

INTERNATIONAL
STANDARD

ISO
19110

First edition
2005-02-15

**Geographic information — Methodology
for feature cataloguing**

Information géographique — Méthodologie de catalogage des entités

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ISO 19110:2005

<https://standards.iteh.ai/catalog/standards/sist/3819053e-970e-46d0-99fd-6335db469e52/iso-19110-2005>



Reference number
ISO 19110:2005(E)

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Published in Switzerland

Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Conformance	1
3 Normative references	2
4 Terms and definitions	2
5 Abbreviations	3
6 Principal requirements	4
6.1 Feature catalogue	4
6.2 Information elements	4
Annex A (normative) Abstract test suite	6
Annex B (normative) Feature catalogue template	16
Annex C (informative) Feature cataloguing examples	31
Annex D (informative) Feature cataloguing concepts	46
Bibliography	55

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Foreword

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 19110 was prepared by Technical Committee ISO/TC 211, *Geographic information/Geomatics*.

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Introduction

Geographic features are real world phenomena associated with a location relative to the Earth, about which data are collected, maintained, and disseminated. Feature catalogues defining the types of features, their operations, attributes, and associations represented in geographic data are indispensable to turning the data into usable information. Such feature catalogues promote the dissemination, sharing, and use of geographic data through providing a better understanding of the content and meaning of the data. Unless suppliers and users of geographic data have a shared understanding of the kinds of real world phenomena represented by the data, users will be unable to judge whether the data supplied are fit for their purpose.

The availability of standard feature catalogues that can be used multiple times will reduce costs of data acquisition and simplify the process of product specification for geographic datasets.

This International Standard provides a standard framework for organizing and reporting the classification of real world phenomena in a set of geographic data. Any set of geographic data is a greatly simplified and reduced abstraction of a complex and diverse world. A catalogue of feature types can never capture the richness of geographic reality. However, such a feature catalogue should present the particular abstraction represented in a given dataset clearly, precisely, and in a form readily understandable and accessible to users of the data.

Geographic features occur at two levels: instances and types. At the instance level, a geographic feature is represented as a discrete phenomenon that is associated with its geographic and temporal coordinates and may be portrayed by a particular graphic symbol. These individual feature instances are grouped into classes with common characteristics: feature types. It is recognized that geographic information is subjectively perceived and that its content depends upon the needs of particular applications. The needs of particular applications determine the way instances are grouped into types within a particular classification scheme. ISO 19109, *Geographic information — Rules for application schema* specifies how data shall be organized to reflect the particular needs of applications with similar data requirements.

NOTE The full description of the contents and structure of a geographic dataset is given by the application schema developed in compliance with ISO 19109. The feature catalogue defines the meaning of the feature types and their associated feature attributes, feature operations and feature associations contained in the application schema.

The collection criteria used to identify individual real world phenomena and to represent them as feature instances in a dataset are not specified in this International Standard. Because they are not included in the standards, collection criteria should be included separately in the product specification for each dataset.

A standard way of organizing feature catalogue information will not automatically result in harmonization or interoperability between applications. In situations where classifications of features differ, this International Standard may at least serve to clarify the differences and thereby help to avoid the errors that would result from ignoring them. It may also be used as a standard framework within which to harmonize existing feature catalogues that have overlapping domains.

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Geographic information — Methodology for feature cataloguing

1 Scope

This International Standard defines the methodology for cataloguing feature types. This International Standard specifies how the classification of feature types is organized into a feature catalogue and presented to the users of a set of geographic data. This International Standard is applicable to creating catalogues of feature types in previously uncatalogued domains and to revising existing feature catalogues to comply with standard practice. This International Standard applies to the cataloguing of feature types that are represented in digital form. Its principles can be extended to the cataloguing of other forms of geographic data.

This International Standard is applicable to the definition of geographic features at the type level. This International Standard is not applicable to the representation of individual instances of each type. This International Standard excludes spatial, temporal, and portrayal schemas as specified in ISO 19107, ISO 19108, and ISO 19117, respectively. It also excludes collection criteria for feature instances.

This International Standard may be used as a basis for defining the universe of discourse being modelled in a particular application, or to standardize general aspects of real world features being modelled in more than one application.

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2 Conformance

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Because this International Standard specifies a number of options that are not required for all feature catalogues, this clause specifies 12 conformance classes. These classes are differentiated on the basis of three criteria:

- a) What elements of a feature type are required in a catalogue:
 - 1) feature attributes only?
 - 2) feature attributes and feature associations?
 - 3) feature attributes, feature associations, and feature operations?
- b) Is there a requirement to link feature attributes, feature associations, and feature operations to only one feature type or may they be linked to multiple feature types?
- c) Is there a requirement to include inheritance relationships in the feature catalogue?

