

AS/NZS ISO 19144.1:2011
ISO 19144-1:2009
ISO 19144-1:2009/Cor.1:2012
(Incorporating Amendment No. 1)

Australian/New Zealand Standard™

Geographic information—Classification systems

Part 1: Classification system structure



AS/NZS ISO 19144.1:2011

This Joint Australian/New Zealand Standard was prepared by Joint Technical Committee IT-004, Geographical Information/Geomatics. It was approved on behalf of the Council of Standards Australia on 15 November 2011 and on behalf of the Council of Standards New Zealand on 14 November 2011.
This Standard was published on 23 December 2011.

The following are represented on Committee IT-004:

ANZLIC—The Spatial Information Council
Australasian Fire and Emergency Service Authorities Council
Australian Antarctic Division
Australian Hydrographic Office
Australian Map Circle
CSIRO Exploration and Mining
Department of Lands, NSW
Department of Primary Industries and Water, Tas.
Geoscience Australia
Land Information New Zealand
Mercury Project Solutions
Office of Spatial Data Management
The University of Melbourne

Keeping Standards up-to-date

Standards are living documents which reflect progress in science, technology and systems. To maintain their currency, all Standards are periodically reviewed, and new editions are published. Between editions, amendments may be issued. Standards may also be withdrawn. It is important that readers assure themselves they are using a current Standard, which should include any amendments which may have been published since the Standard was purchased.

Detailed information about joint Australian/New Zealand Standards can be found by visiting the Standards Web Shop at www.saiglobal.com.au or Standards New Zealand web site at www.standards.co.nz and looking up the relevant Standard in the on-line catalogue.

For more frequent listings or notification of revisions, amendments and withdrawals, Standards Australia and Standards New Zealand offer a number of update options. For information about these services, users should contact their respective national Standards organization.

We also welcome suggestions for improvement in our Standards, and especially encourage readers to notify us immediately of any apparent inaccuracies or ambiguities. Please address your comments to the Chief Executive of either Standards Australia or Standards New Zealand at the address shown on the back cover.

This Standard was issued in draft form for comment as DR AS/NZS ISO 19144.1.

Australian/New Zealand Standard™

Geographic information—Classification systems

Part 1: Classification system structure

First published as AS/NZS ISO 19144.1:2011.
Reissued incorporating Amendment No. 1 (February 2015).

COPYRIGHT

© Standards Australia Limited/Standards New Zealand

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Australia) or the Copyright Act 1994 (New Zealand).

Jointly published by SAI Global Limited under licence from Standards Australia Limited, GPO Box 476, Sydney, NSW 2001 and by Standards New Zealand, Private Bag 2439, Wellington 6140.

ISBN 978 0 7337 9999 0

PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee IT-004, Geographical Information/Geomatics.

This Standard incorporates Amendment No. 1 (February 2015). The changes required by the Amendment are indicated in the text by a marginal bar and amendment number against the clause, note, table, figure or part thereof affected.

The objective of this Standard is to establish the structure of a geographic information classification system, together with the mechanism for defining and registering the classifiers for such a system.

A1 | This Standard is identical with, and has been reproduced from ISO 19144-1:2009, *Geographic information—Classification systems*, Part 1: *Classification system structure*, and its corrigendum, ISO 19144-1:2009/Cor.1:2012, which has been added at the end of the source text.

As this Standard is reproduced from an International Standard, the following applies:

- (a) Its number appears on the cover and title page while the International Standard number appears only on the cover.
- (b) In the source text ‘this part of ISO 19144’ should read ‘this Australian/New Zealand Standard’.
- (c) A full point substitutes for a comma when referring to a decimal marker.

References to International Standards should be replaced by references to Australian or Australian/New Zealand Standards, as follows:

<i>Reference to International Standard</i>		<i>Australian/New Zealand Standard</i>	
ISO/TS		AS/NZS ISO	
19103	Geographic information— Conceptual schema language	19103	Geographic information—Conceptual schema language
ISO			
19110	Geographic information— Methodology for feature cataloguing	19110	Geographic information—Methodology for feature cataloguing
19115	Geographic information— Metadata	19115	Geographic information—Metadata
19123	Geographic information—Schema for coverage geometry and functions	19123	Geographic information—Schema for coverage geometry and functions
19135	Geographic information— Procedures for item registration	19135	Geographic information—Procedures for item registration

The terms ‘normative’ and ‘informative’ have been used in this Standard to define the application of the annex to which they apply. A ‘normative’ annex is an integral part of a Standard, whereas an ‘informative’ annex is only for information and guidance.

