SLOVENSKI STANDARD
oSIST prEN ISO 23143-2:2026

01-oktober-2026

Izmenjava informacij med BIM in GIS - 2. del: Omogočanje izmenjave podatkov z metapodatki (ISO/DIS 23143-2:2026)

Information exchange between BIM and GIS - Part 2: Facilitating data exchange through metadata (ISO/DIS 23143-2:2026)

Informationsaustausch zwischen BIM und GIS - Teil 2: Erleichterung des Datenaustauschs durch Metadaten (ISO/DIS 23143-2:2026)

Ta slovenski standard je istoveten z: **prEN ISO 23143-2**

ICS:

35.240.67	Uporabniške rešitve IT v gradbeništvu	IT applications in building and construction industry
35.240.70	Uporabniške rešitve IT v znanosti	IT applications in science
91.010.01	Gradbeništvo na splošno	Construction industry in general

oSIST prEN ISO 23143-2:2026 **en,fr,de**

DRAFT International Standard

ISO/DIS 23143-2

Information exchange between BIM and GIS —

Part 2: Facilitating data exchange through metadata

ICS: 35.240.70; 35.240.67

ISO/TC **59**/SC **13**

Secretariat: **SN**

Voting begins on:
2026-07-30

Voting terminates on:
2026-10-22

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/DIS 23143-2:2026(en)

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Published in Switzerland

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Foreword

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For an explanation on 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 the following URL: 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).

A list of all parts in the ISO 23143 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 atwww.iso.org/members.html.

Introduction

This document is the second part of a four-part international standard titled *Information exchange between BIM and GIS*. It provides a framework for metadata-based interoperability to support structured and semantically consistent data exchange between Building Information Modelling (BIM) and Geographic Information Systems (GIS).

This part specifically facilitates data exchange by establishing semantic cross mappings between the IDM Data Schema defined in ISO 29481-3:2022 [1] and the GIS Metadata Schema defined in ISO 19115-1:2014 [2]. It focuses on enabling metadata-driven requests and responses between the two domains, leveraging existing metadata structures without introducing new schemas.

The objective of this document is to allow both BIM and GIS systems to formulate, interpret, and respond to metadata-based queries in a harmonized manner. This includes:

1) Identifying and aligning corresponding metadata elements between BIM (ISO 29481-3:2022 [1]) and GIS (ISO 19115-1:2014 [2]), and classify the types of cross-mapping relationships (e.g., 1:1, 1:N, N:1) based on semantic alignment and information granularity;

2) Supporting semantic interoperability and transformation using a metadata registry according to the ISO/IEC 11179 series, enabling consistent interpretation and reuse of metadata across domains;

3) Enabling metadata-driven information requests structured around the Level of Information Need (LoIN), ensuring that exchanged data meets the specific purpose, scope, and granularity required by the user.

This document does not define new metadata elements or schemas but provides a structure based on existing standards. The mapping results are provided in Annex C, enabling standardized metadata alignment and registry-based interpretation.

Information exchange between BIM and GIS —

Part 2:
Facilitating data exchange through metadata

1 Scope

This document provides guidelines for the data exchange between BIM and GIS through metadata. This document explains the role that metadata plays in facilitating data exchange within the framework of the standards referenced in ISO/DIS 23143-1, Clause 6.3 (Metadata resources).

This document offers a perspective on leveraging metadata to ensure interoperability between BIM and GIS. It builds on the core principles established in ISO/DIS 23143-1 by presenting how metadata supports communication between the two domains, thereby facilitating seamless data exchange

This document defines a framework for facilitating data exchange between Building Information Modelling (BIM) and Geographic Information Systems (GIS) through metadata-driven interoperability. It specifies methods for identifying and cross-mapping metadata elements in the GIS Metadata Schema (ISO 19115-1:2014 [2]), and for deriving BIM-side metadata from IDM Data Schema (ISO 29481-3:2022 [1]) to support semantic alignment and structured transformation between the two domains. ISO 29481-3:2022 [1] is used as a source to derive BIM-side metadata candidates for cross-mapping and is not treated as a metadata schema.

The scope of this part includes:

1) Establishing metadata-based cross-mapping rules to support the semantic translation of information between BIM and GIS, including the use of BIM-side metadata candidates (derived from ISO 29481-3:2022 [1]) and GIS metadata elements (ISO 19115-1:2014 [2]);

2) Supporting bidirectional information requests and responses, where each domain (BIM or GIS) can serve as either information provider or consumer.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/DIS 23143-1 and the following apply.

