



REVIEW OF HIGHWAYS ENGLAND ASSET MANAGEMENT - GEOTECHNICAL AND DRAINAGE ASSETS

REPORT OF FINDINGS AND RECOMMENDATIONS

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General Notes

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Executive Summary

Highways England is a maturing asset management organisation with standards-led systems, processes, documentation and competencies, driving safe and value laden asset interventions. It is a complex organisation that benefits from a well-established community of specialist Service Partners operating under three primary contract types - Asset Delivery (AD), Asset Support Contract (ASC) and Design, Build, Finance and Operate (DBFO), each of whom use their knowledge and understanding of the network to support the delivery of routine maintenance and capital renewals across geotechnical and drainage assets.

On the basis of this review of geotechnical and drainage assets, Highways England is observed to be managing the Strategic Road Network (SRN) in keeping with their license requirements to:

‘act in a manner which it considers is best calculated to [...] ensure the maintenance resilience, renewal, and replacement of the network (4.2 b, 5.4 and 5.5) [...] and licence requirements relating to safety, asset management, efficiency and value for money’.

Highways England has demonstrated a consistent approach to the management of their geotechnical and drainage assets through three key factors:

- **alignment** of documentation and processes with license requirements;
- **governance** by experienced and technically expert professionals, guided by embedded standards, systems and structure and;
- **assurance** by consistent monitoring and reporting.

This is particularly true of Highways England’s management of geotechnical assets where the availability of data promotes effective long-term, risk-based and criticality focused interventions that can adequately inform the emergent 30 year horizon Lifecycle Asset Management Plans (LAMPs). The more dynamic nature of drainage assets, however, coupled with limited availability of subsurface asset condition data, makes efficient predictive intervention more difficult. This is not uncommon for similar infrastructure asset organisations.

The next step in Highways England’s journey to exemplary asset management is to build appropriate asset data and information that will enable accurate and consistent whole-life investment decision making over multiple Road Periods. To this end, and as a maturing asset organisation with a culture of continual improvement, Highways England has launched a number of initiatives aimed at delivering added value including a new Value Management (VM) process, roll out of 19 ISO55001:2014¹ aligned processes (initially for drainage assets) and the development of decision support tools such as PEAT (Project Economic Appraisal Tool) and the Network Needs Prioritisation Tool (NPT), all assisting in selecting interventions that aim to deliver an optimal whole life balance of need, safety, availability, sustainability and efficiency. Other notable improvement initiatives are detailed in the main report.

From an asset management perspective, the increased central governance of the AD model, coupled with delivery of planned improvement initiatives, indicates a move to greater efficiency and sustainability and a positive trend in asset management maturity.

¹ The international standard for asset management <https://www.iso.org/standard/55089.html>

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Glossary of Terms

Acronym	Definition
ACCP	Asset Category Condition Profile
AD	Asset Delivery Contract
ADMM	Asset Data Management Manual
AMFP	Asset Management Forward Programme
AIG	Asset Information Group
AMOR	Asset Management Operational Requirements
ASC	Asset Support Contract
BBMM	Balfour Beatty Mott MacDonald
CCC	Change Control Committee
CCTV	Closed Circuit TV
CDM	Construction (Design and Management) Regulations
CoW	Clerk of Works
CPF	Collaborative Performance Framework
CPS	Connect Plus Services
CRMDP	Cyclic and Reactive Maintenance Delivery Plan
CVR	Cross Value Report
DA	Drainage Advisor
DAMP	Drainage Asset Management Plan
DBFO	Design, Build, Finance, Operate
DGMLE	Deputy Geotechnical Maintenance Liaison Engineer
DLE	Drainage Liaison Engineer
DMRB	Design Manual for Roads and Bridges
DTL	Design Team Leader
ECI	Early Contractor Involvement
EDI	Early Designer Involvement
EPM	Enterprise Project Management
FMECA	Failure Mode Effects and Criticality Analysis
GDR	Geotechnical Design Report
GeoAMP	Geotechnical Asset Management Plan
GFR	Geotechnical Feedback Report
GIS	Geographic Information System
GMLE	Geotechnical Maintenance Liaison Engineer
GMRS	General Maintenance Requirements Schedule
GP	Good Practice
GRIP	Governance for Railway Investment Projects
HADDMS	HE's Drainage Data Management System
HAGDMS	HE's Geotechnical Data Management System
HE	Highways England
HPF1	Hold Point Form 1
HPF2	Hold Point Form 2
HPF3	Hold Point Form 3
IAM	Institute of Asset Management

IMRD	Inspection Management & Requirements Document
IT/IS	Information Technology / Information Services
KPI	Key Performance Indicator
LAMP	Lifecycle Asset Management Plan
LD	Lead Designer
LiDAR	Light Detection and Ranging
MRP	Maintenance Requirements Plan
MRTs	Maintenance Response Teams
NEC	New Engineering Contract
NMUs	Non-Motor Users
NNT	Network Needs Tracker
NOMS	Network Occupancy Management System
O&M	Operate & Maintain
OTI	Opportunity To Improve
OMM	Operational Metrics Manual
ORR	Office of Rail & Road
PABS	Performance and Business Support
PAS	Publicly Available Specification
PCC	Project Cost Control
PEAT	Project Economic Appraisal Tool
PFMECA	Process Failure Modes, Effects & Criticality Assessment
PI	Principal Inspections/Performance Indicator
PSSR& GIR	Preliminary Sources Study & Ground Investigation Reports
RACI	Responsible, Accountable, Consulted & Informed
RLoS	Required Level of Service
RSHI	Rock Slopes Hazard Index
SAR	Scheme Appraisal Report
SCF	Scheme Control Form
SCRIM	Skid Resistance Surveys
SES	Safety Engineering Standards
SID	Scheme Information Document
SoFA	Statement of Funds Available
SOI	Statement of Intent
SRN	Strategic Road Network
TiLoS	Time and Location Software
TQS	Technical Query System
TST	Technical Services and Testing
TUPE	Transfer of Undertakings (Protection of Employment) Regulations 2006
VM	Value Management
VRS	Vehicle Restraint System
WD1	Working Day 1
WD2	Working Day 2
WLC	Whole Life Cost

1. Introduction

1.1 Purpose

1. This report has been commissioned by the Office of Rail and Road (ORR) as a deep-dive review of Highways England's management of Geotechnical and Drainage assets. It follows similar reviews of Highways England's Pavement and Structure assets².
2. In its remit to monitor Highways England's performance against the objectives set out in the current Road Investment Strategy (RIS)³ the ORR is looking to investigate and report on whether Highways England are meeting these objectives. In support of this, the primary objective of this review is to report on whether Highways England is managing their geotechnical and drainage assets:
 - **safely** for road users;
 - **robustly** and in a way which will deliver the requirements for the road period;
 - **efficiently** to minimise cost over the long-term by delivering the right interventions, at the right level of quality, at the right cost and at the right time, and;
 - **sustainably** in a way which, if continued, would continue to deliver the requirements in the long-term.

This will inform ORR's review of whether Highways England is meeting its licence requirements.

1.2 Scope

1.2.1 Overview

3. Highways England delivers asset renewals and interventions across a broad range of assets under a number of contract types – Asset Delivery (AD), Asset Support Contract (ASC) and Design, Build, Finance and Operate (DBFO). The number of schemes within the Highways England portfolio meant that it would have been impractical to carry out a deep dive review of activity at each planned and completed scheme. This project therefore required careful attention to scope.

1.2.2 Assets

4. This review focusses upon the planning and delivery of renewals and interventions involving:
 - **geotechnical assets, and;**
 - **drainage assets**

A similar study for pavement and structure assets was delivered by KPMG in March 2017.

1.2.3 Selected Areas

5. In order to build on the geographical coverage of the 2017 pavement and structures study, and to ensure a representative sample of contract types, the following Areas were included within scope:
 - Area 1&2 (South West) – AD model
 - Area 10 (North West) – ASC model
 - Area 9 (Midlands) – ASC model
 - Area 5 (M25) – (DBFO)

² http://orr.gov.uk/_data/assets/pdf_file/0015/25170/kpmg-review-of-highways-england-maintenance-and-renewals-delivery-march-2017.pdf.

³ <https://www.gov.uk/government/collections/road-investment-strategy>

1.2.4 Selected Schemes

6. Based on the outline scoping criteria detailed above, Figure 1 lists the 18no. schemes reviewed as part of this report. The schemes and their outputs were used as evidence of compliance with process / procedure / standards.

