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Preparing for RIS3: Renewals Planning

Task 1 – National Highways’ Renewals Investment Planning Approach and Implications for the RIS3 Planning Process

Final Report

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Acronyms

A to O		P to W	
ACS	Asset Class Strategy	PI	Performance Indicator OR Principal Inspection
AIM	Asset Investment Manager	PIT	Programme Investment Tool
AMSG	Asset Management Steering Group	PR	Pricing Review
AMTP	Asset Management Transformation Programme	RAG	Red-Amber-Green
DBFO	Design, Build, Finance and Operate	RIS	Road Investment Strategy
DDMS	Drainage Data Management System	RP	Road Period
DfT	Department for Transport	RTMC	Road Technology Maintenance Contract
DMRB	Design Manual for Roads and Bridges	S&P	Strategy and Planning
DST	Decision Support Tool	SBP	Strategic Business Plan
EAM	Elliott Asset Management	SCav/SCcrit	Structures Condition (average & Critical)
GDMS	Geotechnical Data Management System	SES	Safety, Engineering & Standards
GI	General Inspection	SMF	Service Measure Framework
HAGDMS	Highways Agency Geotechnical Data Management System	SMIS	Structures Management Information System
HAPMS	Highways Agency Pavement Management System	SRN	Strategic Road Network
HRA	Hot Rolled Asphalt	TAG	Transport Analysis Guidance
IAM	Institute of Asset Management	TCSC	Thin Surface Course System
IAM-IS	Integrated Asset Management Information System	TPMS	Technology Performance Management System
IC	Investment Cycle	UKWIR	UK Water Industry Research
KPI	Key Performance Indicator	VfM	Value for Money
NCS	National Condition Survey	WLC	Whole Life Cost
OD	Operations Directorate		
ORR	Office of Rail and Road		

Executive Summary

This review of National Highways’ Road Investment Strategy 3 (RIS3) renewals investment planning approach is part of a wider study to assist the Office of Rail and Road (ORR) as it prepares for the RIS3 development process. The work follows on from ORR’s 2021 review of National Highways Life Extension Renewals programme. A parallel review has been carried out by EAM that considers how National Highways addresses the concept of ‘whole life costing’ to optimise its renewals interventions over the long term.

The objective of this review is to provide ORR with an improved understanding of National Highways’ approach to renewals investment planning and the evidence that will underpin the company’s plans for RP3.

EAM would like to thank ORR and National Highways and their teams for their cooperation during this review.

National Highways renewals planning capability framework

National Highways has established a framework for progressive development of its asset management capability to determine and plan renewals requirements for RP3 (Figure 0.1). The framework is a staged process that builds towards the aim of ultimately implementing a ‘Service Value Driven’ approach. National Highways has also set out a programme to develop the capability of each asset class against this scale, in stages termed Investment Cycles.

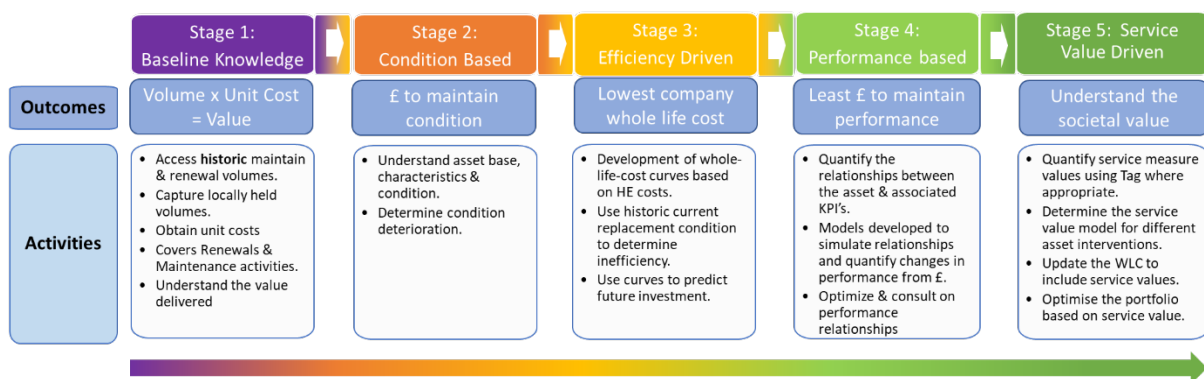


Figure 0.1 - National Highways renewals planning capability framework with stages of increasing confidence and complexity.

The review has focussed on the capability maturity for six nominated asset classes against National Highways’ RIS3 renewals planning expectations for Investment Cycle 3 (IC3), at December 2021. An assessment framework was developed by EAM based on industry practice to assess the capability gap against the expected level of asset maturity at IC3 and subsequent stages (IC4 and IC5).

Engagement was carried out with National Highways’ virtual RIS3 team and asset class teams. Evidence was provided by National Highways to show progress at December 2021 and supplementary evidence was received in March 2022. These were used to inform the assessment.

Assessment of RIS3 renewals planning capability for Investment Cycle 3 (IC3)

The results of EAM’s assessment against progress at IC3 are shown in **Figure 0.2** and described below.

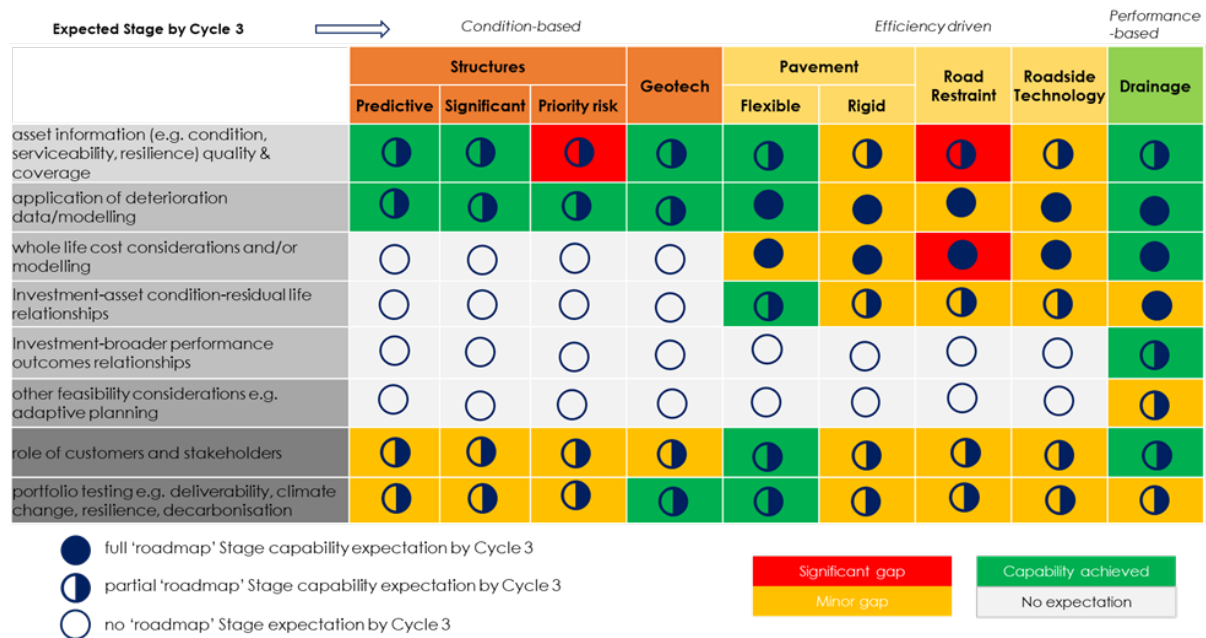


Figure 0.2 - RAG rating of capability by asset class at end of December 2021 (IC3)

The assessment shows that overall there is a mixed level of maturity against IC3 expectations. Maturity gaps have been assessed against capability for asset classes due to reach condition-based and efficiency-driven maturity i.e. Stages 2 and 3 in **Figure 0.1**.

Capability has been achieved (**green rated**) in most areas for the more mature asset classes such as flexible pavements, drainage and geotech, and with predictive structures.

Minor capability gaps (**amber rated**) have been assessed for some asset classes, notably rigid pavements and roadside technology, as well as most asset classes against some cross-cutting criteria such as understanding the role of customers and stakeholders and with the consideration of wider factors such as deliverability and carbon.

Significant capability gaps (**red rated**) have been assessed in two asset classes, priority risk structures and road restraints, and for two criteria, asset information and whole life cost consideration. These are due to a lower level of asset knowledge and the impact that this lack of knowledge has on the ability to develop meaningful whole life cost (WLC) modelling scenarios.

Assessment of RIS3 renewals capability trajectory

The results of EAM’s assessment against National Highways’ trajectory at IC4 and IC5 are shown in **Table 0.1** and described below.

Table 0.1 RAG assessment of likelihood of meeting Cycle 4 and 5 capability milestones

Assessed Maturity based on confidence to reach Stages 1 to 5 within Cycles 4 and 5 Green = No assessed risk, Amber = Minor risk		
Asset Class	Cycle 4	Cycle 5
Pavement - Flexible	Stage 4	Stage 5
Pavement - Rigid	Stage 4	Stage 5
Structures – Predictive (using DST)	Stage 3	Stage 4/5
Structures – Significant Renewals	Stage 3	Stage 4/5
Structures – Priority Risk	Stage 3	Stage 4/5
Road Restraint	Stage 4	Stage 5
Roadside Technology	Stage 4	Stage 5
Drainage	Stage 3	Stage 5
Geotech	Stage 2	Stage 2

Based on the evidence provided by National Highways, rigid pavements and roadside technology have a minor (**amber rated**) risk of not getting back on track in IC 4, but are likely to achieve their maturity target by IC 5 (**green rated**).

Priority risk structures and road restraint were initially assessed as having significant capability (**red rated**) gaps in December 2021. From the assessment of additional evidence National Highways’ ability to meet the IC 4 and IC 5 targets for these assets continues to have a minor (**amber rated**) risk and should continue to be monitored.

Drainage assets have been assessed with a minor (**amber rated**) risk of achieving IC4 due to the planned reverse sequence of maturity i.e. from Stage 4 (performance-based) at IC3 to Stage 3 (efficiency-driven) at IC4. This is due to a potential shortfall in asset knowledge, though National Highways has advised us that it is obtaining further operational data from its Operations Directorate (OD).

Geotech assets have little risk (**green rated**) of failing to meet either IC4 or IC5 targets and have a consistent Stage 2 condition-based maturity expectation. This is the only asset which remains at a lower capability planning requirement through to the dSBP albeit the asset management approach for this asset class is well-established and is appropriate considering allocation and prioritisation of resources.

Recommendations for monitoring RIS3 renewals planning

There are six recommendations aimed at ORR, mainly for RIS3 setting but some during RIS3. These are categorised as:

- Renewals planning capability development
- Handback of DBFO assets
- Alignment of asset management development programmes
- Future development of renewals planning for RIS setting

Recommendation 1: ORR should ask National Highways to provide updates on its renewals planning progress at Investment Cycle IC4 and IC5 milestones. This should include:

- How asset information quality and coverage has improved and will be improved further during RIS3, including deterioration for priority risk structures and road restraint systems.
- That it has achieved efficiency-driven asset class capability, i.e. the delivery of lowest whole life cost for rigid pavements, road restraint and roadside technology assets.

Recommendation 2: ORR should continue to understand National Highways’ capability in the following areas, and should consider whether it requires any interim update prior to the Efficiency Review in 2023:

- The role and expectations of customers and stakeholders such as Transport Focus has been considered in renewals plans for all asset classes.
- Portfolio testing of renewals plans has been carried out to assess wider benefits / dis-benefits such as climate change, resilience, deliverability and decarbonisation.
- How consistency of renewals modelling scenarios and performance measures has been assured across asset classes as the draft Strategic Business Plan (SBP) is developed.

Recommendation 3: ORR should continue to have regard for National Highways’ plans for the handback of DBFO assets into regional operations including the quality and coverage of asset information and potential risk to RIS3 renewals delivery.

Recommendation 4: ORR should continue to have regard for the development and embedment of National Highways AMTP actions and how these contribute to RIS3 strategic investment planning.

Recommendation 5: ORR should continue to have regard to National Highways’ approach to strategic investment planning, including the potential for streamlining the process, and its consideration of associated efficiency.

Recommendation 6: ORR should consider further assessment of the renewals planning approach for Predictive Renewals, Priority Risk Structures and Significant Renewals used to inform the RIS2 and 3 programmes and the effect on the structures condition PI and ‘Steady State’ condition objective.

1 Introduction

This review of National Highways’ Road Investment Strategy 3 (RIS3) renewals investment planning approach is part of a wider study to assist the Office of Rail and Road (ORR) as it prepares for the RIS3 development process. A parallel project has been carried out by EAM that looks at how National Highways considers and addresses the concept of ‘whole life costing’ to optimise its renewals interventions over the long term. The work follows on from ORR’s 2021 review of National Highways Life Extension Renewals programme.

‘Capital Renewals’ are significant, periodic investments in existing assets to maintain or restore their condition and/or level of performance. These represent a large item of spend within the National Highways budget – predicted £5.8bn for Road Period 2 (RP2). Thus, important decisions must be made about the value of the investment required and to optimise both where and when to allocate the available funding.

ORR is the Highways Monitor established under the *Infrastructure Act 2015* as part of the reform of the then Highways Agency (the process known as ‘roads reform’). As well as holding National Highways to account against both its Licence¹ and the Performance Framework², which is defined for each Road Investment Strategy (RIS), ORR has a role in the setting of future road investment strategies. During the process of setting a new RIS, the ORR will conduct an Efficiency and Deliverability Review of National Highways’ draft Strategic Business Plan (draft SBP) and provide advice to government on whether plans for the next road period are challenging and deliverable within the available funding.

Furthermore, in its draft RIS3 approach document³, the ORR set out its intention to place greater emphasis on assessing the quality of, and evidential basis for, National Highways’ maintenance and renewals plans, not just the costs included in them.

Therefore, as ORR starts to prepare for its input to the development of RIS3, which will take effect from 1 April 2025, it is important that it has a good understanding of National Highways’ approach to development of its renewals planning, and the information and processes that are being used to support the business cases for RP3 funding for the various asset classes.

The objective of this review is to provide ORR with an improved understanding of National Highways’ approach to renewals investment planning and the evidence that will underpin the company’s plans for RP3. This review has focussed on the data, tools and processes underpinning the development of the RP3 renewals business cases, to inform ORR of the basis for, and robustness of, the progress in determining investment need for RIS3.

