

Smart Standards

An approach to implementing ISO 19650-2 using tasks in a digital process

June 2021

The tasks created in this proof-of-concept draw upon the methodology of BS EN ISO 19650-2:2018.

All clause references relate to BS EN ISO 19650-2 (also referred to as ISO 19650-2).

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*Note all clause references are to ISO 19650-2

Executive summary

Information management compliant with ISO 19650 can provide a trustworthy digital record for our buildings and infrastructure. To support this, we need to adopt and embed appropriate behaviours and practices that are robust and effective across organisational and asset life-cycle boundaries. This requires process change, which is difficult to achieve.

This proof-of-concept project, enabled by the Construction Innovation Hub, investigated whether actionable tasks could be used to guide organisations in their implementation of the ISO 19650 series of standards.

Tasks were created to address the requirements of ISO 19650-2 clauses:

- 5.1 ‘assessment and need’
- 5.2 ‘invitation to tender’
- 5.3 ‘tender response’ and
- Clause 5.4.3, the establishment of the lead appointed party’s exchange information requirements (within the ‘appointment’ step of the process).

The tasks created used a range of approaches, from confirmation that a requirement had been achieved through to production of an information management resource (e.g. the appointing party exchange information requirements) as a table or series of tables. The structured information in these tables becomes available for reuse.

The proof-of-concept (PoC) was tested with four client organisations, who in the terminology of ISO 19650-2 act as appointing parties. These organisations tested the PoC approach to setting up the information management process for a new project (‘assessment and need’, and ‘invitation to tender’ activities of ISO 19650-2 clauses 5.1 and 5.2), where project appointments are to be made by the client. This approach took each organisation through the steps to generate a set of project information requirements and a set of exchange information requirements.

The testing organisations told us that the approach creates an opportunity to provide guidance as to how tasks (and hence the standard) are implemented. There are also opportunities to deliver guidance in

context, at the time it is needed. Government clients highlighted that it would be essential for such an approach to be able to cascade information, to cope with framework appointments (not available in the PoC).

The purpose of this project was to test a general approach. The tasks that were developed for the proof-of-concept are available for download to enable organisations considering a similar approach to review and learn from them. The tasks are therefore available for scrutiny by technology vendors interested in this market.

The project team considers the use of a task-based approach would increase the consistency of ISO 19650-2 implementation; however, the following should not be overlooked:

- interoperability is the most pressing technical barrier;
- there is a tension between guiding people to the decisions they need to make and constraining their freedom to implement as they see fit;
- significant commercial and IP issues would need to be explored and addressed.

This proof-of-concept has been undertaken in a dynamic landscape in which there are many adjacent initiatives. The project team noted adjacent complementary initiatives, within the UK and internationally. We also imagine how future digital processes might support the implementation of standards.

1. Information management challenges

Creating and curating trustworthy information about our buildings and infrastructure

Greater data-sharing could release an additional £7bn per year of benefits across the UK infrastructure sectors,¹ equivalent to 25% of total spend.²

These estimates highlight the benefits of good-quality information about our buildings and infrastructure. The independent review of building regulations and fire safety in the wake of the Grenfell Tower fire found a 'lack of complete, accurate or up to date information on the buildings the construction industry has created, which are then passed on to be owned and managed by others without knowing what they have'.³

The information flow and documented evidence provided to building control bodies often do not provide an adequate public record to ensure building safety throughout the life of the building.⁴ The independent review of building regulations and fire safety has recommended that Building Information Modelling (BIM) – as delivered by the international standard on information management, ISO 19650 - can be used to create and maintain a digital record. The purpose of the digital record – the 'Golden Thread' – is to ensure that accurate building information is securely created, updated and accessible, throughout the building life cycle.⁵

Construction and asset management organisations therefore have a clear challenge: the adoption of ISO 19650-compliant information management practices that are effective across organisational and asset life-cycle boundaries.

Process change

Setting the right behaviours and practices throughout the design, construction, occupation and maintenance stages, and the hand-offs between these stages, is critical to ensuring building safety,⁶ and other quality outcomes for the building/asset occupiers and users.

Our starting premise has been that creating a purpose- and information-centric mindset is a significant task. In the same way that improvements in health and safety performance need the involvement of the entire organisation, the culture shift towards better information management should not be underestimated. There is a need for both the functional performance of the building or infrastructure asset, and of the information used or created, to be more widely understood.