		Drainage Assets		Geotechnical Assets	
		Planned	Complete	Planned	Complete
Contract type	Managing Agent (superceded model - not selected)	Not selected for assessment (low value due to superceded contract model)		Not selected for assessment (low value due to superceded contract model)	
	Asset Support (phasing out - will be many schemes complete but few planned)	No planned schemes required - superceded model - planning phase under ASC assessed as part of Completed Schemes	•556731 - M66 Both J1 - 2 (AREA 10) •560288 A46 Ashchurch (AREA 9) •559924 A46 Hinton-Evesham (AREA 9) •551136 A5 Bayston to Churncote (AREA 9) •556972 A5 Felton (AREA 9)	No planned schemes required - superceded model - planning phase under ASC assessed as part of Completed Schemes	•538116 M50 J1 MP2/9 WB (AREA 9) •541617 - M61 Whittle Le Woods (AREA 10)
	Asset Delivery (emergent model - will be few schemes complete but more planned)	•A30 Cutteridge to Alphonington EB (AREA 1/2) •A38 Bellamarsh Westbound Layby Inlet (AREA 1/2) •566149 A36WiltonRB-SkewBrgMP59.1-61.7 (AREA 1/2) •566151 A303D'ford-WylyeMPI45.0-147.6 (AREA 1/2)	No schemes available for assessment	• M5 J13 NB Studies Complete, now in Design (AREA 1/2) • A303 Bourton – Studies Complete, now in Design (AREA 1/2)	•M5 J14-15 Itchington Soil Nailing (AREA 1/2) •M5 J14-15 Tytherington Soil Nailing (AREA 1/2) •M4 J16-17 WB 137/8 (AREA 1/2)
	DBFO (not widespread contract model - Area 5 -M25- only - light assessment as contrast to ASC/AD)	Not selected - DBFO is not a widely used contract model. Included as contrast to ASC/AD models only.	•M1 J1-4 (16AD01) (AREA 5)	Not selected - DBFO is not a widely used contract model. Included as contrast to ASC/AD models only.	•M25 MP150/2 (AREA 5)
		Renewal		Renewal	
		Scheme Type			

Figure 1: Scheme selection matrix

7. Note that maintenance activity is undertaken in all regions as 'lump sum'. This means that maintenance is costed at the procurement stage, including a contingency for risk, and subsequently delivered as 'business as usual' activity. Accordingly, maintenance in each area was assessed in terms of process to identify, deliver and report, rather than by selecting discrete maintenance 'schemes'.

1.2.5 Interviews

8. Documentary review of schemes and processes was supported by an extensive stakeholder interview process with key Highways England personnel and their delivery partners. This included – for ASC and DBFO contracts - the interview of Highways England Supply Partners, notably Kier, Connect Plus Services (CPS) and Balfour Beatty Mott Macdonald (BBMM). Meetings were held in February and March 2018 at various locations including Bristol, Manchester, Birmingham and South Mimms.

1.2.6 Asset Management Focus

9. Documentary review and interviews focused on four key asset management topics and included other observations noted during the review. These are listed below in Figure 2. Each focus area (1 to 4, below) was split into further sub-sections by way of supporting questions.

1	Asset management information
2	Maintenance and renewals planning
3	Maintenance and renewals delivery
4	Reporting and review of asset interventions delivery

Figure 2: Asset Management Focus Areas

1.2.7 Report Constraints and Limitations

10. This review was undertaken during a period of considerable change within Highways England. This includes changes to:
- **Contract models:** ASC to AD
 - **Information Management Systems:** potential change of HADDMS/HAGDMS⁴ to IAM/IS
 - **Process:** Value Management Process updates promoting early identification of costs and issues and aligned with Highways England's licence requirements
 - **Management Systems:** Development and adoption of ISO55001:2014 aligned management system including: Processes, Documentation, Nomenclature, Training and Culture.
11. These are positive changes designed to provide Highways England with improved governance and assurance of asset management activities. However, it should be noted that the emergent ISO55001:2014 aligned asset management processes and the recently updated Value Management process were not covered as part of this review.
12. As this review was based on a sample of the Highways England (and supplier) activities, the findings reported do not imply to include all issues within the system.

1.2.8 Acknowledgements

13. RSKW would like to extend our thanks to the Office of Rail and Road, Highways England and their service partners for their time and efforts throughout this project. Particular thanks to the Office of Rail and Road and Highways England Project Managers for their valuable support in facilitating this review.

⁴ Highways Agency Drainage Data Management System (HADDMS) / Highways Agency Geotechnical Data Management System (HAGDMS).

2 Summary Findings

2.1 Presentation of Findings

14. In delivering the primary objective of this review, Section 2.2 provides an assessment of whether Highways England's management of geotechnical and drainage assets is safe, robust, sustainable and efficient. This information is given to support and inform the ORR with their assessment of whether Highways England is meeting the conditions of their license.
15. Key findings were informed by the review process outputs and reported at a strategic level in Section 2.3 through four key areas of asset management. These are:
- Asset management information
 - Maintenance and renewals planning
 - Maintenance and renewals delivery
 - Reporting and review of asset interventions delivery

2.2 Key Findings

2.2.1 Safety

16. As a safety critical organisation, Highways England's approach to managing its geotechnical and drainage assets is founded on a strong safety culture. This was evident in each of the Areas reviewed and across the different contract types and Service Partners. The use of emergency works procedures to address safety critical issues, together with safety consideration as an inherent part of Highways England's Need Identification and Value Management (VM) processes, ensures that the safety of road users and the Strategic Road Network (SRN) is integral to all emergency works, maintenance and renewal activity. It is observed that a well-established, standards-led approach for the management of geotechnical and drainage assets in the Areas reviewed is in keeping with Highways England's license requirements to protect and improve the safety of the SRN, whilst minimising the impact of road works on road users.

2.2.2 Robustness

17. The Highways England Operations Metrics Manual (OMM) was developed in partnership with the ORR and Department for Transport (DfT) as the means to measure performance against the requirements of the road period (2015-16 to 2019-20). It describes a suite of 8 Key Performance Indicators (KPIs) to which Highways England are held accountable. The robust management of geotechnical and drainage assets is a key contributor to performance against these measures.
18. The collection and management of accurate, robust and repeatable asset data and information underpins the decision making process that defines performance in delivering against KPIs. This is governed at Highways England by a suite of robust standards including the Design Manual for Roads and Bridges (DMRB): Volume 4 – Geotechnics and Drainage, supplemented with specific Advice Notes where required. The data is validated by competent persons, stored on corporate information management systems such as HADDMS / HAGDMS, used to inform Highways England's Value Management (VM) process in order to determine need and create the Asset Management Forward Programme (AMFP)⁵ for each Area. The output of this summarised process is a programme of maintenance and renewal works that balances the need to deliver an SRN that is safe, available and in good condition with interventions that are value laden, sustainable and that stimulate economic growth.

⁵ AMFPs are 5 year rolling programme of schemes selected for delivery.

19. Highways England has demonstrated a robust approach to the management of their geotechnical and drainage assets in three key ways:
- **alignment** of documentation and processes with license requirements;
 - **governance** by embedded standards, systems and structure and;
 - **assurance** by consistent monitoring and reporting.
20. This is particularly true of geotechnical assets where the availability of good quality data facilitates effective long-term, risk-based and criticality focused interventions that can adequately inform the emergent 30 year horizon Lifecycle Asset Management Plans (LAMPs)⁶. The more dynamic nature of drainage assets, however, coupled with limited availability of underground asset condition data, makes efficient predictive intervention more difficult.
21. Despite a generally robust approach, there remain some opportunities for Highways England to improve performance. There are two strategic issues impacting the robust management of the SRN;
- i. Document control presents an opportunity to improve. Highways England's suite of key documents is lengthy, complex and in some cases (and with the exception of Geotechnical documents specified in HD22/08⁷) not effectively controlled. Visibility is an issue with documents being held on a number of platforms centrally and in the Areas. Highways England's decentralised operating model, the absence of a central librarian function and, in some cases, issues around handover between Service Partners has meant that some key documentation was not readily available for review. This is a known issue and Highways England has a number of initiatives focused upon improving in this respect including an ongoing consolidation of DMRB and Asset Data Management Manual (ADMM) to reduce the number and complexity of documents. In addition, the move from ASC to the AD contract model returns more control to central Highways England functions. Highways England may wish to consider developing a Central Librarian function to monitor the storage and accessibility of key documents.
 - ii. ASC is a risk based contract model. Success in accurately assessing risk and therefore intervention is reliant upon the availability of sufficient asset inventory and condition data. Given the low levels of condition data describing subsurface drainage assets at present, Highways England should consider the rollout of the more prescriptive AD model (supported by the Cyclic and Reactive Maintenance Delivery Plan - CRMDP) as an opportunity to provide greater clarity over maintenance frequencies and so enhance the robust management of drainage assets.

2.2.3 Efficiency

22. Highways England is committed to delivering the Public value for money. To this end Highways England are actively focused upon delivering at least £1.2 billion in efficiencies over Road Period 1 (RPI) and £2.6bn efficiencies by the end of RP2⁸. It is important to note that these efficiencies do not represent a £2.6bn reduction in funding but instead represents a measure of the value added through the efficient use of funds.
23. A culture of adding value in planning and delivery is well embedded into each of the Areas reviewed for this study. Area efficiencies registers are a fundamental component of the scheme development process and feed into a Central Efficiencies Register.

⁶ LAMPs set out whole-life asset renewal needs over a thirty year time horizon.