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

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
class
⟨UML⟩ classifier of a set of objects

[SOURCE: ISO 19103:2024 [3], 3.14]

3.2
information delivery manual
IDM
documentation which captures the business process and gives detailed specifications of the information that a user fulfilling a particular role would need to provide at a particular point within a project

[SOURCE: ISO 29481-1:2016 [4], 3.10]

3.3
information unit
individual information item, such as a window identifier or a room depth

[SOURCE: ISO 29481-1:2016 [4], 3.12]

3.4
information model
set of structured and unstructured information containers

[SOURCE: ISO 19650-1:2018 [5], 3.3.8]

3.5
level of information need
LoIN
framework which defines the extent and granularity of information

Note 1 to entry: One purpose of defining the level of information need is to prevent delivery of too much information.

[SOURCE: ISO 19650-1:2018 [5], 3.3.16]

3.6
metadata
information about a resource

[SOURCE: ISO 19115-1:2014 [2], 4.10]

3.7
metadata element
discrete unit of *metadata* (3.6)

Note 1 to entry: Metadata elements are unique within a metadata class.

Note 2 to entry: Equivalent to an attribute and/or an association in UML terminology.

Note 3 to entry: Class attributes and relationships are referred to collectively as metadata elements.

[SOURCE: ISO 19115-1:2014 [2], 4.11]

3.8
metadata element set
small and fundamental group of data elements or data element concepts through which resources can be described and catalogued in a domain

EXAMPLE DC (Dublin Core), MARC (MAchine Readable Cataloguing), MODS (Metadata Object Description Schema), etc.

[SOURCE: ISO/IEC TR 20943-5:2013 [6], 3.9]

3.9
metadata entity
set of *metadata* (3.6) elements describing the same aspect of data

Note 1 to entry: Can contain one or more metadata entities.

Note 2 to entry: Equivalent to a class in UML terminology.

[SOURCE: ISO 19115-1:2014 [2], 4.12]

3.10
data type
set of distinct values, characterized by properties of those values, and by operations on those values

EXAMPLE The data type "Boolean" with properties "unordered", "exact" and "non-numeric", and with operations "equal", "not", "and" and "or".

Note 1 to entry: Properties of data type values are ordered or unordered, exact or approximate, numeric or non-numeric and, if ordered, bounded or unbounded, as described in ISO/IEC 11404:2007 [7]

[SOURCE: ISO/IEC 11404:2007 [7], 3.12]

3.11
dataset
identifiable collection of data

Note 1 to entry: A dataset can be a smaller grouping of data which, though limited by some constraint such as spatial extent or feature type, is located physically within a larger dataset. Theoretically, a dataset can be as small as a single *feature* (4.5) or feature attribute contained within a larger dataset. A hardcopy map or chart can be considered a dataset.

[SOURCE: ISO 19115-1:2014 [2], 4.3]

3.12
mapping
correspondence between instances of one model and instances of another model that represent the same meaning

[SOURCE: ISO/TS 18876-1:2003 [8], 3.1.14]

3.13
crosswalk
mapping (3.12) of the elements, semantics, and syntax from one *metadata* (3.6) scheme to those of another

Note 1 to entry: Definition taken from *Understanding Metadata*, 2004, NISO Press.[9]

[SOURCE: ISO/IEC TR 20943-5:2013 [6], 3.1]

3.14
domain difference
type of *heterogeneity* (3.15) arising from different kinds of contexts or cultures

[SOURCE: ISO/IEC TR 20943-5:2013 [6], 3.3]

3.15
heterogeneity
difference arising from different descriptions of the same concept

[SOURCE: ISO/IEC TR 20943-5:2013 [6], 3.4]

3.16
information delivery manual specification
IDM specification
instance of an *IDM* (3.2) and its components

[SOURCE: ISO 29481-3:2022 [1], 3.3]

3.17
interoperability
capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units

[SOURCE: ISO/IEC 2382:2015 [10], 2120585, modified - The notes to entry have been removed.]

