
**Organization and digitization of
information about buildings and civil
engineering works, including building
information modelling (BIM) —
Information management using
building information modelling —**

**Part 4:
Information exchange**

*Organisation et numérisation des informations relatives aux
bâtiments et ouvrages de génie civil, y compris modélisation des
informations de la construction (BIM) — Gestion de l'information par
la modélisation des informations de la construction —*

Partie 4: Échange d'informations



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Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
3.1 Terms relating to phases.....	2
3.2 Terms relating to activities.....	2
4 Process overview	3
5 Process steps	3
5.1 Mobilization and information production.....	3
5.1.1 General.....	3
5.1.2 Mobilization and testing prior to information exchange.....	3
5.1.3 Implementation.....	4
5.2 Shared state.....	4
5.3 Published state.....	5
5.4 Change actions.....	5
5.4.1 General.....	5
5.4.2 Identify issues and risks.....	5
5.4.3 Allocate issues and risks.....	5
5.4.4 Implement changes.....	5
6 Decisions on change of state	6
6.1 Decision A: approve for sharing.....	6
6.2 Decision B: authorize and accept for publication.....	6
6.3 Decision criteria.....	6
6.4 Exceptions.....	7
7 Criteria for reviewing an information exchange	8
7.1 Common data environment (CDE).....	8
7.2 Conformance.....	8
7.3 Continuity.....	8
7.4 Communication.....	9
7.5 Consistency.....	9
7.6 Completeness.....	10
7.7 Other criteria (informative).....	10
Annex A (informative) Open schema and data format standards	11
Bibliography	12

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 59, *Buildings and civil engineering works*, Subcommittee SC 13, *Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM)*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 442, *Building Information Modelling (BIM)*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

A list of all parts in the ISO 19650 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

ISO 19650-1 to ISO 19650-3 require the sharing of project and asset information as part of collaborative and convergent processes. These provide the governance and strategy around the execution of information management during both the delivery phase and operational phase of the whole life cycle. ISO 19650-4 supplements ISO 19650-1 to ISO 19650-3 and ISO 19650-5 by providing the explicit process and criteria for each individual information exchange. The intention is to secure the benefits arising from collaborative and interoperable building information modelling (BIM) by choosing 'open' schemas, data formats and conventions whilst specifying when alternatives may be appropriate.

Information exchange occurs within the information production and consumption process at every level between project teams and asset/facility management and operation teams (see ISO 19650-2:2018, Figure 2 and ISO 19650-3:2020, Figure 3). It is critical that appropriate criteria are applied to ensure the reliability of the information and the repeatability of the processes. The requirements around information exchange (identified in this document) are distinct from any specific "exchange information requirements (EIR)" as used in ISO 19650-1, ISO 19650-2 and ISO 19650-3.

The information exchange process is based on the choice of how information containers (see ISO 19650-1:2018, 3.3.12) are specified to ensure that information can be managed.

In this context, an information container:

- is given a persistent identifier and other metadata;
- can be retrieved, using a common data environment (CDE) and appropriate status metadata;
- is made persistent, using revisioning and systematic archiving.

The use of appropriate quality assurance and quality control measures supports the fulfilment of a specific exchange information requirement related to an individual information exchange by enumerating criteria relating to completeness, compliance to formal exchange schemas, the continuity of concepts between exchanges and the elimination of spatial and specification conflicts.

It promotes a proportional and sustainable approach to information exchange where the immediate delivery of information does not limit its future use.

The concepts and principles relating to the application of the requirements within this document are provided in ISO 19650-1, and in the information exchanges specified in ISO 19650-2 and ISO 19650-3. EN 17412-1^[1] describes a methodology for qualifying an exchange with criteria relating to level of information need.

NOTE Asset delivery and operation have a role in achieving the UN Sustainable Development Goals^[2].