Annex A specifies a test module for each of the conformance classes, as shown in Table 1.

Table 1 — Conformance classes

Attributes only	Attributes and associations	Attributes, associations and operations	Properties associated with multiple features	Inheritance relationships included	Test module
X	—	—	—	—	A.17
—	X	—	—	—	A.18
—	—	X	—	—	A.19
X	—	—	X	—	A.20
—	X	—	X	—	A.21
—	—	X	X	—	A.22
X	—	—	—	X	A.23
—	X	—	—	X	A.24
—	—	X	—	X	A.25
X	—	—	X	X	A.26
—	X	—	X	X	A.27
—	—	X	X	X	A.28

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3 Normative references

The following referenced documents are indispensable for the application 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/TS 19103:—¹⁾, *Geographic information — Conceptual schema language*

ISO 19109:—¹⁾, *Geographic information — Rules for application schema*

ISO 19115:2003, *Geographic information — Metadata*

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1

feature

abstraction of real world phenomena

[ISO 19101]

EXAMPLE The phenomenon named ‘Eiffel Tower’ may be classified with other similar phenomena into a feature type ‘tower’.

NOTE A feature may occur as a type or an instance. Feature type or feature instance should be used when only one is meant.

1) To be published.

4.2**feature association**

relationship that links instances of one **feature** (4.1) type with instances of the same or a different **feature** type

4.3**feature attribute**

characteristic of a **feature** (4.1)

[ISO 19101]

EXAMPLE 1 A feature attribute named 'colour' may have an attribute value 'green' which belongs to the data type 'text'.

EXAMPLE 2 A feature attribute named 'length' may have an attribute value '82,4' which belongs to the data type 'real'.

NOTE A feature attribute has a name, a data type, and a value domain associated to it. A feature attribute for a feature instance also has an attribute value taken from the value domain.

4.4**feature catalogue**

catalogue containing definitions and descriptions of the **feature** (4.1) types, **feature attributes** (4.3), and **feature associations** (4.2) occurring in one or more sets of geographic data, together with any feature operations that may be applied

4.5**feature operation**

operation that every instance of a **feature** (4.1) type may perform

EXAMPLE A feature operation upon a 'dam' is to raise the dam. The results of this operation are to raise the height of the 'dam' and the level of water in a 'reservoir'.

NOTE Sometimes feature operations provide a basis for feature type definition.

4.6**functional language**

language in which **feature operations** are formally specified

NOTE In a functional language, feature types may be represented as abstract data types.

5 Abbreviations

DIGEST	Digital Geographic Information Exchange Standard
FACC	Feature and Attribute Coding Catalogue
GFM	General Feature Model
HTTP	Hyper Text Transfer Protocol
IHO	International Hydrographic Organization
TS	Technical Specification
UML	Unified Modeling Language
URI	Uniform Resource Identifier
XML	eXtensible Markup Language

6 Principal requirements

6.1 Feature catalogue

A feature catalogue shall present the abstraction of reality represented in one or more sets of geographic data as a defined classification of phenomena. The basic level of classification in a feature catalogue shall be the feature type. A feature catalogue shall be available in electronic form for any set of geographic data that contains features. A feature catalogue may also comply with the specifications of this International Standard independently of any existing set of geographic data.

6.2 Information elements

6.2.1 Introduction

The following clauses specify general and specific requirements for feature catalogue information elements. Annex B specifies detailed requirements. Annex C illustrates the application of these requirements. Annex D discusses the application of feature operations as the conceptual basis for determining feature types in a feature catalogue.

6.2.2 Completeness

A template for the representation of feature classification information is specified in Annex B. A feature catalogue prepared according to this template shall document all of the feature types found in a given set of geographic data. The feature catalogue shall include identification information as specified in Annex B. The feature catalogue shall include definitions and descriptions of all feature types contained in the data, including any feature attributes and feature associations contained in the data that are associated with each feature type, and optionally including feature operations that are supported by the data. To ensure predictability and comparability of feature catalogue content across different applications, it is recommended that the feature catalogue should include only the elements specified in Annex B. To maximize the usefulness of a feature catalogue across different applications, the use of a conceptual schema language to model feature catalogue information is recommended.

NOTE Natural-language definitions, feature-type aliases, criteria for the birth and death of feature instances, and other semantic elements of the feature catalogue may be included in a conceptual schema as structured comments or as attributes.

6.2.3 General requirements

6.2.3.1 Form of names

All feature types, feature attributes, feature associations, association roles, and feature operations included in a feature catalogue shall be identified by a name that is unique within that feature catalogue. If the name of a feature type, feature attribute, feature association, association role, or feature operation appears more than once in that feature catalogue, the definition shall be the same for all occurrences.

