Use of Geotechnical Asset Data Within Highways England: The Journey so Far and the Future

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Abstract. Highways England is the government company charged with operating, maintaining and improving England's main arterial roads. It is responsible for around 6,880 km of highway, which carry a third of all traffic by distance travelled and two thirds of all heavy goods traffic in England. It needs to manage and deliver £15 billion of investment between 2015 and 2020, of which £11 billion is capital funding. Highways England has identified four primary civils asset groups for particular asset management focus: pavements, structures, earthworks and drainage. To manage its assets Highways England has invested in asset information management systems to record data, so that it can use the information to enable informed decision making. The asset information system for geotechnical assets has been operational since 2002 and it is used on a daily basis by Highways England staff and its supply chain. Standards and technology have advanced since then and Highways England is currently running a programme to ensure that the system and the information it requires is fit for purpose for the next investment period (up to 2025). This paper describes how Highways England uses geotechnical data in its asset management processes, including data capture, governance, reporting and decision making. It will help organisations who are starting out on the path of geotechnical asset management and provide an insight into the opportunities that current technology can provide with respect to interoperability and informed decision making.

Keywords: Geotechnical data · Geotechnical information · Asset management · Data quality · Highways England

1 Introduction

Highways England operates, maintains and improves England's main arterial roads, referred to as the strategic road network (SRN), spanning approximately 6,880 km. Highways England is a government owned company, managing and delivering £15bn

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investment between 2015 and 2020. The SRN carries a third of all traffic (by distance travelled) and two thirds of all heavy goods traffic, while only representing 2% (by length) of all of England's roads.

Network delays and congestion have significant impacts on Britain's economy, with current estimated costs of £2 billion per year. Without continual network improvements, this figure will likely increase to £10 billion per year by 2040 [5].

To ensure a safe and smooth-running network, highway assets need to be well maintained, through proactive operation, maintenance, and renewal and disposal [7].

Highways England's civil engineering infrastructure includes geotechnical, road pavement, drainage and structures assets. The geotechnical asset comprises 46,900 individual earthworks, which are managed through a programme of physical and remote inspections. These inspections inform maintenance activities and renewal priorities. Approximately 1,600 km of inspections are carried out per year, involving 13,100 individual observations. Approximately £15 m is spent each year on asset management activities to keep the geotechnical asset in good condition. The geotechnical asset is generally a long-life asset having a design life of 60+ years and an effective service life often 120+ years.

Geotechnical asset data and information underpin how Highways England and its supply chain make decisions to manage the geotechnical assets throughout their life cycle to ensure they are safe and serviceable (see Fig. 1). Geotechnical data is an asset in itself and it has tremendous value for the business. It has the potential to deliver many benefits in terms of time, quality and cost savings, ultimately driving optimal use of available funds as well as ensuring timely interventions.

Fig. 1. Life cycle of assets.

This paper presents the journey of geotechnical asset management and the use of geotechnical data within Highways England, from its origins through to present day. Enablers such as governance, standards, processes and 'tools' e.g. an asset data management system are discussed. A description of the geotechnical asset data and information held by Highways England is provided, together with considerations on data quality and current use. Challenges and opportunities for acquiring and using geotechnical data and information are briefly discussed. Finally, future aspirations for the organisation and its use of geotechnical data and information are presented.

2 A Brief History of Highways England's Geotechnical Asset Management

Highways England has a history of being a pioneering organisation in geotechnical asset management. Back in 2000, the organisation was a government body called Highways Agency and geotechnical asset management did not exist as a mainstream

discipline. However, the then Highways Agency recognised the importance of managing both the physical geotechnical assets and the associated data and information.

In the absence of an available commercial off the shelf software, a decision was taken to develop a bespoke asset information system to support geotechnical asset management. The Highways Agency Geotechnical Data Management System (HAGDMS) was developed and went live in 2002. An accompanying standard (HD41/03 [8]) was released in 2003. HAGDMS has since undergone several refreshes to mitigate against software obsolescence and to keep pace with business requirements (see Sect. 3.3 for further details).