CONTENTS

1	Scope	1
2	Conformance	1
2.1	Classes	1
2.2	Conformance of a classification system.....	1
2.3	Conformance of a register of classifiers.....	1
2.4	Representation of classification results	1
3	Normative references.....	1
4	Terms, definitions and abbreviated terms.....	2
4.1	Terms and definitions	2
4.2	Abbreviated terms	4
5	Classification systems.....	5
5.1	Concept	5
5.2	Classification and legend	7
5.3	Hierarchical versus non-hierarchical systems.....	8
5.4	<i>A priori</i> and <i>a posteriori</i> classification systems	8
5.5	Structure of classified data	9
5.6	A classification data set.....	13
6	Management of classifiers	14
6.1	General	14
6.2	Concept dictionary register for a classification scheme	15
6.3	Management of classifiers through registration.....	15
6.4	Register structure.....	15
Annex A (normative)	Abstract test suite	24
Annex B (informative)	<i>A priori</i> and <i>a posteriori</i> classification systems	26
Bibliography.....		30

INTRODUCTION

This part of ISO 19144 is based on publications of the Food and Agriculture Organization (FAO) of the United Nations ^{[1][2]}. The first in a series of International Standards related to geographic classification systems, it defines the structure of such systems, together with the mechanism for defining and registering classifiers.

Since there are many different possible application areas, there is no single classification system that will serve all needs. The method by which classifiers are defined depends upon the application area. In addition, the classifiers used within a particular application area might not be adequate for all situations encountered within that application area and could need to be augmented over time. To facilitate extension of the set of classifiers in a particular application area, classifiers are registered in a register structure compliant with ISO 19135. This allows the set of classifiers to be maintained. The use of the ISO 19135 registration mechanism allows for separate registers to be defined for different sets of classifiers within multiple information communities, thereby satisfying application needs. This approach allows for independence between information communities, but also allows relationships to be developed between different classification systems that potentially allow the conversion, or partial conversion, of data from one classification system to another, or the fusion of data from two separate sources.

The concept of classification systems is well known in the geographic information community. A classification system can be used to subdivide any geographic area into small units, each of which carries an identifier that describes its type. The results can then be represented as a discrete coverage as described in ISO 19123. Many such classification systems can be defined to address any geographic area. Different application areas and different information communities can define their own classification systems. However, if the classification system is defined in a compatible way, interaction between different information communities becomes possible. In addition, in a particular application area, it is desirable that there be a few well-established classification systems, and that these themselves be standardized within information communities.

This part of ISO 19144 describes the common structure, while subsequent parts will allow for the standardization of specific classification systems.

A *coverage* is a function that returns values from its range for any direct position within its spatial, temporal or spatiotemporal domain. A *discrete coverage* is a function that returns the same feature attribute values for every direct position within any single spatial object, temporal object or spatiotemporal object in its domain. The domain is an area covered by the coverage function, and the discrete coverage breaks that area down into a set of spatial, temporal or spatiotemporal objects. The geometry of the discrete coverage used to represent the results of applying a classification system can be any type of discrete coverage — for example, a set of polygons fitted together like a jig-saw puzzle, a set of grid cells, or a set of points or curves.

A classification system consists of a set of classifiers. These classifiers may be algorithmically defined, or established according to a set of classification system definitions. The classifiers are application-area-dependent and are or will be defined in the other parts of ISO 19144 or other standards or publications. A register allows for the maintenance of a set of classifiers for a particular application area. A spatial, temporal or spatiotemporal object defined in terms of a set of classifiers is a *classified* object.

There is a commonality between conventional geographic features and classified objects. A *feature* is defined in ISO 19101 as an abstraction of real world phenomena. An example of a class of feature is a *building*, and a particular building, e.g. the UN building in New York, is an instance of a *feature class*. Conventional geographic features are *atomic units* that are assembled to build one type of geographic information data set.

A classification system works in the opposite manner, from the top down, by successively decomposing the whole within a coverage area. Classified objects are features, in that they are an abstraction of a real world phenomena, but classified objects are *not* atomic, because they are necessarily related to each other by the classifiers that decompose the whole. In a simple example of a classification system, the earth as a whole can be covered by either “land” or “water”, and two classifiers can be defined partitioning the attribute range into

two, identifying objects as being either land or water. Any particular area on the earth, corresponding to a classified object, would be of type “land” or “water”.

ISO 19135 specifies that a *technical standard* be required to define the item classes in any conformant register. This part of ISO 19144 defines schemas for registers conformant to ISO 19135 and serves as the technical standard that defines the item classes required for the registration of classifiers. It establishes a set of rules for specifying definitions that can be used in a particular context to establish classified objects.