6.2.3.2 Form of definitions

Definitions of feature types, feature attributes, feature attribute listed values, feature associations, association roles, and feature operations shall be given in a natural language. These definitions shall be included in the catalogue, unless the catalogue specifies a separate definition source. If the same term appears in both the definition source and the feature catalogue, the definition in the feature catalogue shall apply.

6.2.4 Requirements for feature types

Each feature type shall be identified by a name and defined in a natural language. Each feature type may also be identified by an alphanumeric code that is unique within the catalogue and it may have a set of aliases. The feature catalogue shall also include, for each feature type, its feature operations and associated feature

attributes, feature associations and association roles, if any. The use of functional language specifications to help define feature types is recommended.

6.2.5 Requirements for feature operations

Feature operations, if any, shall be identified and defined for each feature type. Feature attributes involved in each feature operation shall be specified well as any feature types affected by the operation. The definition shall include a natural language definition and may be formally specified in a functional language.

6.2.6 Requirements for feature attributes

Feature attributes, if any, shall be identified and defined for each feature type. The definition shall include a natural language definition and a specified data type for values of the attribute. Each feature attribute may also be identified by an alphanumeric code that is unique within the catalogue.

6.2.7 Requirements for feature attribute listed values

Feature-attribute listed values, if any, shall be labelled for each feature attribute. The label shall be unique within the feature attribute of which it is a listed value. Each listed value may also be identified by an alphanumeric code that is unique within the feature attribute of which it is a listed value.

6.2.8 Requirements for feature associations

Feature associations, if any, shall be named and defined. Each feature association may also be identified by an alphanumeric code that is unique within the catalogue. The names and roles of the feature types that participate in the association shall be specified.

6.2.9 Requirements for association roles

Association roles, if any, shall be named and defined. The name of the feature type that holds the role and the association in which it participates shall be specified.

Annex A (normative)

Abstract test suite

A.1 Introduction

This normative annex presents the abstract test suite for evaluating conformance to this International Standard. This abstract test suite contains fifteen test cases and twelve test modules: a test case for the existence and form of feature catalogue information (A.2); a test case for general feature catalogue requirements (A.3); test cases for each principal feature catalogue information class (A.4 through A.16); and test modules for specific subsets of the functionality of a feature catalogue (A.17 through A.28).

Test cases are based on each principal-feature catalogue information class specified in Annex B, Tables B.1 through B.15. Each class-based test case consists of examining each class element (attribute or role) and verifying that:

- the obligation/condition specification for the presence of the element is met;
- the maximum number of occurrences of the element is not exceeded;
- the type of the value of the element is correct;

NOTE Unless otherwise stated, e.g., by specifying a type in a well-known package or ISO standard, the type specifications as will be given in ISO/TS 19103 may be applied.

- the value of the element is in accordance with the element description;
- any specified constraint on the element is met.

Tests on the class as a whole are specified as class-constraints as specified in Annex B, Tables B.1 through B.15, and/or in test modules.

Test modules are based on useful subsets of the functionality of the feature catalogue template specified in Annex B. Subsets are organized starting with core functionality capable of representing feature types and feature attributes that are unique to a feature type (see A.17). The core representation functionality is extended by supporting one or more of the following

- additional feature property types (for association roles, see A.18; for both association roles and feature operations, see A.19);
- additional relationships among feature catalogue information elements (for multiple-use feature attributes, see A.20; for inheritance, see A.23; for both multiple-use feature attributes and inheritance, see A.26);
- both additional feature property types and additional relationships among feature catalogue information elements (see A.21, A.22, A.24, A.25, A.27 and A.28).

Test modules are specified by the test cases that apply. Test modules A.18 through A.28 extend the core representation functionality specified by test module A.17. These extensions are summarized in Table 1.

To check that a feature catalogue conforms to this International Standard, verify that all of the requirements in at least one test module are satisfied.

A.2 Test case for existence and form of feature catalogue information

Information for the test case is as follows:

- a) test purpose: verify the existence and form of a feature catalogue;
- b) test method: check whether the feature catalogue exists and can be obtained in electronic form, by obtaining a copy of the feature catalogue such as on a computer disk or through a file transfer;
- c) reference: 6.1;
- d) test type: basic.