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Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling —

Part 4: Information exchange

1 Scope

This document specifies the detailed process and criteria for decision makings when executing an information exchange as specified by the ISO 19650 series to ensure the quality of the resulting project information model or asset information model. It details the implementation of the concepts in ISO 19650-1 and is applicable to any information exchange within the delivery stages covered by ISO 19650-2 and operational trigger events covered by ISO 19650-3.

This document is applicable to assets of all sizes and all levels of complexity. This includes portfolios of buildings, campuses, infrastructure networks, individual buildings and pieces of infrastructure. The requirements in this document should be applied in a way that is appropriate to the scale and complexity of the asset. This document makes use of the phrase “shall consider”. This phrase is used to introduce a list of items that the person in question is required to think about carefully in connection with the primary requirement described in the subclause. The amount of thought involved, the time taken to complete it, and the need for supporting evidence depend on the complexity of the asset, the experience of the person(s) involved, and the requirements of any national policy on introducing building information modelling. On a relatively small or straightforward asset, it can be possible to complete, or dismiss as not relevant, some of these “shall consider” items very quickly. One way to help identify which of the “shall consider” statements are relevant can be to review each statement and create templates for assets of different sizes and complexity.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6707-1, *Buildings and civil engineering works — Vocabulary — Part 1: General terms*

ISO 6707-2, *Buildings and civil engineering works — Vocabulary — Part 2: Contract terms*

ISO 19650-1:2018, *Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 1: Concepts and principles*

ISO 19650-2:2018, *Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 2: Delivery phase of the assets*

ISO 19650-3:2020, *Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 3: Operational phase of the assets*

ISO 19650-5, *Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) — Information management using building information modelling — Part 5: Security-minded approach to information management*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6707-1, ISO 6707-2, ISO 19650-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1 Terms relating to phases

3.1.1 stage

distinct period in a project used as a management tool

Note 1 to entry: A stage generally terminates at a key decision point (ISO 19650-1:2018, 3.2.14).

Note 2 to entry: Handover can be viewed as a delivery stage and as an operational trigger event.

Note 3 to entry: Trigger event is defined in ISO 19650-1:2018, 3.2.13.

[SOURCE: ISO 6707-2:2017, 3.3.4, modified — The original note 1 to entry has been removed; new notes 1 to 3 to entry have been added; the preferred term "phase" has been removed.]

3.2 Terms relating to activities

3.2.1 information provider

actor who provides information in an information container

EXAMPLE 1 A structural engineer acts as an information provider in preparing a detailed proposal during a detailed design *stage* (3.1.1).

EXAMPLE 2 A maintenance team acts as an information provider in preparing an inspection report on an asset during an operational trigger event.

Note 1 to entry: Information providers include both the authors of requirements and the providers delivering information according to the requirements.

3.2.2 information receiver

actor who receives information in an information container

Note 1 to entry: An information receiver can be the appointing party or a lead appointed party with responsibility for the authorization and acceptance of information into the published state. See ISO 19650-1:2018, Figure 6.

Note 2 to entry: For appointing party, lead appointed party and appointed party see ISO 19650-1:2018, 3.2.3 and 3.2.4.

3.2.3 information reviewer

actor who reviews information and its information container

EXAMPLE An *information provider* (3.2.1) such as a structural engineer or maintenance team, acts as a reviewer before approval from the work in progress (WIP) state.