With time, the subject of asset management in civil assets became more mainstream. PAS 55 was first issued in 2004 and then officially published in 2008 [2], followed a few years later by ISO 55000 [10].

In 2015, Highways England became a government company operating under a license and subject to regulation by the Office of Road and Rail (ORR). In the same year, an updated standard for geotechnical asset management, HD41/15, was released.

To further develop the knowledge of its geotechnical assets and improve understanding of the hazards affecting them, and the need for interventions and renewals, Highways England has undertaken several research and development projects over the last two decades. Themes include ground-related hazards, proactive monitoring, whole life performance assessment and resilience to geotechnical events.

A timeline of geotechnical asset management within Highways England is given in Fig. 2.

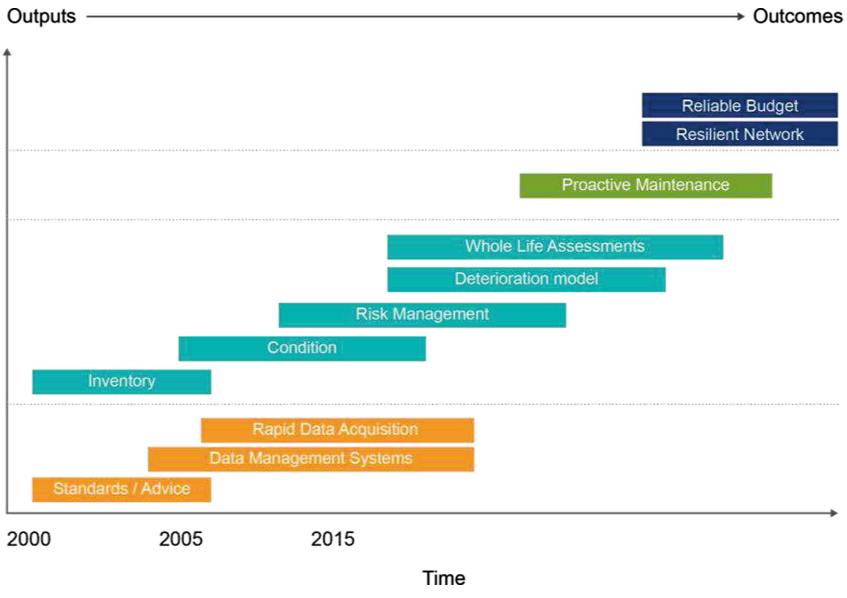

Fig. 2. Timeline of Highways England's geotechnical asset management.

3 Enablers

Key enabling components of asset management are: governance, standards and processes, systems and 'tools' for decision-making and risk. This section presents some of these components in the context of Highways England's geotechnical asset management. Geotechnical asset data and information and their use for decision-making are discussed in Sects. 4 and 5 respectively.

3.1 Governance

A robust approach to the management of geotechnical asset needs to demonstrate that there is alignment to requirements, governance and assurance. Highways England uses a set of asset information principles when managing its data, shown in Fig. 3.

The Asset Data Management Manual [9] sets out the data governance and the information requirements, including data quality requirements. These requirements are independent of any asset information system, they are driven solely by business need. This ensures that the business is not tied to a software provider. A mapping exists from the information requirements to the asset information system to enable the transfer of data.

