



Asset Information Strategy

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Local Government Engineering Department

Local Government Division

Ministry of Local Government, Rural Development, & Cooperatives

Government of the People's Republic of Bangladesh



Local Government Engineering Department

Asset Information Strategy

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This Asset Information Strategy (AIS) is cocreated by the Local Government Engineering Department (LGED) and the United Nations Office for Project Services (UNOPS) under the National Resilience Programme (NRP).

The NRP is a joint programme of UNOPS, UN Women, and UNDP in partnership with the Local Government Engineering Department, Department of Disaster Management, Department of Women Affairs and Programming Division of the Government of Bangladesh (GOB). The Programme is funded by the governments of the UK, Sweden, and Bangladesh.

The AIS is an integral part of LGED's overarching Asset Management System (AMS), highlighting the significance of asset information as a fundamental enabler for decision-making and planning in asset management. This strategy evaluates the current state of asset information management for road pavement and structures, identifies best practices, and proposes actions for LGED to enhance its practices while maintaining a clear view of the organization's objectives.



Executive Summary

Infrastructure is a central pillar for sustainable and resilient development. Physical infrastructure assets provide a means for delivering essential services and play an important role in enhancing and protecting the lives and livelihoods of people and for the developing economy to thrive in Bangladesh.

The Local Government Engineering Department (LGED) under the Ministry of Local Government, Rural Development & Cooperatives is responsible for planning, developing, maintaining and managing local level rural roads, urban and small-scale water resources infrastructure nationwide. LGED recognizes that it is essential to manage assets to sustainably deliver appropriate levels of services to the community and to meet the expectations and needs of the present and future generations.

LGED's strong commitment to fulfilling this responsibility is evidenced by the development of an integrated, interdisciplinary Asset Management System (AMS). Asset Management (AM) provides a new lens through which LGED can refocus strategies and resources to deliver sustainable long-term value and performance from the local level infrastructure assets.

The Asset Information Strategy (AIS) is a key component of the AMS and aims to outline the importance of Asset Information as a core enabler for Asset Management decision making and planning.

This Strategy has assessed the current situation of asset information management for road pavement and structures. It recommends what constitutes best practices, and suggests actions which should move LGED to make improvements with a continued focus on line of sight to the organisation's outcomes. This is built on an already strong base of many years of good data management, and it is felt that within five years LGED could have moved forward significantly creating a strong enabling platform for good asset management.

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Glossary of terms

Term (Acronym)	Definition
Asset Information (AI)	A combination of data about physical assets used to inform decisions about how they are managed, both for short-term operational purposes and for long-term strategic planning.
Asset Information Lifecycle	The Asset Information Lifecycle is represented by stages involved in the management of information: Specify, Assess, Store and Improve (including archive, capture and update), Use.
Asset Information Strategy (AIS)	The AIS provides a high-level approach and direction for the definition, collection, management, reporting and overall governance of its asset information. It should clearly articulate the link between asset information and its role in achieving asset management objectives.
Asset inventory / register	A catalogue (often a database) of all physical assets relevant to an organisation.
Asset Management (AM)	The coordinated activity of an organisation to realise value from its assets. Asset management involves the balancing of costs, opportunities and risks against the desired performance of assets, to achieve the organisational benefits.
Asset Management Plan (AMP)	Documented information that specifies the activities, resources and timescales required for an individual asset group to achieve the organisation's asset management objectives
Asset Management System (AMS)	An asset management system is a set of interrelated and interacting elements of an organization, whose function is to establish the asset management policy and asset management objectives, and the processes needed to achieve those objectives.
Audit	Systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which the audit criteria are fulfilled
Condition data	Assessment of the physical condition of an asset independently of its performance
Data	Numbers, words, symbols, pictures, etc. without context or meaning, e.g. 25 meters
Data quality	The following dimensions are associated with assessment of data quality: Accuracy, Completeness, Validity, Consistency, Timeliness and Uniqueness.
Geographical Information System (GIS)	GIS - generic name for computer systems which store and analyse data using spatial information and relating this to underlying map

Term (Acronym)	Definition
	information
Information	A collection of data expressed with a supporting context e.g. The span of the bridge is 25 meters
Information management	The means by which an organisation maximises the efficiency with which it plans, collects, organises, uses, controls, stores, disseminates and disposes of its information and through which it ensures that the value of information is identified and exploited to the maximum extent possible.
Information technology	The technology used to support business functions and process e.g. applications and software.
Knowledge	A combination of experience, values, information in context, and insight that form a basis of decision making. It can also refer to the process of comprehension, comparison, judgment, memory and reason
Level of Service (LoS)	Parameters, or combination of parameters, which reflect social, political, environmental and economic outcomes that the organisation delivers.
Local Government Engineering Department (LGED)	Local Government Engineering Department
Monitoring	Ongoing measurement activities over time to maintain awareness of the state of a process, entity or system.
Performance data	Assessment of the performance of an asset independently of its physical condition.
Risk Management	A coordinated set of activities and methods used to monitor and control the many unplanned events that can affect an organisation's ability to achieve its objectives. It includes the identification, assessment, prioritisation and treatment of risks to reduce, monitor, and control the probability and/or consequence of unwanted events or to maximise the realisation of opportunities.
RSDMS	Road and Structures Data Management System
Strategic Asset Management Plan (SAMP)	Documented information that specific how organisational objectives are translated into asset management objectives, the approach for developing asset management plans and the roles of the asset management system in supporting achievement of the asset management objectives.

1. Introduction

1.1 Scope and Objectives

The Asset Information Strategy (AIS) provides a high-level approach and direction for the definition, collection, management, reporting and overall governance of its asset information. A significant amount of work has already been completed within the Local Government Engineering Department (LGED) over many years with the development of Asset Information databases, its analysis and establishment of many information related protocols. The Strategy will align this existing capacity and future AM direction and goals as set out in the Strategic Asset Management Plan (SAMP), and suggest actions to reach those from the current status.

1.2 Relevant Documents and Standards

The documents and standards that should be read in conjunction with the AIS are:

- LGED Asset Management Policy (2019)
- LGED Strategic Asset Management Plan (2020)
- LGED Asset Management Plan – Roads (2020)
- LGED Asset Management Plan – Bridges (2020)
- LGED Rural Road and Bridge Maintenance Policy (2013)
- Road Design and Pavement Standards of LGED (2019)
- Road Design Standard (Rural Road) (2004)
- LGED Training Manual on Road Maintenance Management (2008)
- LGED ICT Systems Survey (2018)

1.3 Implementation and Review

This is the first AIS prepared by LGED. This AIS will be reviewed after three years in order to refine and adapt the AIS through an iterative process. Any urgent changes identified during implementation however can be completed in advance of this. This review is centred around achieving a satisfactory level of quality and achievability. Review intervals will be re-evaluated after 3 years, and could be increased owing to changing business needs, constraints or environmental, political or technological changes.

The Head of Asset Management Committee will be responsible for the AIS being appropriate, accurate, achievable and shall ensure that this document is reviewed and updated as necessary. Continual improvement of the AIS will be achieved in collaboration with key stakeholders within LGED.

2. Asset Management Context

LGED will effectively and efficiently manage local infrastructure through a comprehensive Asset Management System (AMS). The AMS will provide a structured, long term approach to manage local infrastructure to contribute to improvements in financial, social, economic and environmental performance.

Key components of the AMS are:

- Asset Management Policy;
- Strategic Asset Management Plan (SAMP); and
- Asset Management Plans



Figure 1: Policy, SAMP and AMPs line of sight in accordance with ISO55000

2.1 Asset Management Policy

LGED’s Asset Management Policy (2019) provides the first stage of ‘line of sight’ between LGED’s organisational mission, vision, and objectives and infrastructure asset interventions. LGED’s Asset Management Policy Statement is as follows:

‘LGED is committed to sustainable asset management, complying with all legislative and regulatory requirements, to contribute to improved resilience and delivering services to current and future generations by managing risk, optimising performance and managing expenditure on infrastructure assets throughout the whole of asset lifecycle.’¹

¹ LGED Asset Management Policy (2019)

2.2 Asset Management Objectives

It is the intention that the LGED's Asset Management principles and objectives, presented in the SAMP are translated through the AMPs into the practices below:

- Asset management decisions to complement strategic planning objectives;
- Asset management decisions adopt risk-based maintenance approaches;
- Empower LGED to start proactively managing their assets;
- Provide justification for future investment and manage level of service for assets;
- Ensure road networks, other infrastructure and assets are managed at optimum cost over the longer term;
- Provide a platform for research, innovation and development of asset management good practice;
- Establish accountability for asset condition and performance.

It is recognised that the AMPs provide a number of Asset Management approaches, some of which are not being practiced yet.

The SAMP outlines the purpose of the AIS will aim to define and describe:

- The importance of asset information;
- The asset information objectives and why asset information is necessary for business decisions;
- How the AM Objectives will be achieved through effective decision making;
- The lifecycle of asset information;
- Understand asset information stakeholders and their needs, roles and responsibilities.
- Improve asset data through an accurate asset register, with condition and criticality ranking (risk of failure and consequence)
- Deployment of cost-effective methods and tools to collect data;
- LGED will, where possible, move away from paper-based data collection and reporting and move towards digital methods to improve the speed, accuracy and reliability of data. This also aligns with the sustainability goals.