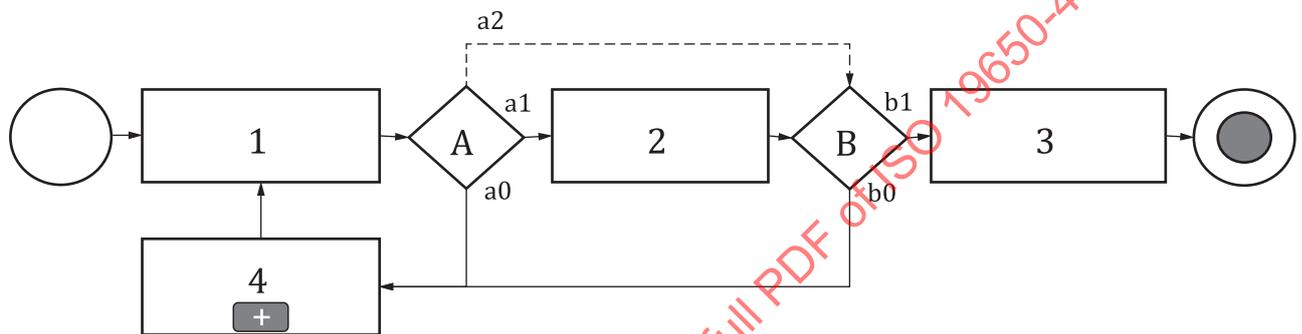
Note 1 to entry: The task team leader acts as reviewer before approval out of work in progress (WIP) state.

Note 2 to entry: The delivery or operational team including the lead appointed party, act as reviewers before the authorization into the published state and its possible acceptance by the appointing party.

Note 3 to entry: An information reviewer can be an artificial intelligence agent or an automated rules-based process.

4 Process overview

Each information exchange, whether executed during or at the end of a stage or trigger event, shall be executed as specified in ISO 19650-2:2018, 5.6 and 5.7 or ISO 19650-3:2020, 5.6 and the associated governance arrangements, as summarized in [Figure 1](#). Each process is detailed in [Clause 5](#), each decision in [Clause 6](#) and the criteria in [Clause 7](#).



Key

- 1 generate work in progress (see [5.1](#))
- 2 use shared state (see [5.2](#))
- 3 use published state (see [5.3](#))
- 4 develop change actions (see [5.4](#))
- A decision A: approve for sharing (a1, see [6.1](#)) or change action (a0, see [5.4](#)) or omission from the shared state (a2, see [6.4](#))
- B decision B: authorize and accept for publication (b1, see [6.2](#)) or change action (b0, see [5.4](#))

Figure 1 — Information exchange process

NOTE [6.4](#) provides the criteria and examples of information exchanges that can omit the shared state given other controls, shown dotted.

5 Process steps

5.1 Mobilization and information production

5.1.1 General

During delivery stages and operational trigger events information providers shall produce information and develop information containers using other shared and/or published resources and reference information as background information, and as work in progress (see [Figure 1](#), key 1).

NOTE Implementation ([5.1.3](#)) can be dependent on steps taken during mobilization ([5.1.2](#)).

5.1.2 Mobilization and testing prior to information exchange

The methods and procedures of undertaking an information exchange shall be tested to ensure flow of information, prior to finalizing requirements and exchanging deliverables.

The information provider shall review and confirm the selected authoring software to use during mobilization (ISO 19650-2:2018, 5.4 and ISO 19650-3:2020, 5.4).

To facilitate the information development process, the information provider shall select authoring software that supports:

- import of the schemas and data formats of relevant reference information;
- export of the requested schemas and data formats; and
- interaction with any agreed issue and risk registering and agreed management tools.

The information receivers and information reviewers shall review and confirm the versions of open data formats and proprietary data formats to be used.

The information receivers shall consider the need and benefits for information exchange using:

- open schema and data format standards that allow cross-party collaboration and
- proprietary or native data formats where this does not disadvantage any information receivers' immediate or future needs.

NOTE Open schemas and data formats are summarized in [Annex A](#).

The information receivers shall check and confirm the selected review and integration software (ISO 19650-2:2018, 5.4 and ISO 19650-3:2020, 5.4) capable of the appropriate handling of information exchanges including:

- importing into a persistent information container;
- federating using applications to create a temporary information resource and
- linking as information references or semantic web linking.

5.1.3 Implementation

All information development and information exchanges shall be executed under the appropriate security arrangements or security management plan (ISO 19650-5).