Registers of classifiers can serve as sources of reference for similar registers established by other geographic information communities as part of a system of cross-referencing. Cross-referencing between respective items in registers of classifiers might be difficult in cases where the structure of registers differs between information communities. This part of ISO 19144 can serve as a guide for different information communities for the development of compatible registers that can support a system of classifier cross-referencing.

The structure of a classification system together with the mechanism of defining and registering classifiers defined in this part of ISO 19144 is general and can be applied to many different information-community-defined classification systems, including soil, landform, vegetation, urbanization and systems for understanding biodiversity and climate change. The use of this document will allow the relationship between different classification systems to be described.

NOTES

AUSTRALIAN/NEW ZEALAND STANDARD

Geographic information—Classification systems**Part 1:
Classification system structure****1 Scope**

This part of ISO 19144 establishes the structure of a geographic information classification system, together with the mechanism for defining and registering the classifiers for such a system. It specifies the use of discrete coverages to represent the result of applying the classification system to a particular area and defines the technical structure of a register of classifiers in accordance with ISO 19135.

The structure can be used to develop specific classification systems that address particular application areas, specified in other parts of ISO 19144.

2 Conformance**2.1 Classes**

Three conformance classes are identified in this part of ISO 19144.

2.2 Conformance of a classification system

Any classification system for which conformance to this part of ISO 19144 is claimed shall be in accordance with Annex A (see A.2).

2.3 Conformance of a register of classifiers

Any register of classifiers for which conformance to this part of ISO 19144 is claimed shall be in accordance with Annex A (see A.3) and ISO 19135:2005, A.1.

2.4 Representation of classification results

Any legend of classifiers for which conformance to this part of ISO 19144 is claimed shall be in accordance with Annex A (see A.4).

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 19103:2005, *Geographic information — Conceptual schema language*

ISO 19110:2005, *Geographic information — Methodology for feature cataloguing*

ISO 19115, *Geographic information — Metadata*

ISO 19123, *Geographic information — Schema for coverage geometry and functions*

ISO 19135:2005, *Geographic information — Procedures for item registration*

4 Terms, definitions and abbreviated terms

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

4.1 Terms and definitions

4.1.1

a posteriori classification

classification (4.1.4) scheme based upon definition of classes after clustering the field samples collected

NOTE 1 Taken from FAO LCCS version 2 (see Reference [2]).

NOTE 2 See Annex B for an examination of this and **a priori classification** (4.1.2).

4.1.2

a priori classification

classification (4.1.4) scheme structured so that the classes are abstract conceptualizations of the types actually occurring

NOTE 1 Taken from FAO LCCS version 2 (see Reference [2]).

NOTE 2 The approach is based upon the definition of classes before any data collection actually takes place.

NOTE 3 See Annex B for an examination of this and **a posteriori classification** (4.1.1).

4.1.3

classified object

spatial object, temporal object or spatiotemporal object assigned to a specific **legend class** (4.1.16)

4.1.4

classification

abstract representation of real world phenomena using **classifiers** (4.1.6)

4.1.5

classification system

system for assigning objects to classes

4.1.6

classifier

definition used to assign objects to **legend classes** (4.1.16)

NOTE Classifiers can be defined algorithmically or according to a set of **classification system** (4.1.5) specific rules.

4.1.7

coverage

feature (4.1.10) that acts as a function to return values from its **range** (4.1.17) for any direct position within its spatial, temporal or spatiotemporal **domain** (4.1.9)

[ISO 19123:2005]

EXAMPLE Raster image, polygon overlay, digital elevation matrix.

NOTE A coverage is a feature that has multiple values for each attribute type, where each direct position within the geometric representation of the feature has a single value for each attribute type.

4.1.8**discrete coverage**

coverage (4.1.7) that returns the same **feature attribute** (4.1.11) values for every direct position within any single spatial object, temporal object, or spatiotemporal object in its **domain** (4.1.9)

[ISO 19123:2005]

NOTE The domain of a discrete coverage consists of a finite set of spatial, temporal, or spatiotemporal objects.

4.1.9**domain**

well-defined set

[ISO/TS 19103:2005]

NOTE Domains are used to define the domain and **range** (4.1.17) of operators and functions.

4.1.10**feature**

abstraction of real world phenomena

[ISO 19101:2002]

EXAMPLE The phenomenon “Eiffel Tower” can be classified with other similar phenomena into a feature type “tower”.

NOTE A feature can occur as a type or an instance. In this part of ISO 19144, *type* is meant unless otherwise specified.