¹ [Highways England: licence \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/101444/highways-england-licence-2015-2020.pdf)

² [Road Investment Strategy 2: 2020-2025 \(publishing.service.gov.uk\)](https://www.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/101444/road-investment-strategy-2-2020-2025.pdf)

³ [Consultation document on ORR’s role and approach to Road Investment Strategy 3 \(RIS3\) - 8 December 2021](#)

2 Scope of Review

Six key asset classes in the current RIS3 renewals programme were selected for consideration in this review. Five of these represent high ‘materiality’ assets as shown in Table 1; National Highways has confirmed that, in effect, these represent the highest value of renewals requirement. These are:

- Pavements; flexible and rigid
- Structures
 - National Highways has identified two sub-classes for structures;
 - Structures – bridges and large culverts
 - Structures – other assets
 This review has focussed on ‘Structures – bridges and large culverts’
- Road restraint systems
- Drainage
- Roadside technology

Geotech was selected as the sixth asset class by ORR to provide a comparison with the approach for the above selected high materiality assets.

The renewals value estimates from National Highways’ RIS2 draft SBP, shown in [Table 1](#), give an indication of the relative materiality of the asset classes. These are further divided into routine renewals and life extension, the latter representing discrete works programmes.

Table 1 Capital renewals estimates for RIS2 draft SBP (£m)

	Asset Class	Renewals estimate (£m)
Routine Renewals	Pavement	1,398
	Structures	478
	Road restraint systems	294
	Drainage	211
	Traffic Signals & Roadside Technology	199
	Road Ancillaries	189
	Geotechnical	113
	Lighting	93
	Tunnels	47
Life Extension	Structures	922
	Pavement	393
	Structures	922
	Additional Incremental VRS	154

2.1 National Highways renewals planning maturity model

National Highways has established a framework for progressive development of its asset management capability to determine and plan renewals requirements for RP3. The framework is a staged process that builds towards the aim of ultimately implementing a ‘Service Value Driven’ approach. This framework is illustrated in [Figure 1](#). It shows a maturity scale and progression of asset management capability from baseline knowledge and condition-based decision making (Stages 1 and 2), through to an efficiency driven and performance-based capability (Stages 3 and 4) and ultimately a service value driven approach (Stage 5).

To develop its RIS3 renewals business case National Highways has established a programme to develop the capability of each asset class against this scale - see [Figure 2](#). Progression to the targeted level of capability for each asset class is to be achieved through a phased development approach with key elements of functionality being addressed in discrete investment cycles (ICs). National Highways has provided evidence to show that each IC has an assurance regime to challenge and assure the target Stage and assess whether the target Stage has been achieved for each respective asset class.

Note that the higher levels of functionality, i.e. to support Stage 4 and 5 capabilities (such as expanding modelling capability and carrying out portfolio testing to consider wider benefits and disbenefits beyond direct works costs), are planned for later investment cycles that will be reached later in 2022 and are thus beyond the scope of this review. The timing and phasing of these investment cycles (IC4 and IC5) is also shown on [Figure 2](#).

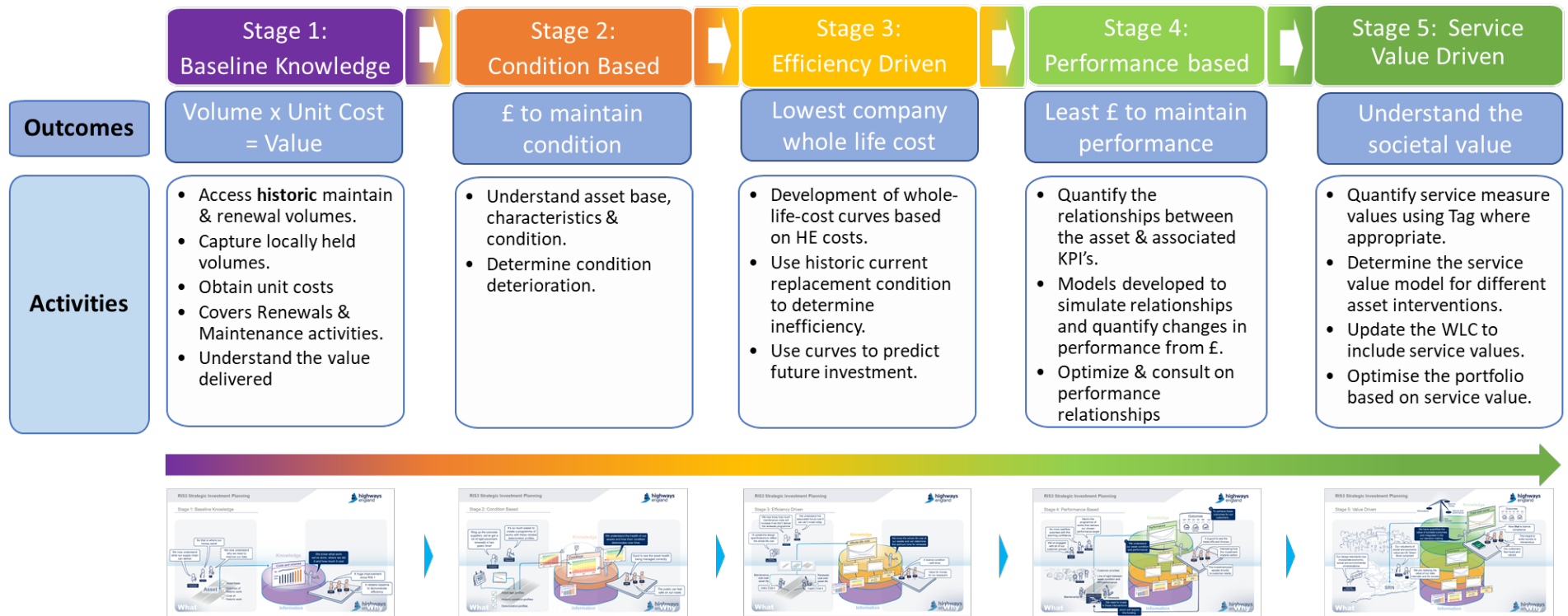


Figure 1 - National Highways renewals planning capability framework with stages of increasing confidence and complexity (note the thumbnails of the details of the five stages of maturity at the bottom of Figure 1 are presented in Appendix A).

Renewals Programme & Approach

Progress along the roadmap varies between asset classes

Objective: Establish an investment planning capability to develop a balance RIS3 renewals investment case.



Renewals Investment Planning Roadmap



Asset Classes	Cycle 1	Cycle 2	Cycle 3	Initial Report	Cycle 4	Cycle 5	Draft Strategic Business Plan
	Nov 20 to Apr 21	May to Aug 21	Sep to Dec 21		Jan to Jul 22	Aug to Dec 22	
Pavement Flexible	Stage 1 / 2	Stage 2 / 3	Stage 3		Stage 4	Stage 5	
Pavement Rigid	Stage 1	Stage 2	Stage 3		Stage 4	Stage 5	
Structures– Bridges and large culverts	Stage 1	Stage 2	Stage 2		Stage 3	Stage 4 / 5	
Structures– Other assets	NA	Stage 1	Stage 2		Stage 2	Stage 2	
Road Restraint	Stage 1 / 2	Stage 2 / 3	Stage 3		Stage 4	Stage 5	
Roadside Technology	Stage 1 / 2	Stage 3	Stage 3		Stage 4	Stage 5	
Drainage	Stage 1	Stage 1 / 4	Stage 4		Stage 3	Stage 5	
Geotech	NA	Stage 1 / 2	Stage 2		Stage 2	Stage 2	
Lighting	NA	Stage 1	Stage 2		Stage 2	Stage 2	
Tunnels	NA	Stage 1 / 2	Stage 2		Stage 2	Stage 2	
Soft Estate	NA	Stage 1 / 2	Stage 2		Stage 2	Stage 2	

Figure 2 National Highways renewals capability development programme and focus of this review (red outline box showing expectations at Investment Cycle 3 [IC3])

2.2 Scope and evidence timescale

It was agreed with ORR and National Highways that this review should focus on IC3, i.e. the evidence that shows National Highways’ delivery of asset management maturity levels Stages 2/3 for five of the selected asset classes and Stage 4 for drainage assets. It was further agreed that this review should assess National Highway’s progress against its programme and evidence provided at the end of December 2021, with a forward look of the likelihood of meeting the respective asset class targets for IC4 and 5. In practice, the assessment did not precisely align with completion of IC3 due to late availability of some of the outputs from work undertaken by National Highways for IC3 (these are further described in [Section 6](#)).

3 Asset management maturity assessment approaches

There are several asset management maturity assessment methods, including against ISO 55000 requirements. These approaches have provided us with the context in which we have assessed the investment planning approach being developed and applied by National Highways for RIS3. Following the initial analysis of information provided by National Highways and comparison with practice in other sectors, it was agreed with both ORR and National Highways that this review would comprise a limited scope asset management maturity assessment using National Highways’ own renewals planning maturity scale ([Figure 1](#)) and programme ([Figure 2](#)) as the benchmarks against which to assess performance. Thus, to enable both ORR and National Highways to focus on areas for improvement, we have assessed National Highways’ capability relative to its own expectations.

It is important to recognise that this is not the same as presenting an assessment of maturity against ‘absolute’ definitions, such as the Institute of Asset Management’s (IAM’s) maturity levels.

The assessment is also guided by the requirement set out in ORR’s project brief: “For each of the asset types, the consultants should evaluate the maturity of Highways England’s approach to renewals planning” against:

- the quality and coverage of asset condition, serviceability and resilience data;
- the application of deterioration data/modelling;
- the extent to which whole life cost considerations and/or modelling informs National Highways’ approach;
- the extent to which relationships between renewals investment and asset condition and residual asset life are understood and modelled;
- relationships between renewals investment and broader performance outcomes;
- the extent to which other feasibility considerations – such as traffic management impacts and asset obsolescence (in the case of technology) – are built into National Highways’ long-term planning;
- the extent to which the plans are informed by customers and stakeholders;
- the extent to which the plans are deliverable in RP3 and beyond.

The above points are the basis for the criteria against which we have assessed the asset classes, both for IC3 delivery and for IC4 and 5 trajectories. The criteria, which are detailed in [Figure 3](#) below, clarify:

- the analytical sophistication of National Highways’ strategic planning approach (e.g. asset and service modelling); and
- its organisational maturity (e.g. testing of plan deliverability requires cross-functional governance processes).

It is important to emphasise that the strength of an investment case needs to be proportionate to the materiality of the proposed expenditure, materiality being related to one or more of:

- the scale of proposed expenditure;
- the degree of change in expenditure being proposed; and
- how critical the expenditure is to delivering service (in its wide sense – customers, environment, society, compliance).

Figure 3, below, shows how our evaluation criteria map against the various maturity scale stages of National Highways capability development programme.

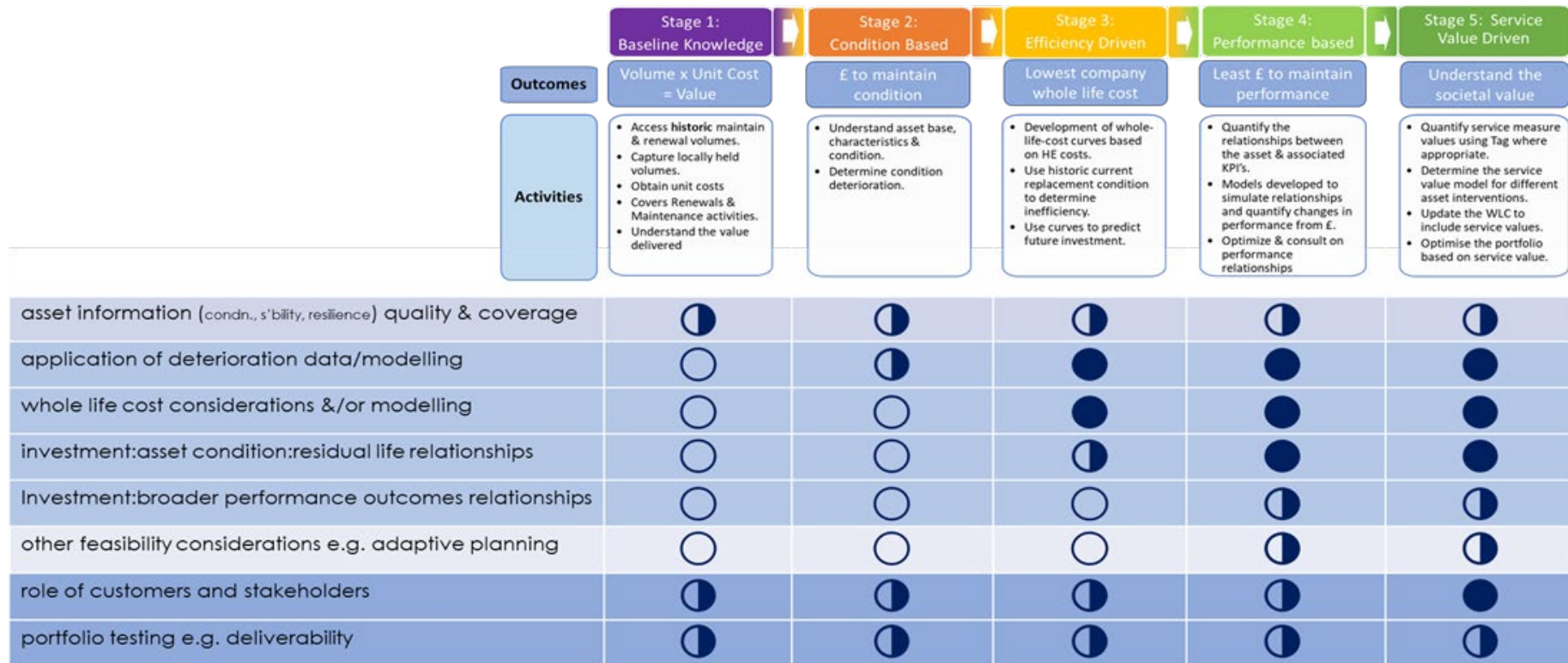
We have assessed National Highways maturity and sophistication of approach against our interpretation of the Stage descriptions provided by National Highways, and our expectations of what would represent good capability in each of these. Note that even within each Stage there are some levels of sophistication of approach, with the achievement of more sophisticated levels in one Stage bordering on the capability expected to be further developed in the subsequent Stage. So, there is more of a continuum from Stage 1 to 5 than the National Highways schematic implies. In turn, this may have implications for any attempt to correlate our assessment with evaluation of National Highways wider development of its asset management system implementation.