A.3 Test case for general feature catalogue requirements

Information for the test case is as follows:

- a) test purpose: verify that general feature catalogue requirements are met;
- b) test method: check
 - 1) if the feature catalogue is specified as applying to a given set of geographic data, then the feature catalogue documents all of the feature types found in that set of geographic data,
 - 2) whether all feature types, feature attributes, feature associations, association roles, and feature operations are identified by a name that is unique within the feature catalogue,
 - 3) whether all feature attribute listed values are identified by a label that is unique within the feature attribute of which it is a listed value,
 - 4) whether all feature types, feature attributes, feature associations, association roles, and feature operations are either defined or reference a definition from another source,
 - 5) if any feature type, feature attribute, or feature association is identified by an alphanumeric code, that alphanumeric code is unique within the feature catalogue,
 - 6) if any feature attribute listed value is identified by an alphanumeric code, that alphanumeric code is unique within the feature attribute of which it is a listed value;
- c) reference: 6.2;
- d) test type: capability.

A.4 Test case for the feature catalogue class

Information for the test case is as follows:

- a) test purpose: verify that the required information is included in objects of class feature catalogue;
- b) test method: test each attribute and role listed in Table B.1 by verifying that for each the specified description, obligation/condition, maximum occurrence, type, and constraint are satisfied;
- c) reference: Annex B, Table B.1;
- d) test type: capability.

A.5 Test case for the feature type class

Information for the test case is as follows:

- a) test purpose: verify that the required information is included in objects of class feature type;
- b) test method: test each attribute and role listed in Table B.2 by verifying that for each the specified description, obligation/condition, maximum occurrence, type, and constraint are satisfied;
- c) reference: Annex B, Table B.2;
- d) test type: capability.

A.6 Test case for the inheritance relation class

Information for the test case is as follows:

- a) test purpose: verify that the required information is included in objects of class inheritance relation;
- b) test method: test each attribute and role listed in Table B.3 by verifying that for each the specified description, obligation/condition, maximum occurrence, type, and constraint are satisfied;
- c) reference: Annex B, Table B.3;
- d) test type: capability.

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A.7 Test case for the feature operation class

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- a) test purpose: verify that the required information is included in objects of class feature operation;
- b) test method: test each attribute and role listed in Table B.5 (and Table B.4) by verifying that for each the specified description, obligation/condition, maximum occurrence, type, and constraint are satisfied. In addition:
 - 1) If feature attributes are unique to a feature type (test modules A.19 and A.25), the type of the following roles shall be FC_FeatureAttribute rather than FC_BoundFeatureAttribute:
 - i) FC_FeatureOperation::triggeredByValuesOf (Table B.5, line 5.3),
 - ii) FC_FeatureOperation::observesValuesOf (Table B.5, line 5.4),
 - iii) FC_FeatureOperation::affectsValuesOf (Table B.5, line 5.5);
 - 2) If the role FC_FeatureOperation::featureType (Table B.4, line 4.4) exists more than once, the association class FC_Binding for each shall satisfy test case A.8. This condition occurs in test modules A.22 and A.28;
- c) reference: Annex B, Tables B.4 and B.5;
- d) test type: capability.

A.8 Test case for the binding class

Information for the test case is as follows:

- a) test purpose: verify that the required information is included in objects of class binding;
- b) test method: test each attribute listed in Table B.6 by verifying that for each the specified description, obligation/condition, maximum occurrence, type, and constraint are satisfied;
- c) reference: Annex B, Table B.6;
- d) test type: capability.

A.9 Test case for the constraint class

Information for the test case is as follows:

- a) test purpose: verify that the required information is included in objects of class constraint;
- b) test method: test each attribute listed in Table B.7 by verifying that for each the specified description, obligation/condition, maximum occurrence, type, and constraint are satisfied;
- c) reference: Annex B, Table B.7;
- d) test type: capability.

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A.10 Test case for the feature attribute class

Information for the test case is as follows: <https://standards.iteh.ai/catalog/standards/sist/3819053e-970e-46d0-99fd-6555db469e52/iso-19110-2005>

- a) test purpose: verify that the required information is included in objects of class feature attribute;
- b) test method: test each attribute and role listed in Table B.8 (and Table B.4) by verifying that for each the specified description, obligation/condition, maximum occurrence, type, and constraint are satisfied. In addition:

If the role FC_FeatureAttribute::featureType (Table B.4, line 4.4) exists more than once, the association class FC_Binding for each shall satisfy test case A.8. This condition occurs in test modules A.20, A.21, A.22, A.26, A.27 and A.28;
- c) reference: Annex B, Tables B.4 and B.8;
- d) test type: capability.

A.11 Test case for the association role class

Information for the test case is as follows:

- a) test purpose: verify that the required information is included in objects of class association role;
- b) test method: test each attribute and role listed in Table B.9 (and Table B.4) by verifying that for each the specified description, obligation/condition, maximum occurrence, type, and constraint are satisfied. In addition:
 - 1) Verify that the value of attribute type (Table B.9, line 9.2) is a domain code from Table B.10,