4.1.11**feature attribute**

characteristic of a **feature** (4.1.10)

[ISO 19101:2002]

4.1.12**feature concept dictionary**

dictionary that contains definitions of, and related descriptive information about concepts that may be specified in detail in a **feature** (4.1.10) catalogue

[ISO 19126:—¹⁾]

4.1.13**identifier**

linguistically independent sequence of characters capable of uniquely and permanently identifying that with which it is associated

[ISO 19135:2005]

4.1.14**item class**

set of items with common properties

[ISO 19135:2005]

NOTE “Class” is used in this context to refer to a set of instances, not the concept abstracted from that set of instances.

1) To be published.

4.1.15**legend**

application of a **classification** (4.1.4) in a specific area using a defined mapping scale and specific data set

NOTE Taken from FAO LCCS version 2 (see Reference [2]).

4.1.16**legend class**

class resultant from the application of a **classification** (4.1.4) process

NOTE The result of a classification process is termed *legend class* in this part of ISO 19144 in order to avoid confusion with the term “class” as used in UML modelling.

4.1.17**range**

⟨coverage⟩ set of **feature attribute** (4.1.11) values associated by a function with the elements of the **domain** (4.1.9) of a **coverage** (4.1.7)

[ISO 19123:2005]

4.1.18**register**

set of files containing **identifiers** (4.1.13) assigned to items with descriptions of the associated items

[ISO 19135:2005]

4.1.19**registry**

information system on which a **register** (4.1.18) is maintained

[ISO 19135:2005]

4.1.20**technical standard**

standard containing the definitions of **item classes** (4.1.14) requiring registration

[ISO 19135:2005]

4.1.21**vector geometry**

representation of geometry through the use of constructive geometric primitives

[ISO 19107:2003]

4.2 Abbreviated terms**4.2.1 General**

CRS Coordinate Reference System

LCCS Land Cover Classification System

UML Unified Modelling Language

4.2.2 Notation

The conceptual schema specified in this part of ISO 19144 is described using the Unified Modelling Language (UML), following the guidance of ISO/TS 19103.

Several model elements used in this schema are defined in other standards in the ISO 19100 series. By convention within this suite of International Standards, names of UML classes²⁾, with the exception of basic data type classes, include a two-letter prefix that identifies the International Standard and the UML package in which the class is defined.

UML classes defined in this part of ISO 19144 have the two-letter prefix “CL”.

Table 1 lists the other International Standards and the packages in which UML classes used in this part of ISO 19144 have been defined.

Table 1 — Sources of externally defined UML classes

Prefix	International Standard	Package
CV	ISO 19123	Coverage core and discrete coverages
DS	ISO 19115	Metadata application information
GF	ISO 19109	General feature model
GM	ISO 19107	Geometry root
MD	ISO 19115	Metadata entity set information
MI	ISO 19115-2	Metadata entity set imagery
RE	ISO 19135	Procedures for registration
SC	ISO 19111	Spatial referencing by coordinates
TM	ISO 19108	Temporal objects

5 Classification systems

5.1 Concept

A discrete coverage returns the same feature attribute for every direct position within any single geometric object in its spatiotemporal domain. The spatiotemporal domain consists of a set of geometric objects that together form the coverage.

EXAMPLE 1 The discrete coverage of postal zones within a country: each zone has a different code and it is not possible to interpolate between these codes. Nevertheless, there could be a high level relationship between the codes. The small country of Monaco is divided into five *quartiers*: “Moneghetti”, “La Condamine”, “Fontvieille”, “Monaco-Ville” and “Monte-Carlo”. These political jurisdictions completely cover the area of the country. The area of Monaco can be represented as a discrete coverage with five spatial objects where each object has the geometry of a polygon. The attribute value for each spatial object is the name of the political jurisdiction. See Figure 1.

2) There is potential confusion between the use of the term “class” as used in UML, “class” as used in a classification scheme and “item class” as used in the procedures for registration. Class as used in a classification scheme is termed legend class in this part of ISO 19144.