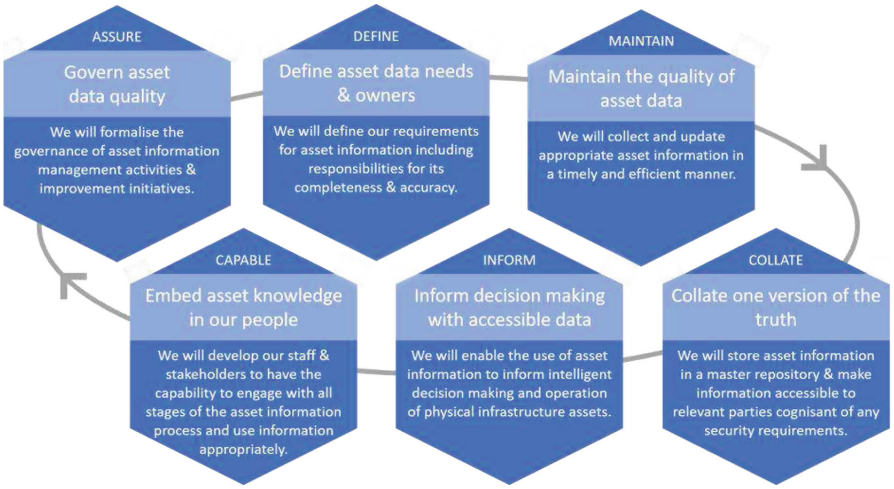

Fig. 3. Asset information principles (from the Asset Data Management Manual [9]).

3.2 Geotechnical Standards

The standard HD41 'Maintenance of highway geotechnical assets' was first published in 2003. It set out the processes of inspection, data capture (inventory and condition) and assessment of characteristics that provided a risk categorisation of observations or defects. These risk categorisations are then used to prioritise interventions on the road

network, such as emergency action, remedial measures or monitoring. Emergency interventions were signed off using online forms (Geotechnical Maintenance Forms).

The changes in the business required an update of the asset maintenance standard, which was released in 2015 [8]. The main changes to the standard were:

- a move away from risk terminology to categorise observations;
- simplification of the observation categories;
- the use of a risk-based approach to determine inspection frequency;
- the formal use of geotechnical asset management plans (GeoAMPs);
- deprecation of geotechnical maintenance forms; and
- data requirements set out explicitly.

The move away from risk terminology was to ensure that there would be no conflict with an over-arching risk framework that applies to all asset types.

The risk-based approach to inspections involved assessment of observations, together with their location on the road network and the impact of asset failure. This approach resulted in a change of inspection regime from 20% of the asset every year (i.e. a five-year inspection cycle) to inspection cycles ranging from one to ten years as shown in Fig. 4 below.

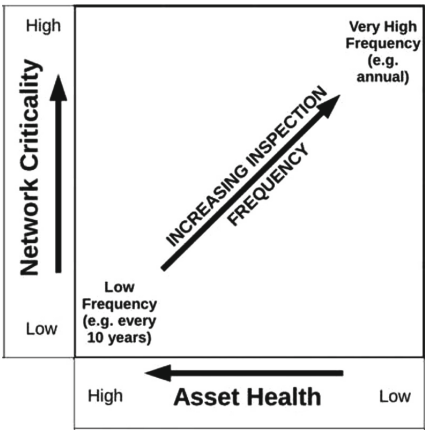

Fig. 4. Risk-based approach to inspection regime for geotechnical assets.

The standard HD22/08 'Managing geotechnical risk' [6] is the principal enabler of geotechnical risk management for Highways England. It sets out the procedures to be followed and certificates to be used during the process of planning and reporting of all geotechnical works carried out on the SRN to ensure that the geotechnical risk related to both acquisition and future maintenance of the assets, is correctly managed.

It should be noted that at the time of writing, Highways England's body of standards - the Design Manual of Roads and Bridges - is undergoing review and the HD41/15 and HD22/08 geotechnical standards described above will shortly be updated and renamed CD641 and CS622 respectively. The new references are used from this point forward.

3.3 Asset Information System

An asset information system is essential to collect and store data for re-use by the business and its supply chain. In the early 2000s, the then Highways Agency commissioned Mott MacDonald, in partnership with the software developer Keynetix to develop a bespoke system. The result was the Highways Agency Geotechnical Data Management System (HAGDMS) [14].

HAGDMS was rolled out in 2002, almost concurrently with the first version of the asset maintenance standard HD41 (see Sect. 3.2). It was important that the documented business processes accompanied the software system, to ensure that personnel were properly trained, and the approach was consistent.

The system is browser-based, using an enterprise-level database and a mapping front end. It allows multiple data sets to be visualised on the map, enabling the asset to be seen in the context of aerial photography, geological mapping and other relevant information. It now contains over 4.5 million individual inventory and condition data objects.