2.3 Asset Information Scope

2.3.1 Introduction

The Institute of Asset Management (IAM) defines asset information as:

“Combination of data about physical assets used to inform decisions about how they are managed, both for short-term operational purposes and for long-term strategic planning.”²

² Institute of Asset Management – Anatomy of Asset Management (v. 3)

Effective asset management planning requires knowledge of an asset, its condition and its use. This entails the collection and maintenance of asset data that can assist asset managers to assess, analyse and report on performance and progress. Good asset data is the foundation on which asset management processes are built (see Figure 2). The availability of appropriate asset data allows all staff involved in the process to obtain an overall view and to apply a consistent management approach.

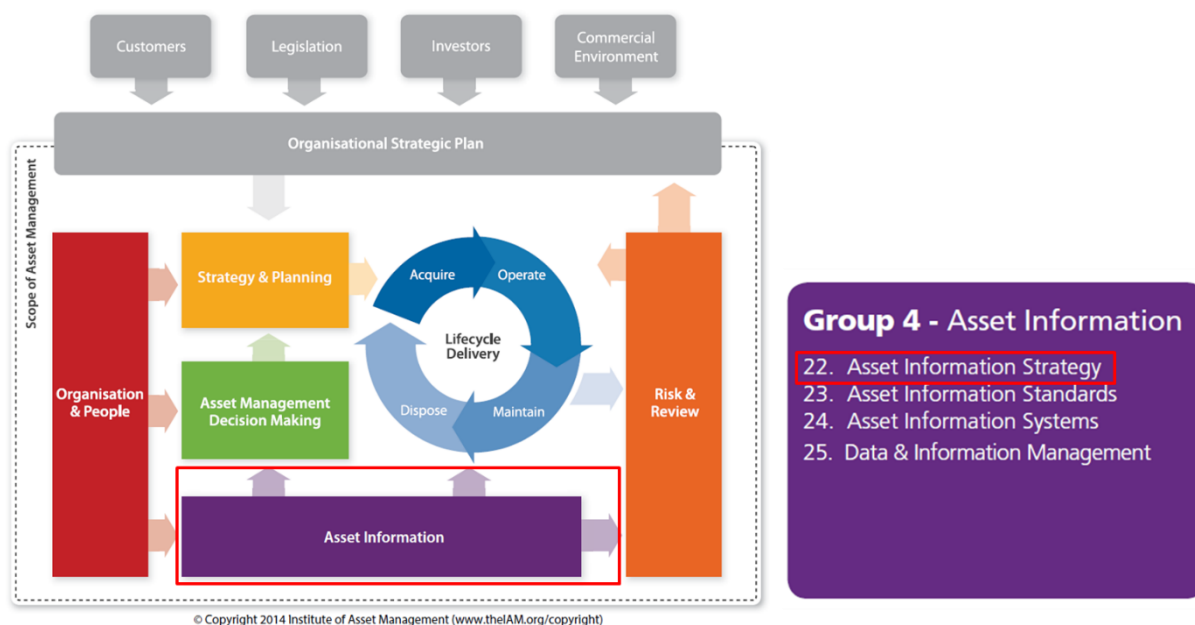


Figure 2: Role of asset information in the IAM Anatomy of Asset Management

2.3.2 Asset Information Principles

In order for LGED to realise the full benefits from an asset information management strategy it must first define a set of guiding principles by which LGED will approach asset information management. These principles will cover all asset types and form the 'rules' by which asset information will be managed and therefore capable to assess the current and desired status against these. In doing so, LGED will eventually achieve the necessary quality of asset information it requires to make effective decisions about its assets and ultimately the organisational outcomes. There are many examples of such Principles in several large asset management organisations which are similar in content. It is proposed that LGED adopt the Highways England Asset Data Principles³ as this organisation most closely aligns to LGED's AM business goals.

³ Highways England – Asset Data Management Manual: Data Principles and Governance v10

Table 1: Guiding Principles on Asset Information

#	Asset Information Principle
1	Formalise the governance of asset information management activities & improvement initiatives.
2	Define our requirements for asset information including responsibilities for its completeness & accuracy
3	Collect and update appropriate asset information in a timely and efficient manner.
4	Store asset information in a master repository & make information accessible to relevant parties cognisant of any security requirements.
5	Enable the use of asset information to inform intelligent decision making and operation of physical infrastructure assets.
6	Develop our staff & stakeholders to have the capability to engage with all stages of the asset information process and use information appropriately.

2.2.3 Asset Information Management

Figure 3 outlines the various elements and lifecycle of asset information management to be considered within this Strategy. Broadly this falls under three main categories which will be described in more detail in the following subsections:

1. **Organisational Outcomes & drivers:** as per the core ISO55000 line of sight principle, LGED’s organisational outcomes are critical also for asset information management. It is important that LGED’s business drivers and the decisions required to achieve those are based on the appropriate information.
2. **Asset Information Lifecycle:** like any asset, information has a lifecycle of its own as well, starting from specification to quality (condition) assessment, storage and finally use of information to enable decision making.
3. **Core Enablers:** at all stages in the AI Lifecycle there needs to be appropriate people, processes, technology and a culture instilled that asset information is important, for each stage of the Asset Information Lifecycle to be successful.

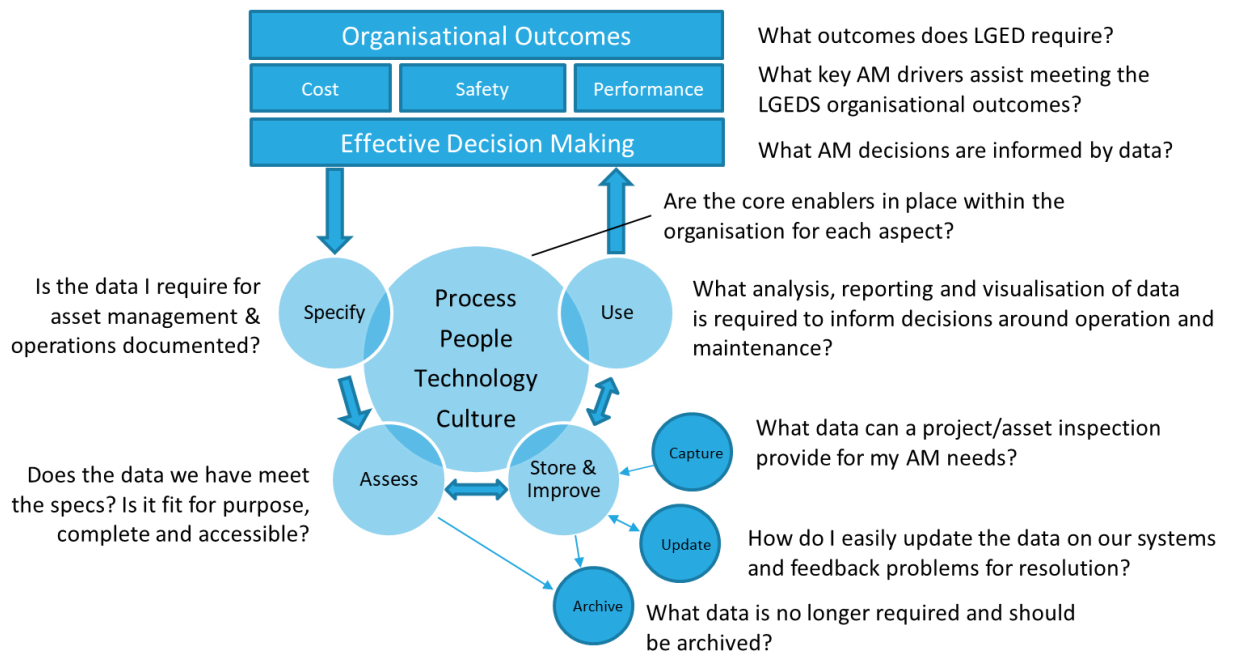


Figure 3: Elements of asset information management

2.3.4 Organisational Outcomes

These are LGED’s organisational high-level objectives and are contained within the Asset Management Policy. All other asset management objectives should have a line of sight to these organisational outcomes. In the LGED AM Policy Statement this is outlined as:

“LGED is committed to sustainable asset management, complying with all legislative and regulatory requirements, to contribute to improved resilience and delivering services to current and future generations by managing risk, optimising performance and managing expenditure on infrastructure assets throughout the whole of asset lifecycle”

This ambition is clearly articulated within this statement and in order to achieve this aim, many aspects rely on the confidence and accessibility of high quality asset information. It is only possible with such a large asset base, by the storage and analysis of asset information to determine whether regulatory alignment and improvements in resilience and reduced risk have been achieved through asset management interventions.

LGED AM Policy

“LGED is committed to sustainable asset management, complying with all legislative and regulatory requirements, to contribute to improved resilience and delivering services to current and future generations by managing risk, optimizing performance and managing expenditure on infrastructure assets throughout the whole of asset lifecycle.”