Figure 4 provides further detail on the expectations of capability at each stage in accordance with our approach to assessment. This is based on the outcomes and activities described for each Stage by National Highways.

To provide further context for our assessment approach we summarised the development of asset management capability towards a value-based approach in two UK infrastructure sectors; water and rail. This is presented in **Appendix B**.

For example the water sector has progressively improved its ability to understand both the likelihood of service failures and the scale of consequences of these failures, and the use of condition grading was an early step towards understanding likelihood of asset failure (and implicitly, service failure). In more recent Pricing Reviews (PR14 and PR19) the regulatory emphasis on asset management declined but has recently re-emerged using the measurement of ‘Asset Health’ as a simpler objective for asset management performance. In the last year, Ofwat published its review of Asset Management Maturity in 2021 and the UKWIR Future of Asset Planning (2022).

In contrast the rail sector’s approach is very safety driven and investment in the sector is still based on ‘compliance’ with monitoring and asset standards policies, as well as actual compliance with statutory and regulatory drivers. These are expressed in asset terms (their state and their performance) rather than service consequences. While there is some asset deterioration modelling, this is not then used to inform a forward look at service performance. Proposed investments are set out in volumes and workbanks, rather than specific interventions whose costs derive from bottom-up unit cost modelling and whose benefits align with a common approach to defining risk and value. This allows neither a forward-looking view of whole life costs nor a means of assigning value to the management and reduction of risks. Network Rail’s various regions and routes appear to have adopted different approaches and varying levels of maturity for asset deterioration, service consequence, costing and valuation. While some regions are actively trying to develop value-based approaches to informing investment planning, they are hampered by the absence of consistent and coherent risk approaches which align asset performance with service consequences.



Key:

- Full 'roadmap' Stage capability expectation
- Partial 'roadmap' Stage capability expectation
- No 'roadmap' Stage capability expectation

Figure 3 – Mapping of EAM maturity assessment framework against National Highways capability development programme

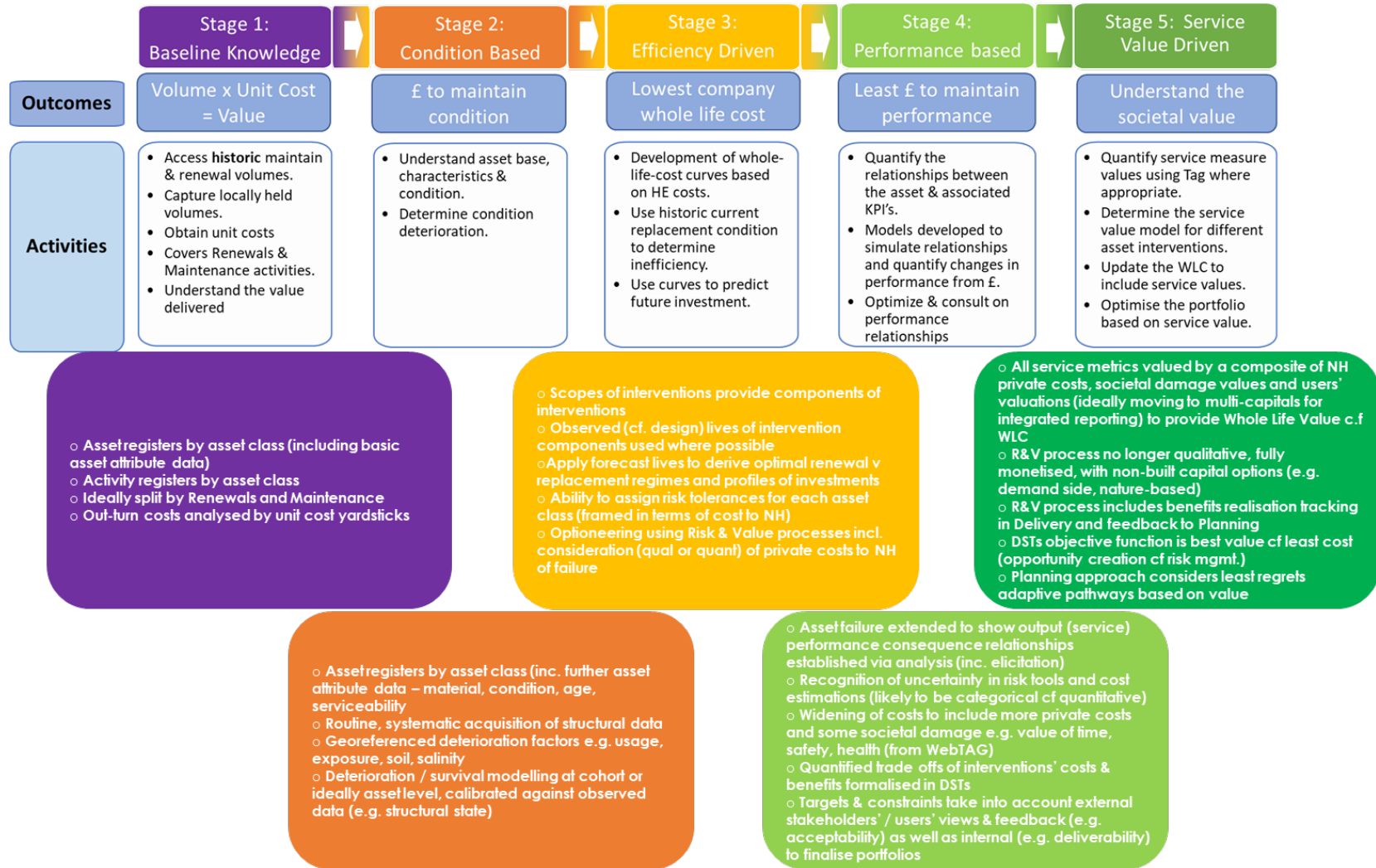


Figure 4 – EAM’s expectations of capability at each stage of the renewals development programme

4 Observations on National Highways’ approach to RIS3 renewals planning

4.1 Virtual Teams

National Highways has adopted a ‘virtual team’ approach (Figure 5) to develop its RIS3 business case and specifically to obtain input and perspectives from across the organisation to develop its asset renewals plans for RP3.

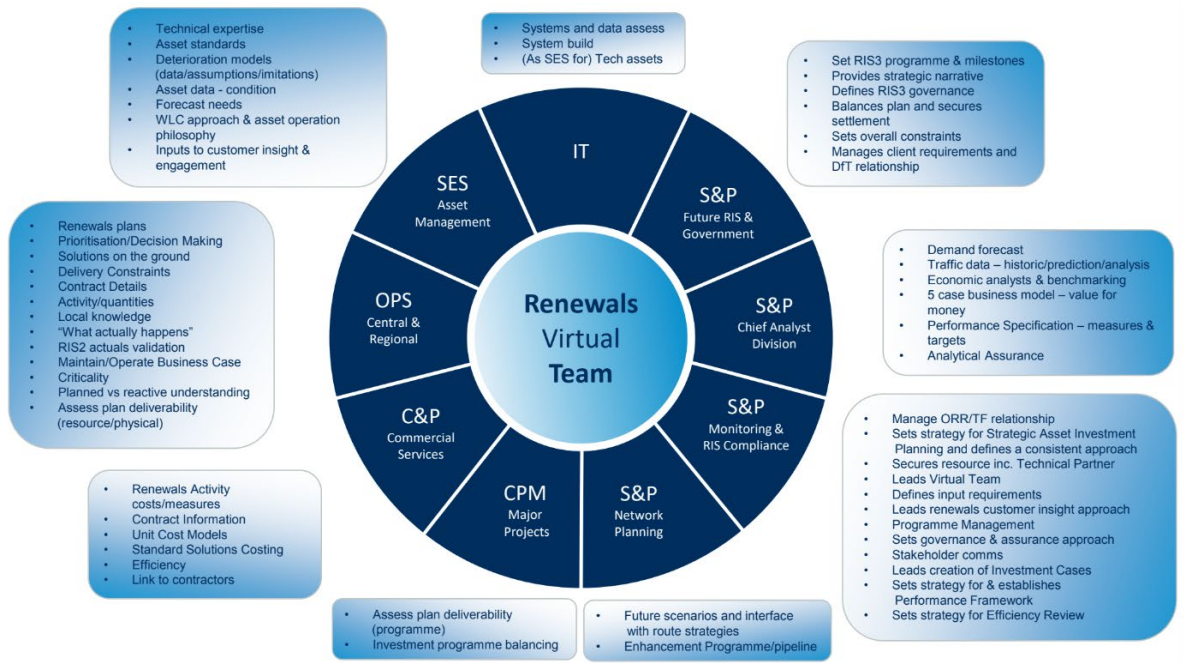


Figure 5 National Highways renewals virtual team approach

The virtual teams for each of the asset classes under consideration for this review were the principal points of engagement and sources of information to obtain an understanding of the National Highways’ approach, current position, development plans and programme as well as risks and issues.

It is evident that this approach is an improvement on that employed for the development of the RIS2 renewals plans and is proving effective in integrating the technical, operational and commercial elements for each asset class. This should support the development of a robust business case with consideration of risks and issues from across the whole organisation. The virtual team governance also seems to be helping to identify potential constraints on programme delivery, such as resourcing – both for National Highways and the supply chain - and coordination with other investment programmes.

The approach also provides a mechanism for renewals planning to be informed of and, where appropriate, aligned with developments in National Highways’ overall approach to asset management which is being taken forward under the Asset Management Transformation Programme (AMTP). We did note that the programme for the AMTP is not aligned with the timeline for RP3 renewals planning. For example, the delivery of revised Asset Class Strategies (ACS) - key documents setting out the asset management approach, status and planning for each asset class – are not due until March 2022. As such, it is important that there is effective communication of National Highways’ developments in asset management implementation from the AMTP to the RP3 planning process. We have seen evidence that the virtual teams are helping to address this.

4.2 RIS3 renewals scenario planning

As part of developing its RIS3 renewals funding proposals, National Highways has established an overarching framework to develop ‘bottom up’ investment scenarios for the various asset classes. These are presented in [Table 2](#).

Table 2 - RIS3 renewals planning scenario framework

Scenario	Description
A	Funding amount is RIS2 + inflation
B	Funding amount of approximately £6bn
C	Programme & funding for ‘Do Minimum’ to maintain safety
D	Programme & funding to maintain current performance (KPIs and PIs)
E	Sustainable asset management option – this option should maintain current performance but should also consider investing at the right time to prevent a build-up of problems in the future (not expected to be as much as the unconstrained scenario).

At this stage in the RIS3 planning process the virtual teams for each of the asset classes have taken independent approaches to develop these scenarios. National Highways’ Strategy and Planning directorate (S&P), which is managing the renewals planning programme, told us that it is undertaking a consistency review to ensure alignment across the asset classes in preparation of the Initial Report (at the end of IC3) and will be adopting this approach for IC4 and IC5 towards development of the draft SBP.

4.3 Identification of renewals need

For the asset classes considered in this review, except for drainage, National Highways’ evaluation of renewals need is derived from assessment of asset condition (which, therefore, requires appropriate levels of supporting asset data).

The approach for drainage is based on consideration of risk to provision of service rather than condition. This is reflected in the current (RIS2) Performance Indicator (PI) for drainage which is defined in terms of flood susceptibility (i.e. with consequent risk to impairment of service).

RIS2 Performance Specification: Drainage PI.

Drainage condition: measure of percentage of carriageway that does not have an observed significant susceptibility to flooding. From 2024/25 it is intended that this metric will be weather normalised.

National Highways has advised that it is developing a performance risk-based approach and narrative to determine renewals need in the draft SBP and this is expected to be available for the higher materiality asset classes by the end of 2022. National Highways’ longer-term expectation (beyond RIS3) is that a performance risk-based approach will be adopted for renewals assessment across all assets. Condition-based modelling will still be used to inform a performance risk approach and understand the impact of asset performance on network safety.

At National Highways’ stage of capability development at the end of December 2021 the investment requirement has been based on the direct costs of works to address asset condition (or performance risk in the case of drainage, as noted above). National Highways has advised that development of modelling capability to consider wider benefits and dis-benefits, e.g. carbon and customer, will be undertaken during IC4 and IC5 to support achievement of the higher stages of capability (i.e. Stage 4: performance based, Stage 5: Value driven). At present, customer and wider dis-benefits/benefits are generally considered in the solutions phase rather than at needs determination.

It is worth noting that, for pavements, National Highways is tasked under the RIS2 Performance Specification with developing a ‘customer-centric’, ride quality PI in 2022. As a PI National Highways will monitor and report performance against this metric in the public domain. National Highways, working with Transport Focus, is on track to deliver this and has advised that the relevant elements of this PI will be incorporated into the pavements key performance indicator (KPI). Thus, future modelling of pavement renewals need based on KPI outcomes will include an element of consideration of customer impact.

RIS2 Performance Specification: Commitment

Develop with Transport Focus during RP2 a measure of ride quality which reflects road users’ experience of the network.

4.4 Asset system development

Having a full and interoperable suite of asset systems with which to support deterioration modelling and to determine both individual asset renewals need and cross-asset scenario modelling is an important part of an overall asset management capability. The Asset Systems Strategy for National Highways will be an output from the AMTP which is currently being drafted, with publication expected to be within the next few months. Its development to date has included review of in-flight renewals projects. In the meantime asset-specific systems are being renewed, with decisions taken to invest in those systems supported by discrete business cases. For the asset classes considered in this review National Highways provided evidence of the following position:

- Structures: Structures management and information system (SMIS) replaced by Integrated asset management information system (IAM-IS) in October 2019.
- Flexible pavements: Highways Agency Pavement Management System (HAPMS) replacement is due to go live in April 2023 This will continue to be a separate, single-asset system but with the facility to link to other National Highways systems
- Geotech: Highways Agency Geotechnical Data Management System (HAGDMS) was replaced by the Geotechnical Data Management System (GDMS) in 2021
- Drainage: Drainage Data Management System (DDMS) to be replaced with the same Geotech platform, GDMS, within 2 years (a contract has been let)
- Roadside Technology: the new platform ServiceNow is currently being rolled out to replace the Technology Performance Management System (TPMS)
- Road Restraint: the need for a proprietary system has been identified, the solution is not confirmed
- Rigid pavements: modelling capability is being developed; National Condition Survey (NCS) data is currently held on an external supplier system ‘kPortal’ but will, in time, be transferred to HAPMS.

The above information was evidenced from the individual asset class teams and the overarching view from National Highways is that the absence of an overarching strategy has not thus far hindered RIS3 renewals planning capability.

4.5 Decision support tools

Decision support tools (DSTs) are important to have confidence in renewals investment scenarios for individual and collective asset classes. For a condition-based approach, these tools will use asset inventory and an assessment of condition together with deterioration modelling to determine

options for the nature and timing of interventions to deliver a required outcome. Works cost (Capex) data applied to these interventions will give an indication of capital cost over the period of analysis.⁴ Consideration of the maintenance works and costs (Opex) associated with the intervention options would support optimisation of whole life costing (WLC). More sophisticated modelling and portfolio testing may include consideration of wider benefits and disbenefits, eg the carbon or customer impact of solution options, which would support a value-based approach to investment planning, such as the ‘Service Value Driven’ approach targeted at Stage 5 of National Highways capability development programme.

Although this review did not carry out a deep dive into each system, there is evidence to show some variation in the development and application of National Highways’ DSTs across the asset classes. National Highways told us that it is planning to review its use of DSTs following completion of the renewals planning exercise.

The current DSTs position for the asset classes considered in this review is shown in **Table 3** below.

Table 3 – Current decision support tools (DSTs) used for renewals planning.

Asset Class	DST for RP3 renewals planning	Notes
Roadside Tech	Asset Investment Manager (AIM) by Probit	Being trialled by National Highways. Use will be reviewed on completion of RP3 renewals planning.
Drainage		
Flexible pavements	Programme Investment Tool (PIT)	PIT models volumetric outputs for capital interventions. Costs for construction, traffic management and risks are then applied. Delay costs are not modelled and Opex works and costs are modelled outside PIT. Carbon, climate impacts are not currently modelled within PIT.
Rigid pavements	N/A	Deterioration modelling capability is under development.
Structures	Agile Assets	The DST uses inventory and condition information held on IAM-IS and provides a deterioration modelling capability to support scenario planning for the assessment of investment need. Modelling considers costs of capital works. Delay costs or carbon impact are not modelled.
Geotechnics	N/A	
Road restraint	N/A	National Highways has an understanding of the deterioration modes and RP3 modelling is being based on the tool developed for RP2.

National Highways has advised that further development of modelling using DSTs to include consideration of wider benefits and dis-benefits will be addressed during IC 4 and IC5.

⁴ Usually 60 years following Treasury guidance: The Green Book. Central Government guidance on appraisal and evaluation. HM Treasury, December 2020.

4.6 Embedment of overall asset management approach

It is noted above that National Highways’ AMTP is the principal channel for development of the organisation’s overall approach to asset management and that this has informed the RP3 renewals planning programme. Though not strictly within the scope of this review, evaluation of the awareness and implementation of organisational objectives and processes for asset management by key stakeholders is an established element of asset management maturity assessment methodologies. In this context, the following observations from the review are of note:

- We heard from Transport Focus, who explained their perspective of customer priorities and that they don’t currently feel as engaged with National Highways’ asset management development process as they would like to be as National Highways develop their RIS3 plans.
- National Highways advised that their AM strategy is being revised for issue in March 2022 and that elements of the strategy - such as the line of sight from commitments to customer, carbon and digital through to delivery - are currently in development by the Asset Management Steering Group (AMSG), National Highways Executive and asset leads, and had not yet been rolled out to the virtual teams or the wider organisation.

4.7 Renewals planning for Road Period 4 and beyond

Although not part of this review scope we were interested to understand any future ambitions that National Highways has to improve its asset management and renewals planning approach for future RIS setting processes beyond RIS3. We heard that there is a developing view in National Highways, though not yet confirmed policy, that strategic renewals planning should evolve to become a continuous process rather than a discrete exercise in the approach to each RIS. The key advantages that this could bring for National Highways are to avoid the organisational resource peaks in the typical five-year RIS setting cycle and to increase the overall efficiency and flexibility of renewals planning from the continuous assessment of need through to solutions development.

A further consideration here is the nature of the RIS setting process. Under the seven-stage process set out in National Highways licence’, the government sets out the financial resources to be made available to National Highways for the upcoming road period at stage two (‘the Secretary of State’s Proposals and Draft RIS’). Moving towards a continuous renewals planning process – rather than one focussed on developing the renewals case the draft SBP (stage three: ‘the Company’s Draft SBP’) – would assist National Highways and ORR in providing advice to government at stage 2.

Notwithstanding these points, it is also recognised that RIS-specific planning will still be required to reflect the objectives and priorities of DfT at the time.

4.8 DBFO assets

In a number of our interviews with asset class teams we were made aware of the potential risks resulting from the expiry of several Design Build Finance & operate (DBFO) contracts in RIS3. These assets will be absorbed into the regional operations teams when the contracts expire. Relevant sections of the network are set out in Table 4.

The asset teams are aware of some potential gaps in asset inventory and condition knowledge that could cause uncertainty in modelling of RIS3 renewals programmes. In the case of Roadside Technology, while National Highways operates and maintains the assets on DBFO commissions for the integration of service across the SRN, there is currently some uncertainty over the ownership of assets installed during the DBFO commissions, which National Highways is working to resolve.

It is understood that National Highways will identify returning DBFOs as a discrete funding line in RIS3, ie distinct from the capital renewals portfolio, as these represent a new cost item in comparison to previous submissions for RIS1 and RIS2. Therefore, at the time of this review, consideration of DBFO assets did not fall within the scope of National Highways planning for capital renewals for RIS3 and thus were not included within the information provided and discussed in this project. National Highways have subsequently advised that the asset virtual teams working on capital renewals have now, in parallel, been tasked with evaluating the requirements and risks arising from the return of DBFO assets. National Highways has noted that the DBFO contract handback requirements should assure the condition of the returning assets.

Table 4 DBFOs returning to National Highways during Road Period 3

Scheme	Return date	Length (miles)
A1(M) Alconbury to Peterborough	March 2026	13
A417/A419 Swindon to Gloucester	March 2026	32
M1-A1 Lofthouse to Bramham Link	April 2026	18
A69 Carlisle to Newcastle	April 2026	52
A30/A35 Exeter to Bere Regis	March 2026	19
A50/A564 Stoke to Derby Link	June 2026	35
M40 Denham to Warwick	January 2027	76
A19 Dishforth to Tyne Tunnel	February 2027	73

4.9 Customer engagement research

The review included discussion with National Highways, and its consultant ICS, on customer engagement and valuation research, where National Highways noted that it was intending to move toward monetising valuations of customer impacts, e.g. by applying HM Treasury’s TAG valuation, in IC4 and developing these further through IC5. The insights from engaging with customers would however feature in all the Stages of National Highways’ renewals approach, across all asset classes. For instance, the qualitative phases of engagement so far have gained users’ views on outcomes of RIS3 and on priority asset classes. The work to date has been used to identify where there is or is not evidence providing support from road users by each asset class.

The scope of the customer research has initially focussed on road services rather than looking at wider aspects of environmental and social valuations. The use of a Service Measure Framework (SMF) associated with the risk maps being applied by National Highways should, based on experience from other sectors, enable these valuations to be successfully applied. National Highways has set out principles on how to use the SMF in Stage 4 but only ‘in principle’ at the time of the discussion. This analysis is likely to be presented to DfT by the Future RIS3 team in Spring 2022.

National Highways’ progression towards application of customer and wider valuations will mean it benchmarks well against other sectors’ approaches e.g. in gas and water where Ofgem and Ofwat require representation of public value in decision making e.g.:

*“A company... should include the **value placed by consumers on relevant service attributes, and any associated social and environmental impacts.** This methodology encourages a sustainable approach towards maintaining base service.” (Ofwat, 2008).*

5 Assessment of RIS3 renewals planning capability for Investment Cycle 3 (IC3)

As described in Section 2.2, the original intention of this review was to assess National Highways’ progress at the end of December 2022, i.e. the planned date for completion of IC3. However, as noted, some of the outcomes from IC3 were not available for this review by the end of December, thus it was agreed with both ORR and NH that the assessment should reflect National Highways’ position at that date with a view on the trajectory to meet IC4 and 5. Further work undertaken by National Highways for IC3 has been provided, but not considered in this assessment, and is presented in [Section 6](#) of this report.

Notwithstanding the above, this assessment has been made at the mid-point for National Highways to develop its renewals modelling in order to draft its SRN Initial Report, a key part of the RIS setting process. National Highways’ programme indicates the following expectations ([Table 5](#)) by the end of IC3.

Table 5 – National Highways Capability targets at IC3

Asset Class	NH Capability target at end of IC3
Flexible pavements	Stage 3
Rigid pavements	Stage 3
Structures – bridges and large culverts	Stage 2
Road restraint	Stage 3
Drainage	Stage 4
Roadside technology	Stage 3
Geotechnics	Stage 2

Thus, at the end of IC3, all asset classes other than drainage should have achieved Stages 1 and 2 i.e. a baseline knowledge of asset inventory and historic unit cost and an understanding of asset condition and deterioration. Flexible and rigid pavements, road restraint and roadside technology asset classes should have achieved Stage 3 i.e. development and use of whole life cost curves to predict future investment.

For drainage, the progression through targets is not planned to be sequential, i.e. while Stage 4 (performance driven) is targeted at the end of IC3, the target for end of IC4 is Stage 3 (efficiency driven). This reflects the performance-based approach being used to identify renewals need for drainage (see Section 4.3) and the fact that the operational flooding data set to support the renewals analysis will not be fully available until early 2022.

5.1 Assessment approach

From the evidence collected in the documentation review and engagement sessions with National Highways, the capability of each of the asset classes has been assessed. A red-amber-green (RAG) scoring system has been used to indicate whether capabilities at December 2022 meet the IC3 requirement for each asset class (using the framework shown in [Figure 3](#)).

The results of this assessment are shown in [Figure 6](#). Asset classes have been reordered left to right in order of their planned improving maturity against National Highways’ renewals planning Stages, i.e. Stage 2 – condition-based, Stage 3 – efficiency driven and Stage 4 – performance based. **Green rated** indicates that the capability expectations have been fully achieved. **Amber rated** indicates that there are minor gaps, whilst **red rated** indicates that major gaps in capability have been identified.

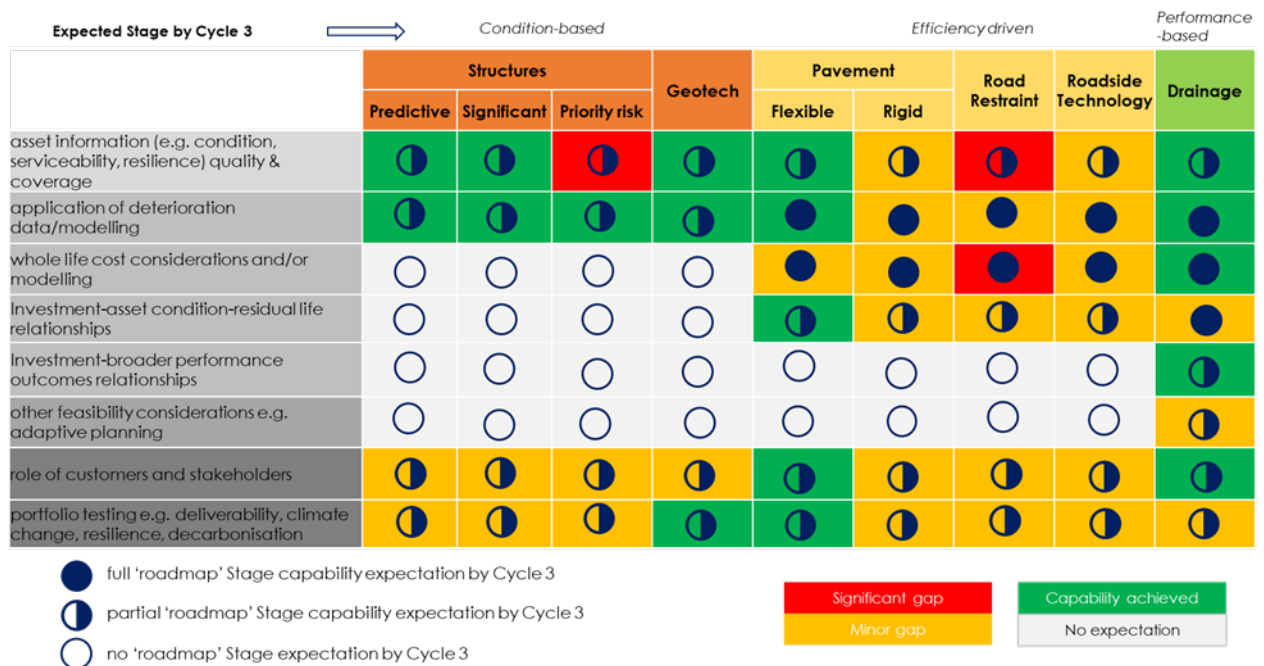


Figure 6 - RAG rating of capability by asset class at end of December 2021

Note that in Figure 6 the Structures (bridges and large culverts) asset class has been further subdivided to reflect the different approaches that National Highways employs to derive renewals need ie:

- **Predictive:**
Those structures where an assessment of future investment need can be made using DST with routine inventory/condition data
- **Significant renewals:**
Large, complex structures where the capability of the DSTs is limited so further information from the local teams is used to inform the planning.
- **Priority risk:**
Structures with one or more of the following features:
 - scour,
 - post-tensioned construction,
 - fatigue,
 - hinge joints and
 - half joints

where structural condition is not easily determined during the routine General or Principal Inspections

National Highways also employs a fourth approach – ‘Preventative’ – for additional or early asset investment that will facilitate better whole life cost management of a structure where predictive modelling may not identify the appropriate intervention. In RIS2 this predominantly comprised the renewal of Cathodic Protection, thus the focus of this review has been on the ‘Predictive’, ‘Significant’ and ‘Priority risk’ streams which, it is understood, will form the greater part of the investment requirement for RIS3.

5.2 Assessment observations

Based on the evidence seen and our assessment presented in [Figure 6](#), overall, there is a mixed level of maturity against the expectations for IC3.

The assessment has identified significant capability gaps (**red rated**) in two asset classes, priority risk structures and road restraints, and for two criteria, asset information and whole life cost consideration. For priority risk structures this is based principally on the lower level of asset knowledge evidenced by National Highways against that expected at this stage in the RIS3 planning cycle. For road restraint in addition to the lower level of asset knowledge, the impact that this lack of knowledge has on the ability to develop meaningful whole life cost (WLC) modelling scenarios. National Highways has shared some additional evidence of recent progress for priority risk structures and road restraint which is discussed in Section 6.

There are minor capability gaps (**amber rated**) against the IC3 expectations for some asset classes, notably rigid pavements and roadside technology. Minor capability gaps are also apparent for most asset classes against some cross-cutting criteria such as understanding the role of customers and stakeholders and with the consideration of wider factors such as deliverability and carbon. Although the IC3 expectation is for partial capability in these areas, we have some reservations as to whether these can currently be achieved. National Highways has shared some additional evidence of recent progress for roadside technology which is discussed in Section 6.

It should be noted that there are some assessment criteria within asset classes where there are no capability expectations at the end of IC3. These mainly apply to the condition-based asset classes such as predictive and priority risk structures and geotech, as well as the criteria of investment modelling and other feasibility considerations. Except for geotech, which remains at capability Stage 2 (i.e. condition-based) up to IC5, all other asset classes are expected to develop these capabilities in future cycles.

More detailed observations from the engagement with National Highways and the review of information to support the above findings are summarised in Appendix C to this report.

The observations supporting the above assessment are summarised in [Table 6](#) below in order of asset class presented in [Figure 6](#).

Table 6 Key observations supporting RAG scores

Asset class	IC3 target	Observations
Structures – predictive	Stage 2	<ul style="list-style-type: none"> There is an established and actively managed General/Principal (GI/PI) inspection regime Inventory and condition data is held on National Highways’ IAM-IS data management system and with a protocol for assurance by qualified staff and regular audit The DST has been recently updated and configured and validated by operational staff. Predictive Structures use the DST for the purposes of maintaining ‘steady state’.
Structures - significant renewals	Stage 2	<ul style="list-style-type: none"> Established risk -based approach using risk ranking 1 to 5 Highest Risk interventions (4/5) to be undertaken in RIS2 Next highest risk interventions (3/2) to be undertaken in RIS2 & RIS3 Intervention risk ranked 1 will be considered in RIS4+
Structures – priority risk	Stage 2	<ul style="list-style-type: none"> National Highways recognises that the GI/PI regime is not sufficient to determine renewals need for these structures

Asset class	IC3 target	Observations
		<ul style="list-style-type: none"> • A risk-based procedure to determine need for detailed investigation to establish works requirement is being finalised. • The approach and extent of asset knowledge for these structures is at an early stage of development.
Geotechnics	Stage 2	<ul style="list-style-type: none"> • National Highways has a well-established procedure for renewals planning (asset risk based) which is documented in the Design Manual for Roads and Bridges, DMRB (CS 641) and will be used for RP3 planning. • National Highways has a long history of managing geotechnical asset data (> 20yrs operation of HAGDMS) which has enabled a mature risk-based approach to evolve. • There is a PI for the condition of the geotechnical asset which is derived from data held in GDMS, this provides a strong link between the data used in geotechnical scheme programme development and the reported PI. • The overarching asset management strategy is to hold the geotech asset in a stable condition.
Flexible pavements	Stage 3	<ul style="list-style-type: none"> • Overall, the data for flexible pavements appears to complete, current and well-managed. • There is an established DST for capital works and costs • Scenario planning for RIS3 capital renewals will take account of maintenance works (Capex/Opex trade-offs). • Disbenefits such as noise, carbon, rolling resistance are not considered in PIT as part of asset need assessment. These are addressed through solution optioneering. • Renewals planning utilises the data that supports the pavement KPI and models impact on that KPI. Hence, there should be good ‘line of sight’ from investment to performance. • From RP3 the KPI will incorporate ‘customer-centric’ parameters/thresholds, thus in future determination of asset need will include an element of customer-framed requirement.
Rigid pavements	Stage 3	<ul style="list-style-type: none"> • National Highways has invested resource and is making good progress in developing its capability for rigid pavements since it commenced this programme in the build up to RIS2. However, it is starting from a lower base than for flexible pavements and therefore much of the work is still in development. • A dedicated survey has been implemented and is being further developed and expanded in terms of coverage. This should provide greater certainty on inventory and further information on condition in early 2022 • Deterioration models to support renewals planning are in development.
Road restraint	Stage 3	<ul style="list-style-type: none"> • Management of the asset has relatively recently been ‘in-sourced’ under the Asset Delivery contract model and a ‘single operating model’ has been developed. • However, data is still held in regional/area systems.

Asset class	IC3 target	Observations
		<ul style="list-style-type: none"> Guidance for standardised data collection has been developed but inspection data is only approximately 40% complete. A protocol for assurance and audit of asset data is under development There is no DST for road restraint – a tool is under consideration
Roadside technology	Stage 3	<ul style="list-style-type: none"> This asset was previously managed by service providers under Roadside Technology Maintenance Contracts (RTMCs) but has now been taken in-house under the Asset Delivery model. A data cleansing exercise undertaken in preparation for renewals planning identified both gaps and double counting in the asset data A new asset database and fault recording system (ServiceNow) is being rolled out but is not yet ready; therefore inventory data recorded in the legacy TPMS has been used for renewals planning. Fault data from National Highways’ Halogen system has been transferred into TPMS to support this exercise. Modelling for renewals was initially undertaken in Excel (Capex only); AIM is now being trialled as a DST to allow better modelling of renewals constraints. National Highways consider that whole life cost models for roadside technology need further refinement as the current model is recommending deferring high-cost interventions in preference to ‘low hanging fruit’ National Highways is currently working on technology roadmaps to understand the impact of obsolescence on planning scenarios. There is evidently sound development being undertaken but the above indicate that the approach is not yet fully established or embedded
Drainage	Stage 4	<ul style="list-style-type: none"> National Highways takes a performance-based approach to managing the drainage asset. The capital renewals plan for RP3 will be based on flooding data and managing/mitigating flooding risk. The drainage PI is based on flooding susceptibility; there is therefore line of sight from recorded flooding hotspots to the drainage PI. Asset inspections are carried out reactively; long-stop condition surveys are no longer carried out due to the scale, affordability and accessibility required. The AIM DST is being used for RP3 planning; its continued use will be reviewed after the RP3 planning cycles have been completed Long term modelling is under development and will consider delay caused by flooding data as well as Environment Agency flood information and the impacts of future climate change.

6 Recent renewals capability developments by National Highways

Since the date of this assessment of National Highways capability at the end of December 2022, National Highways has provided further information on development works that have been / are being undertaken in the closing stages of IC3. These align with the observations that have been made in Section 5 and are described below.

6.1 Whole life cost analysis for RIS3 renewals planning

National Highways has provided further evidence of whole lifecycle cost planning for RIS3. The evidence summarises the WLC work undertaken in IC3 across Rigid Pavement, Flexible Pavement, Road Restraints and Roadside Technology asset classes, i.e. those that should have achieved Stage 3 (Efficiency driven) capability, and introduces how this work will be further developed in IC4 and IC5.

Our review of this evidence is as follows:

- The hypothetical examples provided by National Highways show that it has a good understanding of the principles of WLC across these asset classes.
- The examples show how National Highways builds up the cost elements into a ‘unit cost’ type approach i.e. £ per km or £ per intervention.
- It is not clear at this point how National Highways is using information about its asset base to apply this WLC understanding to develop costed investment portfolios. The asset attribute variables which influence cost are referred to in several of the examples (e.g. the state of concrete for rigid pavement), but it’s not apparent how this asset information is being applied to establish the expected volume of work (the need), which will be key to the cost of the overall (unconstrained) portfolio.
- National Highways makes the point in several of the example cases that age-based WLC does not provide the full picture for its decision making. For instance, while deferring replacements for some asset classes such as Roadside Technology reduces National Highways’ WLC (defined as the costs it directly incurs), this omits the effects on performance and service. Conversely, for Flexible Pavements, National Highways acknowledges that of its two principal surfacing options – thin surface course systems (TCSC) and hot rolled asphalt (HRA) - TCSC has a higher WLC. However, once wider benefits/dis-benefits costs such as noise, carbon and delay are included, a lower Whole Life Value (i.e. the sum of financial and non-financial costs and benefits) is indicated for HRA.
- Conversely, it is noteworthy that while for other asset classes National Highways acknowledges that a wide set of benefits values should be applied, for Road Restraints National Highways has a process that prioritises concrete barriers on the expectation that safety and delay benefits will counter the significant (fourfold) difference in direct WLC compared with steel. It is understood from National Highways that any policy regarding prioritisation of concrete over steel restraint systems is under consideration for Road Period 3. In the meantime, National Highways is working towards achieving Stage 5 (Service value driven) capability by the end of 2022, which will allow the evaluation and comparison of wider benefits and dis-benefits for the available solution options.
- National Highways recognises in these examples that for its overall decision making it will need to move to Stages 4 and 5 and consider performance impacts and service value. National Highways has indicated to us that performance and service-based approaches will be used in the final plan balancing, developing optimal portfolios using performance/service targets within constraints (budget, deliverability etc).

- It is apparent that for some asset classes such as flexible pavement National Highways is already considering the factors and capabilities that will be required for Stage 4 and Stage 5. For roadside technology National Highways is very close to achieving this capability and will move to it in IC4.

6.2 Priority risk structures and significant renewals

National Highways has provided an update on how it is addressing the capability risk identified and described in **Figure 4** of this report, which is based principally on the lower level of asset knowledge than would be expected at this stage of the investment planning process.

National Highways notes that this is a fair reflection of the current position but should not be considered out of context with the RIS 3 maintenance strategy for these structures as they age. National Highways believes that RIS3 is the time to fully implement their management requirements which have been developed to guide a proactive approach to identifying potential hazards and provide the opportunity to negate or mitigate these risks before they become a risk to road users.

The work that National Highways has commissioned to better understand the implementation costs of these management requirements, and that will inform IC4 and IC5, is described below.

Our current basic assessment of need for these assets comes from the available asset inventory data in IAMIS and expert view of the likely need and cost for inspections and maintenance actions based on previously completed schemes. The different Priority Risk Structure types are:

- *Concrete structures with half-joint decks: c. 420*
- *Concrete structures with hinge decks: c.95*
- *Post-tensioned structures: c.1200*
- *Scour susceptible structures: c.2400*
- *Fatigue-prone steel structures: c.800*

In addition to these five groups we are also considering our ‘At Risk’ structures including those with safety critical fixings.

The Management of our Priority Risk Structures project originates from the lessons learned from the A52 Clifton Bridge and the resulting dedicated team set up to review the management of our Post-tensioned structures. The project is building our understanding of the number and location of our priority risk structures using a combination of IAMIS data, liaison with the local Operations teams, and other data from around National Highways.

The local knowledge held in the regions is currently being collated centrally by our project team.

The project commenced in January 2022 and is due to complete this autumn. The refined understanding of the need of our priority risk structures will be used to update our RIS3 investment case and provide greater assurance with the supporting evidence to these needs.

‘Significant Renewals’ has been developed by collecting the following information for individual structures or groups of structures:

- Identified Need
- Identified Work
- Justification

- Cost Estimates
- Basis for cost estimate
- Consequence of not doing work

Interventions have then been identified for individual structures or across multiple locations. ‘Significant Renewals’ are interventions prioritised using a risk-based approach, where the risk is evaluated against Safety, Functionality and Value for Money (VfM). Each intervention is then risk ranked 1 to 5 using the criteria in **Table 7**, below.

Table 7 Significant Renewals (Structures) risk ranking

Level of risk if work not done in RP2	Safety risk	Functionality (level of service/availability of the network for use)	Value for Money
1	No safety	Low functionality	Low VfM
2	Low safety	Low/Med functionality	Med VfM
3	Medium safety	Medium functionality	High VfM
4	High safety	Med/High functionality	High VfM
5	High safety	High functionality	High VfM

Our views on the above approach and the other evidence we have been provided on structures is as follows:

- The strategy for structures in RIS2 and RIS3 (and beyond) as documented in various National Highways publications including the ACS (June 2020) for Structures is a condition-based strategy to keep the stock of structures assets at ‘Steady State’. To monitor this the National Highways’ Performance Indicator for structures, which measures average and critical condition (SCav and SCcrit), are condition-based indicators.
- The Predictive renewals programme which uses the DST, is the tool that is used to determine what is required to maintain ‘Steady State’. However if a significant amount of funding in the RIS2 and RIS3 programmes is spent on ‘Priority Risk’ and ‘Significant Renewals’ schemes, which are more risk-based approaches for structural vulnerability features, at the expense of ‘Predictive Renewals’, there could be a risk that the current strategy of ‘Steady State’ may be impacted.
- Therefore it is recommended that when National Highways updates the ACS for structures, it should review the methodology used to identify predictive, priority risk structures and significant renewals that informs RIS programmes, to confirm that this will continue to achieve the ‘Steady State’ strategy.

6.3 Roadside technology inventory gap analysis

National Highways has shared its approach for validating the inventory data gap for roadside technology, which it carried out in 2021 and which is continuing across its regions. The approach is described below.

When we first received the TPMS file, we worked with an external consultant to identify the correct product type names to select against each of the asset sub-classes (e.g. PTZ CCTV) to allow us to identify the relevant assets.

Once we had these asset volumes, we held a review with our independent data expert to scrutinise our methodology to confirm they were happy with it.

After this initial view, we worked with the regional teams to look at the asset volumes in their area and identify any gaps. We did this in part by plotting the assets we had found in a GIS system – this helped us find gaps on the network (which we rectified by adding missing product types) and look for duplicates (which we rectified by counting these as a single asset).

National Highways held meetings with each of its regions in September and October 2021 to agree this approach and is currently using its Service Now tool to create blended asset inventory and update asset counts. Once this is completed National Highways will be able to re-model based on refined asset inventory and it suggests confidently state that data used in model matches its asset knowledge. This will remove the minor risk identified in our assessment.

7 Assessment of RIS3 renewals capability trajectory

Based on the information that was used for the assessment presented in Section 5 and further information made available by National Highways in Section 6 an assessment has been made of the likelihood or risk of each of the asset classes attaining its maturity target milestones by the end of Cycle 5, i.e. by December 2022. This assessment is presented on a RAG basis in [Table 8](#).

Table 8 RAG assessment of likelihood of meeting Cycle 4 and 5 capability milestones

Assessed Maturity based on confidence to reach Stages 1 to 5 within Cycles 4 and 5 Green = No assessed risk, Amber = Minor risk		
Asset Class	Cycle 4	Cycle 5
Pavement - Flexible	Stage 4	Stage 5
Pavement - Rigid	Stage 4	Stage 5
Structures – Predictive (using DST)	Stage 3	Stage 4/5
Structures – Significant Renewals	Stage 3	Stage 4/5
Structures – Priority Risk	Stage 3	Stage 4/5
Road Restraint	Stage 4	Stage 5
Roadside Technology	Stage 4	Stage 5
Drainage	Stage 3	Stage 5
Geotech	Stage 2	Stage 2

7.1 Observations on trajectory

Referring to [Table 8](#), rigid pavements and roadside technology were assessed as having minor capability gaps (**amber rated**) at December 2021. These asset classes therefore have a minor risk of also missing milestones at IC4 but based on evidence of National Highways trajectory we consider they are likely to achieve their maturity target by IC5.

Priority risk structures and road restraint were assessed as having significant capability gaps in December 2021. As discussed in Section 6 we have been provided with additional evidence to show how National Highways is beginning to address these gaps. The delivery of these ongoing workstreams will determine whether National Highways meets its maturity targets in IC4 and IC5. For this reason our assessment of National Highways’ ability to meet the IC4 and IC5 targets for these assets are shown as having a minor risk at this stage and is something that we suggest ORR continues to monitor.

For Structures as a whole, whilst the approach being adopted by National Highways for ‘Significant Renewals, Priority Risk and Predictive’ (DST) workstreams appears sensible, we believe this could negatively impact the Condition PI for Structures and potentially impact the key strategic objective of maintaining the structures stock at a ‘Steady State’ condition. National Highways have confirmed that the work identified via the ‘Predictive’ renewals (DST) strategy will maintain ‘Steady state’ and that ‘Significant Renewals’ will have little impact on the condition KPI. Our assessment also considers that the approach adopted for ‘Priority Risk Structures’ may have little impact on the condition KPI. The Predictive renewals programme which uses the DST, is the tool that is used to determine what is required to maintain ‘Steady State’. If a significant amount of funding in the RIS2 and RIS3 programmes is spent on ‘Priority Risk’ and ‘Significant Renewals’ schemes, which are more risk-based approaches for structural vulnerability features, at the expense of ‘Predictive Renewals’, there could be a risk that the current strategy of ‘Steady State’ may be impacted.

More generally, where we assessed asset classes as having met their IC3 capability target in December 2021, with the following exception, we do not consider any further risk to meeting their IC4 and IC5 planning targets provided National Highways continues to progress at its current pace. The exception is with drainage where, due to the planned reverse sequence of maturity i.e. from Stage 4 (performance-based) at Cycle 3 to Stage 3 (efficiency-driven) at Cycle 4, we consider that there may be a minor risk of lack of asset knowledge, although National Highways told us that it is obtaining further operational data from its Operations Directorate (OD).

Of note is the consistent capability expectation for the geotech asset class from Cycle 3 to Cycle 5 which stays at Stage 2 i.e. condition based. This asset class is of lower ‘materiality’ than the others considered in this review and the evidence from engagement with National Highways shows that it is one of the more maturely managed asset classes and that the approach is appropriate considering allocation and prioritisation of resources.

8 Conclusions and recommendations for ORR

The scope of this review asked us to provide recommendations to ORR on how it should approach its duties to the RIS3 process in the light of our findings.

Renewals planning capability development

Conclusion 1: Overall, our assessment shows that National Highways has met its own renewals planning capability targets for the end of December 2021 (IC3) for some asset classes but for other classes there are minor shortfalls. There are two asset classes, priority risk structures and road restraint, where our assessment shows achievement to date is significantly below expectation.

Conclusion 2: There is significant work remaining to be delivered to achieve the targets for IC5. The foundation of National Highways’ approach is sound and its commitment and management of resource is effective so, overall, it is considered that these targets should be achievable provided National Highways continues to progress at its current pace. The status and trajectory of both road restraint systems and priority risk structures indicated a degree of risk that for these asset classes the IC5 target may not be met.

Recommendation 1: ORR should ask National Highways to provide updates on its renewals planning progress at Investment Cycle IC4 and IC5 milestones. This should include:

- How asset information quality and coverage has improved and will be improved further during RIS3, including deterioration for priority risk structures and road restraint systems.
- That it has achieved efficiency-driven asset class capability, i.e. the delivery of lowest whole life cost for rigid pavements, road restraint and roadside technology assets.

Recommendation 2: ORR should continue to understand National Highways’ capability in the following areas, and should consider whether it requires any interim update prior to the Efficiency Review in 2023:

- The role and expectations of customers and stakeholders such as Transport Focus has been considered in renewals plans for all asset classes.
- Portfolio testing of renewals plans has been carried out to assess wider benefits / dis-benefits such as climate change, resilience, deliverability and decarbonisation.
- How consistency of renewals modelling scenarios and performance measures has been assured across asset classes as the draft Strategic Business Plan (SBP) is developed.

DBFO assets

Conclusion 3: Although not part of this review, the National Highways renewals planning team explained that they are considering the impact and RIS3 funding need that the DBFO sections due to be returned to regional operations will have on the overall requirement for renewals planning. There is some uncertainty over the ownership of certain asset classes installed during the DBFO commissions, which National Highways is working to resolve.

Although these assets are currently being operated and maintained by the concessionaires, National Highways does have some visibility of asset condition and work is underway to evaluate the impact of their return on network performance and funding requirements.

Recommendation 3: ORR should continue to have regard for National Highways’ plans for the handback of DBFO assets into regional operations including the quality and coverage of asset information and potential risk to RIS3 renewals delivery.

Alignment of asset management development programmes

Conclusion 4: Strategic investment planning is led by Strategy and Planning (S&P) to a programme evidently dictated by the RIS planning process while National Highways’ overall approach to asset management is being taken forward under the Asset Management Transformation Programme (AMTP) led by Safety, Engineering and Standards (SES) over a programme of several years. A maturity is required to align the needs for RIS planning cycles with continuous improvement in (tactical) asset management.

Evidence shows that milestones from the AMTP such as Asset Class Strategies, Asset Systems Strategy, Asset Management Strategy and coordination of development of DSTs are not necessarily aligned to optimise support to the RIS3 renewals planning process but that this is an evolving capability in National Highways with the existence of the AMTP and S&P’s representation on its steering group, being a significant step forward from the RIS2 processes and capability.

There is still a need to consider alignment of the investment planning requirements with the continuous improvement activities, noting that they are different (strategic/tactical) although for the same ultimate purpose. Timely availability of key outputs from the AMTP would support consistency and efficiency in the delivery of the strategic investment planning process and promote engagement with and embedment of the asset management approach with key stakeholders, both within National Highways and external, such as Transport Focus.

Recommendation 4: ORR should continue to have regard for the development and embedment of National Highways AMTP actions and how these contribute to RIS3 strategic investment planning.

Future development of renewals planning for RIS setting

Conclusion 5: There is a developing view in National Highways, though not yet confirmed policy, that strategic renewals planning should evolve to become a continuous process rather than a discrete exercise in the approach to each RIS. The key advantage that this could bring is to avoid the organisational resource peaks in the typical five-year RIS setting cycle and smooth the renewals funding, development and delivery process. It is recognised that RIS-specific planning will still be required to reflect the objectives and priorities of DfT at the time.

Recommendation 5: ORR should continue to have regard to National Highways’ approach to strategic investment planning, including the potential for streamlining the process, and its consideration of associated efficiency.

Risk for RIS setting for structures

Conclusion 6: There is a risk that the current approach to structures renewals through the Predictive, Priority Risk Structures and Significant Renewals workstreams, could negatively impact the condition PI for structures and National Highways’ ambition to maintain the structures stock at ‘Steady State’. This conclusion has been based on a possible scenario where Significant Renewals and Priority Risk Structures dominate RIS2 and RIS3 expenditure, at the expense of Predictive Renewals, or there is underfunding.

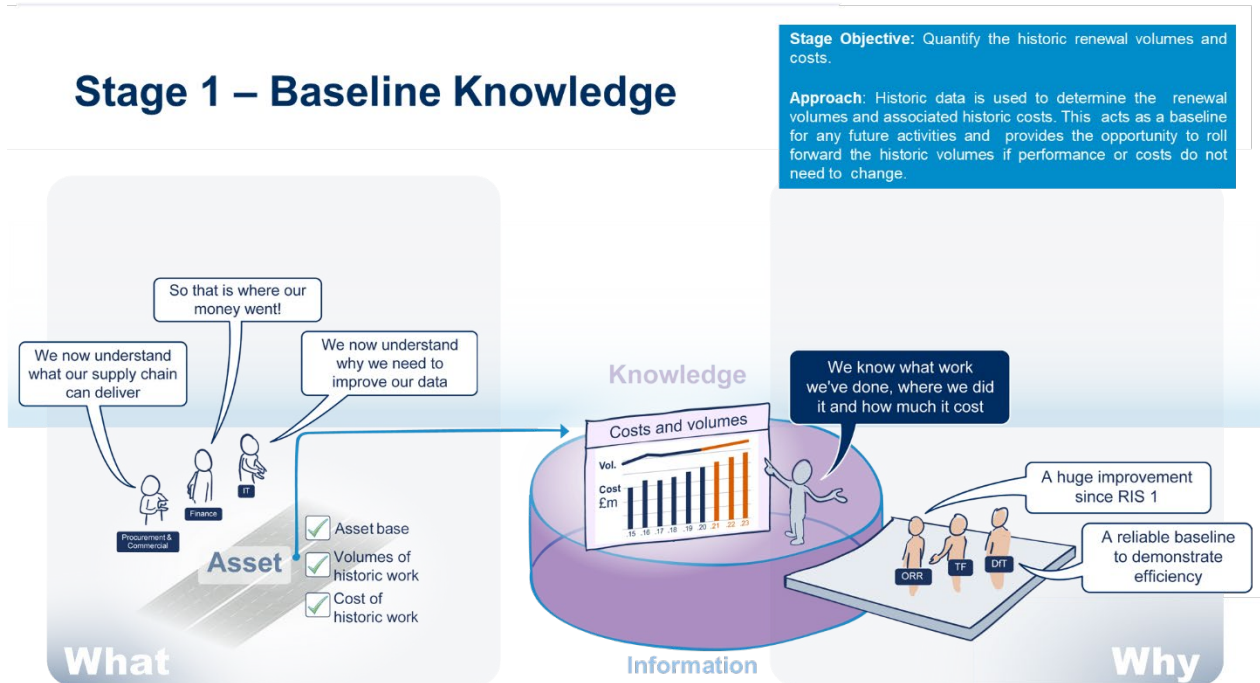
National Highways may well have to balance competing drivers for investment, especially if there are funding constraints imposed by DfT. However the modelling work they are undertaking should put them in a better position to explain the interaction and the impacts in terms of the condition based and risk-based drivers.

Recommendation 6: ORR should consider further assessment of the renewals planning approach for Predictive Renewals, Priority Risk Structures and Significant Renewals used to inform the RIS2 and 3 programmes and the effect on the structures condition PI and ‘Steady State’ condition objective.

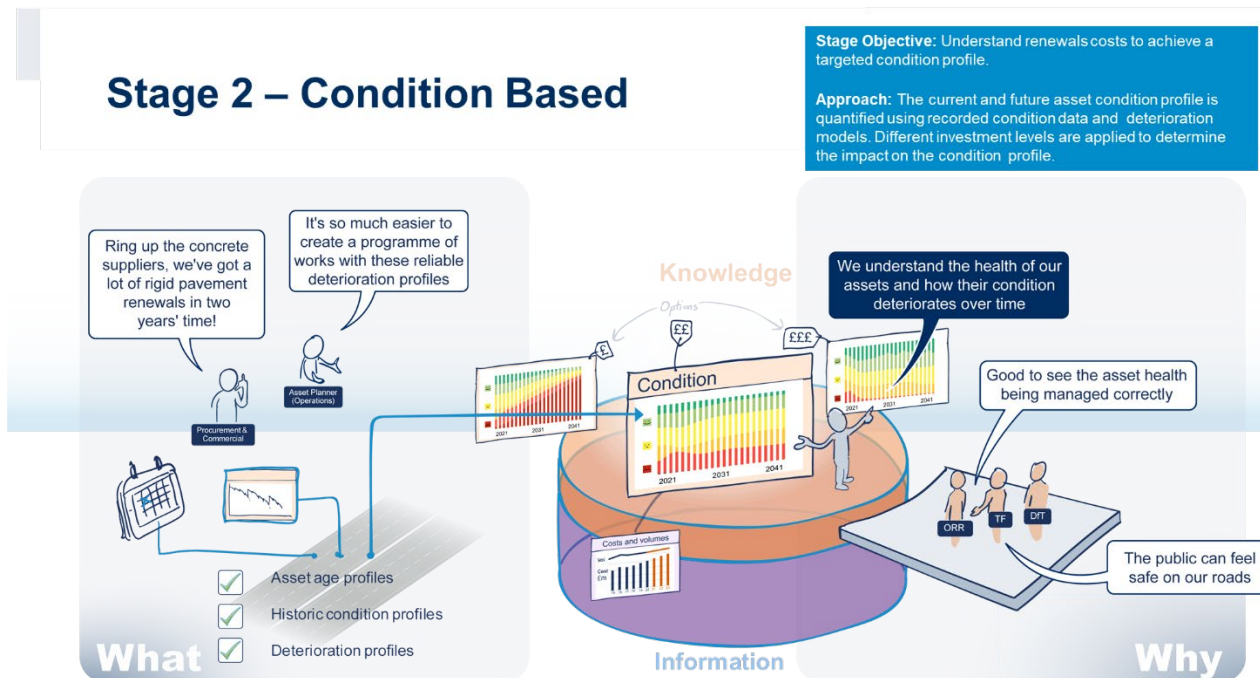
9 Appendix A

National Highways 5 stages of renewals planning maturity

Stage 1 – Baseline Knowledge



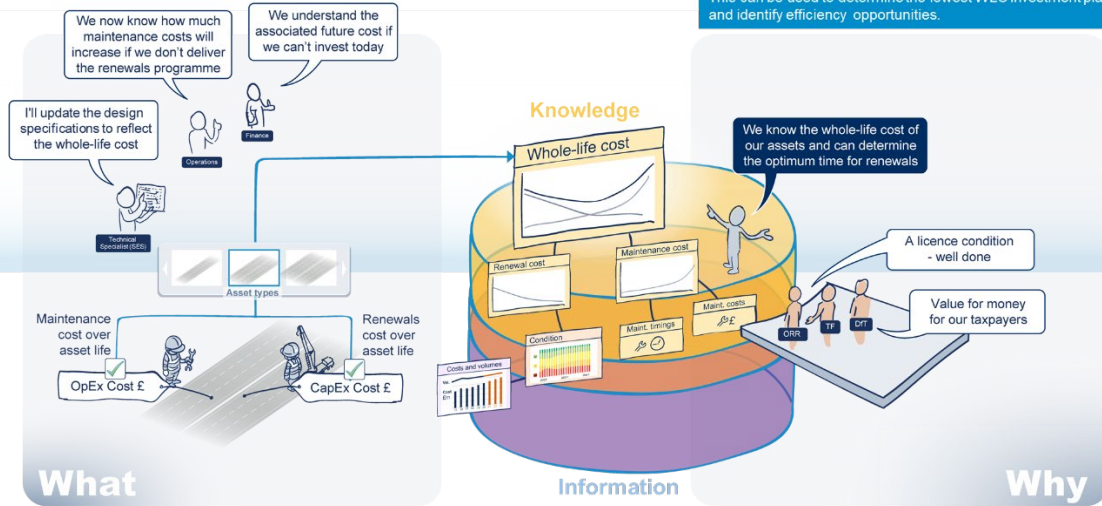
Stage 2 – Condition Based



Stage 3 – Efficiency Driven

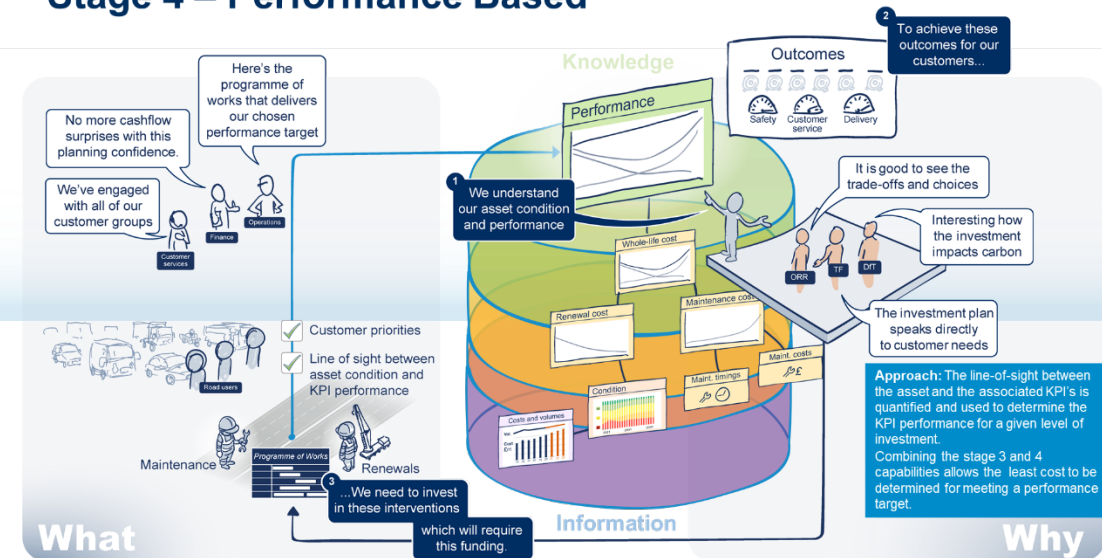
Stage Objective: Determine the lowest whole-life-cost (WLC) by balancing the reactive and proactive costs.

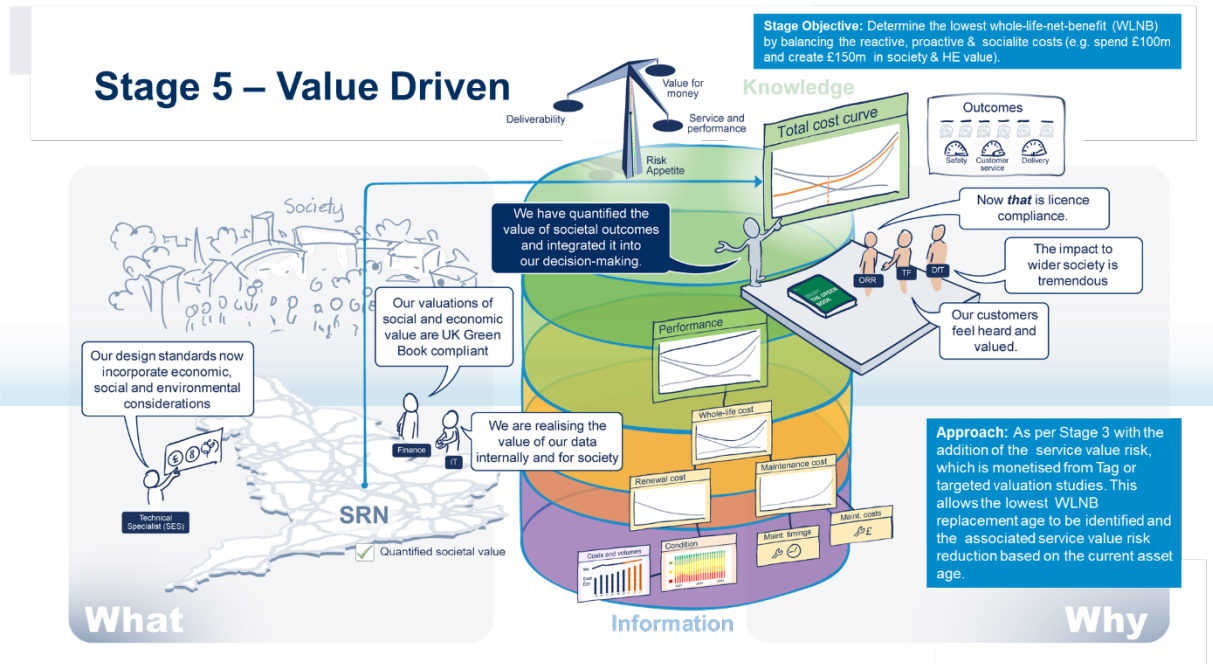
Approach: Determine the reactive and proactive company costs over the life of the asset to produce a life-cycle-curve. This can be used to determine the lowest WLC investment plan and identify efficiency opportunities.



Stage 4 – Performance Based

Stage Objective: Determine the least cost to achieve a performance target.





10 Appendix B

Condition, whole life cost, service performance & service value-based Asset Management Planning: a summary of water and rail approaches

Sectors have watershed moments where high profile, extreme events have wide ranging and enduring repercussions for how the sector approaches the management of risks. Derailments and their consequences have driven a particular focus and asset risk management approach in the rail industry, with the political responses that come with this. In the privatised water sector, droughts, floods, pollution and drinking water failures provide a backdrop which requires multiple hazards, risks and consequences to be considered. This note touches on the evolution and influencing events in the two sectors.

Water Sector

The water sector has progressively improved its ability to understand both the likelihood of service failures and the scale of consequences of these failures.

The use of condition grading was an early step towards understanding likelihood of asset failure (and implicitly, service failure). Water mains condition grading was as much based on frequency of mains failure (i.e. asset performance) as the physical state of a main, so a circular definition to some degree. Whereas for sewers, Condition Grade was based on physical attributes such as defects and material type and more clearly about the asset state.

The Sewer Rehabilitation Manual – originally driven by some spectacular sewer collapses in the 1980s such as in Manchester (where a bus fell into a void) – defined sewer ‘criticality’ by the cost to repair (depth, size) more than by any explicit reference to service consequences of asset failure.

In the run up to privatisation in 1989, there were attempts to understand the value and state of the stocks of assets which were being sold, in order to inform investors of liabilities in the sale prospectus, for instance. Once privatised, Ofwat required companies to provide it with formal Asset Inventory submissions which catalogued the Gross Modern Equivalent Asset Value by Condition Grade. Having an asset register is clearly a key start point for asset management in any organisation – it’s hard to manage assets if they’re not on a register – and this was an early piece of the jigsaw in developing whole life costs.

The consequences for environmental service of sewerage assets not performing were represented pre-privatisation in industry standard approaches such Formula A flow standards (consequence). With privatisation, the companies and the environmental regulators co-developed Urban Pollution Management requirements (frequency, severity and quantity of environmental impacts), coastal modelling (2D models of bacteriological impacts on Bathing Waters), which were all driven by the significant environmental programmes that the UK undertook to meet EU standards following decades of under investment while in the public purse.

On the clean water side of the sector, following the high-profile failures of service in the 1995/6 drought, there was strong political pressure for improvements to supply/demand planning, including reduction of leakage, which led to industry standard approaches for economic levels of leakage, and a statutory requirement for Water Resources Management Plans (WRMPs).

As noted in the accompanying report on WLC incentives, the Environmental Audit Committee’s heavy criticism of Ofwat’s PR99 approach to understanding the scale of need for capital maintenance investment led to Ofwat issuing its MD161 letter. This in turn led to a whole sector collaboration to produce the UK Water Industry Research’s Common Framework (CF) in 2002. In both MD161 and the CF, there was recognition of the ‘so what?’ – that condition informs probability,

but an approach was needed to also account for consequence, in terms of the economics of service loss.

In tandem, Ofwat began to ramp up its use of ‘serviceability’ (a mix of asset performance and service performance) in its regulatory mechanisms. The development of both the CF and serviceability coincided with the repercussions of the Hatfield rail disaster. One effect of this was to put significant scrutiny onto sectoral regulators, not only about whether they were policing their regulated entities, but also whether they were allowing sufficient long term maintenance investment as part of their price controls.

Meeting the expectations of MD161 and the CF requires both costs and benefits to be assessed as Net Present streams. Good unit cost modelling was developed (including carbon and, more recently, water footprints), as well as forward looking asset deterioration models coupled to service performance. The ability to understand how Base and Enhancements interact to better reflect efficient interventions (e.g. accelerated Base, Q overlaps etc) was also enabled by this bottom-up cost estimation.

In the last decade, the development of WRMP approaches has continued, with an increasing emphasis on the need to include uncertainty e.g. using Real Options Analysis (which had been flagged as a technique in the CF in 2002). A requirement for Drinking Water Safety Plans (DWSPs) has formalised a hazards-based approach to managing supply catchments. On the sewerage side of the sector, Drainage & Wastewater Management Plans (DWMPs) are similarly taking a catchment based, sink-to-sea approach to integrating risk management to address structural, quality and capacity drivers – with a realisation that ‘wastewater’ is a resource rather than a waste.

From the early 2000s, the role of service valuation has increasingly played a part in defining investment needs. An increasing understanding of its strengths and weaknesses has followed, with customer and stakeholder engagement improving accordingly, to the point where if this does not feature in a company’s plan it will not progress far in the price review process.

A widening of value beyond financial costs and customers’ stated preferences (‘WTP’) has taken place in the last 5-6 years, to include Six Capitals-type valuations. Companies’ modelling includes climate change effects for both the structural deterioration and the capacity requirements of assets. Interventions look beyond Manufactured Capital to include the management of land types in catchments (Natural Capital) and the role of behavioural change (Social and Human Capitals).

Asset management’s role in the regulatory process peaked at PR09. Subsequent regulatory emphasis on AM declined in PR14 and PR19. The notion of ‘Asset Health’ has re-emerged as a simpler interpretation of an objective for AM, overlooking the sophistication of analytical developments, reflecting perhaps that Ofwat’s internal capability has until recently meant that it was unable to interpret the nuances.

In the last year, Ofwat has re-engaged with the sector on AM, notably in its review of Asset Management Maturity in 2021 and in the UKWIR Future of Asset Planning (2022). It is notable that this project comments on condition as being “discredited”. A re-visit of asset health definitions in this project look a lot like serviceability. This is being driven by a strong focus on resilience, but perhaps without a real understanding that of the 4 Rs of resilience, Reliability represents only one (Resistance, Redundancy and Response & Recovery being the others).

Rail sector

The Hatfield disaster drove not just rail sector thinking but also water – as noted above, it shaped Ofwat’s positive adoption of the UKWIR Common Framework’s risk-based approach – but took different paths. Water took the view of consequence across multiple failure types (e.g. – Manchester

sewer collapses, Camelford incident, drought, flooding, pollution) whereas rail was directed to focus on safety. Railtrack’s response to Hatfield was as much a cause of the fallout as the actual asset-related hazards – a blanket approach of Temporary Speed Restrictions was applied in the absence of full and perfect knowledge of the state of the asset base. From an AM perspective, it’s debatable whether this was a proportionate approach which balanced multiple risks.

Investment in the sector is still based on ‘compliance’ with monitoring and asset standards policies, as well as actual compliance with statutory and regulatory drivers. These are expressed in asset terms (their state and their performance) rather than service consequences. While there is some asset deterioration modelling, this is not then used to inform a forward look at service performance.

Proposed investments are set out in volumes and workbanks, rather than specific interventions whose costs derive from bottom-up unit cost modelling and whose benefits align with a common approach to defining risk and value. This allows neither a forward-looking view of whole life costs nor a means of assigning value to the management and reduction of risks.

Across the Regions and Routes, and the asset classes within these, there are different approaches and varying levels of maturity for asset deterioration, service consequence, costing and valuation. While some Regions are actively trying to develop value-based approaches to informing investment planning, they are hampered by the absence of consistent and coherent risk approaches which align asset performance with service consequences.

Paradoxically, the rail sector’s social valuation techniques and resources are very sophisticated, with an abundance of detailed value metrics and associated valuations drawing on international research collaboration, of which the water sector should take note. However, without neither a means of robustly estimating risks and changes in risks, to which value can be assigned, nor the whole life costs of dealing with risks at a granular level, the sector has yet to acquire several pieces of the jigsaw for implementing and applying a service value-based approach to AM planning.