HAGDMS contains a mobile data capture package called PocketGAD (where GAD stands for Geotechnical Asset Data), which provides validation at the point of data entry and conversion of data to the correct format to be added to the online database. HAGDMS also holds the official geotechnical records database, which comprises reports in PDF format.

HAGDMS has been successfully used by the business and its supply chain to support proposals for work and provide data for performance reporting. To date, there are over 1500 users from Highways England, its supply chain, other stakeholders and academia. Because the data is used by the business it is maintained effectively and not left to deteriorate.

3.4 Knowledge Products

In addition to the process standards, Highways England has developed geotechnical knowledge products to provide background knowledge and information in a clear way and using a consistent language. Intended audiences for these knowledge products are technical and non-technical stakeholders from the organisation and supply chain representatives.

Examples include guidance notes on inspections and classification of defects, ‘hand-back’ of information from schemes, ground-related hazards and procurement of ground investigation. Knowledge manuals are produced as required by the business.

4 Geotechnical Asset Data and Information

4.1 Data and Information Needs

Deciding what data to capture and how to capture it is very important and can have a significant impact on the ability to manage the asset.

The Highways England geotechnical asset maintenance standard CS641 was written by engineering geologists. Naturally, the focus was on capturing data that

would help the engineers understand what comprised the asset e.g. type, geometry and geology/earthworks fill materials (i.e. what and where). The assumption was that the geology would provide useful insights into the composition and, therefore, the deterioration of the asset. The detailed, engineering focus is a common theme in Highways England's asset processes and is understandable, especially given the time in which they were created (i.e. prior to asset management becoming a mainstream activity).

Being able to answer questions such as: 'where are the earthworks constructed in London Clay with a slope angle of 26° and height greater than 2.5 m?' seemed important to be able to assess the risk of asset failure. Questions such as these are still valid, and it can help prioritising risk-based activities, such as inspections. However, it is better recognised now that the geotechnical assets serve a purpose, and they should be considered in terms of what they do, not just what they are.

In order to establish data and information needs, it is a useful exercise to set out the key questions that should be answered. These can be broken down into 'who', 'what', 'where', 'when' and 'how much'. For example: 'who is responsible for inspection?', 'what is the total length of the asset?', 'where are certain types of assets?', 'when were assets last inspected?' or 'how much does it cost to maintain the asset?'.

Statutory and legal requirements should also be considered. For example, recording reasons why inspections could not be carried out may be important for defence against third party claims. It will often be found that the engineering information actually forms a small part of the overall information requirements, which will be largely concerned with governance and process.

Data itself needs to be managed. The more data that is collected, the more onerous the data management becomes. Therefore, data should only be captured if it has a defined purpose.

Highways England set out to collect inventory and condition information about its geotechnical assets to help operational teams manage the assets in terms of prioritising maintenance and renewals activities, as described below.

4.2 Asset Type and Modelling

At an early stage Highways England defined its primary geotechnical asset types as embankments, cuttings, at grade and bunds. The definitions of these asset types are set out in CS641 and depend on elements such as minimum height, breaks at structures and differences in geology.

In reality, it is very difficult to truly define an asset in this way, because there is seldom a distinct boundary, even at some structures (e.g. large culverts). In practice the use of these distinctions in assets types, whilst of interest, is not used for decision support, e.g. the proportion of a length of embankment to at-grade section is not an important consideration.

The distinction, or limiting height, between a Major Earthwork (cutting or embankment) and an at grade section was set at 2.5 m. This was based on work carried out by Perry [13] and is derived from tendency for assets to develop defects above this height rather than an engineering definition.

Geotechnical assets tend to be designed and constructed as discrete units (e.g. a cutting, or embankment) but in the context of asset management and maintenance, they

are managed as sub-sections, e.g. parts of "an asset". It does not make sense to replace or repair a whole cutting, just because one section of it has failed. Thus, it can be more helpful to treat "the asset" as a continuous length of earthwork, which has different characteristics.