Asset Management Objectives		AM guiding principles				
		 Supporting economic and socio-economic activity	 Sustainable environmental practice	 Enhanced equal empowerment of men and women	 Resilient infrastructure and disaster response	 Climate Change
Implement	a structured Asset Management System consistent with the requirements of ISO55000 integrating all LGED’s functional units	●	●	●	●	●
Adopt	holistic, risk based investment practices utilising accurate and relevant asset information	●	●	●	●	●
Understand	the risk represented by and the performance requirements of local level infrastructure in order to improve delivery of investment programs, maintenance and operational works.	●	●	●	●	●
Deliver	effective Asset Management activities that positively contribute towards national commitments and the UN Sustainable Development Goals.	●	●	●	●	●
Prioritise	programs, projects and activities which deliver increased resilience and reduces vulnerabilities to shocks and stresses	●	●	●	●	●
Integrate equality	by incorporating gender needs into planning, design and operation of assets and reducing vulnerabilities, through increased participation and engagement of females	●	●	●	●	●
Generate data	which is consistent, integrated, accessible and reliable across LGED and develop data management principles and governance	●	●	●	●	●
Promote	community awareness of critical infrastructure in place and the importance of resilience with respect to climate change and disaster events.	●	●	●	●	●

Figure 4: LGED Asset Management Objectives (from SAMP)

2.3.5 Organisational Drivers

These are the key indicators and/or drivers which are essential for LGED to meet its Organisational Outcomes. They are usually measurable and reported upon regularly to manage and identify any change for better or worse.

Within LGED the AM Objectives outlined within the SAMP can be condensed into three core organisational drivers which can be measured and assessed namely:

- Safety
- Cost
- Performance

Each one of these core drivers will match some or all of AM objectives and thus in part deliver the AM guiding principles, e.g. a safe, well maintained road network within budget, can be measured in its effective performance to deliver socio-economic benefits, be resilient to external climatic factors and be within environmental regulation. The link between these is important to determine and document, in order to identify the key indicators to measure and report.

2.3.6 Effective Decision Making

These are the decisions made by stakeholders which are based on asset information to ensure that the appropriate maintenance regimes and operations are occurring. The decisions taken by the LGED officials vary considerably depending on their positions and posting locations. HQ are concerned more about the finances and managing budgets across the country, whereas field offices are concerned with direct interventions to improve asset performance such as resurfacing. Both are based on data but its manipulation and reporting granularity will vary.

2.3.7 Information Lifecycle

This section describes each element of the Asset Information Lifecycle and its importance. The best practice anticipated for each element though is presented in Section 5.1 later in this document.

2.3.7.1 Specify

The specification of assets required to be stored and managed within LGED's systems should be driven by the information and knowledge needed for effective decision making. This often exists as an Asset Information Specification which describes the asset characteristics to be stored, the asset hierarchy and the attribute information about the asset (i.e. data describing the asset). This usually constitutes the what, where, condition and performance aspects of an asset and how they are related to each other.

This specification is of critical importance as it is used to assess data quality and define information requirements for providers of data both internally and externally to the maintainer (e.g. development projects).

2.3.7.2 Assess

There is a tendency to think of data quality as either good or poor but in reality there are different attributes that combine when considering data quality. Each of these attributes are important in understanding data quality and therefore the confidence that should be placed in using the data for an intended purpose. These attributes are:

- **Completeness** – the degree to which a dataset is populated with all the required data. This relates to the presence of a record as well as the degree to which the mandatory attributes are completed.
- **Accuracy** – whether the data record is a correct reflection of the asset it is related to.

- Consistency – data should be consistent across different datasets. Identifiers should be the same and the record should be representing the same physical entity.
- Uniqueness – there are no duplicate records in the system. Records represent a physical entity once in the system.
- Validity – the data adheres to the rules outlined in the data model. This can be ensuring the correct codes are used or ensuring relationships between records are valid.
- Timeliness – data should be available when decisions need to be made. This means that the time taken between an asset being added, removed or modified and the update of the asset register record is appropriate for the intended use of the data.

The data currently held within the Asset registers should be assessed based on these attributes, starting with critical assets and their attributes. The assessment should be made using the asset information specification and input from data owners.

Once an assessment has been made and the quality of data is found to be compromised, then the cause of quality issues should be investigated carefully. The cause of failing to ensure data quality may be due to a shortfall in data governance, process, people and technology associated with the asset data management.

2.3.7.3 Store & Improve (including archive, capture and update)

The storage and constant improvement of asset information within asset registers and records management systems is a key stage in the Asset Information Lifecycle. The purpose of a data store is to ensure the asset information is available to all who require the information in a secure manner. This is either in its native asset register record structure or once it has been aggregated, filtered or presented graphically as an output from analysis and reporting.

To this end the asset store should reflect the asset information specification exactly, as this outlines what data is required by the business for effective decision making. However, this is not always the case with the asset/record registers developed in advance of specifications. The registers often have evolved over time and can contain too much information which is not systematically used, difficult to maintain and thus out of date.

It is essential that the critical assets and their attributes identified by asset owners are prioritised for maintenance and updated within the asset store first. The change to the asset will occur as a result of activity impacting the asset, whether that is through a development project or maintenance on the asset renewing or improving its condition. Missing or incorrect data should be picked up through the Assess stage of the Asset Information Lifecycle.

Data stores have typically grown organically and there is the real possibility that significant amounts of data currently stored, captured and maintained are not actually being used due to limited visibility of the data by the wider business. This data should therefore be archived to prevent wasted effort in its update and maintenance. The remaining data which is deemed to be critical and core to the business will then receive more time and attention and hopefully

its quality will improve as a result. Other datasets such as historical traffic information and traffic accident data should also be archived, for future analysis.

2.3.7.4 Use

Analytical tools (e.g. Power BI, GIS) and ever more powerful computing capability can harness the data stored for improved asset management, and therefore maximising its value to the various parts of the organisation. This utilisation of data enables effective decision making in order to meet the business outcomes as shown, which have driven its specification at the outset and thus coming full circle in the Asset Information Lifecycle.

For example, analysing asset information and performance data for trends together with root cause analysis of asset failure or condition degradation can result in more efficient maintenance and better targeted intervention strategies. Data profiling and analytics can also be used to highlight and improve data quality.

2.3.8 Core Enablers

2.3.8.1 People

The people within LGED are the ultimate implementers and benefactors of an asset information strategy and asset information management. Their commitment will determine the effectiveness of the strategy and therefore, the organisation's capability, competence and behaviour are critical. The structure of data ownership roles and responsibilities are also critical to the success of the implementation of improvements in asset information quality.

2.3.8.2 Process

The UK Institute of Asset Management's specific guidance on asset information states that:

"Most activities of an organisation should be specified and managed as part of an overall business process. Typically, data is an input to an activity, may be acquired or changed by that activity and then be an output from the activity."

Throughout the Asset Information Lifecycle there are many business processes critical to the success of the operation. These either rely on data as their input (as stated above) or describe the activity of data management itself. For example, a development project reflects a macro scale process of asset information change in its own right. It requires asset information for its design and culminates in a change to the physical asset which must be reflected in the asset stores, operations and asset condition reporting.

2.3.8.3 Technology

For effective asset information management, the systems and technologies adopted by the organisation should be driven by and contribute to achieving its business objectives. The storage of asset information within an Enterprise Asset Management system should support the asset management activities and effective decision making. The system's content should be informed by the Asset Information Specifications which documents the organisation's data requirements.

This technology not only includes the central systems but also the equipment used during condition inspections and in the field (e.g. mobile computing devices), and the software used for data capture and analysis. This technology should be fit for purpose, with training and suitably skilled operators available in the country, affordable and with access to suitable vendor support.

2.3.8.4 Culture

As identified in section 2.3.8.1, the way people approach asset information management is critical to robust, evidence based decision making that drives organisational outcomes. Culture refers to how people enact organisational policies and use technological platforms. An organisation's culture will improve if a strong purpose for asset information is communicated and people are enabled to contribute their efforts to support this purpose. Behaviour change requires that individuals can see how they can be personally benefited from those changes and are provided opportunities to act in ways that allow them to realise this benefit. Improving communication about the importance of an individual's role related to asset information, and the knock-on benefit to the organisation can also create a positive culture about asset information management.

3. Stakeholders

The stakeholders relying on asset information and the decisions and outcomes resulting can be divided into two main categories – external and internal stakeholders (see Figure 4). The following sections describe each type of stakeholder and their requirement for asset information.



Figure 5: Internal and External Stakeholders for LGED

3.1 Internal LGED Stakeholders

Based on the LGED organisational role flowchart within the Asset Management Plans, an assessment of key asset information stakeholders is possible. Figure 5 presents the various roles in the lifecycle of data management within LGED’s tiers of organisation. There will be

variation for each different asset type but this presents an overall summary. As a result of the roles outlined below, the needs of each level differ, as does the needs within a specific level e.g. HQ has a number of different roles in the various teams.

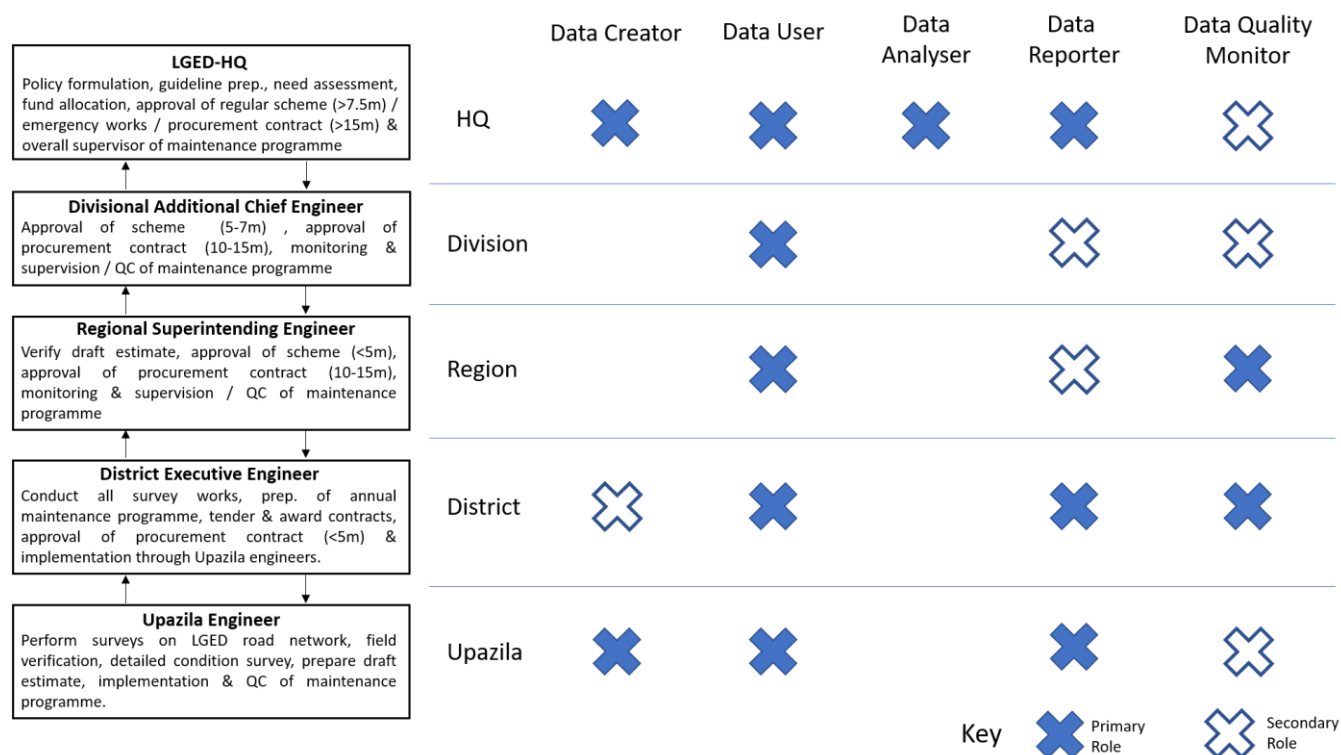


Figure 6: Asset Information stakeholder roles within LGED

3.2 Asset Information External Stakeholders

External stakeholders rely on LGED’s asset information typically in the form of generated reports or the outcomes of the asset management process. These stakeholders include different government ministries, divisions and departments including local government divisions, Planning Commission, Ministry of Finance, development partners, local communities or elected officials. They rely on the information provided by LGED to assist answering specific infrastructure related questions, preparing budgets, or understanding the future development of their community.

4. Current Situation Assessment

4.1 Assessment Approach

An assessment has been made of the current situation by looking at each element of the asset information management lifecycle as per Figure 3. Assessment has been made through a desktop review of existing asset management framework and official documents together with a series of structured interviews and meetings conducted within LGED offices during February 2020 (see Appendix A).

The various elements of the Asset Information Lifecycle were assessed and categorised with a Red, Amber or Green (RAG) status as described in the table below. The individual elements will be described in the following sections for both roads and structure asset types.

Table 2: Categorisation of the Asset Information Lifecycle

Status Colour	Description of Asset Information Management Status
Green	Good or best practise has been observed in this element of asset information management.
Amber	Currently acceptable practice has been observed but improvements or enhancements could be made.
Red	Poor or no evidence of this element being in place or practised and requires attention.

4.2 Roads Asset Assessment

The major asset by proportion of budget is overwhelmingly the road pavement asset management and therefore this has been considered independently of other assets. Therefore, the most focus in terms of asset information management and systems to date have been for this asset type.

Overall, the following assessment has been made of the Asset Information Lifecycle for the Road asset information represented in Figure 6 and described in the table below. This assessment is purposefully brief in order to present an overview of the current situation in each area.

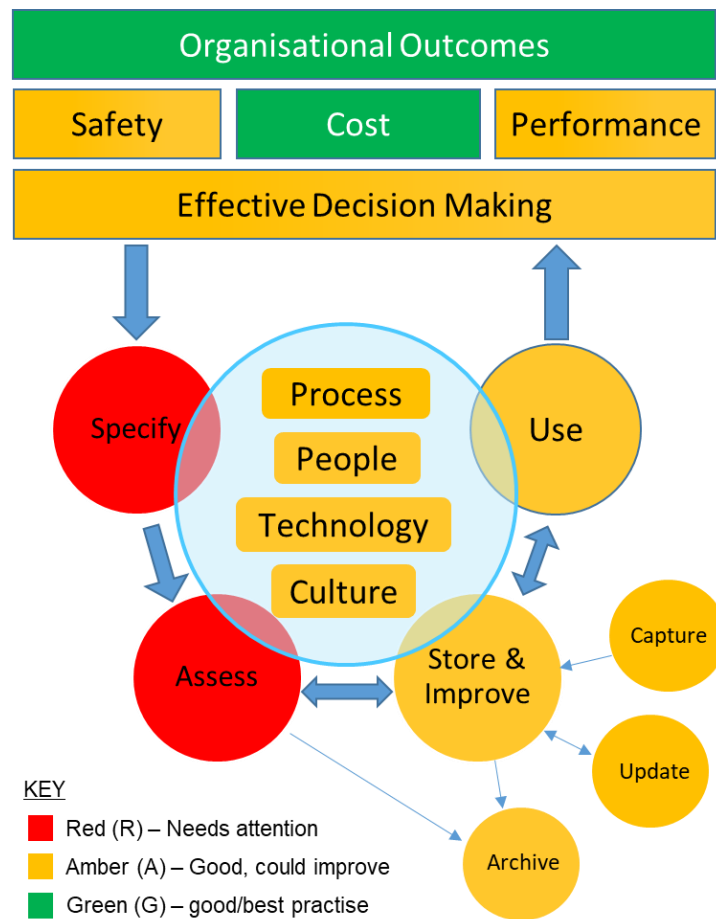


Figure 7: Assessment of the current Roads Asset Information Lifecycle

Table 3: Assessment of the Asset Information Lifecycle for the Road Assets

Element	Sub Element	RAG	Comment
Organisational Outcomes		Green	Asset Management guidance and objectives are well defined in the draft Asset Management Policy and Strategic Asset Management Plan (SAMP) but not yet widely disseminated. However, many of these objectives are already embedded within other key documents and guidance so understood within LGED to a degree, but without necessarily a link to asset management.
Org. Drivers	Safety	Amber	Stated in SAMP but traffic accidents are not consistently recorded and linked to the condition/operation of roads which sometimes could be a factor, and therefore an indicator.
	Cost	Green	Stated in SAMP, closely monitored and audited by LGED HQ and so is used as a main driver of the asset management function impact presently.

Element	Sub Element	RAG	Comment
	Performance	Yellow	Stated in SAMP but not measured, other than the serviceability of the road relating to its condition and accessibility. Opportunities could arise from SMART measurements linked to broader levels of service for socio-economic and environmental requirements for improved asset management
Effective Decision Making		Yellow	RSDMS assists by providing maintenance priorities (estimated that ~80% are unchanged in the final plan) but other aspects particularly around safety and broader performance could be assisted by better storage and use of the data captured.
Specify		Red	The information required for road AM decision making exists in the form of the RSDMS data schema. However, this database content is currently not fully documented and is an area for improvement to better communicate what is held in the database to enable wider use of the data stored. Other datasets should be specified first to meet the anticipated enhanced decision support for asset management in future. Equally this should benefit development projects in their asset information handover requirements.
Assess		Red	Data quality assessment is performed within the process of update and capture of road pavement data, and some assessments are performed by the various levels of LGED. However, without a specification describing the required data this assessment is, as a result, limited. There lacks a dedicated process to monitor the completeness and accuracy of data also held within the RSDMS.
Store & Improve	Overall	Yellow	RSDMS database is considered an essential resource for LGED. It has been well designed, maintained and relied upon throughout the LGED. The main area for improvement is that the current MS Access database could be migrated to a server based relational database with a web interface, and connections to other systems, all of which are planned by the ICT Unit (see UNOPS ICT Survey, 2018)
	Capture	Yellow	Vehicle mounted devices are used for capture of pavement roughness but this does not cover the whole rural road network. New development projects could also provide data directly to RSDMS (as a form of capture) if specified as a deliverable. This does not currently occur however, and the information is only updated after commissioning by field offices.
	Update	Yellow	Field office teams update RSDMS annually with road inventory, condition and planned activities, but often there are delays in updating information such as the actual maintenance activity conducted. Other important information such as traffic counts are also not being updated according to the schedule suggested in the respective manuals/guidelines. This leads to data quality issues and a knock-on effect to its effectiveness in decision making.