4 Abbreviations

BIM	Building Information Modelling
GIS	Geographic Information System
GML	Geography Markup Language
ICT	Information and communications technology
IFC	Industry Foundation Classes
INSPIRE	Infrastructure for Spatial Information in Europe
MDA	Model driven architecture
OGC	Open Geospatial Consortium
SDI	Spatial Data Infrastructure
UML	Unified Modeling Language
XML	eXtensible Markup Language
1D	One Dimensional
2D	Two Dimensional
3D	Three Dimensional

5 Metadata for BIM-to-GIS and GIS-to-BIM

5.1 Context for facilitating data exchange through metadata

Within the framework provided by ISO 7817-1:2024 [11], which establishes the concepts of the Level of Information Need (LoIN), metadata play a critical role in standardizing and enabling meaningful data exchange between GIS and BIM systems. The LoIN framework defines the extent, structure, and semantic granularity of the information required at various stages of a project life cycle, ensuring that the exchanged data are aligned with the intended use and decision-making context of each stakeholder. In this context, metadata facilitate semantic interoperability by:

— Defining the scope and granularity of information to be exchanged between systems;

— Supporting the data exchange process as defined in ISO 19650-1:2018 [5], whereby metadata document the fulfilment of information requirements;

— Enabling the alignment of schemas and datasets between BIM and GIS systems via shared metadata registries.

Figure 1 illustrates the architecture of metadata-driven dataexchange between GIS and BIM systems under the LoIN framework. Figure 1 distinguishes between the Application Model Level (which refers to the

metadata schemas such as ISO 19115-1:2014 [2] for GIS and ISO 29481-3:2022 [1] for BIM) and the Data Level (which includes concrete datasets and feature instances such as ifcXML files or CityGML features).

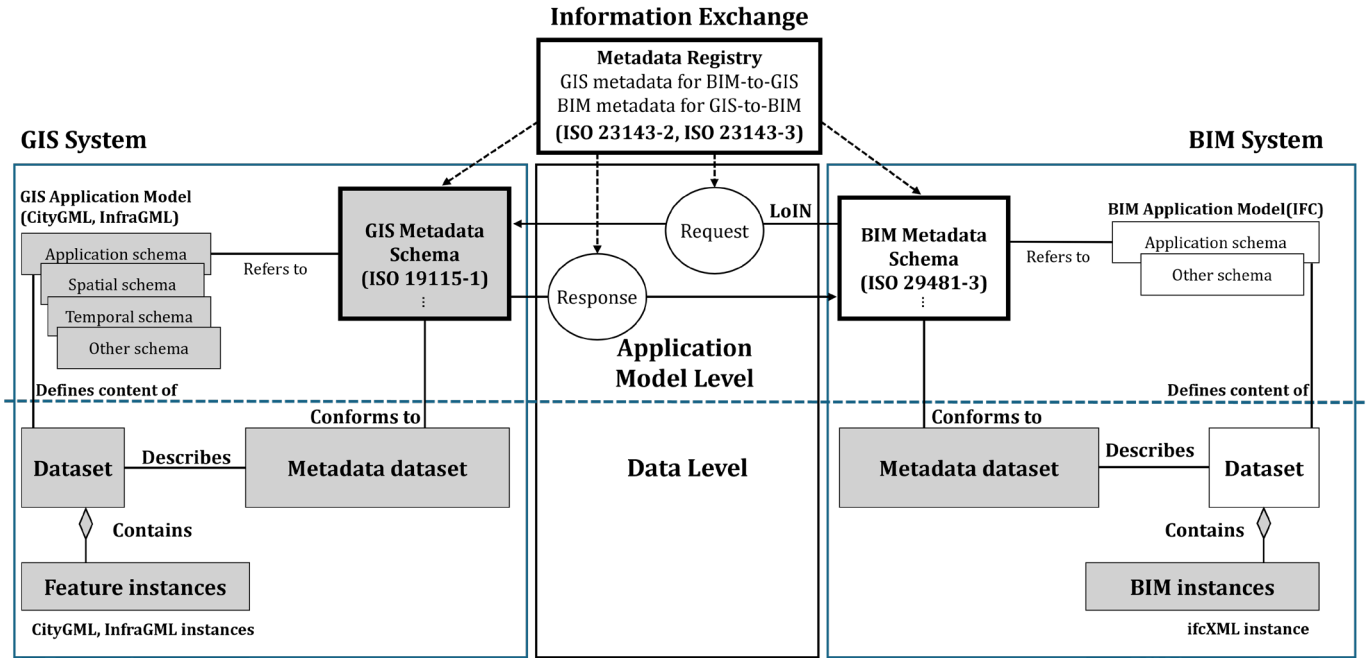

Figure 1 — Data exchange between BIM and GIS through metadata in the context of BIM Level of Information Need (LoIN)

A metadata registry (compliant with the ISO/IEC 11179 series) acts as the semantic bridge between systems, enabling structured and interoperable communication between BIM and GIS environments. The architecture supports bidirectional information requests and responses, allowing both GIS and BIM systems to act as either the information provider or consumer, depending on the use case and project context.