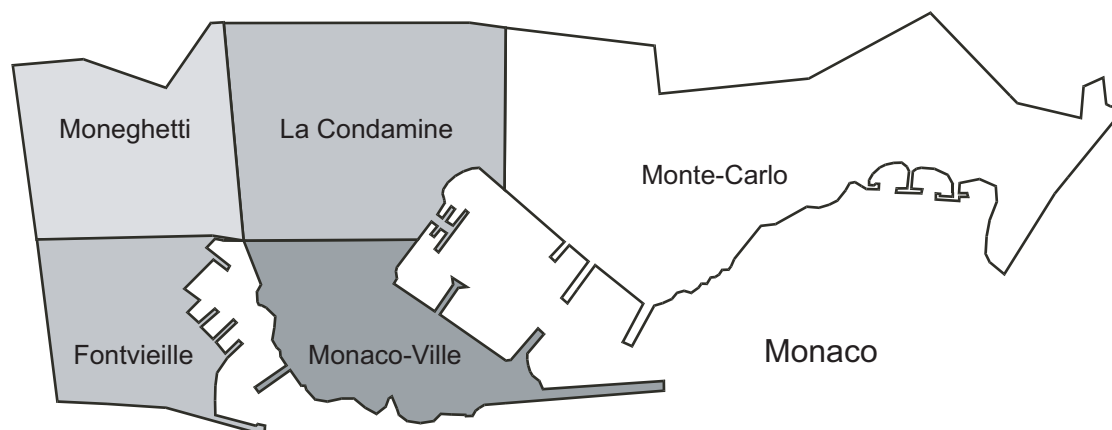


Figure 1 — Example of discrete coverage with polygon geometry

The geometry of the spatial objects associated with a discrete coverage can also be grid cells within a grid structure. Each of the grid cells may carry an attribute.

EXAMPLE 2 A discrete coverage with grid geometry of the same area as used in the previous example. See Figure 2. The figure legend identifies the instances of the attribute values that actually exist in the data.

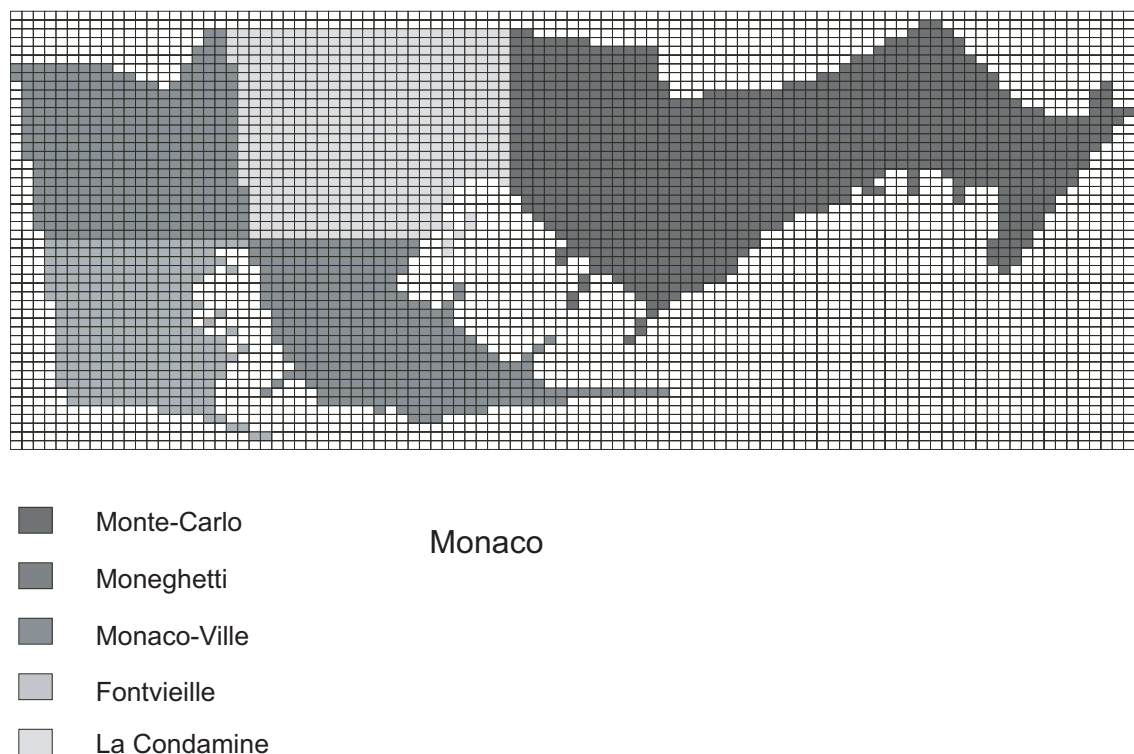


Figure 2 — Example of discrete coverage with grid geometry

NOTE The discrete coverages illustrated by the above examples are simple because only one relatively simple attribute has been used. However, in reality the attributes for each of the coverage spatial objects can be very complex. In order to describe land cover it is necessary to integrate a large number of descriptive parameters related to soil, biology and density into a comprehensive land cover classification system. Such a classification system is of course application-area-dependent. An oceanographer will have a different classification system than that of a meteorologist. Classification systems can vary widely in different application areas, but for similar application areas there needs to be some commonality in order for data from different sources to be used together.