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Australian/New Zealand Standard™

**Geographic information—Spatial
schema**



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AS/NZS ISO 19107:2005
Geographic information—Spatial schema

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Australian/New Zealand Standard™

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PREFACE

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

This Standard is identical with, and has been reproduced from ISO 19107:2003, *Geographic information—Spatial schema*.

The objective of this Standard is to specify, and provide geographic information system, developers with, conceptual schemas for describing the spatial characteristics of geographic features, and a set of spatial operations consistent with these schemas.

The terms ‘normative’ and ‘informative’ are used 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.

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ISO	AS/NZS ISO
19111 Geographic information— Spatial referencing by coordinates	19111 Geographic information—Spatial referencing by coordinates

Only international references that have been adopted as Australian or Australian/New Zealand Standards have been listed.

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INTRODUCTION

This International Standard provides conceptual schemas for describing and manipulating the spatial characteristics of geographic features. Standardization in this area will be the cornerstone for other geographic information standards.

A feature is an abstraction of a real world phenomenon; it is a geographic feature if it is associated with a location relative to the Earth. Vector data consists of geometric and topological primitives used, separately or in combination, to construct objects that express the spatial characteristics of geographic features. Raster data is based on the division of the extent covered into small units according to a tessellation of the space and the assignment to each unit of an attribute value. This International Standard deals only with vector data.

In the model defined in this International Standard, spatial characteristics are described by one or more spatial attributes whose value is given by a geometric object (GM_Object) or a topological object (TP_Object). Geometry provides the means for the quantitative description, by means of coordinates and mathematical functions, of the spatial characteristics of features, including dimension, position, size, shape, and orientation. The mathematical functions used for describing the geometry of an object depend on the type of coordinate reference system used to define the spatial position. Geometry is the only aspect of geographic information that changes when the information is transformed from one geodetic reference system or coordinate system to another.

Topology deals with the characteristics of geometric figures that remain invariant if the space is deformed elastically and continuously — for example, when geographic data is transformed from one coordinate system to another. Within the context of geographic information, topology is commonly used to describe the connectivity of an n -dimensional graph, a property that is invariant under continuous transformation of the graph. Computational topology provides information about the connectivity of geometric primitives that can be derived from the underlying geometry.

Spatial operators are functions and procedures that use, query, create, modify, or delete spatial objects. This International Standard defines the taxonomy of these operators in order to create a standard for their definition and implementation. The goals are to:

- a) Define spatial operators unambiguously, so that diverse implementations can be assured to yield comparable results within known limitations of accuracy and resolution.
- b) Use these definitions to define a set of standard operations that will form the basis of compliant systems, and, thus act as a test-bed for implementers and a benchmark set for validation of compliance.
- c) Define an operator algebra that will allow combinations of the base operators to be used predictably in the query and manipulation of geographic data.

Standardized conceptual schemas for spatial characteristics will increase the ability to share geographic information among applications. These schemas will be used by geographic information system and software developers and users of geographic information to provide consistently understandable spatial data structures.

AUSTRALIAN/NEW ZEALAND STANDARD

Geographic information — Spatial schema

1 Scope

This International Standard specifies conceptual schemas for describing the spatial characteristics of geographic features, and a set of spatial operations consistent with these schemas. It treats vector geometry and topology up to three dimensions. It defines standard spatial operations for use in access, query, management, processing, and data exchange of geographic information for spatial (geometric and topological) objects of up to three topological dimensions embedded in coordinate spaces of up to three axes.

2 Conformance

2.1 Overview

Clauses 6 and 7 of this International Standard use the Unified Modeling Language (UML) to present conceptual schemas for describing the spatial characteristics of geographic features. These schemas define conceptual classes that shall be used in application schemas, profiles and implementation specifications. The document concerns ONLY externally visible interfaces and places no restriction on the underlying implementations other than what is needed to satisfy the interface specifications in the actual situation such as:

- Interfaces to software services using techniques such as COM or CORBA
- Interfaces to databases using techniques such as SQL
- Data interchange using encoding as defined in ISO 19118.

Few applications will require the full range of capabilities described by this conceptual schema. This clause, therefore, defines a set of conformance classes that will support applications whose requirements range from the minimum necessary to define data structures to full object implementation. This flexibility is controlled by a set of UML types that can be implemented in a variety of manners. Implementations that define full object functionality must implement all operations defined by the types of the chosen conformance class, as is common for UML designed object implementations. Implementations that choose to depend on external “free functions” for some or all operations, or forgo them altogether, need not support all operation, but shall always support a data type sufficient to record the state of each of the chosen UML type as defined by its member variables. Common names for “metaphorically identical” but technically different entities are acceptable. The UML model in this International Standard defines abstract types, application schemas define conceptual classes, various software systems define implementation classes or data structures, and the XML from the encoding standard (ISO 19118) defines entity tags. All of these reference the same information content. There is no difficulty in allowing the use of the same name to represent the same information content even though at a deeper level there are significant technical differences in the digital entities being implemented. This “allows” types defined in the UML model to be used directly in application schemas.

There are 39 conformance options for application schemas that define types for the instantiation of geometric or topological objects. They are differentiated on the basis of three criteria.

The first two criteria (complexity and dimensionality) determine the types defined in this schema that shall be implemented according to an application schema that conforms to a given conformance option. In defining the dimensionality of object types to be implemented, the application schema will be required to specify which of