The information provider shall plan the exchange of information, to support collaborative working and the CDE process as described in ISO 19650-1:2018, Clause 12, and exchange it conforming to the agreed governance (ISO 19650-2:2018, 5.5 or ISO 19650-3:2020, 5.5) with appropriate status:

- when the information is in a coherent state (ISO 19650-2:2018, 5.7);
- early in a delivery stage or operational trigger event and
- often, when changes have been made.

NOTE See [6.1](#) for the subsequent decision A for approval into the shared state.

5.2 Shared state

Information reviewers shall review the information container, against the criteria for reviewing an information exchange (see [Clause 7](#)), using the shared information as reference material and context where necessary. (ISO 19650-1:2018, Clause 12). See [Figure 1](#), key 2.

NOTE 1 See [6.1](#) for the preceding decision A for approval into the shared state.

NOTE 2 Reference information can be provided by the appointing party or other teams.

NOTE 3 See [6.2](#) for the subsequent decision B for authorization and acceptance into the published state.

5.3 Published state

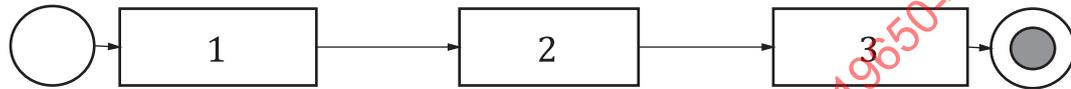
The information receiver shall use the information exchanged in the published state for the key decisions, completion of a delivery stage or operational trigger event and subsequent, stages and trigger events (ISO 19650-1:2018, Clause 12). See [Figure 1](#), key 3.

NOTE See [6.2](#) for the preceding decision B for authorization and acceptance into the published state.

5.4 Change actions

5.4.1 General

Change action can be required from issues and risks detected at decision A and at decision B (see [Figure 1](#), key 4), as illustrated in [Figure 2](#).



Key

- 1 identify issues and risks (see [5.4.2](#))
- 2 allocate issues and risks (see [5.4.3](#))
- 3 implement changes (see [5.4.4](#))

Figure 2 — Change action process

5.4.2 Identify issues and risks

An information reviewer shall review the information to identify any issues and risks relevant to the purpose for the information exchange (see [Figure 2](#)).

EXAMPLE 1 The structural engineer can review their coordination models against any shared coordination models.

EXAMPLE 2 In response to the outcome of a thermal analysis, the mechanical engineer resizes the air handling unit, and updates the mechanical coordination model. The electrical engineer reviews the coordination model and respond to new electrical supply demands of the mechanical systems.

EXAMPLE 3 The maintenance team can review that the received report uses agreed equipment identifiers.

NOTE A collaborative issue register can hold the information delivery risks (see ISO 19650-2:2018, 5.3.6 and ISO 19650-3:2020, 5.3.6). Commercial, operational and health-and-safety risks can be handled separately.

5.4.3 Allocate issues and risks

An information reviewer shall document all identified issues and risks for revision and corrective actions to the lead appointed party or as set out in the appointment. A determination can then be made as to whether the issue or risk can be allocated directly or requires a collaborative review (see [Figure 2](#)).

NOTE Documentation can be through BCF^[3], through other messages or by direct entry into a register.

5.4.4 Implement changes

The information provider shall implement any necessary revisions and change actions in their work in progress state, (see [Figure 2](#)), by returning to [5.1.3](#) ([Figure 1](#), key 1).

NOTE Only the information provider can modify and revise an information container in their WIP.

6 Decisions on change of state

6.1 Decision A: approve for sharing

An information provider shall review their information using the criteria in [Clause 7](#) prior to either withholding or granting approval for the information to transition to the shared state (ISO 19650-1:2018, 12.3, ISO 19650-2:2018, 5.6.3 and ISO 19650-3:2020, 5.6.3). See [Figure 1](#) and [5.4](#) for corrective actions.

An information provider shall consider the effectiveness of the processes in effect:

- quality assurance processes by the information provider to ensure compliance;
- quality control processes by the information provider and receivers to check for compliance.