In this model:

— A BIM system may initiate an information request based on its IDM Data Schema (ISO 29481-3:2022 [1]), aligned with LoIN (Level of Information Need) specifications.

— The request is semantically interpreted by the GIS system, which uses the GIS Metadata Schema (ISO 19115-1:2014 [2]) to identify relevant datasets and generate a structured response.

— The response, expressed in GIS metadata, is then translated and contextualized within the BIM environment using cross mapping results and metadata registry entries.

— Conversely, a GIS system may initiate a request for detailed building information or spatial context, which is constructed according to the GIS metadata schema and fulfilled by the BIM system using IFC-based content.

— In both directions, the respective application schemas (e.g., CityGML, InfraGML, IFC) define the content structure, while the metadata registry provides semantic correspondence and interoperability across schema boundaries.

This bidirectional exchange mechanism ensures that both GIS-to-BIM and BIM-to-GIS workflows are supported within a metadata-driven framework and semantically aligned data exchange.

5.2 Cross mapping of metadata elements in BIM and GIS

5.2.1 Context for cross mapping

Cross mapping of metadata elements between BIM and GIS aims to ensure semantic interoperability across domains with fundamentally different information structures. ISO/IEC TR 20943-5:2013 [6] provides a standardized procedure for mapping metadata between heterogeneous domain models, and this procedure is applicable to the semantic alignment of BIM and GIS metadata. By aligning heterogeneous metadata elements through this structured approach, cross mapping improves the consistency and interpretability of data exchanged between BIM and GIS environments.

Figure 2 illustrates the three main processes involved in the data element concept mapping procedure, as defined in ISO/IEC TR 20943-5:2013 [6]. This procedure supports semantic alignment between heterogeneous metadata structures, such as those found in BIM and GIS domains.

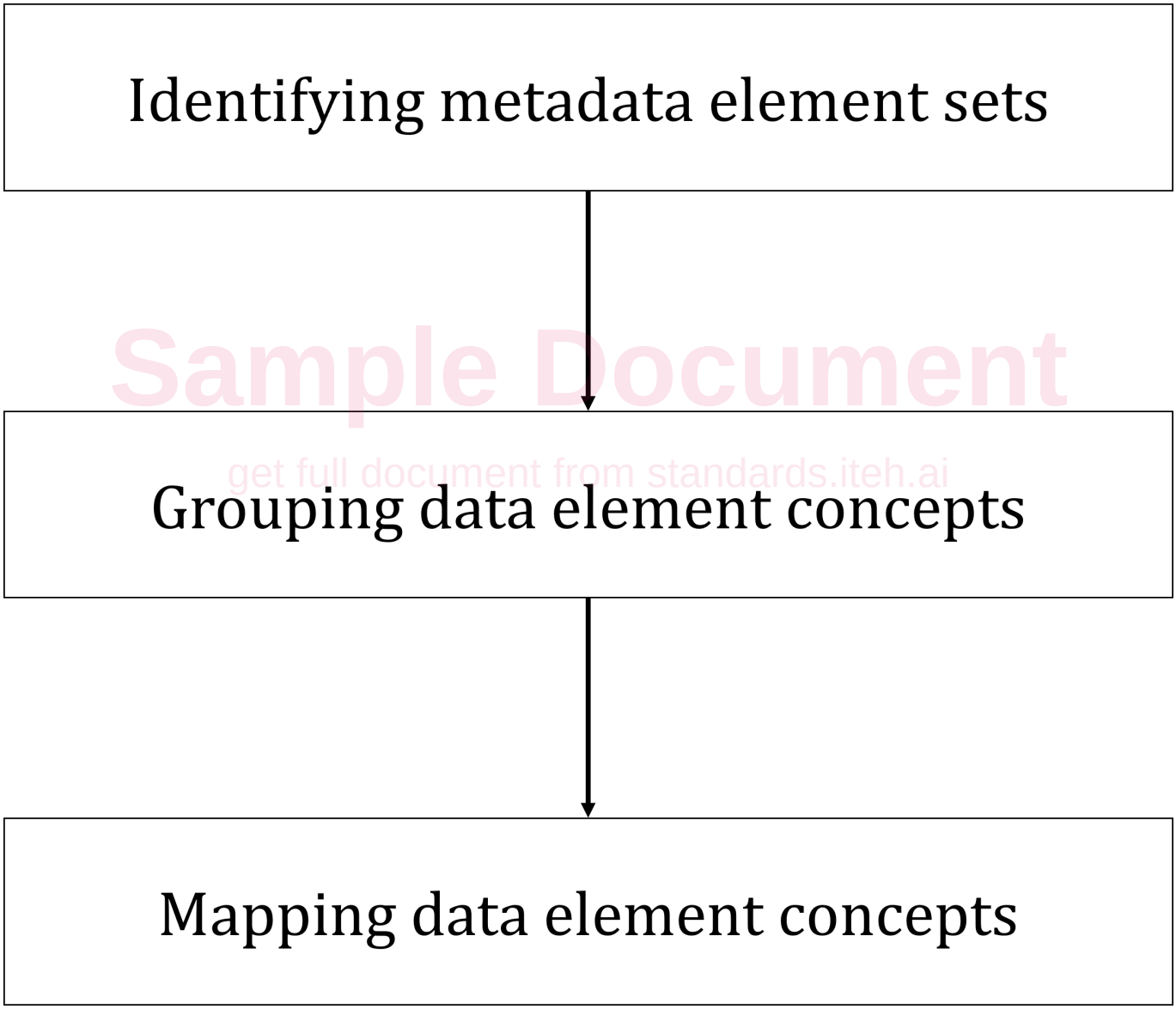

Figure 2 — Procedure for data element concept mapping (ISO/IEC TR 20943-5:2013 [6])

— Identifying Metadata Element Sets : The first step is to determine which metadata element sets should be mapped. This involves surveying available metadata schemas within the domain of interest (e.g., BIM's IDM data schema and GIS's ISO 19115-1:2014 [2] metadata schema). This step ensures that relevant and compatible datasets are selected for further analysis.

— Grouping Data Element Concepts : Once the candidate metadata element sets are identified, the next process is to classify and organize the data element concepts. This step includes the following sub-processes:

  — Identifying object classes (e.g., specId, authoring, businessContextMap, er),

    Grouping concepts according to their object classes,

    Identifying and grouping properties associated with each object class (e.g., guid, shortTitle, documentStatus). This classification supports the creation of semantic groupings across different metadata standards.

— Mapping Data Element Concepts : The final step involves mapping the grouped concepts into a unified table. Each row corresponds to a common data element concept, and columns represent its equivalents across the different metadata standards. Giving notes according to types of heterogeneity (e.g., lexical, hierarchical, syntactic differences) supports documentation and interoperability tracking, and clarifies how each mapping was interpreted.

To apply this procedure in the context of BIM and GIS metadata schema cross mapping, the general concept mapping process defined in ISO/IEC TR 20943-5:2013 [6] can be reinterpreted as follows:

Table 1 — BIM and GIS metadata schema cross mapping procedure (based on ISO/IEC TR 20943-5:2013 [6], figure 2)

Main Processes	Sub-Processes(adapted to BIM and GIS context)
Identifying metadata element sets	a) Identifying BIM metadata schema (e.g., ISO 29481-3) and GIS metadata schema (e.g., ISO 19115-1) to be mapped b) Identifying BIM application schema (e.g., IFC classes) and GIS application schema (e.g., CityGML, InfraGML, IndoorGML, or Indoor Feature Model(ISO 19164)) to be mapped c) Determining the data exchange context (e.g., utility data, floor plans) and Level of Information Need (LoIN)
Grouping data element concepts	d) Grouping BIM and GIS metadata elements by shared object classes (e.g., specId, authoring, businessContextMap, er) e) Identifying properties (e.g., guid, shortTitle, documentStatus) within each object class f) Organizing metadata elements by corresponding properties across BIM and GIS domains
Mapping data element concepts	g) Identifying common data element concepts (e.g., IfcWall ↔ Construction::WallSurface) h) Mapping BIM and GIS elements to shared concepts using semantic correspondences stored in the metadata registry (ISO/IEC 11179) i) Giving notes according to types of heterogeneity for documentation and interoperability tracking

5.2.2 Cross mapping consideration between IDM data schema and GIS metadata schema

To enable reliable semantic interoperability between BIM and GIS, it is essential to align the structural hierarchy of metadata elements defined in their respective standards. The IDM schema defined in ISO 29481-3:2022 [1] (BIM domain) and the metadata schema defined in ISO 19115-1:2014 [2] (GIS domain) follow different conceptual layering. However, from a GIS domain perspective, their elements can be cross-