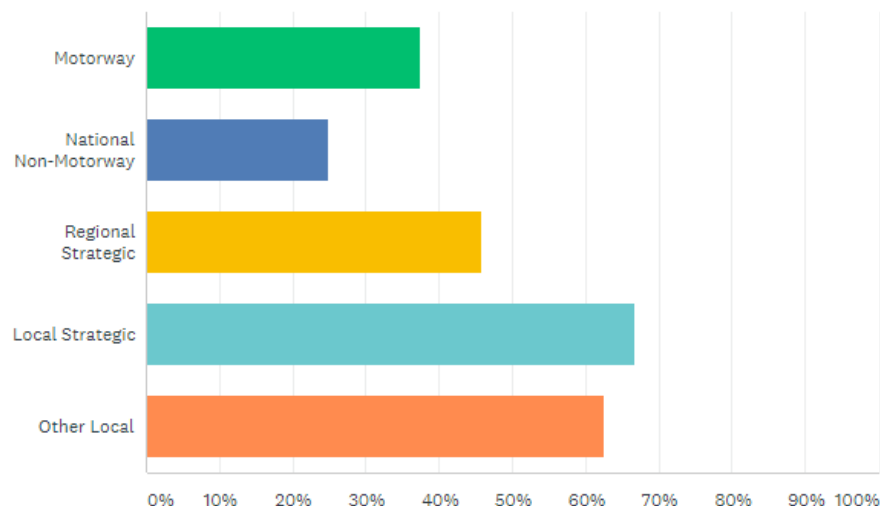
All organisations indicated that they undertook proactive inspections and that they adopted a risk-based approach to defects management, across all aspects from determining frequency of inspection through to responding and monitoring:
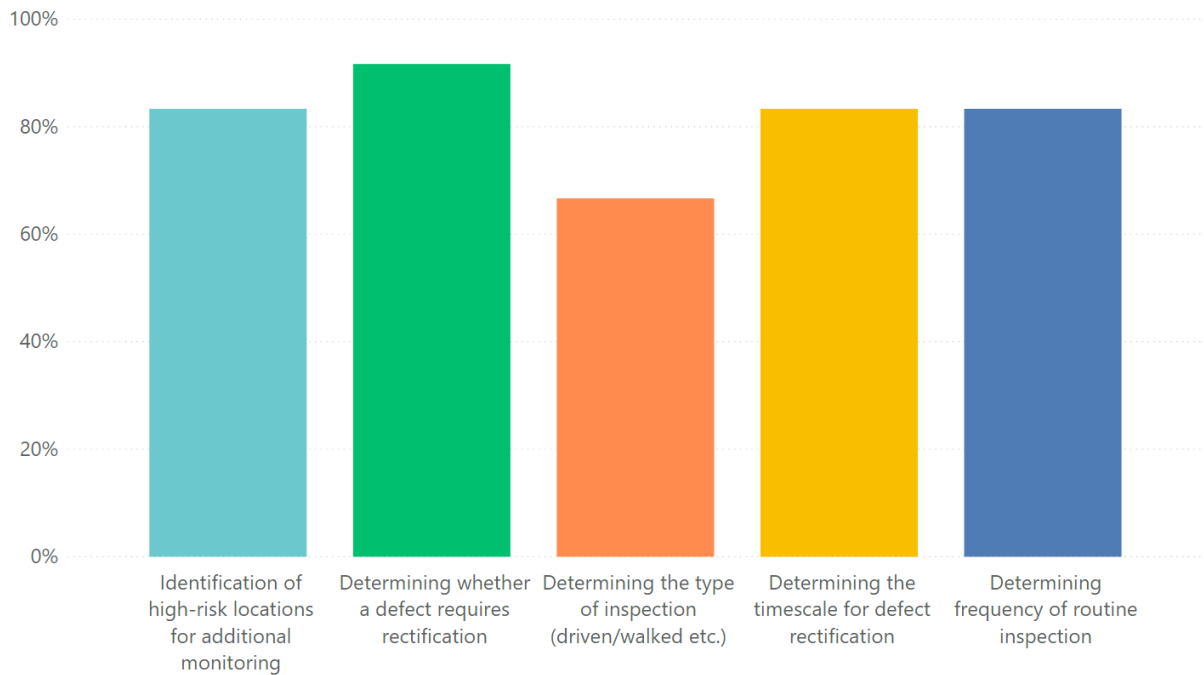
All organisations consulted carried out proactive safety inspections; safety inspection frequencies ranged across the comparator organisations from daily to three-yearly, depending on road type. These were mostly undertaken visually (either walked or driven) but 22% of respondents carry out surveys using imagery, either automatically or to support visual assessment. Nearly all respondents operated varying frequencies on their network based on road classification, traffic levels and risk assessment.