Element	Sub Element	RAG	Comment
	Archive		Out of date information is archived and backed up every year providing a wealth of historical information which could be analysed.
Use			Automated prioritisation & ranking of maintenance activities is well established and assisting LGED in its AM decision making, Reports are regularly generated from RSDMS and used by both internal and external stakeholders and is relied upon greatly. However, there is a lack of analysis being performed beyond operational basis, and it is considered that use of historical data, external datasets comparison and analytical tools such as GIS should be more widely adopted. This would provide greater insight and potentially could improve AM related decision making and assess the impact of interventions.
Core Enablers	Process		Processes are followed within LGED at various levels of the organisation when capturing asset information, assessing its quality, and entering the data into the necessary systems. There is scope however for considerable improvements around data governance and the asset information handover/handback processes during the development project lifecycle.
	People		There are many highly motivated individuals managing, entering and analyzing data within LGED. The ICT unit has significant capacity to produce and procure systems fit for use within LGED. There was however a lack of individuals and capacity identified in field offices to cope with the amount of data required to be updated and checked throughout the year. There is also a need to define and assign data management roles and responsibilities for certain functions at different levels within LGED. The GIS Unit similarly has good capacity for spatial data management and map production, but this could be extended to provide a more analytical role. They could make greater use of the information available to determine asset risk and effectiveness of interventions.
	Technology		<p>RSDMS is considered to be a well designed database and considerable development has been made to normalize information and share data between systems. There are plans to migrate this MS Access based software to a server based relational database with a web front end which will reduce the maintenance and data sharing effort.</p> <p>The GIS Unit also are making good use of available data and technology to produce useful mapping products and data which can be linked to the RSDMS.</p> <p>However, there is a lack of documentation about the system including limited data dictionaries and software documentation. There is a lack of resilience in this critical software and system as a result should the system fail, or key personnel leave LGED's ICT unit.</p>
	Culture		There is a strong culture recognising the importance of the RSDMS and asset information within LGED and an understanding of the role it plays in

Element	Sub Element	RAG	Comment
		A	aiding the organisation to operate. There were still issues with provision of complete and accurate data on time to HQ for a variety of reasons. This highlights there are still improvements to the culture about the importance of data to LGED’s business to improve data quality and decision making.

4.3 Structures Asset Assessment

Using the same approach an assessment of the Asset Information Lifecycle of other structures (bridges, culverts etc) was performed. The findings of this assessment made through desktop study and meetings within LGED stakeholders is presented in Figure 7, with a table below the figure describing the assessment findings in more detail.

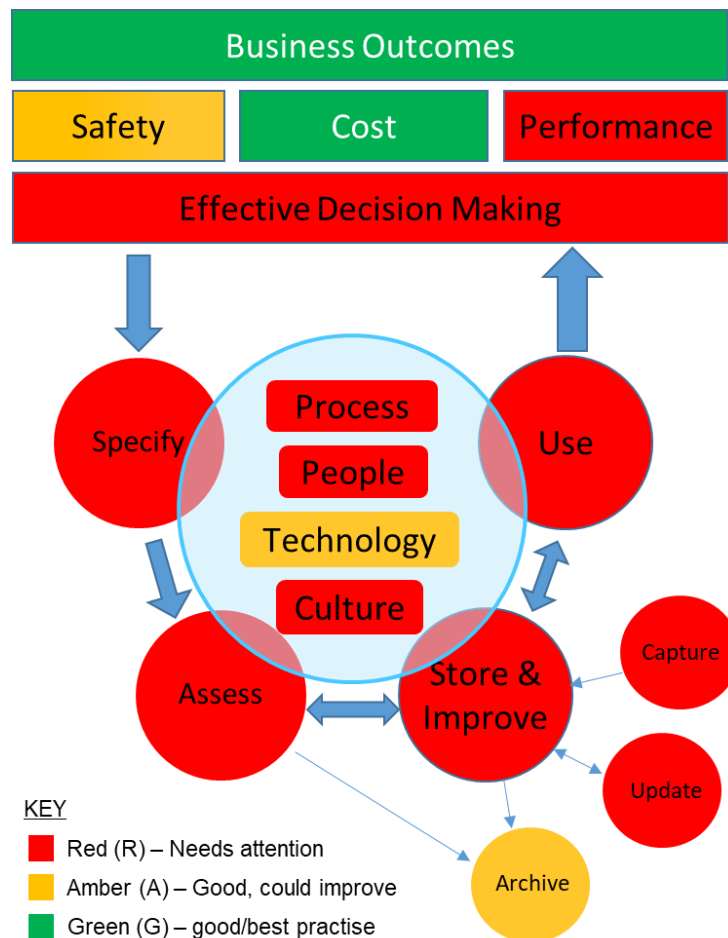


Figure 8: Assessment of the current state of the Structures Asset Information Lifecycle

Table 4: Assessment of Asset Information Lifecycle of Structure Assets

Element	Sub Element	RAG	Comment
Organisational Outcomes		Green	Asset Management guidance and objectives are well defined in the draft Asset Management Policy and Strategic Asset Management Plan (SAMP) but not yet widely disseminated. However, many of these objectives are already embedded within other key documents and guidance so understood within LGED to a degree, but without necessarily a link to asset management.
Org. Drivers	Safety	Yellow	Stated in SAMP but traffic accidents are not consistently recorded and linked to the condition/operation of structures which sometimes could be a factor, and therefore an indicator.
	Cost	Green	Stated in SAMP, closely monitored and audited by LGED HQ and so is used as a main driver of the asset management function impact presently.
	Performance	Red	Stated in SAMP but not currently measured, other than its serviceability relating to the structure being operational only and the road accessible. Opportunities could arise from SMART measurements linked to wider levels of service for socio- economic and environmental requirements. This is particularly true of structures which can be critical assets crossing rivers, railways or equivalent and directly affect road usability and more susceptible to the impacts of climate change.
Effective Decision Making		Red	Decisions are not always based on asset information due to a lack of confidence in the condition data quality. There is a rule-based asset management decision flowchart prepared for structures, but in testing with data from the systems the output did not achieve the anticipated results and so could not be put into practice.
Specify		Red	Structure data is stored within the systems (RSDMS & Bridge management System) within LGED, but as with roads are not adequately documented or disseminated as an information specification describing what is or needs to be stored.
Assess		Red	It has been widely reported that although the inventory of structural assets will be reasonably accurate, the condition of such assets is poorly recorded or missing in many cases. There is a lower priority given to this assessment compared to road pavements, for various reasons.

Element	Sub Element	RAG	Comment
Store & Improve	Overall	Red	The data stores and systems are in place to store information about structures managed by LGED, but these are not always populated or current and are reported to be inaccurate. There is a dedicated Bridge Management System (currently under development) for additional information in addition to the basic information stored in the RSDMS which could also store non-structured data i.e. drawings etc.
	Capture	Red	It requires considerable expertise, time and equipment to capture condition information of structures during inspections and therefore this is fairly inadequate or missing currently. Asset Information (including drawings) is also not being provided by development projects.
	Update	Red	For similar reasons as above, this data is not being updated frequently within the LGED systems.
	Archive	Yellow	Like other assets any information that is stored within the databases are routinely backed up and stored each year.
Use		Red	Inventory information about structures is reported to internal and external stakeholders from the asset information systems. However condition information is of poor quality and cannot be relied upon currently for analysis.
Core Enablers	Process	Red	There are few processes in place or consistently followed or documented for systematic structural inspections and condition data capture forms are onerous and long. There are also limited data quality and monitoring processes in place. A risk based approach should prioritise certain critical assets over others in key locations or routes as a start.
	People	Red	There is a lack of qualified professionals available to conduct the more complicated and time consuming structure inspections in order to improve this asset information. Inventory information is reasonable as entered and updated by Upazila field offices who can identify asset types.
	Technology	Yellow	There are several systems in place, of which some are web based, which will be able to store information once available. Inspection forms are being migrated onto mobile data capture forms which will provide consistency and improved data quality once teams are in place. This in addition to other forms of non destructive testing technology, image capture and analysis could assist with condition surveys.
	Culture	Red	Structures information is not considered accurate, and the challenge of improving that scenario to encourage greater importance of this asset information type as a result, even though these are sometimes critical assets.

5. Desired Asset Information Management State

5.1 Outline of Desired State

The table below outlines what is anticipated within the LGED context what is considered good practice for each aspect of asset information management, as a measure of relative success.