When discussing geotechnical assets, there is a natural tendency to concentrate on the visible asset, e.g. slopes and associated slope defects such as landslips. This can result in efforts being focused on the known defects and hazards. However of equal or greater importance are the buried defects that tend to reveal themselves suddenly. These buried defects include, for example, solution features and historical mining. Areas of untreated, soft ground and poorly compacted earthworks also present potential buried defects; however, these tend to result in slow, progressive failure.

It is important that potential buried defects should be included in the risk-based approach and the data associated with such features should be captured. The use of remote sensing techniques may aid identification of areas of hazard and/or movement and monitoring.

Highways England took a decision to model the geotechnical asset as a series of linear features (earthworks). This includes low height earthworks, such as at-grade sections. The earthworks are defined by start and end (Ordnance Survey) co-ordinates. The straight polyline that is defined by the two points is then projected onto the road centreline, such that the linear feature follows the road layout.

This simple model has proven to be very well suited for the nature of the asset, with some minor drawbacks, particularly where there are compound geometries. Suggestions have been made to move to a segmentation of assets, a polygon model, or even a 3D representation. This however would significantly increase the amount of data to be captured and managed, with little benefit to the asset management process. More data does not necessarily mean better decision making.

4.3 Data Capture/Inspections

Physical inspections are the primary means to capture inventory and condition data for existing assets. They are carried out by trained personnel and approved by suitably experienced geotechnical engineers and engineering geologists. Data such as geometry, and defect observations are recorded.

During the initial (principal) inspections, the geometry was recorded at significant changes in slope type/angle/height etc. and not at set intervals. Attempts were made to auto-populate some of the inventory data, using digital terrain models; however, these perceived "quick wins" required intensive checking for accuracy, and in the end the human eye proved to be a more reliable form of data capture.

After most principal inspections had been completed (c. 2009), repeat or refresh inspections were carried out, still at 20% each year. These enabled the data quality to be enhanced and deterioration to be tracked, based on the lessons learned from previous years.

Data captured in the field is tagged as "preliminary" until it has been approved following a review. It is then deemed acceptable for decision making purposes in the business.

As discussed in Sect. 3.2, during the period 2014/2016 Highways England moved to a risk-based approach to asset management. Inspections were therefore prioritised, based on an assessment of risk, rather than 20% by rote. A system of return frequencies was established of between one and ten years, depending on a suite of influences that were assessed to quantify risk. This enabled resources to be targeted and involved less time for personnel to be exposed to live traffic. A timeline of physical inspections is shown in Fig. 5.

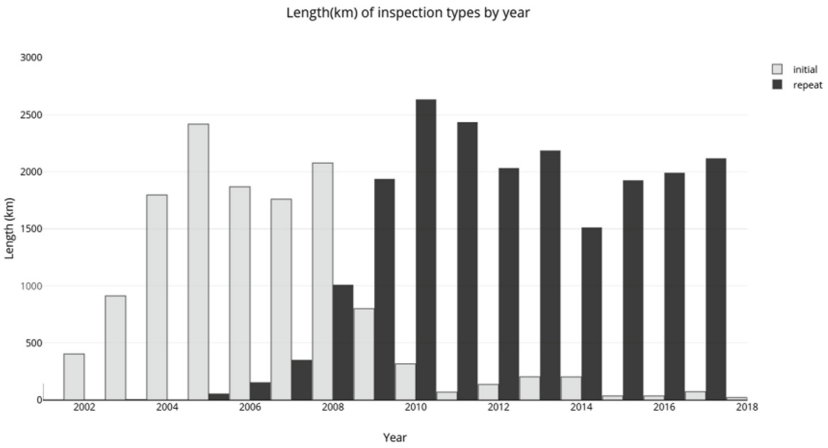

Fig. 5. A timeline of principal inspections (length of inspection per year, by type).

4.4 Data Quality

Data quality is arguably the most important aspect of any information system. Defining data quality can be difficult. The terminology used isn't always consistent and the difference between the quality of data and information isn't understood. ISO5500 [10] is not particularly prescriptive about data quality but it does require data quality to be part of the asset management system. Other useful guidance on the management of geotechnical information is presented in BS8574 [4]. While it was primarily written for project information, the principles apply equally to asset management.

Highways England has periodically reviewed the quality of the geotechnical data it holds. Some of Highways England's requirements for data quality are set out in the ADMM, however the accuracy of information and consistency are not currently defined. Essentially there are two aspects to quality: the accuracy of information and the validity of data. Supporting these, there is consistency of data, i.e. keeping data the same wherever it is stored in different systems (to be avoided if at all possible) and the governance of data, including its collection, approval and reporting. The governance of reporting is often the most overlooked aspect.

Reporting of data should be accompanied by the metadata associated with the process of reporting i.e. the date/time of the data snapshot, the system(s) from which the data was obtained. The tools used to generate the report, the person who processed

the report etc. As mentioned, this information is often overlooked, however it is very important because it provides traceability and repeatability, which enhances confidence data and in the report.

4.5 Other Available Geotechnical Information

In addition to the data collected about the existing assets during inspections, Highways England holds information relating to the acquisition and maintenance of the asset. This data takes the form of geotechnical report records (unstructured information) and the ground investigation data in Association of Geotechnical and Geoenvironmental Specialists (AGS) format (structured information).

Approximately 17,000 records are held in PDF format and are available to the supply chain through an online viewer within HAGDMS. The reports are produced in accordance with the Highways England standard for managing geotechnical risk CS622 [10]. The report records were initially scanned from paper copies as some the reports date from the 1960s. Since 2008 all reports are produced into PDF from native file formats.

The AGS format, which has been mandated by Highways England, has been widely used in the United Kingdom since 2000. The data is used when planning ground investigations and works. It allows designers to create graphs, charts and 3D models to build conceptual ground models. The re-use of the report records and AGS format data provides significant cashable benefits to Highways England in the form of avoiding duplicate investigations and abortive works. HAGDMS currently holds 774 AGS files, which have been shared with the British Geological Society to make the information available more widely.

5 The Use and Re-use of Data

5.1 Support to Asset Acquisition

During the acquisition phase, existing geotechnical data are used by Highways England and its supply chain to support development of planning, design and construction of new assets or renewal of existing assets. The re-use of existing data generates significant cost benefits through managing risk and avoiding duplication of investigation works. The re-use of data in the AGS data format is especially useful, enabling the design team to rapidly create conceptual geological and geotechnical models, by importing the data into visualisation tools.

5.2 Support to Decision-Making

Geotechnical data and information are used to inform decisions that are made during the asset management process. Informed decisions, based on reliable data provide correct prioritisation of schemes, credibility for funding, and schedules for maintenance and renewals.

Highways England uses decision support systems, i.e. the suite of processes, information systems, documents, risk frameworks and algorithms (tools), to enable informed decisions to be made. In the context of geotechnical asset management these are:

1. Inspections scheduled according to a risk-based approach.
2. Interventions programmed on an annual basis with a rolling 5-year horizon, using a risk-based approach, included in the GeoAMPs (Geotechnical Asset Management Plans) and supported by the inspection information.
3. Schemes put forward using a value management approach, considering cost/benefit.

The above decision processes support the day-to-day maintenance of the asset at an area or regional level. Long term planning i.e. five-year business case funding for the geotechnical asset at a national level uses the inputs, namely the GeoAMPs from an appropriate point in time. Highways England does not use an algorithm to generate scheme or spending decisions.

Work has been carried out to determine whether deterioration modelling could help with this, but the results to date have been inconclusive. Further work, possibly on a cross infrastructure, national, or international level needs to be undertaken to establish reliable deterioration models. In the rail sector, Network Rail, the largest rail infrastructure owner in the UK, has developed an operational, data-based deterioration model, which was used as the basis of a near £1bn investment funding case [15]. A long term research initiative is the ACHILLES project looking at bringing together new advances in research and technology with design and asset management practices from different long linear assets (LLAs) to reduce the risks posed to infrastructure systems by deterioration of geotechnical assets [12].

It is important to highlight that much of this data is also invaluable for network improvement assessments, managing the interface with third parties (e.g. service crossings and adjacent development) and contributing to national geological/geotechnical knowledge. These wider applications stretch and challenge the breadth and complexity of specific data that is currently captured.

6 Challenges and Opportunities

In 2017, Highways England commissioned a project to examine the way that it manages geotechnical information [1]. The project looked at how data and information are shared throughout the asset management processes, including desk studies, ground investigations, monitoring, design and construction and asset maintenance. The review identified and prioritised continuous improvement activities that are currently being implemented.

Findings highlighted a series of challenges and opportunities related to the use of geotechnical data that exist within Highways England, its supply chain and the wider industry. These are summarised below.

There are challenges associated with Highways England being in a regulated environment, where it is important to provide evidence that management is effective in achieving agreed outcomes, also in supporting future investment proposals.

Highways England is transforming the way it uses data to optimise operational practices. Geotechnical data and information are typically collected during site investigations and the exchange of this data uses manual transfer between parties. Data is still communicated via PDF and AGS formats, which is adequate for final report records. However, these formats do not leverage the information obtained during the site investigation because PDF is a static format and there is a lack of online, suitable visualisation tools.

Another challenge for Highways England is that research information is not easily accessible due to the format (typically PDF) in which it is held. However, there are ongoing efforts to disseminate knowledge products more effectively and to make them available to the business and its supply chain via a dedicated website called Supply Chain Portal.

Whilst the awareness of the importance of good data management is increasing, the adoption of relevant standards such as BS8574 [3] is generally slow. There is a significant opportunity around improving the data transfer process using technology and innovation.

Traditionally only used for typically limited to drilling and logging activities, mobile data capture has great potential to increase productivity in the industry.

Building Information Modelling (BIM) has been a high-profile initiative to increase the use of data throughout the construction industry. The development of BIM is just starting to include ground investigation data.

National asset infrastructure owners typically have siloed approaches to asset information. This hinders cross infrastructure cooperation and increases complexity and costs in the supply chain. Industry-wide collaboration is needed to break these silos, together with a more open approach to data sharing.

7 The Future

7.1 Ongoing and Planned Initiatives

Highways England is in the process of updating its asset information systems, including HAGDMS, which will be known as Geotechnical & Drainage Management Service (GDMS). Technology has moved on in the seventeen years since the system was first launched and the business needs have developed. Some of the old functionality will be deprecated and the system will be streamlined and modularised to ensure that it can be updated easily in the future. The mobile data capture software and hardware will be updated, and the mapping interface will be upgraded to be able to access the wide range of Web Map Service (WMS) data sources available, such as the British Geological Survey and Coal Authority. This will reduce support costs and ensure that the third-party data is up-to-date.

Regarding inspections, gaining access to the road network is becoming increasingly problematic due to the introduction of all-lane running (Smart Motorways). The health and safety issues of working on a live carriageway are sometimes difficult to justify. Alternative methods of inspection and monitoring are therefore being explored, such as the use of LiDAR, InSAR and other remote sensing technologies. Instrumentation with

wireless data communications is likely to be used extensively to provide real-time monitoring.

Activities that are planned in the short term include:

- Improved access to Highways England's data and clarity about data requirements.
- Improved re-use of geotechnical data and use it to inform asset management decisions.
- Increased support to the supply chain to innovate and improve data quality/collection speed.
- Improved use of geotechnical data to increase the resilience to geotechnical events.
- Improved understanding of ground-related hazard.
- Improved procurement of ground investigations.
- Standardisation of industry-wide data requirements.
- Development of digital exchange of ground models.

7.2 Vision and Roadmap

Highways England has developed a vision 'to be a leading organisation in the management and provision of geotechnical information', so that it can be used optimally to operate and maintain assets. To achieve this vision, activities need to be undertaken in the key areas presented in Table 1 below.

Table 1. Key areas for improvement.

Theme	Activity
Training	Communicate Highways England's requirements for geotechnical data and equip the supply chain with the tools necessary to meet these
AGS Data format	Develop processes for data to be transferred and communicated consistently
Access to information	Coordinate and centralise geotechnical information so that it is readily available for relevant stakeholders
BIM	Work with the industry and other asset owners to establish consistent data structure for BIM requirements to be met
Data quality	Establish and embed geotechnical data/information quality processes and controls

The combined elements of the vision will provide Highways England with the tools to align to the principles of ISO55000, BS8574, and general best practice in information management.