Three quarters of respondents indicated that Inspectors are required to hold relevant qualifications, with most based on national rather than local standards.

Most respondents indicated that they had mechanisms in place to monitor quality and accuracy of inspections, with most of these being undertaken internally, with only one carrying out independent checks.
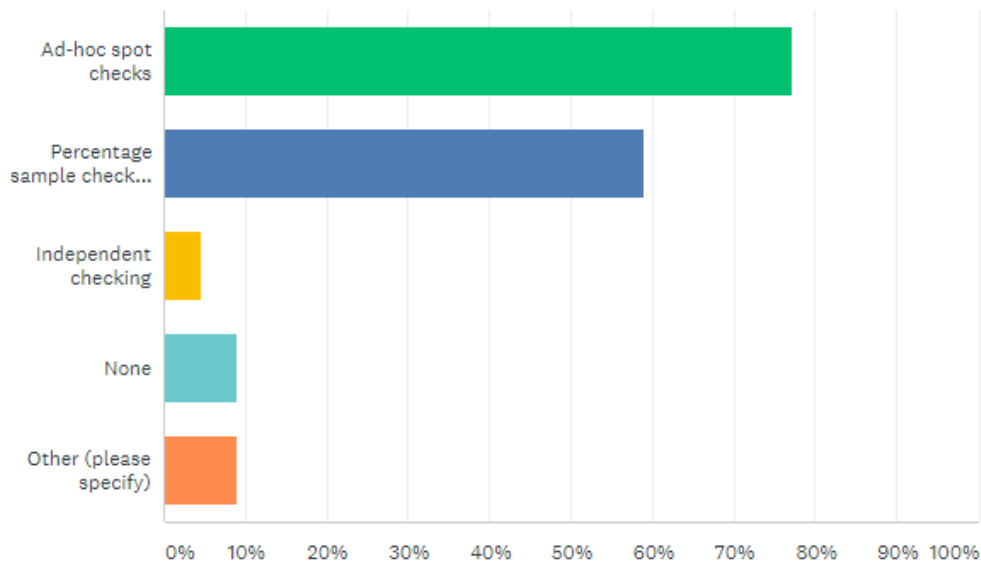
A wide range of mechanisms were adopted for reporting of defects by third parties:
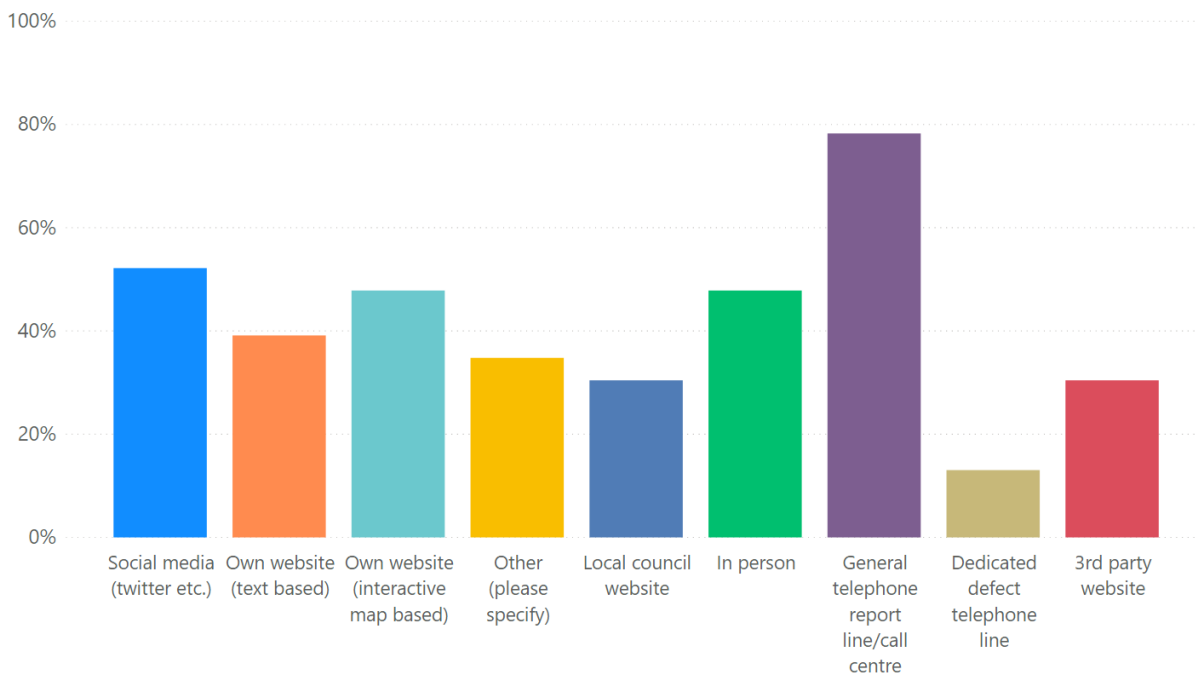

The first stage of response to a report of a defect was, in most cases, to issue to an Inspector for an ad-hoc inspection, but a significant minority of a third of comparators