Table 5: Desired State of LGED Asset Information Management

Element	Sub Element	RAG	Comment
Organisational Outcomes			Asset Management Guidance and objectives are well defined in the Asset Management Policy and Strategic Asset Management Plan. This document is widely distributed and referenced by other guidance, and within job roles and system development.
Org. Drivers	Safety		Measures of safety such as traffic accidents are regularly and consistently monitored and there are targets (ideally zero accidents) relating to the operation and condition of the infrastructure element maintained by LGED.
	Cost		Costs associated with asset management and infrastructure continue to be closely monitored and audited by LGED HQ and are within the budget allocated.
	Performance		The criteria for the performance of an LGED asset is related to the Rural Road and Bridge Maintenance Policy (2013). The performance criteria may meet different guidelines such as socio-economic, speed of traffic but also its resilience to other factors such as flooding and other external impacts possibly resulting from climate change.
Effective Decision Making			The decisions which are being made around the management of LGED assets are based (in any part) on asset information and its analysis. Both internal and external stakeholders will have different questions they need to answer for asset management/development purposes. These decisions should therefore be documented and an assessment made of the asset information requirements to support each stakeholder's decisions as overlaps will be likely. They will likely require more than just the inventory of assets, but also relate to the asset's maintenance history, condition, intervention impact etc.
Specify			The asset information required (i.e. structured data, inspections, surveys, reports, photos, drawings etc) to make decisions will be fully documented. This is often completed within an Asset Information Specification or Standard which describes the asset, the information required to be store and the update timeframe, tolerances, units, category lists etc.

Element	Sub Element	RAG	Comment
Assess			<p>There are a number of dimensions to the quality of asset information namely:</p> <ul style="list-style-type: none"> • Completeness: are all the assets and attributes recorded • Consistency: can we match the asset data stores • Uniqueness: is there a single view and ID for the asset e.g. road code • Validity: does the data match the asset specification • Accuracy: does the data stored reflect the physical asset <p>Regular monitoring and reporting of some, or all, of these asset information dimensions should be conducted within LGED.</p>
Store & Improve	Overall		The data stores and systems should be in place and match the asset information specifications already produced. They should be accessible to those who require to enter, report and analyse the asset information, with the appropriate levels of data security considered.
	Capture		There will be several approaches to the capture of asset information depending on the asset type and method. These should all be well documented and aligned to the Asset information Specifications. These will include condition inspections and also information at handover from development projects. Each should have information standards outlining what is required, by when and to what tolerance or option categories (e.g. condition ratings) etc.
	Update		In a similar approach within Capture, the update of data is required to keep it up to date and accurate (relative to the physical asset). It should be performed with a regularity based on the rate or cause of change and the decision making period. Updates should be completed on time in order not to hold up key decision schedules (e.g. annual planning/budget cycles).
	Archive		Information relating to any assets that have depreciated or been demolished/replaced should be archived out of the live production asset database for future reference and analysis. This could also include poor quality or any asset information not required within the Specifications, as data has a cost to its maintenance, and therefore it is better to be archived.
Use			The use of asset information predominantly refers to the reporting and analysis of asset information. This should be informed by the effective decision making requirements of stakeholders as outlined above. The output of asset information use can take many forms, it could be direct use of the raw data, the aggregation of data or analysis of trends to inform change over time or resulting from interventions or external factors (e.g. climate change).

Element	Sub Element	RAG	Comment
Core Enablers	Process		The processes required to keep each aspect of the asset information lifecycle should be known and well documented. The level of detail should include who is responsible, the inputs and outputs. They could be a series of workflows describing each step. Some of these processes could be based on International ISO standards such as ISO 19650 for delivery of asset information from Capital projects.
	People		<p>It is critical that individuals within LGED or contracting to LGED have the appropriate skills and experience. It is also important that their roles and responsibilities should be well defined. These can form part of an existing function of LGED staff. Some standard roles which should be clearly allocated include (see Figure 8 after this table for more detail and their inter relationship):</p> <ul style="list-style-type: none"> ● Data Owner ● Data Custodian ● Data Provider ● Data User / Analyst ● Data Auditor ● Data Architect
	Technology		The technology used to store, capture and inspect LGED assets should be developed with their requirements well documented and using asset information specifications and aligned to the organisational outcomes. Technology should be appropriate, accessible, secure and well supported. This will include mobile applications for inspection data capture, central asset registers, websites and analysis software tools such as GIS. The technology could also include the remote capture (e.g. roughness) or testing equipment.
	Culture		Instilling a positive culture within LGED about the importance of asset information is as critical as the other core enablers described above. Without there being a willingness at all levels in LGED to prioritise resource and time to keep asset information up to date and accurate, then all other aspects will be of minimal benefit. This can be instilled by explaining how asset information is used in the success and decisions within LGED which impacts them and the communities they serve.

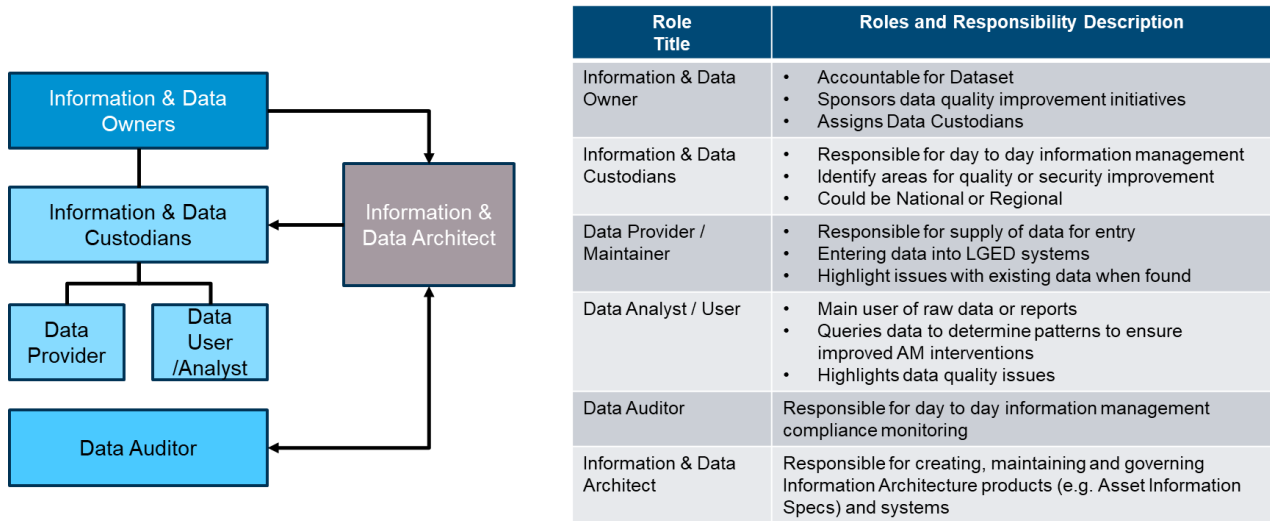


Figure 9: Asset Information management: roles and responsibilities, and interrelationship

5.2 Roads Assets

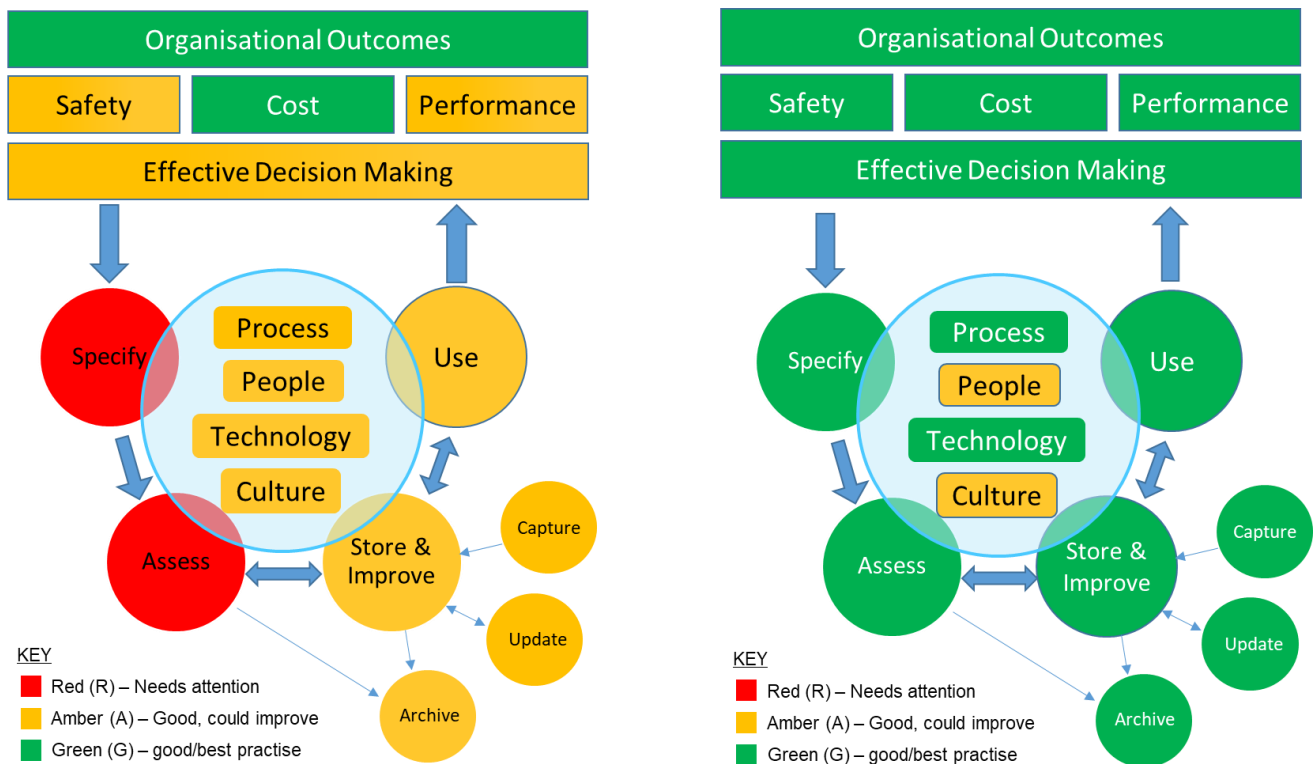


Figure 10: Current and desired future state for Road Asset Information Lifecycle

There is a strong desire to move LGED’s road asset information management into a state of best practise for the road pavement asset. There is a strong existing platform and some good

practise in place to build on. With a focus in certain key areas and with a programme of activities this should be possible in the next five years as outlined in Figure 9. Aspects which may have a longer timeframe to develop are the people and cultural aspects which will potentially take longer to impact real change to behaviours.