⁷ DMRB, volume 4 geotechnics and drainage, section 1 earthworks, Part 2 HD 22/08 managing geotechnical risk

⁸ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/600019/N160284_HE_Capital_Efficiency_Delivery_Plan.pdf

24. Highways England has launched a number of initiatives aimed at delivering added value including a new VM process and the development of decision support tools such as PEAT (Project Economic Appraisal Tool) and the Network Needs Prioritisation Tool (NPT) both assisting in selecting interventions that deliver the optimal whole life balance of need, safety, availability, sustainability and efficiency. This approach is in line with that adopted by a number of operators in the water sector⁹ where decision support tools are routinely used to guide management activity linked to asset health, service and investment.
25. There is a focus on co-delivery of multiple interventions, promoted by the Network Occupancy Management System (NOMS) process which is effective in minimising the cost of delivering asset improvements and maximising availability of the network to Highways England's customers. There is a risk that bringing forward renewals or maintenance to co-deliver multiple interventions simultaneously may reduce the cost of delivery but may incur significant loss of value from a whole life perspective. Highways England should be mindful of factor in residual asset value when considering early renewal to derive efficiency from co-delivery.
26. As Highways England's asset condition data and deterioration profiling improves (particularly with respect to drainage assets) it will become more practical to adopt a 'just in time' model of intervention, minimising cost of delivery through less reactive intervention and minimising loss of whole life asset value by intervening at the right time. Highways England are using innovative tools and techniques (such as Sewerbatt¹⁰ and LiDAR) to accelerate the validation and collection of drainage asset data. However, there is work to do in relation to agreeing, for example, the practicality of gravity fed surface water drain deterioration modelling before Highways England can adopt a truly predictive approach. The preparation of an Asset Information Strategy would assist in documenting this journey and identifying key 'blockers' and 'enablers' along the way.
27. A sustainable approach to efficiency starts with the procurement process. Low levels of condition data and deterioration models to effectively assess risk to drainage assets can create uncertainty for bidders. It is recognised that the use of the more prescriptive AD contract model supported by the CRMDP will provide greater clarity over Lump Sum cost to bidders, however caution should be exercised in technically validating assumptions made by those bidding for significant packages of work under any contract model.

2.2.4 Sustainability

28. Whole life approaches to asset management are a fundamental part of delivering sustainable outcomes. As previous studies have shown, Highways England's annual budgeting process can act to constrain the consistent delivery of optimum whole-life interventions because variations in budget availability can, at times, result in less sustainable options being delivered. This review of geotechnical and drainage assets observed that these constraints still exist to some extent although Highways England has acted to improve this situation with the development and roll-out of LAMPs which were evident in some Areas. LAMPs will afford Highways England the opportunity to programme asset need over multiple Road Periods. They will also allow Highways England to measure and understand the impact that a given Statement of Funds Available (SoFA) will have on subsequent Road Periods.
29. Of particular note was the use of a rolling 30-year management plan in Area 5. This is driven by a requirement for the Managing Agent to hand back assets at contract end in the same or improved condition. Deterioration data for drainage assets is used to inform maintenance and intervention activity over a 30 year planning period in order to maintain a consistent

⁹ <https://www.ofwat.gov.uk/wp-content/uploads/2017/09/Targeted-Review-of-Asset-Health.pdf>

¹⁰ <http://acousticsensing.co.uk/sewerbatt-product-overview/>

Asset Category Condition Profile (ACCP). Highways England may wish to draw upon this experience for adoption nationally when data availability allows.

2.2.5 Geotechnical Assets

30. Geotechnical assets can be defined as the man-made or natural earthworks below the road pavement layers and the adjacent land beside the road.
31. Each Area within the scope of this review has approaching 100% geotechnical condition data coverage. Using a robust suite of risk control documents, including HD41/15¹¹ and HD22/08, allows Highways England to take a risk based, criticality approach to the management of geotechnical assets. This approach is currently used to inform investment decisions that are safe and maintain network availability. In time, it will also blend well with and support the development of the emergent Lifecycle Asset Management Plans (LAMPs) and long-term planning over a decadal timeline, leading to value laden, safe and sustainable approaches to geotechnical asset interventions.

2.2.6 Drainage Assets

32. Drainage can be defined as the system which removes water from trafficked surfaces, sub-layers and other parts of the highway asset. The drainage system is made up of individual 'Point', 'Continuous' and 'Region' inventory items. Definitions for each inventory item can be found in HD43/04¹².
33. In comparison to Geotechnical assets, drainage assets are relatively simple in design but complex to manage because of their interconnectivity, the potential for serviceability to change rapidly and the large proportion of sub-surface components. Highways England's maintenance of their subsurface drainage assets is predominantly reactive although all Areas reviewed demonstrated a commitment to proactively reviewing and mitigating flooding hotspots and other priority drainage assets in line with Highways England's strategic KPI5 ('Delivering better environmental outcomes')¹³. It should also be noted that Highways England has introduced a system of performance related pay for key roles. This is focused upon on delivering activity aligned with meeting the outcomes of the RIS, including the mitigation of flooding hotspots.
34. Surface visible drainage assets are maintained on a risk based cycle under ASC contracts and on a prescribed cycle under the AD model. Coverage of drainage condition data is not as comprehensive as that describing the geotechnical portfolio. There are a number of initiatives underway to improve the process and documentation underlying Highways England's approach to drainage assets including a review of the DMRB (which includes HD43/04 for drainage) with a view to consolidating the documentation and incorporating current best practice. The review of HD43/04, in particular the specification that all Areas produce DAMPs¹⁴ (in line with geotechnical standard HD41/15), will provide Highways England with greater visibility of the activity undertaken and planned to manage their drainage assets. This will enhance Highways England's ability to regularly review all drainage asset management activity and align with delivering the requirements of the RIS.
35. In addition to the review of DMRB, Highways England recognises that past changes in contract model and service partners has left some uncertainty around roles and responsibilities for managing drainage assets. A comprehensive RACI matrix (Responsible / Accountable / Consulted / Informed roles) has been developed and is due to be incorporated in Highways England's emergent ISO55001:2014 aligned asset management system. The change to the AD contract model, increasing use of condition data, the

¹¹ DMRB, volume 4 Geotechnics and Drainage, Section 1 Earthworks, Part 3 HD 41/15, Maintenance of highway geotechnical assets

¹² DMRB, volume 4 Geotechnics and Drainage, Section 2 Drainage, Part 4 HD 43/04, Drainage data management system for highways.

¹³ Delivery of improved biodiversity, as set out in Highways England's Biodiversity Action Plan.

¹⁴ The DAMP is an annual snapshot of drainage schemes undertaken and planned.

increased clarity afforded by a revised DMRB and well defined roles and responsibilities will allow Highways England to manage its drainage assets more robustly, efficiently and sustainably.

36. Hydraulic modelling is used widely across other drainage asset management organisations to attempt to predict the need to intervene in advance of asset failure. Success in developing an accurate model is closely linked to the availability of good quality inventory, structure and condition data. The data requirements of any proposed hydraulic model should be a key consideration when developing an Asset Information Strategy (Recommendation AMI-1).

2.2.7 Asset Management

37. Highways England is a maturing asset management organisation with robust, standards-led systems, processes, documentation and competencies, driving safe and value laden asset interventions. It is a complex organisation that utilises specialist service partners operating under three primary contract types (AD, ASC, DBFO), each of whom use their knowledge and understanding of the network to support the delivery of routine maintenance and capital renewals. The proposed move to a predominately AD model will help simplify and strengthen the control Highways England has on the decision making process. During this transition Highways England has an opportunity to draw upon the PAS55/ISO55001 aligned practices and experience that exists within their supply chain.
38. There are a number of ongoing and planned improvements to asset management and asset management system practices within Highways England including:
- improvements to data and information quality/coverage that will enhance the accuracy and assurance of asset need;
 - the emergent LAMPs which shall be used to support delivery of the most efficient and sustainable approach to maintaining the network over multiple Road Periods;
 - the recent (March 2018) roll-out of an improved VM process;
 - the consolidation of asset management documentation;
 - the compilation of a comprehensive RACI assigning clear roles and responsibilities for the management of drainage assets;
 - the introduction of IAM IS to streamline existing corporate information systems;
 - the roll-out of 19 ISO55001:2014 aligned processes (initially for drainage assets), and;
 - the development of the Asset Steward Review Programme for improved governance.
39. From an asset management perspective, the increased central governance of the AD model, coupled with delivery of a number of planned improvement initiatives indicates a move to greater efficiency and sustainability and a positive trend in asset management maturity.

3 Asset Management Topic Findings & Recommendations

40. The following section summarises the key findings and suggested recommendations aligned to the asset management topics that drove this review.

3.1 Asset management information

3.1.1 Quality and coverage of asset management information

41. Asset management information is informed and governed at Highways England by a suite of robust standards including the DMRB: Volume 4 – Geotechnics and Drainage, supplemented with specific Advice Notes where required. It was evident that all assessed Areas of Highways England are delivering against these standards and, in some cases, going beyond the basic requirements. Throughout Highways England and their Supply Partners there is a clearly defined focus upon the acquisition and validation of asset condition and deterioration information upon which interventions are based and which drive the maintenance of a safe and available network.
42. Highways England manages a suite of asset management related documentation including strategies, plans, procedures, standards and guidance notes as well as core scheme related output documentation. There is a clear structure to this documentation and it is aligned with delivering a safe and available network. Key documents across the contract models reviewed are detailed in Table I.

Description	ASC Document	AD Document	DBFO
<i>Inspections</i>			
Defines inspection frequency, data needs and feature assessment method for geotechnical assets	HD41/15	HD41/15	HD41/15
Provides guidance and support to Geotechnical Inspectors	Field Inspection Guidance	Field Inspection Guidance	Field Inspection Guidance
Defines inspection frequency and method for drainage assets	Maintenance Requirements Plan (MRP) - delivering outcomes detailed in Area Asset Management Operational Requirements (AMOR)	Inspection Management Requirement Document (IMRD)	DBFO Contract
Defines inspection data needs for drainage assets	HD 43/04	HD 43/04	HD 43/04
Describes the method for feature assessment and non-CCTV surveys	IAN 147/12	IAN 147/12	IAN 147/12
Describes the method for carrying out CCTV surveys	SD 15	SD 15	SD 15
<i>Maintenance</i>			
Defines maintenance frequencies for all asset categories	MRP	Required Level of Service (RLoS)	DBFO Contract
Defines maintenance requirements for all asset categories	MRP	Cyclic & Reactive Maintenance Plan (CRMDP)	DBFO Contract

Table I: Key documents

43. The coverage of data relating to geotechnical and drainage assets varies between assets and Areas. Through a combination of Principal Inspections, Route Tours and Watchman reports, coverage of geotechnical inventory & condition data across the network in each of the Areas reviewed is close to 100% (Table 2).
44. Coverage of drainage asset condition data ranges between 14% and 46% of the network in the areas considered in the review (Table 2). This is predominantly the result of two factors; the difficulties in surveying sub-surface assets and the reactive approach to sub-surface drainage inspection and intervention. The volume of reactive activity reported in some Areas has meant that there is little scope within Lump Sum funding to proactively increase knowledge of drainage asset condition. This reactive activity supports a safe, free flowing network but limits progress in acquiring asset condition data. It is therefore not considered to be the most efficient nor sustainable approach to long term asset management.

	Drainage asset data coverage		Geotechnical asset data coverage	
	Inventory	Condition	Inventory	Condition
Area 1&2	≥99%	37%	≥99%	≥99%
Area 5	88%	35%	≥99%	≥99%
Area 9	90%	46%	≥99%	≥99%
Area 10	≥99%	14%	≥99%	≥99%
National average	88%	34%	≥99%	≥99%

Table 2: Drainage and Geotechnical Asset Data Coverage, May 2018

45. Highways England has adopted some innovative approaches to accelerating their progress in understanding their drainage assets, most notably the recent LiDAR survey of all surface visible assets and the use of Connectivity surveys to assess the service condition of sub-surface assets. Connectivity Surveying is a useful tool and is enhancing Highways England's ability to detect and maintain underperforming assets before they impact on the safety and availability of the highway, however, without also understanding the structural health of subsurface assets, it will remain difficult for Highways England to predict asset failure across the wider drainage portfolio and intervene in a timely, more efficient manner in advance of failure. It is understood that work is under way within Highways England to develop a Drainage Decision Support Tool which may facilitate investment decisions, aligned to Highways England's strategic outcomes, using lower volumes of data or different data to that currently collected. As any Decision Support Tool is developed, data requirements should be reflected in an Asset Information Strategy and any supporting documents.
46. Highways England's choice of contract model has impacted upon their ability to understand their drainage assets. The ASC model adopted a risk based approach to asset maintenance and inspection. This has biased data collection toward 'hot spots' or areas of failure. The approach to inspection and maintenance under AD is initially prescriptive, albeit with the potential to adjust the frequency of works as understanding of the assets grows. This will facilitate the capture of a broader dataset over time.
47. Asset data is of key importance in informing procurement activity. The Area 10 DAMP from 2016 states that the "low volume of drainage condition data available at the tender stage made it difficult to accurately forecast the cost of Lump Sum maintenance". In the absence of empirical data, Highways England's Area 10 service partner's bid included the assumption that the drainage network would be "free flowing". This assumption was founded on the belief that, "piped drainage systems should be self-cleansing by design" and that "if the surface assets are properly maintained to prevent debris and excess silt entering the system, routine maintenance of pipework should not be required". This led the bidder to conclude that, "drainage maintenance under lump sum would be limited to surface assets".

48. This review questions whether the assumption of 'free flow' was realistic given that underground drainage assets are susceptible to blockages caused by for example, root invasion and misuse. The Area 10 DAMP states that "it became clear at an early stage in the contract that the condition of the drainage was not as expected" and Area 10 have embarked upon a "5 phase recovery plan" for which additional funding will be required. This seems to bear out the conclusion that the assumption of 'free flow' was indeed unrealistic. The assumption of zero need to maintain subsurface drainage assets arguably could and should have been technically challenged by Highways England at the tender stage. It is also legitimate to ask whether more could have been done by bidders to qualify the assumption of 'free flow'. Over the whole life of the contract, this may theoretically result in a negative impact upon Highways England's ability to efficiently manage its drainage network and should be considered in future procurement exercises.
49. For example, a significant non-infrastructure delivery partnership (£1.1bn/11 years) with one of the UK Water and Wastewater Companies is (at the time of reporting) being let. The Water Company has specified that potential participants should carry out a "Price and Delivery Assessment" whereby bidders deliver defined services over a 12-16 week period of activity (at bidders' cost) to identify and resolve actual risk prior to final bid. It does not seem unreasonable for Highways England to expect bidders to undertake similar pilot studies in order to test assumptions included in their bids. Increased clarity over the work required to inspect and maintain drainage assets will also allow potential Service Partners to more accurately assess Lump Sum cost when tendering, affording Highways England greater security that bidders are adequately funded to deliver the requirements of the contract.

3.1.2 Inspection Process, Data/Information Governance and Assurance

50. Highways England's approach to data collection is governed and assured by well-established process, validation tools and competent person review.
51. Data is collected from a number of sources that can be principally categorised as planned and incidental;
- **Planned:** Principal Inspections (PI) and Monitoring Data, Watchman Reports – formal, core data collected at periodic intervals or as part of a targeted investigation into a defect.
 - **Incidental:** sources ranging from Highways England employees engaged in their daily duties to members of the general public or anyone using the network.
52. Geotechnical inspection data is captured by experienced Inspectors using Highways England's PocketGAD tool. Features are graded in-situ and the tool allows the submission of photographic evidence alongside field notes. Each inspection dataset is uploaded directly to HAGDMS where it is held in quarantine until validated by the Area Geotechnical Maintenance Liaison Engineer (GMLE). Only then is it available for use in identifying the need for intervention. This is considered a robust approach to primary data collection.
53. Drainage inspection data is managed in a similar manner although there are some opportunities for Highways England to improve the governance around this critical process, namely:
- HD43/04, SD15¹⁵ and IAN147/12¹⁶ do not prescribe the minimum competence level of those tasked with conducting Inspections or Monitoring.
 - Drainage inspection data is checked and formatted in Confirm¹⁷. There is currently no automated link between Confirm and HADDMS and no process to govern the

¹⁵ SD 15 Manual of Contract Documents for Highway Works, Volume 5 Section 9, Implementation Standard for CCTV Survey of Highway Drainage Systems

¹⁶ IAN 147/12 Interim Advice Note Drainage surveys and data

¹⁷ Confirm is a database which is used for storage and validation of inspection, survey and maintenance data

two-way transfer of information between the systems. This results in the storage of two sets of primary data and reported confusion around which data takes primacy.

54. At the time of reporting, Highways England are reviewing and consolidating the DMRB, including HD43/04 and working to develop an automated link between Confirm and HADDMS. This will improve the quality and security of the primary drainage dataset, allowing Highways England to act more efficiently and with more confidence. It should be noted however that the structure of information held on Confirm (which specifies maintenance by carriageway section) is not well aligned with the taxonomy of data resulting from CRMDP (which is identified on an asset by asset basis). If left unresolved this may stymie the progress made in unifying Confirm and HADDMS.
55. Since the change to the AD contract model in Area 1&2, the Watchman role (review of surface visible assets at traffic-speed by specified 'Watchmen') and Watchman report (a quarterly summary of network Watchman observations) have not been proactively embedded into the management function. Moves are afoot to re-invigorate this process but it was not embedded as 'business as usual' at the time of reporting. Highways England should ensure that this important source of network intelligence is not lost.
56. Highways England clearly recognises and understands the importance of the data they collect to the overall decision making process. Careful consideration to this has been given in the supporting standards and guidance documents. The processes, tools and expertise used to govern and assure this data are generally robust and there was clear evidence of appropriate peer review.
57. Highways England may wish to consider developing an Asset Information Strategy to describe its high level approach to managing its assets. This would provide a strategic view of the information required to achieve Highways England's asset management outcomes. For example, Highways England are collecting data to describe their drainage assets' location, inventory and condition. This data may, in the future, be used to inform a hydraulic model of the drainage network as is common in many water companies. At the same time, Highways England are involved with a number of initiatives which may question existing strategies or propose new opportunities, for example the CIRIA working group¹⁸ which at the time of reporting, is researching whether deterioration modelling in gravity fed drains is practical. The Asset Information Strategy would provide an opportunity to draw together all of these strands of thinking and research and propose clear outcomes. The outcomes would inform and direct data capture activities and afford the opportunity to track progress in meeting the desired Asset Information goals.
58. Highways England has also developed the Asset Data Management Manual (ADMM). This is an important 'enabler' which defines the asset data management obligations following the completion of schemes and maintenance activities. An Asset Information Strategy would sit above the ADMM in the Asset Management Document hierarchy and cover the asset information needs across the entire planning lifecycle, including intervention planning. It will ensure that key tools such as the ADMM and new Value Management process maintain alignment with Highways England's asset management objectives.

¹⁸ https://www.ciria.org/Research/Project_proposals2/Deterioration_degradation_assets.aspx

Recommendations – Asset Management Information

Ref AMI-1	<ul style="list-style-type: none"> • Consideration to development of an asset information strategy. This is to identify data needs whilst ensuring alignment of data collection activity with Highways England's strategic business objectives. (<i>Link to para. 57</i>)
Ref AMI-2	<ul style="list-style-type: none"> • Consideration of addition of competency definitions in standards and aligned to a centrally administered competencies database/matrix. To include not only competencies of technicians but also of those in the wider asset management landscape. (<i>Linked to para. 53</i>)
Ref AMI-3	<ul style="list-style-type: none"> • Consider the alignment of taxonomoy in CRMDP against the emergent IAMIS system. (<i>Linked to para. 54</i>)
Ref AMI-4	<ul style="list-style-type: none"> • The Watchman system was developed under the MAC contract model and continued under ASC. Highways England should ensure that it or an equivalent function is equally embedded in its AD contract model. (<i>Linked to para. 55</i>)
Ref AMI-5	<ul style="list-style-type: none"> • Consider review of the document management framework including the addition of a central librarian function. (<i>Linked to para. 21 i</i>)

3.2 Maintenance and renewals planning

3.2.1 Inspection & Monitoring Regimes

59. Monitoring and inspection programmes are informed by the suite of documents detailed in Table 1. Approaches are relatively common across all regions reviewed although differences exist between the approach taken to the inspection and maintenance of geotechnical assets and drainage assets. The primary driver of the difference in approach across the two asset categories is the availability and quality of asset condition data.
60. Highways England Standard HD41/15 governs activity with respect to Geotechnical assets. The predecessor document, HD41/03 prescribed a cyclic approach to the inspection of geotechnical assets (20% of the network per year). This approach did not offer the efficiency of a risk based approach but did mean that the Geotechnical portfolio was inspected in its entirety over a 5 year period. This facilitated the collection of a comprehensive dataset describing asset condition and allowed HD41/15 to adopt a more efficient, risk based approach to asset inspection and maintenance.
61. Inspection and maintenance of drainage assets differs according to the contract model in operation in the reviewed Areas. The ASC model (Area 9 & Area 10) adopts a risk based approach to delivering outcomes specified in the Area Asset Management Operational Requirements (AMOR). Service Partners are required to prepare a Maintenance Requirements Plan which assigns risk based frequencies to the maintenance and inspection of different drainage asset types. Whilst risk based maintenance can offer efficiencies over and above a prescribed programme, it is heavily reliant upon the quality and availability of data which can be used to calculate risk.
62. Notable good practice was evident in Highways England's Area 9 who had taken steps to compensate for the low levels of empirical asset data by conducting detailed Failure Mode Effect Analysis (FMEA) on generic drainage assets. This data was subsequently used to inform the cyclic maintenance programme detailed in the Area 9 Maintenance Requirement Plan

(MRP). A similar approach has been adopted by Network Rail¹⁹ who are, at the time of reporting, using Failure Modes and Effects Analysis (FMEA) to evaluate the consequences of failure and develop improved maintenance regimes.

63. It is understood that pressure on resources meant that more urgent Lump Sum activity (responding to flooding) was taking precedence over preventative maintenance and inspection of some drainage assets (for example, interceptors) as prescribed by the FMEA data in the MRP. This is not considered to be a sustainable approach as the burden of reactive work will grow in the absence of effective maintenance of aging assets.
64. The Area 5 DBFO has 88% Inventory coverage and 35% Condition coverage of drainage data, in line with Highways England's national average, after a prescribed programme of inspecting or validating 10% of their portfolio inventory per annum. Area 5 use this data in conjunction with the 'Agile Assets' software platform to support the life cycle management of their drainage assets. Agile Assets is used to inform maintenance and intervention activity over a 30 year planning period. This forms the basis of the Area 5 AMFP and is considered to be a safe, robust, efficient and sustainable approach. This assessment should be considered in the context that;
 - the M25 is one of Britain's newer motorways and so experiences a lower rate of failure;
 - the length of the Area 5 DBFO contract means that after 9 years on the patch, Area 5 have had the opportunity to iron out a number of teething issues and;
 - the focus on a handback condition score (ACCP) means that Area 5 are required to do 'just enough' to maintain the ACCP rather than the broader approach to network health noted in other Areas.
65. The AD contract model in use in Area 1&2 prescribes a cyclic programme of initial inspection and maintenance with the potential to adjust the frequency of works as understanding of the assets grows. This is considered to be safe, robust and sustainable approach that will drive the collection of a broad asset dataset and deliver efficiencies over time.
66. Highways England is monitored externally using Performance Indicators (PIs) given in the Operational Metrics Manual (June 2016). PIs covering drainage and geotechnical assets are focused upon inventory and condition data coverage and the identification and mitigation of flooding hotspots and other priority drainage assets. They are well aligned with reporting Highways England's progress in delivering the requirements of the RIS.
67. Highways England's approach to the inspection and maintenance of geotechnical assets is robust, efficient, safe and increasingly sustainable.
68. Highways England's approach to the monitoring and maintenance of drainage assets is safe, as a result of the commitment to react quickly to remove water from the highway and will become increasingly efficient and sustainable as data improves. The use of the AD contract model and innovative data collection techniques (including the use of LiDAR nationally and trialing of SewerBatt in Area 1&2) will accelerate progress toward this end. This is similar in approach to that adopted by many UK water companies who routinely use inspection tools such as SewerBatt for early blockage detection and Electrosan²⁰ for monitoring infiltration. Other infrastructure asset owners including Network Rail are continuing to seek cost effective opportunities to adopt Remote Condition Monitoring (telemetry). Under suitable conditions, sensors may be deployed to effectively monitor asset degradation and highlight the need to intervene before individual assets fail.

¹⁹ <https://cdn.networkrail.co.uk/wp-content/uploads/2016/11/Asset-Management-Strategy.pdf>

²⁰ <https://www.electrosan.com/>

3.2.2 Asset interventions programming and budget allocation

Selection, prioritisation and development of the asset interventions programme

69. Highways England's approach to asset intervention and renewal is led by the relevant DMRB Standards. Across both Geotechnical and Drainage portfolios, the approach can be described at a high level by the following stages:
- Identify Need
 - Study
 - Technical Discussion
 - Value Management
 - Design
 - Construction
 - Review
70. The initial stage, 'Identify Need', is driven by analysis of data collected from Principal Inspections, further monitoring and studies or reports of issues from other sources. Defects or features are graded as per HD41/15 (Geotechnical) and HD43/04 & IAN147/12 (Drainage). Geotechnical features are reviewed by the Area GMLE and Drainage defects are scored in HADDMS after initial review by the Area Drainage Liaison Engineer (DLE) or Asset Champion. The accurate scoring of defects is fundamental to how Highways England intervenes to maintain the safety and availability of the network. The process observed was considered robust and sustainable.
71. Each identified Feature or defect is reviewed by the relevant Area asset lead who assesses the significance of the report and if necessary, proposes further studies and requests principal designs for a suitable intervention or renewal.
72. Urgent safety led works are initiated without delay, geotechnical features or drainage defects graded 1-3 are assigned routine or enhanced monitoring regimes and features or defects graded 4 or 5 are taken forward for intervention.
73. Highways England consider 3 options at this stage; Do Something (intervene to renew the asset), Do Minimum (intervene to make the asset safe for a period of 12 months before further review), or Do Nothing. Each option is presented to Highways England's Value Management process for consideration.
74. Some good practices were observed, over and above the requirements of the Standards, notably the use of dashboards like Area 9's Network Needs Tracker or Area 1&2's Route Manager review process. Both are designed to make Network Need Visible to the Highways England community and to distil local knowledge to inform or validate scheme options or provide insight into local community issues and other activity planned within the Region which may affect programming. Both initiatives are designed to reduce turbulence and increase efficiency in planning and delivery.
75. Highways England operates a mature VM process to assure that interventions deliver the right outcome for road users. The 'Asset Renewal Scheme Justification and Appraisal Document' governs this process. The VM process uses a standard set of indicators and factors against which scores are applied to describe the scheme options' potential value. VM uses weighted scores (out of 100 points) to describe a proposed scheme's impact upon:

- **Safety (30%)** - All schemes must be assessed in accordance with GD04/12²¹, the standard for safety risk assessment on the strategic road network
 - **Value for money (50%)** - All renewal schemes are assessed against value for money criteria by use of an Economic Indicator. The Economic Indicator compares the initial works cost and Whole Life Cost (WLC) of the Do Minimum and Do Something options. WLC forecasts for geotechnical and drainage renewals are informed by the Project Economic Appraisal Tool (PEAT).
 - **Sustainability (20%)** - the environmental indicator function allows calculation of a sustainability score aligned to multiple environmental and social indicators set out in the Asset Renewal Scheme Justification and Appraisal Document.
76. Scheme options selected through VM are included in either year 1 or year 2 of the 5 Year Asset Management Forward Programme which is reviewed in February/March of each year. The Scheme Appraisal Report (SAR) records the inputs and outputs from the VM process.
77. The current Value Management (VM) process is well embedded and focused upon delivering value for money, safe and environmentally beneficial asset interventions. Two potential limitations have been identified. These are:
- i. As might be expected in a safety critical organisation, a strong safety culture is evident in both documentation and action. However, this does not appear to match the weighted scoring for safety (30%) outlined in 'Asset Renewal Scheme Justification and Appraisal Document'. This is primarily an issue of perception as schemes presented for consideration in VM are already selected based on their contribution to safety.
 - ii. It is important to note that the VM sustainability score is comprised mainly of environmental indicators. Long term financial sustainability, business longevity or the sustainable contribution to the growth of UK Plc do not appear to be given sufficient weight in the current VM process. Whilst this is an effective tool for promoting schemes with an environmental benefit, an opportunity exists to assess whether a renewed asset will continue to meet the needs of the network over many Road Periods. This broader view of sustainability would support the development of the LAMPs on an Area or individual asset basis.
78. Highways England acknowledges these issues and at the time of this report, was advanced in plans to roll-out an updated and improved VM process. The new VM process places greater emphasis upon clarity of design and cost in the early (needs) phase of the renewal process, rather than the later (solutions) phase. Although not within the scope of this review it was evident that the new VM process will create efficiencies in some activities as seen in Area 1&2 and Area 9 where Early Contractor Involvement (ECI) and Early Designer Involvement (EDI) is seen to facilitate a more robust, efficient and sustainable selection of schemes to take forward to delivery.
79. Highways England Areas currently describe intervention and renewal plans across all asset categories via Asset Management Forward Programmes (AMFPs). AMFPs record a 5 year perspective, with greater detail reported annually for geotechnical interventions via Geotechnical Asset Management Plans (GeoAMPs)²². Some Areas have produced DAMPs

²¹ DMRB, volume 0 Introduction and General Requirements, section2 General Guidance, Part 3 GD 04/12 Standard for Safety Risk and Assessment on the Strategic Road Network

²² The GeoAMP is an annual snapshot of geotechnical schemes undertaken and planned.

but this was not universal practice as drainage standard HD43/03 does not require the production of DAMPS.

80. Highways England is progressing toward an ISO55001:2014 aligned asset management system. A fundamental component of mature asset management is the ability to forecast the lifespan of assets within a portfolio and hence predict where intervention may be required in order to maintain desired performance levels. This understanding of asset performance over lifespan will facilitate a robust calculation of asset investment need over multiple Road Periods.
81. Highways England are aware of the need to take a longer view of asset need and are working to address this through the implementation of LAMPS which are evident in the Southwest Region. There is also anecdotal evidence that Area 9 has adopted and prepared a LAMP (although this was not evidenced and so it is not possible to report whether the LAMP is an Area or Regional document).
82. Highways England's journey toward adopting LAMPS can be characterised in 3 stages;
- **Current:** Highways England use historic need and design life to validate the request for future funds (SoFA requests).
 - **Emergent** (in use in Area 1&2 & Area 9): preparing and adopting 30 year LAMPS. LAMPS use theoretical asset performance data ('design life') to strategically identify asset need and hence request funding over a 30 year period. This is an excellent initiative, with Highways England taking a long term view of asset health and need. However, feedback from Service Partners suggests that 'actual life' data is significantly different to 'design life' for some asset categories and so 30 year projections of need should be used with caution.
 - **Mature:** Highways England use empirical data ('actual life/deterioration profiles') to refine the 30 year network performance model and more confidently request funds aligned to asset need.
83. Highways England acknowledges that further effort will be required in coming years to compile 'actual life' data (deterioration profiles) for each asset type in their portfolio. This data will add increased confidence to the long term asset planning processes being developed.

Statement of Funds Available (SoFA)

84. Highways England is organisationally committed to deriving maximum value for the public from money spent. They are also committed and bound by license to maintain the road network in a safe condition.
85. Highways England receives funding on a 5 yearly cycle from the Department for Transport (DfT). It is therefore imperative that Highways England accurately forecasts asset need over the coming 5 year 'Road Period' and identifies an appropriate level of funding requirement to allow it to meet its license requirements in a safe, efficient, robust and sustainable manner. The Office of Rail and Road (ORR) applies an efficiency challenge to the funding requirement identified by Highways England, which results in advice to DfT on the appropriateness of Highways England's efficiency case within its identified funding requirement. Highways England's forecast funding requirement must be credible and robust in the face of technical and economic challenge to stand up to this scrutiny.

86. The DfT will allocate a sum of money to Highways England, known as SoFA (Statement of Funds Available) which is the 5 year funding allowance.
87. A fully mature asset data led planning model would allow asset condition to be projected over a decadal timeline and investment across multiple Road Periods identified based upon asset need. Success in this 'bottom up' approach depends upon having sufficient visibility of asset inventory and condition, together with associated FMEA data and deterioration models to build credible models describing whole life asset performance.
88. Highways England acknowledges that this, at the time of reporting, is aspirational given the low levels of condition and deterioration data describing some asset categories (particularly sub-surface drainage assets). Steps are taking place to improve this data and the regions reviewed are approaching 100% complete in terms of geotechnical assets. In addition, some Highways England Regions have started to produce LAMPs (Lifecycle Asset Management Plans) which look at need over multiple Road Periods at a Regional level. These are both important steps toward fully mature asset management.
89. Highways England are conscious that given the number of assets in each category, a small inaccuracy in base data can iterate into a significant over or under prediction of long term asset need. This is recognised by Highways England who, whilst committed to developing an empirical data led model, are aware of the need to validate the 'bottom up' forecast with a 'top down' view of asset need. This 'top down' approach reviews historic asset spend and factors the design life of assets in the portfolio to give a strategic projection of investment need over the coming Road Period.
90. The use of two techniques to validate the request for funds is considered a robust approach, given Highways England's restrictions posed by the lack of historic deterioration models across all asset types.

3.2.3 Planning and Developing Schemes

91. As an input to the VM process, most Areas start the preparation and planning of scheme development through two initiatives - Early Designer Involvement (EDI) and Early Contractor Involvement (ECI). These are undertaken at the end of the 'needs' phase so that an accurate view of design and costs is available early on in the process. In principle that means that there should be fewer variations in the Value Management (VM) workshops and the scheme should proceed as planned. Schemes are signed off by the Highways England project sponsor and commercial team prior to delivery. This is seen as an effective and efficient process and it is understood that early insight is a key feature of the new VM process.
92. In general terms, Highways England and its Service Partners govern the delivery of schemes using gated processes. Although aligned with Highways England requirements, each Area reviewed has developed their own process to govern and document intervention. Area 10 and Area 5 DBFO processes were exemplary, clear, well documented and discussed in a common language that suggested that all interviewees were very familiar with the requirements for compliance with their Area process. Whilst each Area process was effective in delivering controlled, documented and well governed outcomes, the variety of approaches and associated terminology across Areas did not readily facilitate a centralised perspective.
93. Highways England operates a Construction Works Framework. Suppliers qualify for inclusion by meeting Highways England's prescribed standards in financial, technical, environmental and quality management. This provides confidence that the supplier is suitably competent and provides an opportunity to drive safety, efficiency and sustainability through the supply chain.

94. Schemes can be delayed at the construction phase due to unforeseen issues. This creates a gap in the Forward Programme and so most Areas employ a 'Design Bank' concept, where a selection of non-urgent schemes are held, designed and ready for VM. This means that gaps in the delivery programme can be filled with appropriate activity at short notice, resulting in efficiencies in delivery. It should be noted that from a supply partner perspective, Design Banks have proved difficult to create and maintain. An increased focus on efficiency in scheme delivery has meant that Service Partners are looking to do more with their allocation. This, coupled with the fact that there is a risk associated with holding schemes in Design banks (changed priority or specification potentially meaning loss of invested time and funds) has meant less contingency planned work being driven through the system. This leaves different regions across England with varying levels of contingency work available to call down.

3.2.4 Alignment of geotechnical and drainage assets

95. Highways England's current approach to the prioritisation of need across asset types is a function of the Value Management (VM) process. A primary output of VM is an approved option to intervene and its associated VM score. Using VM scores as a guide, area Asset Champions meet regularly to discuss the priority of approved options and the sequencing of intervention works across all asset types.
96. Panel discussions, whilst a useful way to prioritise complex issues, can be subject to dominance bias i.e. the most experienced Asset Lead can dominate less experienced Panel members and so disproportionately affect the outcome of discussions. To mitigate this potential bias, Highways England's Service Partners in Area 1&2 have developed a Needs Prioritisation Tool (NPT) to compare priorities across all asset types. The tool currently only scores schemes for impact upon safety and network availability although it is understood that the NPT is being developed to allow scoring of 6 factors across multiple asset categories. This will add an additional objective element to prioritisation of schemes across multiple asset types.
97. It is also understood that Highways England's new Value Management process includes a formal comparison of cross asset need. This and the use of decision tools such as the NPT are good examples of how Highways England is looking to enhance the efficiency and sustainability of its interventions programme.
98. Highways England is primarily funded via Renewals capital made available by the DfT. However, there are £900million of additional 'designated' funds which Highways England scheme champions may draw upon to fund interventions with a particular benefit. Designated Funds (DF) are 'a series of ring fenced funds designated to Highways England to address a range of issues beyond the traditional focus of road investment'²³.
99. Schemes may be funded using Designated Funds if they can prove a specific benefit to the environment, cycling, safety and integration (CSI), air quality, innovation or growth and housing. Awareness around how to access Designated Funds varied at the time of reporting. Some Areas (Area 1&2 in particular) reported that Designated Funds were considered as an essential part of the scheme development process whilst National Asset Leads reported that they needed to prompt some Area Champions to consider the Designated Funding available to them.
100. Highways England's VM process considers the whole life cost of 'Do Something', 'Do Minimum' and 'Do Nothing' options. 'Do Minimum' options are usually cheaper to deliver in the short term but can be more expensive and less efficient over the whole life of the asset

²³ www.gov.uk/guidance/highways-england-designated-funds

than 'Do Something' options. Annual budget constraints can sometimes force Highways England to adopt a 'Do Minimum' approach to some interventions. The use of DF can effectively provide more funding to Highways England and so facilitate the selection of a 'Do Something' option over the less efficient, 'Do Minimum' option.

101. It is understood that the new VM process will be used to assess proposals for the use of DF. This is a positive step and will provide a robust check that improvements to the network funded by DF are aligned to delivering Highways England's strategic outcomes.

Recommendations – Maintenance and Renewals Planning

Ref MRP-1	<ul style="list-style-type: none"> Highways England may consider the use of FMECA information (as used in Area 9) to inform the frequency of asset maintenance activity in all Areas as the AD model rolls-out. To extend the scope of this initiative, consideration may also be given to undertaking Process FMECA (PFMECA) to identify and mitigate critical process risk. <i>(Linked to para. 62, 110)</i>
Ref MRP-2	<ul style="list-style-type: none"> There is opportunity for the emergent VM process to consider adding greater weight to the broader factors of sustainability (i.e. beyond environmental indicators) to promote stronger alignment of selected scheme options with Highways England's business objectives. <i>(Linked to para. 77ii)</i>
Ref MRP-3	<ul style="list-style-type: none"> As part of Highways England's ongoing review of the DMRB, consider updating drainage standard HD43/04 with a requirement to produce Drainage Asset Management Plans (DAMPs). <i>(Linked to para. 79)</i>
Ref MRP-4	<ul style="list-style-type: none"> Highways England's roll-out of the new AD contract model presents an opportunity to re-align their Service Partners' gated processes to a common standard, enhancing the opportunity for cross Area and cross Region collaboration and comparison. <i>(Linked to para. 92)</i>
Ref MRP-5	<ul style="list-style-type: none"> Highways England may consider development and delivery of awareness training to promote the use of designated funds. <i>(Linked to para. 98, 99)</i>

3.3 Maintenance and renewals delivery

3.3.1 Monitoring delivery

102. Scheme finance and a construction works plan are agreed by Highways England during each individual VM process. In Area 5 (DBFO) the Lifecycle Proposal process performs a similar function.
103. Performance in delivering works to plan and budget is managed in all Highways England Areas reviewed via individual Area's gated process. All Areas have adopted and incorporated Highways England's centrally driven collaborative Working Day 1 (queries) and Working Day 2 (response) meeting structure. Working Day 2 meetings include a review of the full year forecast and any monthly realignment together with any significant changes to funding or and updates project milestones. Scheme financial forecasts are updated based on any new information, and accruals are made on the scheme ledger to track project cost.
104. The Working Day 1&2 structure is informed by (and informs) an array of meetings across Highways England's areas, generally aligned with monthly Area Performance Meetings and Quarterly Regional Programme Board Meetings. Highways England's Central Asset Management office maintains a National view of performance against plan by aggregating information from each Region.

- I05. Whilst there is no common National nomenclature or meeting structure beyond Working Day I&2, progress and performance monitoring in all Areas was seen to be robust.
- I06. Some exemplar practice was noted in Area I&2 where scheme performance data was made available to all teams (commercial, design, delivery) via the Area Office dashboard. Colleagues are encouraged to proactively identify and resolve restrictions on availability of resource which may impact scheme progress.

3.3.2 Assurance of quality

- I07. Highways England's Supply Partners are subject to rigorous assessment of their quality assurance process at the bid stage of contract appointment. Strong gated processes were evident in each Area and this ensures that necessary checks are undertaken before moving on to the next stage of works delivery. Governance and direction is given, in part, by the requirements held within HD22/08, SD15, IAN147/12 and HD19/15²⁴.
- I08. Throughout the design and construction phases, Highways England maintain a watching brief, supported on a regular basis by collaborative planning and review meetings. This culminates with the sign-off by Highways England of the Geotechnical Feedback Report (GFR) and Post Construction Survey Report for geotechnical and drainage outputs respectively.
- I09. It should be noted that whilst Highways England has adequate quality assurance controls across the lifecycle of works, the nature of outsourced design/build/manage contracts such as ASC and DBFO place responsibility for planning, delivering and reviewing asset interventions with service partners. This creates additional risk for Highways England (the accountable body) in ensuring adequate governance and assurance of this key component of asset management. Highways England may consider undertaking a Process Failure Modes, Effects and Criticality Assessment (PFMECA) to identify the impacts of this, and other, critical process steps.

3.3.3 Variations to maintenance and renewals programme

- I10. Highways England is under pressure to manage their maintenance and renewal programme in a background of competing priorities and restrictions on funds available. On occasion, this results in variations to the maintenance and/or renewals programme. Appropriate control of these changes is therefore important to ensure efficient, forward looking reprogramming of the Highways England Delivery Plan²⁵.
- I11. Variations can be the result of many triggers. One cited example was SCRIM (skid resistance) surveys for pavement assets, where the generation of a significant amount of pavement related activity in an Area over a short period of time can place a financial and resource drain upon other asset delivery plans/schemes.
- I12. Minor changes to the delivery plan are managed by Portfolio Managers within the portfolio for each Area. Major changes are escalated via the Working Day I&2 structure and the Area and Regional Performance meetings. The output of the Working Day 2 meeting is a set of updated Management Accounts supported by commentary and the annual refresh of GeoAMPs/DAMPs and the AMFP.
- I13. Further escalation is available through the Highways England internal Change Control Committee (CCC) which meets monthly. The CCC reviews all variation for which a change control form has been submitted, notably if the:
- cost of scheme changes by £100k in either direction;

²⁴ DMRB, Volume 5, Assessment and preparation of road schemes, Section 2, Preparation and Implementation, HD19/15 Road Safety Audit

²⁵ <https://www.gov.uk/government/publications/highways-england-delivery-plan-2015-2020>

- scope of work changes;
- start or delivery date changes by more than 90 days.

I 14. It is considered that this process is safe, robust and, with the use of Design Banks, efficient. It is noted however that the use of schemes within the Design Bank may promote efficiency in delivery, but not necessarily deliver the asset intervention at the optimum time, nor provide the most efficient use of resources at an asset level as schemes need to be refreshed to keep the bank relevant. This may result in less sustainable delivery of 'bank' schemes.

Recommendations – Maintenance and Renewals Delivery

Ref
MRD-1

• Highways England may wish to consider how the knowledge of exemplar practice is shared across the organisation including, for example, the Area 1&2 Office Scheme Performance Dashboard and the Area 9 'Consider the Customer' consultation initiative. (Linked to para. 106)

3.4 Review and reporting of asset interventions delivery

3.4.1 Measuring Impact of interventions

- I 15. Optimal outcomes and improved performance are a function of good decision making. A complete understanding of the impact of any interventions on the SRN, in the context of effective monitoring processes, historic performance data and long-term asset need, is a key element of this decision making process. It is therefore important that Highways England clearly define what the intervention expects to achieve, assess whether the intervention met that aim, and determine what the impact was.
- I 16. As an amalgam of a number of processes, scheme impact is measured at Highways England on several levels. These include:
- On a scheme by scheme basis;
 - At Area/Regional programme level;
 - At national programme level as measured against Highways England's business objectives and license conditions.

Together, these help support a complete understanding of any interventions on the SRN and thus can be used to drive improved performance and delivery of optimal outcomes.

- I 17. On a scheme level, safety, value and sustainability are assessed via the Value Management process. The VM scoring mechanism selects schemes displaying the most advantageous balance of positive impact upon each variable. A successful intervention should allow an asset to be re-classified as lower risk than pre-intervention, thus giving a quantitative assessment of the impact of a specific intervention upon the safety of a particular part of the network. There are some limitations in this process, particularly as regards the management of linear assets. The current Feature based approach for geotechnical assets can at times give an overly negative assessment of asset health (one significant feature can draw down the classification of an entire stretch of asset). Highways England's ASC contracts contain a mechanism to allow the reporting of a risk ratio, describing the average classification of a linear asset per kilometer. This approach can be used to take a more holistic view of the health of a linear asset, albeit it is most useful when assessing multiple instances of Grade 3 defects (which may indicate an area in flux and trigger further investigation).

- I18. Each Area maintains an Efficiencies Register detailing value added to and by schemes throughout the design and delivery process. The Regional Efficiencies Register is managed by the Efficiencies Lead and subject to monthly review by the Efficiency Panel. Efficiency data is collated nationally by the Central Efficiency Team and presented to the ORR to evidence progress against Highways England's £1.2bn RIS-1 efficiency target.

3.4.2 Reporting

- I19. Highways England operates in a monitored environment. The ORR has a legal duty under the Infrastructure Act 2015 to carry out activities to monitor the performance of Highways England. At a strategic level Highways England is therefore required to produce an Annual Reporting Statement, the governance of which is assured centrally through the Operations Metric Manual (OMM). The OMM was developed by Highways England in partnership with the ORR and DfT to ensure that performance, as measured against eight Key Performance Indicators and a suite of associated Performance Indicators (see Section 3.4.3), is accurately measured and reported. This includes the development of appropriate processes and reporting systems to assure these reportable outputs.
- I20. At a programme level, mechanisms exist to support the reporting of intervention works. This includes the governance required to fulfil the requirements of HD22/08 and the use of Area and Regional Asset Management Forward Programmes (AMFP) which detail all proposed asset management activity over a 5 year period. Supporting this, and in addition to the risk management reporting process associated with works delivery, GeoAMPs summarise the annual planned and programmed works. In some Areas DAMPs are produced but there is no requirement in the DMRB (HD43/04) to compel Service Partners to do so. For ASC and DBFO contracts the GeoAMPs and DAMPs are held and controlled by the supplier with Highways England having access rights on request. This system leaves highways England exposed to the small risk that important information is not pushed back up to them from the service partner. Extending the scope and application of Highways England's centralised document controls could mitigate against this risk.
- I21. At an operations level, mechanisms exist to support the reporting of asset health, including, for example, asset condition and inventory. Feature/defect grades are assigned to asset inspection information and, following competent person review and validation, this data is made available on Highway England's corporate information systems (HADDMS/HAGDMS) as a tool to support effective decision making and reporting. Good practice was observed in Area 5 where Asset condition is monitored and reported through the DBFO Asset Category Condition Profile (ACCP). This is a requirement of the DBFO contract (Schedule 14) and a useful way to demonstrate an improving or deteriorating asset portfolio. Highways England may wish to consider adopting this approach in other Areas. Delivery of maintenance and renewals in all Areas reviewed was reported through a series of collaborative meetings. All Areas make use of the Highways England Working Day 1&2 structure and many had gone further including pre-planning (Working Day -2) meetings, regional programme review meetings and community stakeholder events.
- I22. For effective and accurate performance or progress reporting, appropriate information controls and governance is needed. For the most part this documented information is evidently well controlled and managed via HADDMS/HAGDMS and Sharepoint platforms. This assists with the efficient and accurate reporting of information when it is needed. However, owing to the size, complexity and decentralised structure adopted by Highways England, and particularly where suppliers under ASC contracts operate their own document control procedures, a number of isolated opportunities for improvement were observed. This includes:
- the indexing of documents in the central repository (HAGDMS/HADDMS);

- the availability of some key documentation following change of contract/supplier, and;
- the process/governance of document review.

I23. Highways England recognise this is an area for improvement and the Asset Information Group (AIG) are currently reviewing the requirements of the DMRB alongside the roll out of the 19 ISO55001:2014 aligned processes. This will ultimately enhance the efficient and accurate reporting of performance at Highways England.

3.4.3 Performance indicators

I24. Performance monitoring and measurement is a fundamental requirement of good asset management and an understanding of how and why KPIs are measured is an important contributor to success. Highways England maintains a suite of KPIs and PIs to monitor performance of geotechnical and drainage assets against each of its strategic performance obligations (license requirements). These are documented in the Operational Metrics Manual (OMM) and reported to and monitored by the ORR. The OMM details a framework for monitoring and reporting the impact of asset interventions and the performance of the network as a whole, across multiple asset types.

I25. The 2018 OMM publication does not contain any information to record when and by whom the document had been prepared, reviewed and amended (e.g. a document control page). Notwithstanding this document control observation, the OMM is a useful and clear description of KPIs 1-8, each component PI and the measures used to monitor performance in meeting them.

I26. Although the OMM reflects good practice in providing a clear reference document and promoting a performance based culture, it is also important that due consideration is given to wider asset management requirements. Effective and mature asset management requires the monitoring of the performance of assets, asset management activities and the asset management system (AMS) itself. The OMM in its current form describes PIs focused upon asset inventory, condition and the mitigation of flooding hotspots and other priority drainage assets. As Highways England embeds its emergent ISO55001:2014 aligned management processes, there is scope to develop the OMM to include a focus on the performance of the '19 processes' (i.e. the asset management system itself) and/or the wider 39 subjects of asset management as detailed in the Asset Management Landscape²⁶. This may include, for example, number of AMS audit (internal/external) non-conformances, timely production and control of documentation (GeoAMPs/DAMPs/LAMPs) and the percentage of Principal Inspections and cyclic maintenance completed on schedule.

I27. Existing PIs relevant to drainage assets were reviewed and considered relevant and well aligned with Highways England's requirement for accurate asset condition and inventory data, in order to drive a more predictive approach to intervention.

I28. It is understood that a number of 'repeat attends' to floods are driven by a lack of holistic focus as regards reactive intervention. Anecdotal evidence suggested that reactive interventions may target the failed or underperforming asset but do not routinely look to inspect and maintain linked or dependent assets. A PI may be used to focus attention on the holistic remediation of drainage issues, promoting a more efficient and sustainable approach by reducing the burden of reactive intervention over time. Over time, a reduced burden of reactive activity would assist Highways England in improving performance against KPI5 by allowing more scope within budget to proactively identify flooding hotspots and issues around priority assets.

²⁶ The Asset Management Landscape, Second Edition, GFAM, March 2014

- I29. Existing PIs relevant to geotechnical assets were reviewed and considered to be well aligned with delivering a safe network. Geotechnical asset inventory data is understood to be approaching 100% complete and so the relevance of PI 'Geotechnical Asset Inventory (length)' may be re-considered. It may be of more value to replace this PI with 'Percentage of Geotechnical Principal Inspections completed on schedule' to monitor the upkeep of this dataset.
- I30. Highways England may wish to consider adoption of an ACCP type metric, as used in the Area 5 DBFO. Whilst acknowledging that the existing OMM contains a measure focused upon the percentage of geotechnical assets which are not Feature Grades 3, 4 or 5, there are no high level indicators of portfolio health associated with other drainage assets. The ACCP measure used in Area 5, is an effective indicator of improving or deteriorating portfolio health, although it would be more intuitive to multiply the number of assets in each category by their Feature Grades and then divide by the number of assets to obtain the average Feature Grade. It should also be noted that it is a requirement of the DBFO contract that a particular geotechnical structure is classified based upon the worst case feature present along its length. As such the ACCP approach provides a relatively conservative assessment of the linear asset. A more realistic approach could be achieved by considering absolute length of the various Feature.

3.4.4 Benchmarking of performance

- I31. Highways England's Asset Inspection and Asset Management Community Group is a central function that governs and shares best and consistent practice across Areas. This has been recently supported with the development of the Asset Steward Review programme that seeks to benchmark the maturity of Highways England's emergent 19 asset management processes against the requirements of ISO55001:2014 – the international standard for asset management.
- I32. Whilst there is evidence of internal benchmarking within Highways England, the process does not currently appear to be consistent across all Areas or scoped to fully cover the benchmarking of asset, asset management and asset management system performance. No evidence was observed for systemic external benchmarking although anecdotal evidence suggests that performance comparisons are made, in an inconsistent manner, with the water industry where former water industry people in key positions at Highways England use their experience to compare approaches. In addition, Highways England Standards and Engineering Safety (SES) actively participate in a number of cross sector benchmarking projects (e.g. CIRIA, Geotechnical Asset Owner's Forum – particularly focused upon transport infrastructure owners). There is an opportunity to improve central visibility and therefore co-ordination and awareness of benchmarking activity across Highways England.
- I33. As good practice in asset management is largely independent of asset type, the emergent Highways England approach, which is consistent with ISO55001:2014, will enable and encourage objective comparison of Highways England's performance across sectors and between regulated/non-regulated and public/private environments. This can then be used to drive continuous improvement in asset, asset management and asset management system activities at Highways England.
- I34. In summary, this review observes that there is due process for the benchmarking of performance within Highways England although there is opportunity for tightening the governance and increasing the scope and frequency of this benchmarking to cover assets, asset management and asset management system performance in a more structured and consistent manner, both internally and externally. Highways England acknowledge this and are working to formalise this process in line with the emergent, ISO55001:2014 aligned, 19 asset management processes that are being rolled-out across the organisation.

3.4.5 Lessons learnt

135. In each of the Areas reviewed, and for the management of geotechnical and drainage assets, lessons learnt are captured through a process of continual improvement to support the delivery of routine maintenance and renewal interventions. With a number of different organisations responsible for undertaking this key asset management activity, it is reasonable that the methods to capture, analyse, store and disseminate lessons learnt vary across Areas.

136. Good practice identified across the Areas, includes:

- Area wide lessons learnt registers (all Areas);
- Post intervention delivery workshops, both internally (Highways England and Supplier) and externally (customers and other stakeholders) (Area 9)
- Designers toolkit (all Areas)
- Cross Value Reporting System (Area 10)
- Gateway controls for consistent trigger of lessons learnt process (Area 5)

137. Whilst each Area utilises a lessons learnt process, the degree (scope and application) to which these are formally implemented, either as a matter of course or through triggers, varies across Areas. Whilst the lessons process is a fundamental element of good asset management, on a case by case basis it is sometimes critical and sometimes unnecessary. Highways England may wish to consider the development of clear guidance and decision making criteria to determine when and how lessons learnt should be undertaken. A mechanism for sharing lessons learnt nationally should also be considered alongside recommendation MRD-1. Crossrail's Learning Legacy website is one such mechanism which Highways England may wish to draw upon²⁷.

Recommendations – Review and Reporting

Ref RR-1	<ul style="list-style-type: none"> • Area 5 use deterioration data for drainage assets to inform maintenance and intervention activity over a 30 year planning period in order to maintain a consistent Asset Category Condition Profile (ACCP). Highways England may wish to draw upon this experience for adoption nationally when data availability allows. (Linked to para. 121)
Ref RR-2	<ul style="list-style-type: none"> • Highways England should consider review and update of the OMM (or equivalent) to include focus: <ul style="list-style-type: none"> • on the performance of the emergent ISO55001:2014 aligned AMS processes ('19 processes') and/or the wider 39 subjects of asset management as detailed in the Asset Management Landscape. • on the holistic remediation of drainage issues to promote a more efficient and sustainable approach by reducing the burden of reactive intervention over time. • on 'Percentage of Geotechnical Principal Inspections completed on schedule' to monitor the upkeep, rather than collection (which is currently prescribed) of asset condition data. (Linked to para. 126, 128 & 129)
Ref RR-3	<ul style="list-style-type: none"> • Highways England may wish to consider the development of clear guidance and decision making criteria to determine when and how lessons learnt should be undertaken. This recommendation is linked to MRD-1 and consideration should be given to a mechanism to share lessons learned across Areas. (Linked to para. 137)

²⁷ <https://learninglegacy.crossrail.co.uk>

Report ends.