indicated that at least some defects would not be inspected until the next inspection, and three respondees indicated that reports would be issued directly to the works contractor for rectification. One respondent described their approach of triaging defects by Inspectors who assess and prioritise these defects based on the reported information. A range of mechanisms are used to feedback on progress for 3rd party reports including email, message and 3rd party and road authority websites.

In relation to the assessment of defects a range of factors are considered, with potential and actual safety hazard predominating:
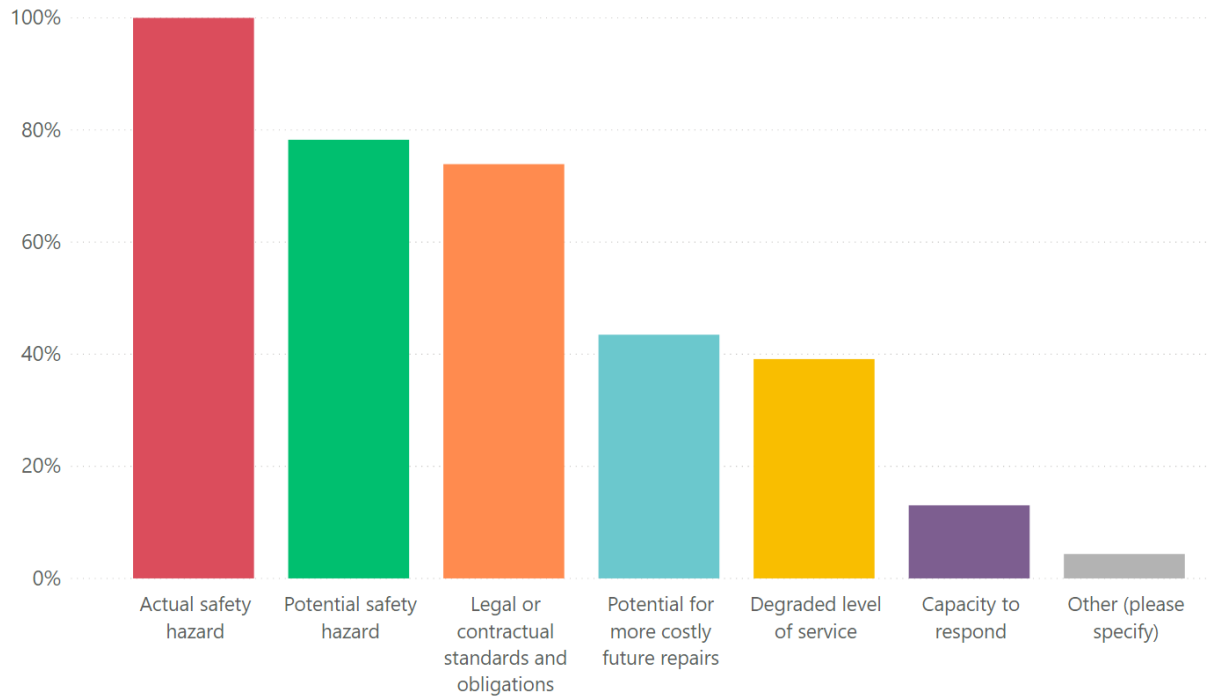