The actions necessary to progress this improvement are provided in Section 6 to reach this desired state in the Asset Information Lifecycle. However, there will need to be significant commitment by LGED to reach this ambitious target within 5 years.

5.3 Structure Assets

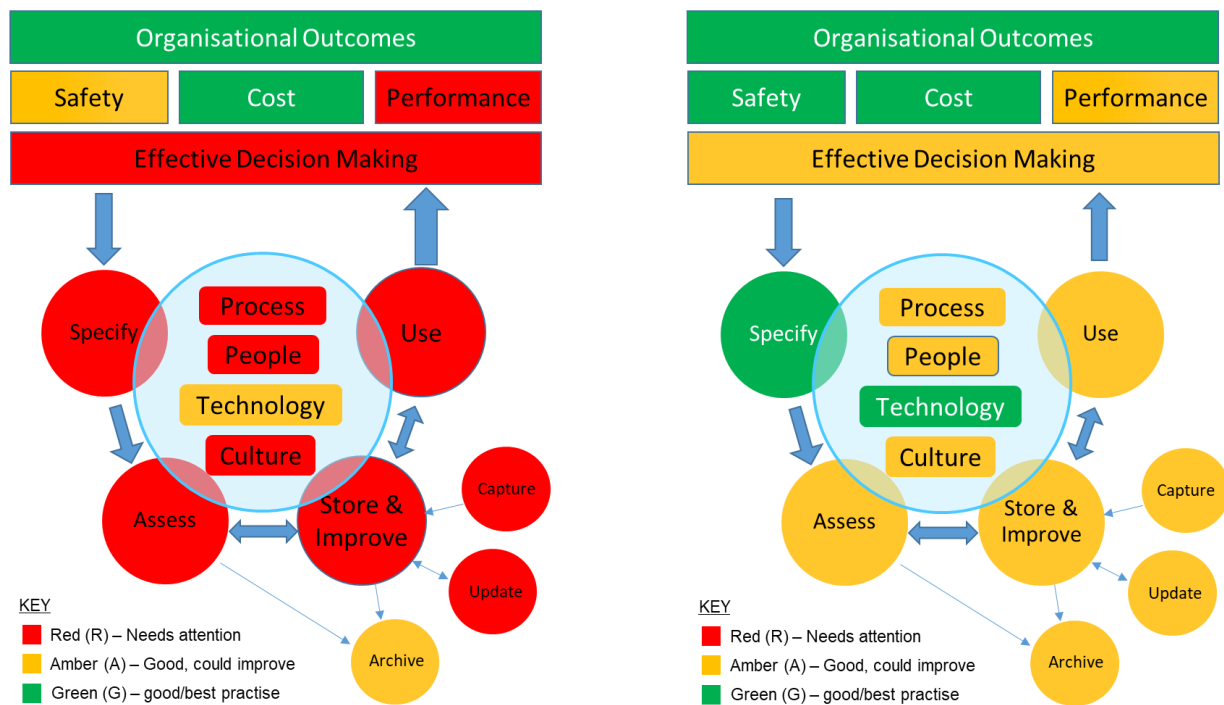


Figure 11: The current and future state assessment of Structure asset information management

As with the Road pavement asset, there is equally a desire by LGED to improve the data management situation for Structures. However, starting at a lower level with the quality of condition data, and the fact that the improvements require a considerable amount of resources, it is likely that after five years the situation will be much improved but not fully reach best practise (see Figure 10).

There are limitations on resources, both financial and personnel, and it is thought that the focus should be prioritised. This is to ensure certain assets types will have improved, but not be consistent geographically or for all structure types.

5.4 Gap Analysis

To understand why there are differences between the actual and desired state of asset information management, a more in-depth analysis would need to be conducted. However, this situation is a fairly common scenario for large organisations such as LGED to be in. There will have been many historical decisions and pressures relating to staffing, budgets and legislation etc. which will have all contributed to this position. Many of which will have limited bearing on the future desired state. It is more important to focus on the existing factors which are having an ongoing negative impact or establishing those which are not yet in place.

Asset registers, the information stored and processes to capture and update, have usually evolved in direct response to operational or regulatory requirements as they arose. For example, the commencement of road condition assessments in order to plan and prioritise future works required a database to be developed to store that information systematically as a first requirement. Additional information (e.g. structures) to be stored were added over time, and the database and processes we see today, is a product of those various needs. This is reasonable, and commonplace within many similar organisations around the world, where a broader asset management strategy or plan did not exist during the development of such systems. These asset information systems were responding to operational, and not necessarily the strategic requirements of the organisation.

What is more important however, is how to address the elements which will drive asset information management within LGED to the desired state, now that an Asset Management Plan is in place. Non-existence of some important parameters such as road design information including pavement structural properties, visual inspection records of shoulders and slopes, natural disaster data, traffic signage and road safety is apparent within the existing LGED systems. A key consideration within any future system or process should be how to ensure these parameters/information are kept up to date. It is now more critical that the future asset information quality and/or its use is improved to enable a more risk based approach to asset management. The recommended actions made in the next section will start to identify those elements, and put in place a robust Asset Information Lifecycle. This in turn will support the key decisions to be made, and assist LGED in becoming an even more effective asset manager.

6. Recommended Actions

A list of thirteen actions have been presented in the table below, with a brief description, the aspect of the Asset Information Lifecycle they are intended to impact, and their relative complexity and importance to LGED’s Asset Management success. The quadrant presented in Figure 12 outlines the ideal order of the actions to be completed. This list of actions (Table 6) is not exhaustive and further work should develop these further to create programmes of work. There may need to be additional activities identified as more information is gained, and their feasibility and funding agreed.

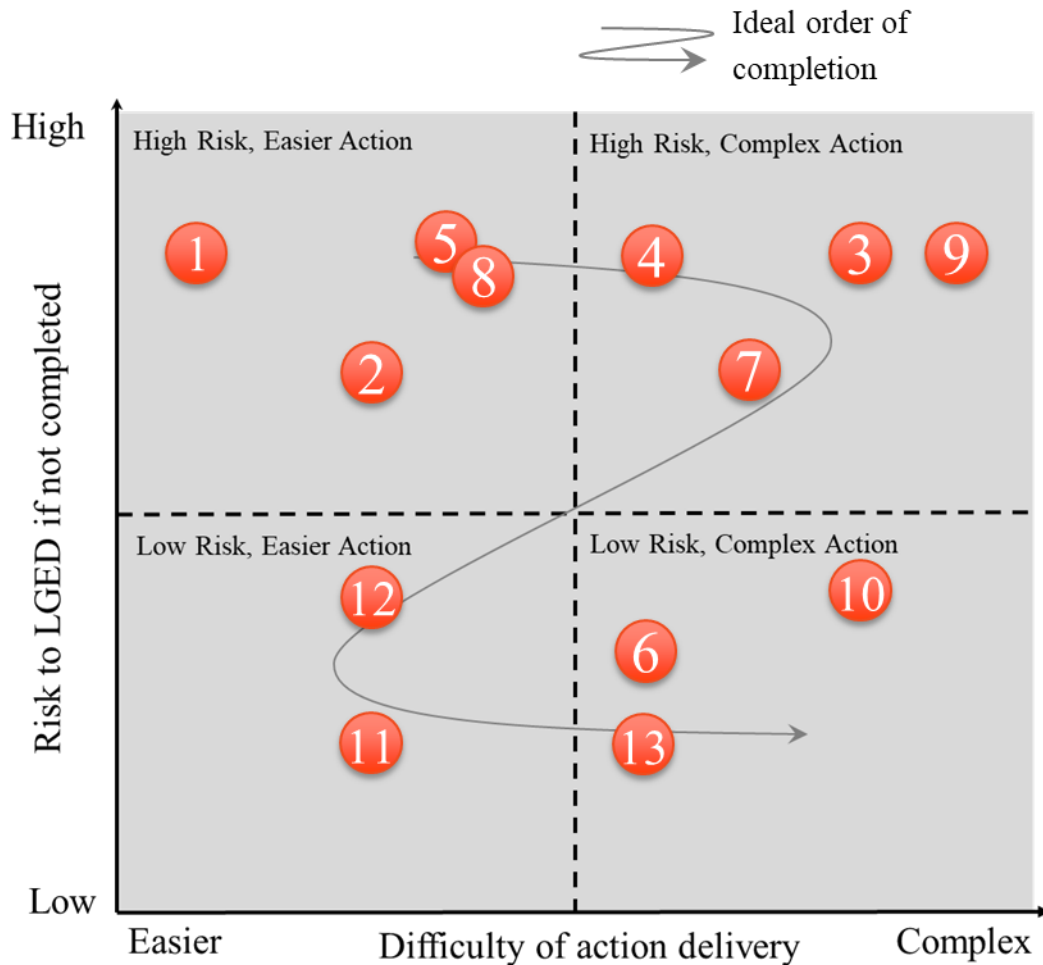


Figure 12: Actions to be completed – Difficulties and Risks if not completed

Table 6: Asset Information Lifecycle: Recommended Actions

#	Recommended Action	Recommended Action Description	Lifecycle Aspect(s)	Difficulty of Action	Risk if not done
1	Agree/Publish LGED Governing Data Principles	This outlines a measure by which system development, process and all actions related to asset information management should be compared. It sets the rules by which those involved should work to and a culture within the organisation. Use of the Highways England’s data principles is a good starting point but should be refined based on LGED’s context and priorities.	Culture	1	8
2	Define Data Ownership Responsibilities and RACI Matrix Development	As outlined in Section 4, there have not been data management roles assigned to individuals. It is important that LGED define the roles and responsibilities and possibly create a RACI (responsible, accountable, consulted, informed) Matrix. Appropriate people within LGED would then be assigned that role for each key asset type. This will increase accountability and ownership of asset information which will be the first step in their improvement.	People Process	3	7
3	Asset Information Specifications / standards documentation	A lack of documentation was highlighted within the assessment. A programme of activity to document the required asset information based on asset management decision making now and in future should be conducted. Initially an agreed documentation standard should be developed then populated gradually starting with the priority asset types. This will form a basis for future system development and for development projects contractual Exchange Information Requirements (EIRs) of asset information.	Specify Assess Store & Improve	8	8
4	Accessible Single Source of Truth	It is important to support and continue with the planned activities to better connect the various asset information systems currently existing within LGED. With consistency and accessibility of data which is not duplicated or siloed the data will provide greater value and will improve the quality overall. A central data source will also enhance the analysis potential to potentially determine the root cause of issues found, intervention success and financial benefits. It is important that the end users of the data have the ability to also feedback or correct when inaccurate data is found, to create a virtuous circle of continuous	Store & Improve Technology Use Culture	8	6

#	Recommended Action	Recommended Action Description	Lifecycle Aspect(s)	Difficulty of Action	Risk if not done
		data improvement. This can only occur when users feel their inputs are being acknowledged and see the changes benefiting their role.			
5	Asset Information Handover / Handback process for Development Projects	One of the key points of change to the asset base is when a new asset is constructed or demolished. Therefore, if data is delivered in the format required as per the Asset Information specifications/standards, it can quickly be updated within the asset registers. A project is in effect a data capture process. Guidance and template documents are widely available based on ISO 19650 standards. This is largely a development of processes and contractual documents to require the delivery of data on a project. This also includes drawings, reports etc. which should be stored with metadata about their content in systems such as the Bridge Management System. This requirement of projects to deliver asset information should also be mentioned within LGED’s Asset Management Policy to enforce its importance.	Store & Improve Process	4	8
6	Data sharing – improve inter governmental data sharing / cooperation	This activity is to highlight assets at risk from external factors such as floods or climate change impacts etc. Through overlay of datasets, analysis can be performed on the asset to determine its risk now and in future, and therefore resilience to external impacts. Currently there is some sharing of data but a cross government information working group could enhance the availability of datasets (particularly geospatial) for such analysis. Potentially contributing to a Government of Bangladesh open data portal could also enable others such as academics to also perform analysis which LGED could benefit from.	Use Effective Decision Making	6	4
7	More analytical capacity using historical data to monitor data quality and asset performance assessment using GIS and other techniques	There are many years of backdated information stored from the RSDMS system, and therefore an opportunity to assess the impact of maintenance interventions with the data alone. This could potentially reveal where conditions deteriorate possibly resulting from use, terrain, adverse climatic events or otherwise which could be useful in determining a risk-based approach to asset management and the most effective asset management strategies. Currently there is limited analysis performed, or the capacity to do so, and so bolstering this with GIS	Use Effective Decision Making	7	7

#	Recommended Action	Recommended Action Description	Lifecycle Aspect(s)	Difficulty of Action	Risk if not done
		analysts, data scientists etc. could assist with this. They could also identify data quality issues through data profiling techniques with the existing data to highlight potential problems through statistical analysis.			
8	Regional role in data validation and inspections	Currently the data responsibility for validation largely relies on the field officers entering data correctly, and then the District level collation of information. The role of the Regions for data quality checking/validations, and for potentially a role in improving inspection data by having a dedicated structures inspection teams at this level who would perform multiple inspections.	Assess People	4	8
9	Asset Condition Data Improvement programme	A gradual improvement of data, especially for something as complex as structure condition, will not happen within a reasonable timeframe for the LGED Asset Management Framework. Furthermore, some additional asset datasets such as pavement structural properties, visual inspection records of shoulders and slopes, natural disaster data, traffic signage and road safety data all need to be collected and stored progressively. Therefore, a programme of data improvement could be commissioned for specific highly critical asset types on priority routes. A programme would make a step change in data quality improvements necessary to enable effective decision making. This will require additional staffing and budget and could potentially be outsourced to a private sector firm. Technology support would be required in the form of mobile data capture tools and forms updating central systems, and the quality assurance checks and validation also.	Assess Use	9	8
10	Incorporate Knowledge Management within improvements	It is important not to forget there is lots of tacit knowledge existing within LGED in all levels of the organisation across the country. In order to capture best practice and experience a Knowledge Management approach should be considered which will include communities of practice, online libraries, collaboration tools such as Yammer can log lessons learned after projects and successful maintenance interventions etc.	People Process	5	7

#	Recommended Action	Recommended Action Description	Lifecycle Aspect(s)	Difficulty of Action	Risk if not done
11	Define Asset information Specification change process	Once an asset information specification has been developed there should also be a process of change control put in place also. This is to reflect that the need for asset information does change over time, with changing needs, decisions and priorities. There should be a process in place where LGED groups can request changes to datasets. The final agreement will be with the data owners who are accountable for the capture	Specify Process People	3	3
12	Review of commercially available Asset Management Systems	It is recommended that an evaluation of commercially available off the shelf (COTS) asset management systems should be considered before further development of internal systems. Asset Management systems such as Maximo (with linear extension), Bentley AssetWise etc should be assessed for suitability to the LGED requirements. These should be evaluated against the current software also. It should be noted that these COTS systems still require considerable configuration to an organization's specific information management needs (including language). However they will likely come with a data structure and templates for roads/structures. The functionality, support (in country), cost, upgrades, ability to link with GIS, and ability to consume existing data to ensure historical information is not lost, should be considered as part of the evaluation. The evaluation may highlight that the existing system is actually the best option to develop due to these other constraints and its existing functionality and user familiarity.	Technology	5	3
13	Improve culture through inclusion of Asset Information management within CPD	One aspect highlighted within the assessment was the requirement to improve a culture that data is important to LGED at all levels. A continued professional development (CPD) 'syllabus' should include aspects of asset information management and this linkage to decision making and ultimately organisational outcomes. LGED staff value the systems they have greatly, but it is their role in providing timely and accurate data into the systems, and feedback where quality issues are found could be improved.	Culture	3	6

References

The following reference materials were used in the production of this document.

Government of Bangladesh (including LGED specific documents):

- LGED Asset Management Policy (2019);
- LGED Strategic Asset Management Plan (draft) - 2020;
- LGED Asset Management Plan - Roads (draft) - 2020
- LGED Asset Management Plan - Bridges (draft) - 2020
- LGED Capability Building Plan for Asset Management System (2020);
- LGED Professional Development Strategy for AMS (2020);
- LGED Rural Road and Bridge Maintenance Policy (2013);
- LGED Training Manual on Road Maintenance Management (2008).
- Road Design and Pavement Standards of LGED (2019);
- Road Design Standard (Rural Road) (2004);
- *"Feasibility Report for an Integrated Decision Support System (DSS)"*, Technohaven Company Ltd, March 2019
- *"Improving Asset Management Through Better Asset Information"*, American Public Transportation Association, APTA SUDS-TAM-RP-005-19 (2019),
- *"Revised IT-ICT-MIS Strategy and IS Usage Guideline (2019), Digital LGED Vision 2021"*; Technohaven-IBCS-Primax Consortium

International Standards, guidelines and professional publications:

- Highways England Asset Data Management Manual, V10
- ISO 55000:2014 Asset Management – Overview, principles and terminology
- ISO 55001:2014 Asset Management – Management Systems – Requirements
- ISO 55002: 2018 Asset Management - Management Systems - Guidelines for the application of ISO55001
- ISO 8000-61 (2016) Data quality - Part 61: Process reference model
- ISO 8000-63 (2019) Data quality - Part 63: Process measurement.