Research has shown that even when codes of practice and specifications (such as the ISO 19650 series) are established, people tend to rely on existing knowledge and established patterns of work, affecting the outcomes that result.⁷ Without process transformation, performance improvements from new technology are marginal.⁸ Furthermore, process transformation necessitates changes in working relationships, and the information flows between project participants that cannot be addressed solely through skills training for individuals.⁹

BSI, CDBB and the UK BIM Alliance work together to deliver the UK BIM Framework, which sets out the approach for implementing BIM in the UK using the framework for managing information provided by the ISO 19650 series. It includes the published standards and guidance to support their implementation. However, there are many built environment sector organisations without the internal resources to translate this guidance into a change in their working practices.

¹ New Technologies Case Study: Data sharing in Infrastructure. A final report for the National Infrastructure Commission by Deloitte, November 2017.

² Developing new statistics of infrastructure, Office of National Statistics, August 2018.

³ The Golden Thread. Understanding the capability and capacity of the UK built environment to deliver and retain digital information. I3PT and CIOB, December 2020.

⁴ Building a Safer Future – Independent Review of Building Regulations and Fire Safety: Final Report. HM Government, December 2017.

⁵ Building a Safer Future – Independent Review of Building Regulations and Fire Safety: Final Report. HM Government, May 2018.

⁶ Construction Playbook: Government Guidance on sourcing and contracting public works projects and programmes. HM Government, December 2020.

⁷ A Practice-Based Conceptual Model on Building Information Modelling (BIM) Benefits Realisation by Zomer et al., Proceedings of the 18th International Conference on Computing in Civil and Building Engineering, 2020.

⁸ Real time progress management: Re-engineering processes for cloud-based BIM in construction by Matthews et al., published in Automation in Construction vol 58, 2015.

⁹ A Review of Building Information Modelling protocols, guides and standards for large construction clients by Sacks et al., November 2016.

2. Tasks as the key to an auditable process

Information management standards identify the required activities of the organisations involved in a project. There is little, if any, detail on how these requirements could or should be achieved. This gives organisations the freedom to design their own processes; however, it can also result in inconsistency in the approaches being taken across a project team.

This project set out to test whether ISO 19650-2 requirements, delivered as actionable tasks, could support its implementation.

Benefits sought through the use of this approach include:

- Improved consistency of information management between projects;
- Improved quality of information management resources (e.g. BIM Execution Plan);
- Direction of effort to most relevant activities;
- Ability to verify whether expected information management function responsibilities have been completed;
- Increased ease of integration of information management tasks into existing project tasks, avoiding duplication of effort.

Information management is just one aspect of delivering a successful design and construction project or asset management intervention. The availability of information management tasks for incorporation into project management processes should help to achieve this. Information management using BIM as business-as-usual becomes a more viable operating model.

The use of a platform to deliver tasks supports a collaborative approach to completion; tasks may be distributed across a team (both within and between organisations) with ease. It is also possible to configure a platform to deliver information management activities as part of the overall project management, removing a barrier to adoption.

A platform can be used to audit completion of tasks with user actions automatically recorded and time-stamped. The auditing process could be used to demonstrate implementation of the UK BIM Framework, a core policy of the Construction Playbook.

Workflow automation would support a review and approval process of completed tasks and notify delivery of information management resources. Where activities are incomplete, automated reminders help individuals to manage their work, potentially across several projects. These automated processes are less error-prone than manual tracking and reporting.

The use of a platform to deliver information management activities eases dissemination across multiple projects and teams. While training and education will be important, the tasks themselves can be easily replicated for widespread implementation.

Our trial did not just track completion of activities, which can be offered by project management software; it also generated information deliverables, increasing auditability and reducing scope for error. Furthermore, our trial provided explanations for the purpose of the tasks and cross-references to UK BIM Framework Guidance as well as ISO 19650-2. This is designed to improve user understanding of the tasks and their purpose.

3. Development of tasks to support implementation of ISO 19650

Overview

The proof-of-concept (PoC) project has explored how the requirements in ISO 19650-2 (the standard) could be represented as a sequence of actionable tasks deployed on a software platform. The Morta platform was used to test the approach but the project focused on the tasks and production of outputs.

Project activities were the creation of tasks to support implementation of selected clauses from the standard and the testing of these activities with volunteer client organisations ('appointing parties' in the terminology of the standard).

To prove the concept, we developed tasks to address the following ISO 19650-2 clauses:

- 5.1 'assessment and need'
- 5.2 'invitation to tender'
- 5.3 'tender response' and
- Clause 5.4.3, the establishment of the lead appointed party's exchange information requirements (within the 'appointment' step of the process).

These clauses also generated the following information management resources:

- the project information requirements (PIR) – clause 5.1.2
- the appointing party's exchange information requirements (EIR) – clause 5.2.1
- the lead appointed party's BIM execution plan (BEP) – clause 5.3.2
- the lead appointed party's exchange information requirements (EIR) – clause 5.4.3.

Different types of task

Some of the tasks created only sought confirmation that a requirement from ISO 19650-2 had been achieved. For example, the requirement for an appointing party to establish the reference information to be shared with prospective lead appointed parties (clause 5.1.6) task was, 'Please confirm that you have obtained the information required'.

Other tasks guided users through the production of an information management resource. We used this approach for:

- project information requirements
- appointing party exchange information requirements
- lead appointed party BIM execution plan and exchange information requirements

For each activity associated with production of an information management resource, the user is guided through a sequence of tasks to build the resource as a table or series of tables and text responses. Tables provide structure for the user responses and enable the responses to be reused elsewhere within the tasks. The table columns reflected the details set out in the relevant ISO 19650-2 clause. For example, in relation to the appointing party exchange information requirements, the whole table is developed through a series of tasks that progressively add the detail set out in clause 5.2.1 a) to e).

In preparing the tasks it was important to retain the distinction between the ISO's absolute requirements, written as 'shall' statements, and absolute considerations, written as 'shall consider' statements.

The 'shall consider' tasks enable users to record that something has been considered even when no subsequent action is required. To capture cases where additional considerations needed to be included, a further task to document them was also presented. For example, the last task in the sequence to action the project's information standard was, 'Should you have any further considerations please add them as a task below' (clause 5.1.4).

4. Testing the concept

The proof-of-concept (PoC) was tested with four client organisations, who in the terminology of ISO 19650-2 act as appointing parties:

- Department for Education
- Environment Agency
- Manchester Foundation Trust working with Arcadis
- University of Cambridge Estates Department

These organisations tested the PoC approach to setting up the information management process for a new project ('assessment and need', and 'invitation to tender' activities of ISO 19650-2 clauses 5.1 and 5.2), where project appointments are to be made by the client. This approach took each organisation through the steps to generate a set of project information requirements and a set of exchange information requirements.

Approach benefits

'This can help upskill the supply chain.'¹⁰

The client organisations testing this approach told us that it creates an opportunity to provide guidance as to *how* tasks (and hence the standard) are implemented. There are also opportunities to deliver guidance in context, at the time it is needed.

They also thought that task management functionality, to ensure that all relevant activities were completed and to have a high-level view of information management compliance across all current projects, was beneficial.

'This approach educates people on what information management should be, going beyond 3D modelling.'¹¹

¹⁰ Tester comment
¹¹ Tester comment

Approach considerations

Organisations will need to spend time setting up this approach to ensure that it aligns with their organisational processes and is integrated with other resources.

The tasks we created assumed knowledge of ISO 19650-2. We heard that if the approach were adopted, more explanation would be necessary, especially for those transitioning from the former standards (PAS and BS 1192).

It was suggested that it would be useful to have the information protocol in an editable format.

Comments on functionality

Government client testers stated that it would be essential for such an approach to be able to cascade information, to cope with framework appointments (not available in the PoC).

Testers valued the ability to define tasks and response type, and to assign tasks to enable collaboration and then monitor their progress. The project team noted that it would be beneficial to integrate information management tasks with other project management actions, rather than creating a separate silo of tasks.

Testers commented that they would like the flexibility to integrate this approach with other organisational processes such as the information delivery plan approach that has been developed by some government departments.

The following required functionality was identified by the testers. The ability to:

- import organisational resources;
- export to other formats such as Word, Excel, PDF;
- interface with external information systems;
- contain a library of organisation responses; and
- provide help, including an in-context glossary.

5. Outputs: example tasks

The purpose of this project was to test the use of actionable tasks to support implementation of ISO 19650-2. The tasks we created are shared here to enable organisations considering a similar approach to learn from them.

Below, we have provided the task breakdown structure and the response types developed for this proof of concept.

These were structured as follows:

- **Process:** This is the highest level of grouping for a set of tasks. In this project these mainly corresponded to the top-level clauses within ISO 19650-2.
- **Process description:** This is a description of what the process entails, along with high-level tasks.
- **Level:** This can be a 'subprocess' or a 'task'.
- **Title:** This is the title of the 'subprocess' or 'task'.
- **Description:** This is more information about the 'subprocess' or 'task'.
- **Response type:** If this process requires a response, the response can follow three types, which control the information flow into the platform. By structuring information, we improve the quality of information and ensure it is fit for reuse. The three types used within this project were:
 - Text response – this is a free text field.
 - Enumeration – this is a pre-defined list of values (drop-down list).
 - Table – see adjacent table. This can incorporate the above response types.

Table 1: Sample structure excerpt (not all columns are shown)

Process	Level	Title	Description	Response type
5.1 Assessment and need	Subprocess	Establish project information requirements – consideration		
	Task	Project scope	Please consider the project scope. If you have anything you would want to record on the project scope in the PIR please confirm it below.	Considered/not considered Text response
	Task	Purposes of information	Please consider the purposes of information for this project. If you have anything you would want to record on the purposes of information in the PIR please confirm it below. The below includes sample purposes of information. It is recommended that you revise these purposes to suit your organisation's and project's purposes.	Considered/not considered [purposes table]
	Task	Project plan of work	Please consider the Project Plan of Work. If you have anything you would want to record on the Project Plan of Work in the PIR please confirm it below.	Considered/not considered [plan of work table]

Export formats

The exports have been made available in four formats: [Word](#), [Excel](#) and [JSON](#).

6. Barriers to adoption

In this proof-of-concept, we identified additional technical, behavioural and commercial issues outside the scope of our project. The principal technical issue is likely to be interoperability. This package of work has identified these issues but has not sought solutions.

Technical issues to be addressed: interoperability is paramount

If an organisation makes an information submission on a platform that is not part of their normal business processes (through being required to do so as part of a project) they will also need to retain that information in their own records. Similarly, clients will need to ensure that their records are updated. We have therefore identified requirements for there to be a simple way to extract the information in an interoperable format and for systems to lock and store the information for an agreed period.

Where this approach is integrated with existing project management tools, organisations will need to ensure that there is no duplication of activities.

Behavioural change required to drive effective implementation

A key challenge for industry is how to help industry to engage with the standards and guidance to achieve 'broad and deep use'. There is concern that people need not just to complete tasks, but rather to understand and respond to them.

There is a tension between guiding people to the decisions they need to make and constraining their freedom to implement as they see fit. From the feedback received from testers, the project team thought that not all the testers understood their role in the project as framed within the UK BIM Framework Guidance. In this context, it is valuable to consider how tools such as this approach can deepen the understanding of their role.

As with any new approach, users will need training; organisations should not neglect the requirement for information management and ISO 19650-2 training. Where this approach is used across a collaborative team, the training will enable the team to adjust to new patterns of work.

Commercial and IP issues

We have identified several commercial and IP issues that would need to be addressed before a commercial platform could provide services:

- Licensing of the standards – the standards and guidance are supposed to be read together. There are ways in which a platform could support this, but they would require licensing formats that facilitate this.
- The licensing model would need to allow for the fact that organisations might be compelled to use several platforms. An organisation's licence would need to permit use of the standards digitally across multiple platforms.
- The UK BIM Framework Guidance is currently freely available under licence conditions that prevent it from being exploited commercially.

7. National/international initiatives which affect this topic

This proof-of-concept has been undertaken in a dynamic landscape in which there are many adjacent initiatives. The project team is aware of the following complementary initiatives (this list does not aim to be exhaustive).

A European standard has been written to capture the concepts and principles of 'level of information need'. This topic was introduced in the ISO 19650 series and is part of the project information standard and the exchange information requirements. The new standard is available in the UK as BS EN 17412-1:2020 *Building Information Modelling – Level of Information Need*.

A European working group has been developing guidance for implementing exchange information requirements and BIM execution plans. This adds practical detail to the requirements in ISO 19650-2. At the time of writing, this guidance is being considered for final approval prior to publication.

The Scottish Futures Trust has developed a 'Standard Information Management Plan' that provides a common approach to embed robust information practices across the supply chain in accordance with BS EN ISO 19650 parts 1 and 2.

The Centre for Digital Built Britain (CDBB) has commissioned the development of an Information Requirements Wiki toolkit. This is a collaborative and crowd-sourced repository of key information requirements that can be both used as a learning tool and inform participating public-sector client organisations' information requirements.

Client Information Management Platform functional requirements is a programme of work which addresses the requirements of serial procurers with framework agreements and 10s or 100s of concurrent projects. This requires a layered approach to information requirements definition split between organisation, framework and project levels. This work was initiated by CDBB's BIM Interoperability Expert Group and is being developed by the Government and Industry Interoperability Group.



8. Future scenarios

In the future, digital transformation could affect the entire standards life cycle, from initial definition, through to development, implementation within industry, to assurance to review/revision. This project has focused on how digital processes could support the implementation of standards.

As we look to the future, it may be possible that:

- Individuals undertaking information management will be able to use data and analytics on how different roles in the organisation are interacting with their processes to make decisions on changes and improvements;
- Educational content and guidance can appear in context when needed by the user;
- Standards will be implemented and communicated within the applications that professionals use to complete their work;
- Evidence can be collected on how standards are being implemented.



9. Conclusion and next steps

Every project, asset and organisation is different; however, many projects have relatively consistent underlying processes. This proof-of-concept explored the use of tasks to communicate and structure information-management-related processes for built environment organisations. This approach could be extended to other processes and functions, both those specific to individual entities and those operating across a sector.

Processes are used to embed a way of working in our teams; they create a sense of 'how we do things' and what is important. Organisations seeking to adopt good practice and industry standards will find the task much simpler if they ensure that their internal processes are aligned with and support the standards they are adopting. There are many ways in which they can do this, but we can reasonably expect that digital platforms are likely to be increasingly used to support an ever-wider range of processes.

While this project started with the aim of exploring automated compliance, we do not think that this is likely in the near term (five years). Certain aspects of tasks can be objectively verified from the associated metadata, and this level of verification is still valuable; however, the proof-of-concept found that many tasks require a person to decide whether a response is sufficient and appropriate. As this method of working is adopted, the project team considers that the benefits of information reuse will be more widely recognised, constrained choice will become less of an issue, and the process of change will accelerate.

The project team considers that the use of a task-based approach would increase the consistency of ISO 19650-2 implementation. We note that there will always be a stage of process alignment whenever such a methodology is adopted:

- larger businesses will tend towards adapting such tools to organisational processes;
- small and medium-sized enterprises, if they do not adapt the tools, will have to adapt their organisational processes to those encoded in the tool.

It is therefore necessary to plan (and allow for the cost) of this process alignment during implementation. Training should also be provided as part of this implementation. For larger, serial procuring organisations, information delivery requirements will typically need to be embedded in term framework agreements. The opportunity to include information delivery scope must be taken when these framework agreements are periodically reproced.

If we believe that process alignment is important for successful implementation of new standards, and that digital platforms will rise in popularity, it is worth considering the potential impacts of this. There would be increased demand for content for such platforms. This content could obviously be developed multiple times by different software vendors. An alternative would be that content could be developed for the sector and made available to platform developers.

The processes that were developed within the proof-of-concept are provided as downloads from [CDBB's website](#). Please do refer to them if you are interested in the way in which the clauses were encoded as actionable tasks.

If you would like to provide comments on this project, please contact engagement@cdbb.cam.ac.uk.

10. Project participants

This study was supported by a team comprising David Churcher, Hitherwood Consulting, and Sarah Davidson, University of Nottingham, as subject matter experts; Mo Shana'a at Morta as technology expert; and the project was led by Nicola Pearson, Centre for Digital Built Britain (CDBB).

The PoC team reported to an advisory panel throughout the project:

Stuart Chalmers, National Physical Laboratory; Paul Dodd, Scottish Futures Trust; Anne Kemp, Atkins and The UK BIM Alliance; Alex Luck, CDBB; Fiona Moore, CDBB; David Philp, Construction Innovation Hub; Dan Rossiter, BSI; Neil Thompson, CDBB; and Steve Yeomans, BRE.

The following organisations tested the tool as appointing parties (clients):

- Environment Agency (EA)
- Department for Education (DfE)
- Manchester University NHS Trust (MFT) and Arcadis
- University of Cambridge Estates Department (UoC)

In particular: Karen Alford and Graeme Tappenden, EA; Jeannine Gavaghan, DfE; David Bailey, MFT; and Nick Voegt, Arcadis; and Chris Hinton, UoC.

Thank you to all those who gave generously of their time throughout this project.



About the Construction Innovation Hub

The Construction Innovation Hub brings together world-class expertise from the Manufacturing Technology Centre (MTC), BRE and the Centre for Digital Built Britain (CDBB) to transform the UK construction industry.

With £72 million from UK Research and Innovation's Industrial Strategy Challenge Fund, and working around the four core themes of **Value, Manufacturing, Assurance and Digital**, we are changing the way that buildings and infrastructure are designed, manufactured, integrated and connected within our built environment.

We are a catalyst for change. We are driving collaboration to develop, commercialise and promote digital and manufacturing technologies for the construction sector. We are helping to build smarter, greener and more efficient buildings much faster and cheaper than we currently do.

Research is helping us to understand how the industry needs to change in terms of skills, product standards, capacity and innovation. This is combined with an academic programme to create the security-minded frameworks and rules that will underpin the future digital built environment and grow exports for UK know-how.

We are working closely with other initiatives as part of the Government's Transforming Construction Challenge programme. Through collaboration across the sector, we can provide a better built environment for future generations.

Further information

For further details about the Construction Innovation Hub or the Value Toolkit, please contact:

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