In relation to the factors determining the urgency of response there was no one predominant factor:
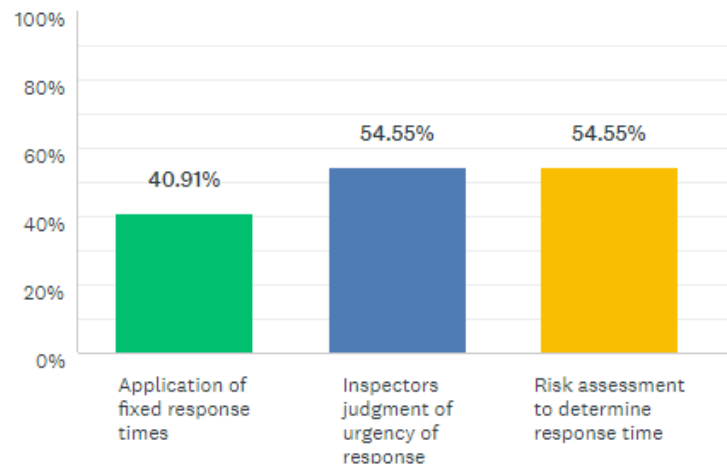
Who carries out defect maintenance within an organisation varied between the respondents, with the majority including this as part of an overall works contract, but a significant minority having their own dedicated works team:
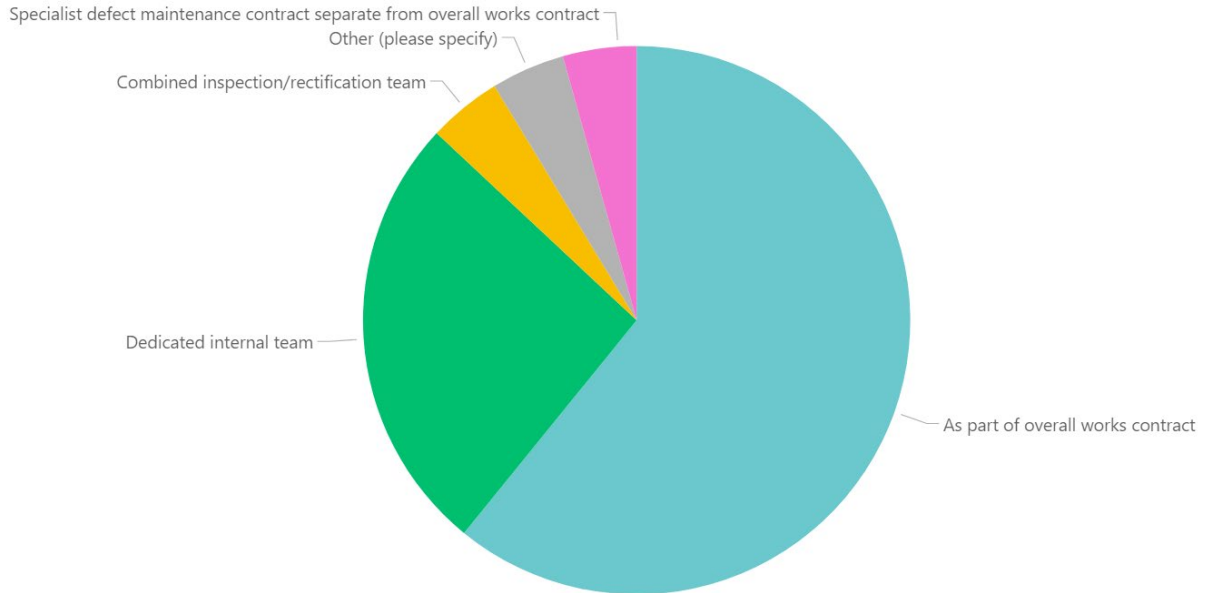
Most respondents indicated that they had separate budgets for defects maintenance. A few respondents indicated that they were trialling AI based analysis of imagery for inspections, but none indicated that they had moved beyond the trial stage.

The respondents indicated extensive use of defect data to inform asset management for a range of purposes: