

CPNI

Centre for the Protection
of National Infrastructure

HOW THE ENVIRONMENT AGENCY DEVELOPED ITS INFORMATION MANAGEMENT PLATFORM

EA IMP CASE STUDY



Background

The Environment Agency is a non-departmental public body sponsored by the UK government's Department for Environment, Food and Rural Affairs (DEFRA). Responsible for protection and enhancement of the environment across England, it employs around 10,600 staff, organised into four directorates. Of these, Flood and Coastal Risk Management (FCRM) deals with approximately half the Agency's annual expenditure to build, maintain and operate flood defences, maintain rivers and provide effective flood warnings to communities.

The Environment Agency:

- operates through 14 local areas;
- has a capital works programme, today managed through six regional hubs supported by 15 consultants and contractors in two collaborative frameworks.
- as of 2021, across its flood and coastal risk management portfolio, was typically managing some 800 parallel capital projects;
- has a huge legacy portfolio of assets, some of which have aspects which are sensitive. It:
 - operates some 2,000 sites;
 - is responsible for 8,000km of coastal and main river defences; and
 - manages over 22,000 structures.



Like many owner-operator organisations with an extensive pre-digital portfolio, the Agency had historically struggled to maintain asset information from across its legacy projects. Prior to the adoption of BIM-based processes:

- 10,000 project and asset-related files received every month could not easily be checked and assimilated into FCRM management systems;
- newly completed projects were sometimes not added to asset registers for 18-24 months as it took time to find required data and, in some cases, surveys had to be commissioned to gather the data;
- information was not always classified in accordance with agreed standards, not version-controlled, and there was inconsistency about secure storage and provenance. As a result, Environment Agency people often had to take project or operational decisions based on information that was incomplete or outdated.

The Environment Agency began to systematically address some of these challenges when, in 2011, the UK government announced it would be mandating building information modelling (BIM) across centrally procured public sector projects from 2016. It also aimed to support DEFRA's open data approach enabling sharing of non-sensitive data across the Environment Agency, its suppliers and other public bodies.

The Environment Agency had a small handful of information management specialists, both directly employed and consultants. This group included Flood and Coastal Risk Management Manager, Karen Alford, and consultants Graeme Tappenden and Alan Proctor. They, with a few of Environment Agency's 400+ project managers and specialists from the Agency's framework partners, formed a 20-25-strong Environment Agency BIM (now Digital) Working Group.



The challenge

By April 2016, the Environment Agency was able to share documents, drawings and digital models held in files.

Commonly, these were:

- created during design and construction of new assets;
- managed in a project information management platform (a 'common data environment', CDE, as defined in PAS 1192-2:2013); and
- handed over to the client owner-operator upon completion of the project

“We needed to shift from ‘document BIM’ to having data we could immediately start to use right across the asset life cycle.”

Graeme Tappenden





The Environment Agency wanted to:

- own data that it could use in specifying and procuring new works, in validating and verifying that incoming information met its requirements, and in ongoing asset management;
- securely store and reuse data across internal systems – to share via geographical information systems (GIS), for example;
- apply an ISO 19650-5-compliant security-minded approach, with long-term system resilience bolstered through adoption of interoperable, non-proprietary technologies; and
- share and exploit data at a portfolio level to drive continuous performance improvement across capital works, Environment Agency operations and with relevant external stakeholders.

“It wasn’t enough just to receive documents, drawings or even the model files after handover of a project. To better specify future project information needs, we wanted to compare what was delivered against what we had specified. We also wanted to assure that received information was accurate and could be rapidly assimilated into our systems for future asset management.”

Karen Alford
Flood and Coastal Risk Management
Manager, Environment Agency

The solution

Development of what became known as the Environment Agency Information Management Platform began as a demonstration project. Key concepts were regularly shared with the Public Sector Information Management Group, helping inform related efforts in other government organisations. This case study focuses mainly on Environment Agency activities, but notes related UK developments that guided Agency thinking.

BIM Basics

In common with other UK government departments, the Environment Agency set about incrementally implementing the 2011 Government Construction Strategy and BIM Level 2 objectives.

The Environment Agency BIM Working Group launched a 'BIM Basics' programme. This enabled suppliers and internal teams to improve content delivery and helped the Environment Agency to better understand its structured data requirements.

The BIM Basics programme involved the creation of:

- framework level Employer's (now Exchange) Information Requirements (EIRs) with back-to-back framework level supplier BIM Execution Plans;
- project level contractual stage Information Delivery Plans with back-to-back project stage supplier Master Information Delivery Plans (MIDP) and federation strategies;
- development of a standards-based client-side 'CDE' and file-naming policies. Environment Agency processes and systems have continued to be progressively updated based on emerging best practice.

“The Environment Agency said it did not have all the answers, so we tried to be agile. We jointly developed ideas, proofs of concept, then minimum viable products, testing them with the supply chain. If something worked well, it became part of the EIRs, part of business as usual.”

Paul Morgalla
Principal Scientist, Atkins

Early BIM Basics successes included:

- the implementation of BS 1192 naming conventions;
- working with NBS to extend Uniclass 2015's coverage of civil works;
- alignment of asset management practices to ISO 55001; and
- support of DEFRA's open data ethos.

With the foundations in place, the Environment Agency started the next phase of its information management transformation in 2016.

The Environment Agency Digital Asset Data and Information Initiative

The Environment Agency Digital Asset Data and Information (DADI)¹ initiative encompassed a more focused, long-term programme which is still ongoing in 2022.

It encompasses a number of elements as set out in Figure 1 below.

Its vision is:

“For the Environment Agency and its partners to have information they can trust and rely on... to make sound business decisions quicker and faster.

Our staff and partners to be productive anytime, anywhere, from any device using the most appropriate technology.

To use smart technology in a coherent, secure way and build our capability to prepare ourselves for more digital working in the future.”

Figure 1: Some of the elements which enable DADI assured information delivery



References:

1. DADI is a multi-step, modular, Environment Agency-specific programme.

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As was the case with Environment Agency BIM Basics, the DADI programme was broken down into a series of smaller Agency information management ‘task and finish’ projects, each of which built on previous stages, and for which a sound Treasury model business case was developed to get budget approval.

Key early developments included a data services portal. This continues to give access to the agency’s delivery standards, methods and procedures, including container naming conventions, key geospatial data, information delivery plans (IDPs), and, perhaps most important of all, a data requirements library (DRL, see **Figure 2**)² – all accessible via DEFRA’s data services platform. Collectively, these data standards and data sets comprise the Agency’s reference data library.³

The Environment Agency also worked with its incumbent cloud technology provider Asite to develop a client-side immutable file store with appropriate security to protect sensitive information – an ‘employer’s CDE’ – that became the platform from which information could ultimately be automatically verified, then extracted, transformed and loaded to DEFRA enterprise systems.

“Standards compliance was a big driver. The Environment Agency is a serial procurer with a high volume of capital projects, so we must standardise as much as possible. My director Jim Barlow could see the problem: the same things described in different ways in different solutions. He recognised the value of greater data consistency to the Agency’s asset management journey.”

Karen Alford
Flood and Coastal Risk Management Manager,
Environment Agency

“As the Environment Agency is the owner-operator of its assets, senior operational representation is invaluable in getting buy-in, investment and project engagement”

Alan Proctor

References:

2. An Agency-specific digital project deliverable, recommended for other organisations’ IMPs.
3. An Agency-specific digital project resource; however, a reference data library is again recommended for other organisations’ IMPs.

2016-2018 'AIM CDE' functional requirements

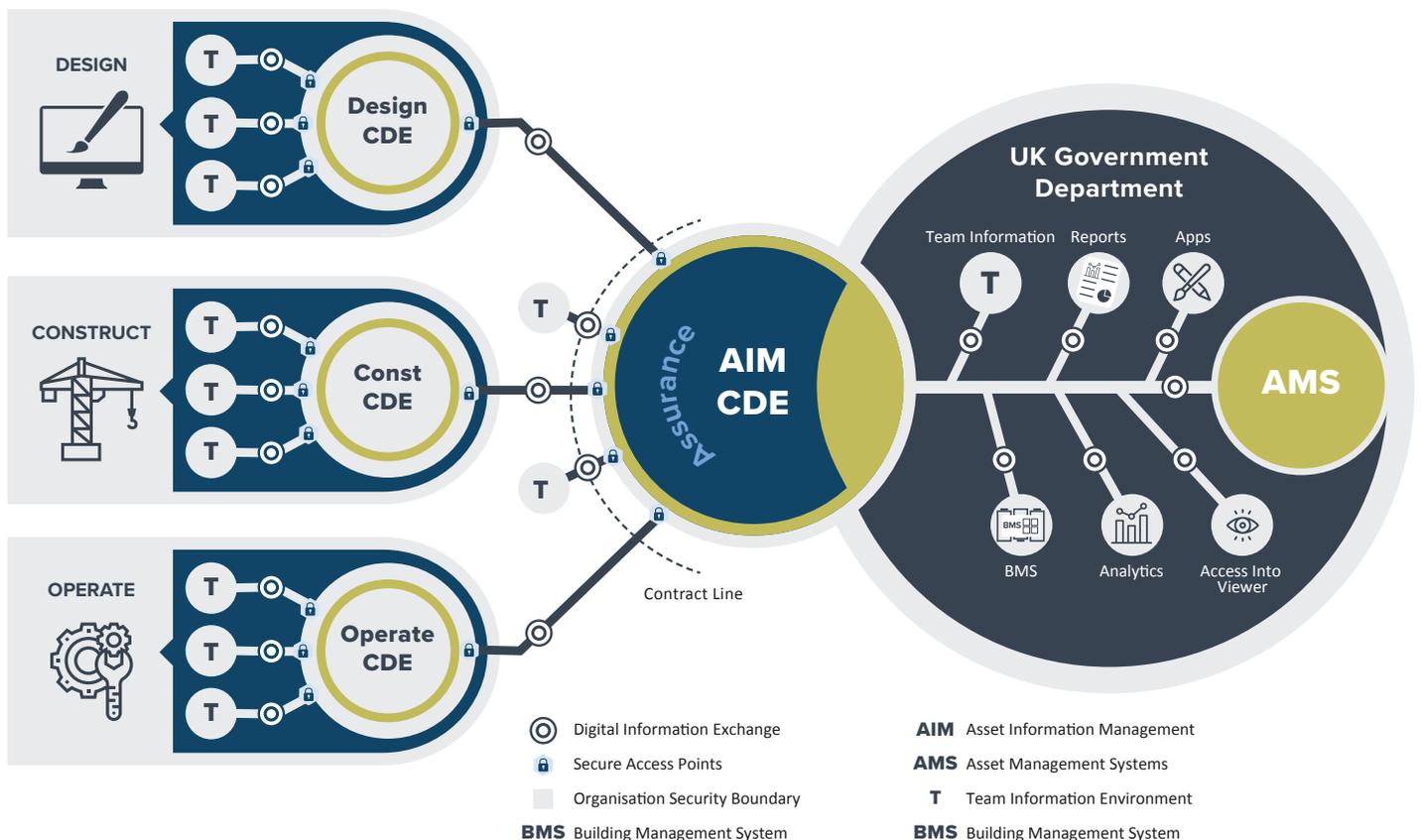
In 2016, 'stretch' targets for BIM adoption were proposed to push UK BIM development beyond then current technological capabilities. One of these targets related to how asset-operating organisations could get better asset information models (AIMs). A key challenge was extracting delivered information from project 'CDEs' so that, once it had been verified as reliable, it could be readily used for whole-life asset management.

The Environment Agency was one of several government bodies which wanted to extract data held in files, assure that data against industry and organisational standards, and enable its storage and reuse in its own enterprise systems.

Drawing on his work with the DADI programme, Graeme Tappenden was appointed to define functional requirements for an 'AIM CDE'.

A cross-government workshop started to map out different departments' information requirements.

Figure 2: The AIM CDE concept



Note: Each party will implement components of an ISO19650 Common Data Environment managed process

The 'AIM CDE' functional requirements document was published in February 2018.

Early 2018 also saw the collapse of a Tier 1 UK contractor involved in, and managing data about, government construction programmes. While this did not directly affect the Environment Agency, it highlighted the risks around outsourcing information management and not retaining ownership of key asset and capital project information.

Data requirements library (DRL) development

Development of what became the DRL started in 2017, when the Environment Agency's data standards advisor Emma Walker began updating the Asset Information Management System terminology guide.

This was originally a PDF document mainly describing data needed for inspections and to assign maintenance funding for civil structures, but use of the document quickly extended beyond these areas. Other Environment Agency departments also wanted to specify data structures and definitions for their asset management purposes, to cover mechanical, electrical, instrumentation, control and automation systems. Over a 6-9 month period the DRL was developed as a web-based resource, expanded and made available to external stakeholders.

From an initial 53 asset types, the DRL extended to over 120 asset types, and to meet new business requirements such as cost and carbon. It has become the de facto standard for specifying Agency asset information requirements, and is continually, using a governance process, updated and improved.

“Several organisations – like the Environment Agency – wanted to shift from retrospective acceptance of files to sharing reliable data held across internal systems, and to having reference data accessible before a project started. We created a ‘Starship Enterprise’ diagram (see Figure 2), summarising wider information needs, and relating them to internal client-side systems and, on the other side of the contract line, to project CDEs.”

Graeme Tappenden

Change management

Work on the DRL and parallel projects had to allow time for new framework partners to develop and deliver base capabilities. The Environment Agency's Water and Environment Management framework expired in July 2019 and a new roster of consultants and contractors was appointed for a four-year £1.5bn Next Generation Supplier Arrangement running to 2023, with the opportunity to run to 2027. Some existing partners, including Atkins, were reappointed, but new framework partners also needed to be onboarded.

Across individual capital projects change management was vital. Individuals, often Environment Agency graduate project managers and engineers, were appointed as BIM leads, helping to extend digital thinking through people's local participation in live projects.

“There are now three information managers across six regional hubs, these roles are supporting the embedding of existing digital, data and information requirements and future changes. This makes change ‘stickier’ so that it is maintained.”

Alan Proctor

Capability across delivery partners was growing so we had to go at a pace that recognised the development required to support our ambition. We had to allow people to get up to speed and get the basics right. Then we can do the exciting stuff and automate things and eliminate their mundane, time-consuming tasks.”

Karen Alford

Flood and Coastal Risk Management Manager,
Environment Agency

“We reconstituted the Environment Agency BIM Working Group as a digital ‘community of practice’. This supported designers and constructor partners in using the progressively updated EIRs, IDPs and DRL systems developed through the DADI programme. Digital maturity across the Environment Agency and its framework used to be highly variable, but our information management requirements are now much clearer. How we get digital asset delivery to become business as usual is our next challenge.”

Paul Morgalla

Principal Scientist, Atkins

2020 – to date Information Management Platform

A BIM Interoperability Expert Group (BIEG), overseen by the Public Sector Information Management Group, published a 2020 report⁴ highlighting the need for greater interoperability to achieve the whole-life benefits of BIM implementation. It identified enablers of better interoperability, including development of ‘AIM CDE’ capability.

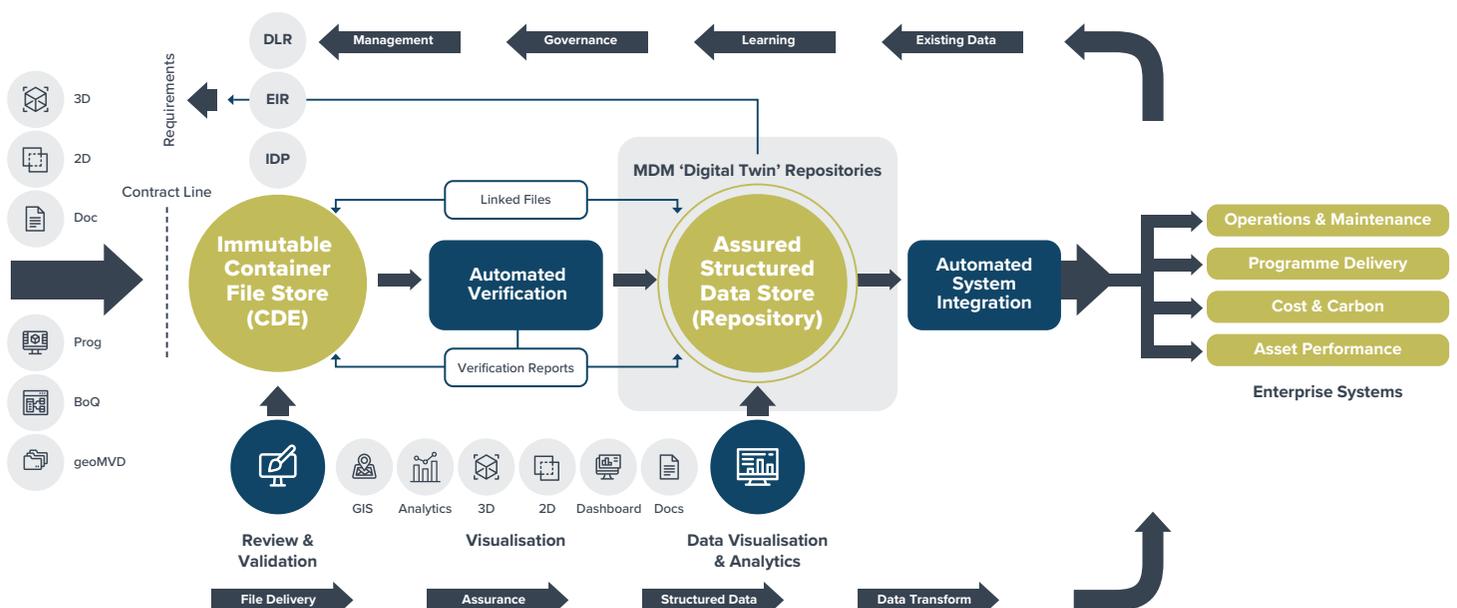
Graeme Tappenden led a BIEG workstream ‘Information Management Platform’ (IMP) to explore best practice and this recommended a multi-system platform approach, rather than suggesting a single technology or workflow.⁵

Work in the Environment Agency to develop its functional requirements, now named its IMP to make it consistent with the recommendations of the BIEG, has continued.

A Datastore Rules and Visualisation (DRV)⁶ project was instigated to automate systems integration and start to build a structured data repository (Figure 3). Components include a rules catalogue, a structured data store, and visualisation technologies.

Previously, users had to check through submitted documents and manually add data to Environment Agency asset management systems. With the DRV, project information can be imported from external CDEs and immutably stored in the client-side CDE, with data extracted and automatically verified against requirements before being incorporated into the Environment Agency’s structured data store. The addition of automated systems integration would enable information from the structured data store to be used with confidence for Agency operations, programme management, cost and carbon analysis and asset performance monitoring purposes.

Figure 3: Components of the Datastore Rules and Visualisation project include a rules catalogue, a structured data store, and visualisation technologies



References:

- 4. BIM Interoperability Expert Group: Report (CDBB, March 2020)
- 5. The Government and Industry Interoperability Group has produced an IMP Overview document, which references this case study.
- 6. The DRV is an Environment Agency-specific digital project; however, other organisations’ IMPs will have similar needs.



“With the Environment Agency currently managing around 800 capital projects at any one time, automating receipt of project information is critical for timely, accurate, efficient and appropriate sharing of information in future.

This is not just about exploitation within the Environment Agency, it is about exchanging appropriate information with other organisations including delivery partners, other government departments and agencies, and local authorities. Our asset data is now supporting project delivery and flood modelling activities across the industry. An incidental benefit of sharing more information has been a sharp reduction in the number of Freedom of Information requests received by the Environment Agency, and also faster responses to those that we do have.

Rapidly updated Agency systems that rely on asset data also means quicker updates to flood risk models. And it’s not just about completed assets; we want to share appropriate information about planned and ongoing construction and maintenance work and generally provide taxpayers and other stakeholders with greater transparency about Environment Agency activities.”

Karen Alford

Flood and Coastal Risk Management Manager,
Environment Agency

Benefits to date

- Continuous progressive improvement of the RDL including EIRs, IDPs, and standardised specifications of data requirements in the DRL.
- Systematic supply chain involvement and buy-in to improvement of Environment Agency-wide information management, via a digital community of practice.
- Heightened operational awareness of data-driven approaches.
- Improved quality and timeliness of data delivery from capital project teams, and – via DRV – quicker incorporation of interoperable capital project data into Environment Agency asset management and operation systems, with consequent reduction in re-survey costs.
- Scalable, standards-compliant capture and reuse of interoperable information across a geographically dispersed owner-operator, framework partners and other stakeholders.
- Fewer Freedom of Information requests resulting from improved appropriate availability of Environment Agency information in a digitally readable format (the Environment Agency mapping site gets c. 2.5m visits per annum, with c. 4m calls on its API service, including daily repeat calls).
- Incremental update of information from suppliers, mitigating potential information gaps in event of supplier failure.
- Personnel resource savings, estimated £1m per annum, and upskilling through automation of previously manual information selection and upload processes.
- Better information audit trails and improved provenance of whole life asset data.
- Seek and maintain active top level buy-in, and formal change management expertise.

Development of the Environment Agency IMP is ongoing and it is anticipated that further and more measurable benefits will emerge as the strategy matures.





“We buy physical assets and the information that accompanies them, and we now treat both elements as equally important. Our engineering projects create huge amounts of digital information and managing that is a challenge for us and the industry. Having the standards to enable information to be effectively managed is essential and having standards that are increasingly common across the industry will be critical in the future. We still have a long way to go but the foundations we have in place are enabling real efficiencies now and for the future.”

Jim Barlow

Deputy Director Engineering Standards and Assurance,
Environment Agency



Lessons learned to date

- Create a working group with enterprise-wide membership (spanning operations and capital works) and a brief to specify, manage and assess digital projects and make successful developments business as usual.
- Collaborate with like-minded client organisations facing similar challenges and constraints.
- Relate the value of standardised information to the purpose and functions of the organisation to get strategic buy-in and investment support.
- Publicly share ideas so that partners and suppliers can understand and contribute to co-development activities.
- Think long-term: adopt a staged approach that prioritises then tackles key information requirements, systems and processes in a logical sequence.
- Consider the cost and timing of any new or replacement technologies within the organisation, allowing time for implementation and training.
- If possible, time key system developments so they are not interrupted or delayed by major re-procurement processes affecting key supply chain partners.
- Incorporate ongoing compliance with evolving information management requirements into procurement strategies.
- Recruit information management evangelists across the organisation and framework partners – it's not just about technologies, it's about people and processes too.
- Maintain a sustainable pace of change management.
- Ensure new IT systems and technologies align.
- Develop data standards to achieve interoperability within the business.

It is expected that further learning will be identified as the strategy matures.



Next steps

The IMP is an ongoing initiative at the Environment Agency. Once established as an organisational resource, it will need to be maintained and updated as technologies and information management practices advance. The IMP strategy has also required organisation-wide change management and process adaptation; sound information management practices being developed will underpin the skills, knowledge and expertise of people across the Environment Agency, its partners, suppliers and other stakeholders.





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