A route to achieving that vision is shown in Fig. 6 and the goals and associated benefits are described in some detail in Table 2. The people involved, be they Highways England staff or designers, asset managers or ground investigation contractors, will be key to the successful implementation of the vision and roadmap.

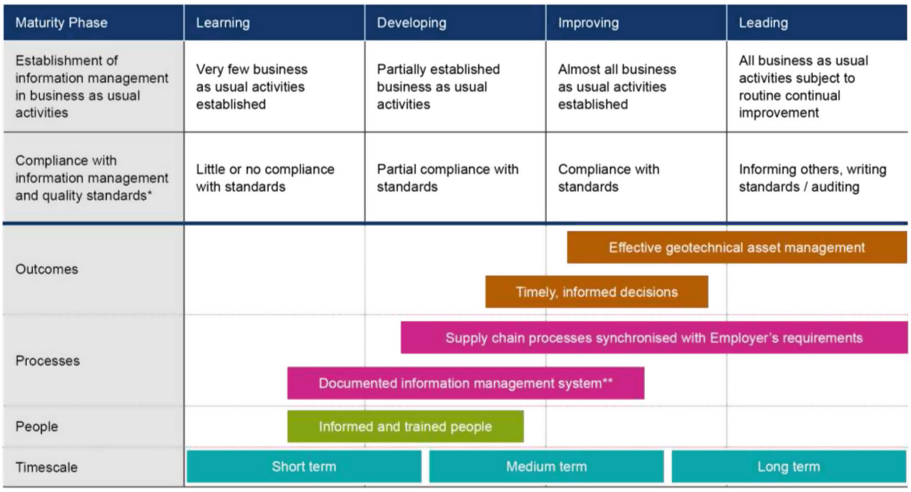

Fig. 6. Geotechnical information as an asset - maturity roadmap.

Table 2. Goals and benefits of improved use of geotechnical data and information.

Goal	Benefit
Informed and trained staff and suppliers who understand the importance of geotechnical data and information	An appropriate skill level of people is critical in delivering geotechnical information improvements
Documented geotechnical information and data management system	Forms the bedrock of decision making and informs stakeholders of the requirements and processes. Regular audits should be undertaken to ensure awareness is maintained
Geotechnical data stored and visualised in a way that allows easy access for analysis	Being able to rapidly assimilate geotechnical information is crucial for the efficient delivery of schemes
Leaders in geotechnical information management	Highways England should be at the forefront of geotechnical information management to drive productivity in the sector using mobile data capture, interoperability, re-use of data and visualisation of information
Easy transfer of geotechnical information and data between schemes and the maintenance environment	Technology currently exists to enable easy transfer of data however it is not being used. Interoperability between software systems will greatly reduce time spent importing/exporting - support to BIM goals

8 Conclusions

Geotechnical data and information have a key role in supporting and enabling asset management activities. This is particularly true for geotechnical assets, which have a long lifespan (60+ years). Availability of good quality data is key to support decision making over the whole life cycle and to facilitate effective, risk and criticality-based maintenance and renewal interventions.

Since 2000, Highways England, and its predecessor Highways Agency, have been trailblazers in investing resources and funds to set up the necessary governance, standards, processes and tools to enable effective geotechnical asset management.

There are challenges ahead but also opportunities, particularly associated with rapidly evolving technological solutions for faster data acquisition, transfer, storage and management. Collaboration among Highways England, its supply chain and the wider industry will be key to overcome these challenges.

Geotechnical data is an asset that has tremendous, potential value for Highways England and other geotechnical asset owners. However, the potential can only be realised if continued investment and improvement is delivered to ensure that the right data is captured, stored, managed and re-used. Improved asset knowledge will lead to more informed decision-making, resulting in greater efficiencies and, ultimately, to a safer, more resilient road network.

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