11 Appendix C

Supporting asset class maturity evidence from National Highways engagement

The asset class information and observations supporting our assessments are summarised below.

Flexible Pavements

Data

- For flexible pavements there are established, annual, network-wide condition surveys (TRACS, SCRIM, TRASS) achieving very high percentage coverage with formalised assurance processes that are owned & managed by National Highways (SES).
- Inventory & condition data are held in HAPMS, a long-established asset data system that is due to be updated in April 2022
- Hence, overall, the data for flexible pavements appears to complete, current and well-managed. National Highways views this asset as ‘data rich’.

Decision support tools

- There is an established Decision Support Tool (DST), i.e. the Programme Investment Tool (PIT). The deterioration modelling in this DST has been updated to incorporate failure modes for the most used surfacing on the Strategic Road Network (SRN), i.e. thin surface course systems (TSCS).
- PIT models works costs and outputs. Wider benefits/disbenefits are not modelled, e.g. user delay is not modelled. Disbenefits such as noise, carbon, rolling resistance are not considered at determination of asset renewals need, rather they are addressed through solution optioneering.

Scenario modelling

- Scenario planning for RIS3 capital renewals will take account of maintenance works (Capex/Opex trade-offs).
- The KPI on pavement condition is derived from the network survey data and the scenario planning for the renewals case models impacts on the KPI. Hence, there should be good ‘line of sight’ from investment to performance.
- From RP3 the pavement KPI will incorporate changes developed through National Highways work with Transport Focus on a ‘customer-centric’ ride quality measure. Hence, the determination of asset need should in future include an element of customer framed requirement.
- Disbenefits such as noise, carbon, rolling resistance are not considered in PIT as part of asset need determination. These are addressed through solution optioneering.

Risk

- Risks to the development of renewals plans for this asset include the availability of roadspace and the need to maintain regular Opex/Capex works to limit the need for higher capital interventions.
- National Highways has access to TRACS & SCRIM data to assess the condition of the pavement assets for DBFO contracts returning in-house to its operational regions in RP3.

Rigid pavements

Data

- National Highways has developed a Network Concrete Survey (NCS) to obtain the data required for network surveys beyond that captured by current whole network surveys (TRACS & SCRIM [surface condition]). Data parameters for rigid (up to 50mm asphalt surfacing) pavements will be captured by the next generation of TRACS surveys from 2023/24.
- NCS1 has been completed but limited to lengths (schemes) identified in RP1. NCS2 (completed but not analysed) covers an extended area of the SRN to capture all rigid pavement.. This will check/challenge National Highways’ current understanding of rigid pavement inventory.
- NCS data is currently held on KPortal and managed by the National Highways Centre of Excellence. National Highways plans to transfer this data to HAPMS, a new version of which will be live in 2023.
- Overall, work is progressing well to improve asset knowledge but has not yet reached the completeness and confidence of flexible pavements.

Decision support tools

- Initial deterioration models built on NCS1 data will be refined using NCS2 data, i.e. modelling capability is still under development.
- In time, rigid pavement modelling will support the prioritisation of reconstruction works.

Scenario modelling

- Reconstruction is seen by National Highways as a better WLC option than Life Extension Works (LEW); the use of LEW is recognised by National Highways to maintain serviceability & manage funding/delivery constraint.
- Scenario planning for rigid pavements considers:
 - Volume and deliverability of works
 - funding levels
 - timing - when to deliver; options to bring schemes forward are considered, as acceleration gives the lowest overall WLC
 - extent of interventions.
- The volume of rigid pavements works is expected to increase over successive RPs and be completed by RP6 i.e. by 2045.

Risk

- Deliverability is a key risk in terms of available funding, supply chain resource and roadspace availability.

Structures

Categorisation of renewals

- National Highways’ updated renewals planning roadmap identifies two sub-categories for structures:
 - Bridges and large culverts
 - Other assets (including gantries, retaining walls etc)
- This review has focussed on ‘Bridges and large culverts’ for which National Highways has identified three streams of renewals planning works:
 - Predictive:

Those structures where an assessment of future investment need can be made using DST to maintain the stock at ‘Steady state’ condition.

- Priority risk:

Structures with one or more of the following features:

- scour,
- post-tensioned construction,
- fatigue,
- hinge joints and
- half joints

which are considered to have critical structural elements where structural condition is not easily determined during the routine General or Principal Inspections. These are, are therefore, subject to special risk-based management processes those requiring a more detailed investigative risk-based approach to identifying works need and, hence, renewals investment.

- Significant Renewals

Developed from the learnings of Oldbury Viaduct

Structures where interventions are prioritised using a risk-based approach, where the risk is evaluated against Safety, Functionality and Value for Money

Each intervention is then risk ranked 1 to 5 against Safety/Functionality/Value for money

- Preventative

Schemes identified under the ‘Preventative’ stream are essentially works that will benefit the durability of a structure by slowing down deterioration through the use of impregnating concrete structures, repainting steel structures etc.

- Schemes within these streams – principally predictive or priority risk - may be further categorised as ‘significant’ if they are likely to require proportionally high investment and/or cause high levels of impact (in terms of National Highways costs and/or disruption to road users).

Data

- There is an established General/Principal (GI/PI) inspection regime.
- However, this is acknowledged by National Highways to not be sufficient to identify priority risk structures.
- Structures asset condition and inventory information is held on National Highways’ Integrated Asset Management – Information System (IAM-IS) which has replaced the Structures Management and Information System (SMIS). IAM-Is is faster and has more functionality but there have been ‘teething troubles’ with Agile being able to read IAMIS data.

Decision support tools

- The DST for structures is Agile Assets which has replaced the Structures Investment Tool (SIT); the Agile tool is used for modelling ‘predictive’ structures/works and makes use of the GI/PI data and inventory data.
- The DST does not address all the issues of ‘priority risk’ structures as they have components that are generally not visible during GI / PI inspections so these the DST has no data to model the condition of these elements.
- National Highways is finalising its risk-based approach for ‘priority risk’ structures (fatigue prone steel structures remains) which it considers optimal timing to roll out across the

structures stock during RP3. National Highways recognises it needs to ‘raise its game’ here (i.e. its current process is immature and not fully deployed).

- The actual nature/scale of required works for ‘priority risk’ structures will only be revealed by detailed investigation and analysis during RP3, thus there will be significant uncertainty at the RP3 renewals planning stage. Additionally the National Highways Executive will need to take a view on this risk and funding to address it.

Scenario modelling

- The renewals investment planning scenarios for structures are not currently defined; this will follow in next year’s planning cycles i.e. by December 2022.
- The link between Capex/Opex for structures renewals is recognised by NH for example with preventative maintenance (e.g. prevention of water ingress and renewal of expired cathodic protection). This link is acknowledged to have strengthened since National Highways moved from the Asset Support Contract to its current Asset Delivery (AD) contract delivery model.
- National Highways has found that with the level of current investment the condition PI has remained consistent, however the volume of needs has grown, due in part to the increasing age profile of the asset base. National Highways now has more needs to address to maintain the same condition score.

Road Restraint

Data

- Although National Highways is “*confident in the completeness (98%) & accuracy of its inventory*” established through surveys & network intelligence, inspection data is currently only approximately 40% complete and is unlikely to achieve 80/90% in time for the RIS3 dSBP submission, though National Highways told us that it will use data ‘infilling’ for RP3 planning.
- Road restraint condition data is obtained from the inspection regime defined in the Asset Data Management Manual (ADMM). This is condition rated 1-5.
- Data is held in local Confirm systems – National Highways told us that this works well but that a single, central asset data system would be preferred.
- National Highways’ SES directorate’s Asset Management Development (AMD) team is working on an approach to audit/assure road restraint data.

Decision support tools

- There is no DST for road restraint. National Highways will be developing RP3 renewals planning based on an update of the deterioration modelling developed for the RIS2 business case.
- Further modelling/tools for road restraint are under development. Through these National Highways aim to consider delay and customer impact in planning.

Scenario modelling

- Wider planning considerations such as the impact of carbon will be considered in the next planning cycle (RP4).
- National Highways told us that the selection of concrete vs steel road restraint is a risk-based decision approach, however there are challenges in mapping accident data to barrier type as part of this process.

General

- Progress over the last 4-5 years since the management of road restraint was in-sourced under National Highways’ move to the AD contract model. National Highways now has ‘single operating model’ for the road restraint asset.
- The above assessment raises potential issues around the robustness of road restraint data, the development of systems/tools and hence the overall maturity of the renewals modelling approach.

Roadside Technology

Data

- A data cleansing exercise carried out by National Highways prior to the commencement of RP3 renewals planning identified some gaps and double counting in roadside technology inventory. The outcome from this exercise has been an increased asset volume over that recorded in RP2.
- Data collection/management for roadside technology has been in-sourced under the AD model. This is now overseen by National Highways’ central Technology Operations Centre (TOC) function. Inspections are undertaken to comply with the Asset Delivery Asset Maintenance Requirements (ADAMr) guidance.
- Asset data is not currently confidence rated however National Highways is considering employing the metric previously used to monitor service provider performance when it was outsourced to the Roadside Technology Maintenance Contracts (RTMCs).
- A new ‘ServiceNow’ asset database and fault recording system is being rolled out but is not yet ready and therefore inventory data recorded in the legacy Technology Performance Management System (TPMS) has been used for renewals planning (this includes fault data from National Highways’ Halogen system also transferred into TPMS).
- The above asset data and system transition demonstrates active ownership and efforts to improve asset knowledge but does give rise to some questions such as how well-established National Highways’ roadside technology data processes and systems are and, hence, the degree of data robustness for effective renewals planning.

Decision support tools

- Roadside technology modelling was initially undertaken by National Highways in Excel (capex only), but an externally managed Asset Investment Modelling (AIM) DST is now being used which allows better modelling of renewals constraints.
- WLC models for roadside technology need further refining. National Highways is concerned at the deferral of high-cost interventions preferred in the WLC tool in preference to ‘low hanging fruit’.

Scenario modelling

- National Highways told us that asset energy consumption data will support carbon modelling in the future. This will ideally be developed for use in the remaining RIS3 renewals planning cycles.
- Obsolescence is a further factor in roadside technology renewals; this impacts the feasibility of rolling out like-for-like asset replacements versus whole system swap-outs. National Highways is currently working on technology roadmaps to understand these scenarios.
- The above evidence indicates that National Highways’ roadside technology modelling capability for renewals is still under development and has some minor risks

Risk

- Renewal deliverability risks for roadside technology are therefore major infrastructure upgrades requiring future renewals funding and roadspace accessibility peaks.
- National Highways is currently trying to resolve some aspects of the ownership of roadside technology equipment on DBFO contracts prior to their handback to regional operations in RP3.

Drainage

Approach

- National Highways takes a performance-based approach to managing the drainage asset, i.e. it measures performance of the network using flooding events data rather than surveying asset condition (this differs from the condition-based approach used for the other asset classes considered in this study).
- The Drainage PI is based on flooding susceptibility; there is therefore line of sight from recorded flooding hotspots to the drainage PI.

Data

- National Highways told us that an additional operational flooding data set should be available early 2022 to enhance its RIS3 renewals planning.
- Drainage inspections are carried out reactively; long-stop condition surveys are no longer carried out because of the scale, affordability and accessibility required for these types of inspections. National Highways told us that it is currently reviewing this approach going forward.
- Drainage inventory and events (flooding etc) are recorded on the Drainage data Management System (HADDMS); the contract for a replacement system was let on 1/11/21 and a new system should be operational in 2 years but too late for RIS3 planning.

Decision support tools

- As with roadside technology, National Highways will use the AIM DST tool for RIS3; long term modelling is under development and will consider delay caused by flooding data as well as Environment Agency flood information and the impacts of future climate change.
- The continued use of AIM will be reviewed alongside National Highways’ other DSTs after the RP3 planning cycles have been completed

Scenario modelling

- The capital renewal bid for RP3 will be based on flooding data and managing/mitigating flooding risk.
- National Highways told us that they have recorded an increase in flooding events during RIS2 and therefore the RIS3 bid is likely to require an increase in RIS2 funding.
- The strategy for drainage WLC analysis is being reviewed at present but will continue to use a 60-year horizon and have multiple scenarios.
- National Highways recognise the importance of Opex activity to reduce the risk of certain flooding events as flooding risk links strongly to safety and customer (two of National Highways’ business imperatives).
- The drainage standards (CG501) that will be applied to the development of renewals works for RP3 consider climate change adaptation requirements.

Geotech(nical)

Approach

- National Highways has a well-established procedure for renewals planning (asset risk based) which is documented in CS 641 Managing the maintenance of highway geotechnical assets and will be used for RP3.
- Each National Highways operational region has a Geotechnical Asset Management Plan (GeoAMP) owned by the operations team; these include a ‘forward look’ extended to 10 years to cover more than one road period to support its renewals planning.

Data

- Geotech inventory and condition data is held on the Geotechnical Data Management System (GDMS) which replaced the previous system HAGDMS in 2021; geotechnical inspection data is reviewed and authorised before loading into GDMS.
- National Highways has a long history of managing geotech asset data (> 20yrs operation of HAGDMS) which has enabled a mature risk-based approach to evolve.

Decision support tools

- There is no formalised DST for geotech which makes it unique among National Highways’ asset management approaches. National Highways told us that its approach recognises that deterioration of the geotech asset is different to other assets; features may be defective but stable, or deterioration may be over a very long timescale. The approach is ‘dynamic’ rather than ‘algorithmic’.

Scenario modelling

- There is a non-targeted PI for the condition of the geotechnical asset which is derived from data held in GDMS, this provides a strong link between the data used in geotechnical scheme programme development and the reported PI.
- The overarching asset management strategy is to hold the geotech asset in a stable condition.
- While the need for managing the geotech asset will be determined using the CS641 process, National Highways told us that renewals solutions will consider wider impacts, benefits/disbenefits.
- The strong interaction between the performance of geotech/drainage/environmental assets is recognised by National Highways. Drivers such as National Highways’ carbon strategy and biodiversity net gain requirement are likely to influence renewals solutions.
- National Highways’ ‘natural asset accounting’ is at an early stage but is being developed and is likely to have an increasing influence on the asset management/renewals planning approach. The current renewals planning process will therefore identify a separate pot for flooding impacts/climate change alongside the capital renewals bid.