6.2 Decision B: authorize and accept for publication

The information receiver shall review an information container using the criteria in [Clause 7](#). The information receiver shall either reject or authorize and accept for the published state (ISO 19650-1:2018, 12.5, ISO 19650-2:2018, 5.7.2 and ISO 19650-3:2020, 5.6.6). See [Figure 1](#).

NOTE This decision process can be carried out in two steps, the first requiring authorization by the lead appointed party and the second requiring acceptance by the appointing party, as described in ISO 19650-2:2018, 5.7.4 and ISO 19650-3:2020, 5.7.2.

The information reviewers shall consider the effectiveness in ensuring compliance of the quality management processes including:

- quality control and assurance processes applied by the information provider before sharing;
- quality control processes applied by information reviewers after sharing.

6.3 Decision criteria

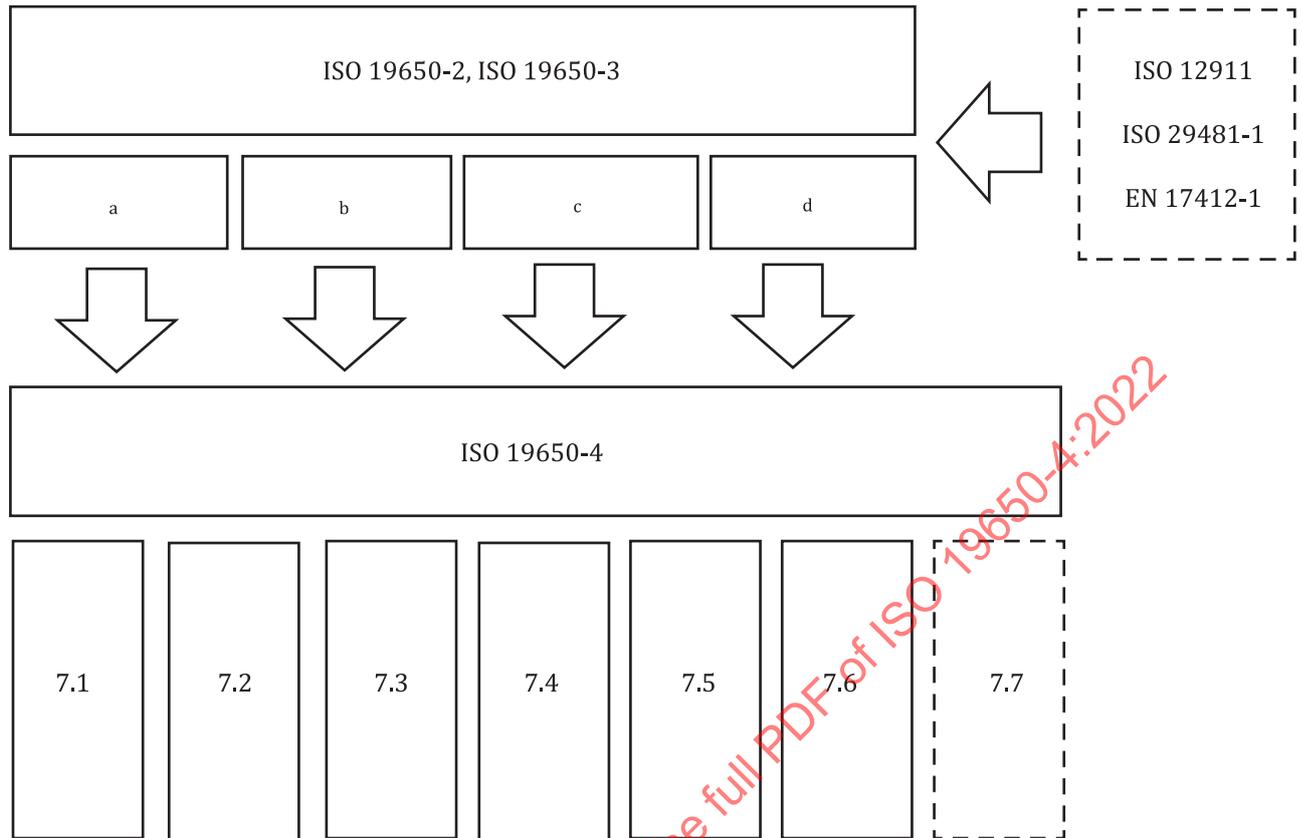
An information reviewer shall support or endorse the information exchange prior to decision A on sharing or prior to decision B on publication if the acceptance criteria in [Clause 7](#) are met, or otherwise raise the pertinent issues for resolution. [Figure 3](#) illustrates sources for criteria.

All the criteria shall be applied to each information container, except as allowed in [6.4](#).

NOTE 1 Criteria can be derived from ISO/TS 12911^[4], ISO 29481-1^[5] and EN 17412-1^[1], and from the information standard, shared resources, information production methods and procedures and any EIR as defined in ISO 19650-2 and ISO 19650-3.

NOTE 2 These criteria can be in the information standard, information production methods and procedures and the applicable EIR and are outlined in ISO 19650-1:2018, 11.3. See also ISO 19650-2:2018, 5.2.1 and ISO 19650-3:2020, 5.2.2.d and [5.4.3](#). Partial acceptance is discussed in ISO 19650-2:2018 5.7.2 and 5.7.4 and ISO 19650-3:2020 5.6.6 and 5.7.2.

NOTE 3 Structured information and consistent processes can support systematic and automated compliance checking.

**Key**

- a project/asset information standard
- b project/asset shared resources
- c project/asset information production methods and procedures
- d EIR

[7.1](#) - [7.7](#) information criteria defined in [clause 7](#).

Figure 3 — Illustration of the sources of criteria

6.4 Exceptions

The review process may exclude information containers that are not subject to revision or change as long as the quality, naming and associated metadata are checked by the information receivers.

The information reviewers shall consider exempting the following cases:

- electronic representations of physical evidence related to administration, certificates and acceptance documents;
- direct process monitoring signals once appropriate automatic filters and triggers have been established following their initial activation including testing;
- photographs, scans and video material.

7 Criteria for reviewing an information exchange

7.1 Common data environment (CDE)

The information reviewer shall check that the naming and metadata requirements of the CDE are correctly applied to the information container.

The information reviewer shall check the metadata describing:

- the information necessary to support the required workflow;
- the information within the container.

The information reviewer shall check that security and handling requirements have not been breached, especially relating to the visibility of the information container to others.

NOTE 1 Refer to ISO 19650-1:2018, Clause 12, ISO 19650-2:2018, 5.1.7 or ISO 19650-3:2020, 5.1.9 and ISO 19650-5.

NOTE 2 If the CDE is composed of multiple CDE solutions, then it can also be necessary to check that the naming and metadata is retained and that the legally significant archive is maintained.

7.2 Conformance

The information reviewer shall check the information container against the chosen exchange schema and data format.

NOTE 1 These checks are part of the checks against the project information standard in ISO 19650-2:2018, 5.6.3, against the asset information standard in ISO 19650-3:2020, 5.6.3 and 5.6.6, and against the acceptance criteria mentioned in ISO 19650-2:2018, 5.7.2 and 5.7.4 and ISO 19650-3:2020, 5.7.2.

EXAMPLE Checking that the schema adheres to ISO 16739-1^[6] and the data format adheres to ISO 10303-21^[7] as agreed in the project/asset information standard.

7.3 Continuity

The information reviewer shall check for the continuity of the content compared with:

- other information containers;
- previous versions of the current information container;
- previous status changes;
- previous delivery stages and operational trigger events;
- previous delivery or operational phases;

with respect to:

- geospatial co-location, including geo-location, site location and asset location;
- calendar coordination;
- spatial, physical, and process entity naming including
 - process, site, facility, storey/region, types and systems and zones, packages and method statements;
- space/location, component and task entity naming;
- attribute, property, material and shape/profile naming.

NOTE 1 This is necessary to support comparisons and progress tracking, ensuring that only actual changes are detected.

NOTE 2 These checks explain in more detail the information container and information model reviews mentioned in ISO 19650-2:2018, 5.6.4, 5.6.5 and 5.7.2, and in ISO 19650-3:2020, 5.6.4, 5.6.5 and 5.6.6.

7.4 Communication

The information reviewer shall check that the exchanged information can be or has been stored without degradation or loss due to translation or conversion.

NOTE 1 Degradation can only be detected after the information container has been exchanged, so tests can also be conducted during mobilization in collaboration with the information provider, and any lessons learned applied.

The information reviewer shall consider effects of information degradation due to changes of:

- date format or calendar assumptions;
- units of measure;
- character sets or encoding.

The information reviewer shall consider effecting comparison using:

- visual inspection;
- reports; and/or
- file size and checksums.

NOTE 2 These checks explain in more detail the information model reviews mentioned in ISO 19650-2:2018, 5.7.4 and ISO 19650-3:2020, 5.7.2.

7.5 Consistency

The information reviewer shall check for the internal consistency with any referenced information containers in terms of:

- spatial, physical and process consistency including the absence of duplication and conflicts such as overlaps or gaps;
- attribute and property consistency such as contradictions;
- gaps or overlaps with adjacent information containers within the federation strategy;
- incorrect allocation with other information containers within the federation strategy;
- appropriate accuracy including quantitative accuracy of locational and property values and thematic accuracy of classification and text properties.

An information reviewer shall consider the intended status code prior to the shared state or the assigned status code prior to the published state as specified in ISO 19650-1:2018, 3.3.12 and 12.1.

NOTE These checks explain in more detail the information container and information model reviews mentioned in ISO 19650-2:2018, 5.6.4, 5.6.5 and 5.7.2, and in ISO 19650-3:2020, 5.6.4, 5.6.5 and 5.6.6.

7.6 Completeness

An information reviewer shall check for the presence and adequacy of the information against the level of information need specified by the EIR and any additional expectations.

NOTE 1 This can include entities, relationships, properties and shape, and their representations and descriptions (see ISO/TS 12911^[4] and EN 17412-1^[1]).

An information reviewer shall consider the following three requirements:

- to satisfy the purposes associated to the immediate delivery stage or operational trigger event;
- to support oversight and coordination of the delivery or operational phase, including support for coordination of spatial, physical and process aspects;
- to enable long-term management and societal requirements, using standard naming and classification and open standards.

An information reviewer shall consider:

- the intended status code prior to the shared state or the assigned status code prior to the published state as specified in ISO 19650-1:2018, 3.3.12 and 12.1;
- using a formalized procedure when checking against the information requirements or checklists derived from them, possibly including structured rules using repeatable automated processes;
- means of sharing checking procedures with information providers through the information production methods and procedures.

NOTE 2 Information Delivery Manuals (IDM), Model View Definitions (MVD) and Information Delivery Specifications (IDS) definitions can have a role in checking for the completeness in terms of entities, relationships, properties and geometry (see ISO 29481-1 and ISO 29481-3^[5]).

NOTE 3 These checks explain in more detail the checks against level of information need mentioned in ISO 19650-2:2018, 5.6.4 and 5.7.2, and in ISO 19650-3:2020, 5.6.4, 5.6.6 and 5.7.2.

7.7 Other criteria (informative)

The information reviewer can also check for satisfaction of the asset delivery and/or operational requirements using judgement and analysis tools as appropriate. Delivery and operational phase requirements can be articulated within the appointment documentation.

The reviewer can consider:

- functional criteria;
- capacity and performance criteria;
- technical standards;
- commercial and legal requirements;
- health and safety considerations.

NOTE This review can be particularly significant at the end of each delivery stage or operational trigger event. See CEN/TR 17439-1 ,6.4^[8].