TECHNICAL REPORT

ISO/TR 14825

Geographic Data Files (GDF)

Fichiers de données géographiques

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 main task of technical committees is to prepare International Standards. In exceptional circumstances a technical committee may propose the publication of a Technical Report of one of the following types:

— type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;

— type 2, when the subject is still under technical development or where for any other reason there is the future but not immediate possibility of an agreement on an International Standard;

— type 3, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example).

Technical Reports of types 1 and 2 are subject to review within three years of publication, to decide whether they can be transformed into International Standards. Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/TR 14825, which is a Technical Report of type 2, was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee ISO/TC 204, *Transport information and control systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This document is being issued in the Technical Report (type 2) series of publications (according to subclause G.3.2.2 of part 1 of the ISO/IEC

Directives, 1995) as a "prospective standard for provisional application" in the field of transport information and control systems because there is an urgent need for guidance on how standards in this field should be used to meet an identified need.

This document is not to be regarded as an "International Standard". It is proposed for provisional application so that information and experience of its use in practice may be gathered. Comments on the content of this document should be sent to the ISO/TC 204 Secretariat.

A review of this Technical Report (type 2) will be carried out not later than three years after its publication with the options of: extension for another three years; conversion into an International Standard; or withdrawal.

INTRODUCTION

The Geographic Data Files (GDF) standard has been developed to meet the needs of professionals and organizations involved in the creation, update, supply and application of referenced and structured road network data.

It has been created in order to improve the efficiency of the capture, the production and handling of road related geographic information. This increase in efficiency is obtained by supplying a common reference model on which users can base their requirements and producers can base their product definition. In addition to this, the standard facilitates the exchange of information, defined according to this reference model. For this, it contains the definition of an exchange format which avoid compatibility problems at both the users and the producer's side of the information flow. In this respect, producers and users should not be viewed as two totally distinct groups. It is envisaged that an important application of the standard will be the combination of information present in already existing geographic information data bases, into one, more comprehensive source of road-related information.

To ensure maximum compatibility with these already existing sources and also to make use of the strengths of the structure in which these sources have been defined, the basic foundation of the standard is based on a general, non-application specific data model. On top of this data model, a road network specific application model has been built. Together they make up the GDF standard. Due to its general character, the data model also is able to support other types of applications, thus facilitating the future creation of a wide variety of geographic information sources which can be combined with maximum flexibility.

The standard consists of twelve chapters, of which six (chapter 5 to 10) together form the reference model. They each contain the elaboration and definition of one clearly identifiable aspect of road related information. Chapter 4 contains a more general description of the standard. It contains the definition of the general data model as well as the definition of the basic components of the standard, thus explaining the structure of the rest of the standard. Chapter 11 describes the logical data structure by which the conceptual models as defined in the previous chapters can be represented.

Chapter 12 defines the exchange format by which the information can be exchanged.

1. SCOPE

This standard specifies a system for the interchange of digital road related geographic information. It takes into account all the requirements of applications in the road transport and traffic telematics (RTTT) field. Within this field, the standard is application independent. The standard contains the following detailed specifications :

a) A reference model according to which the information covered by the standard shall be defined. The core of the reference model is formed by a data model and a data dictionary in which the individual information components and their interrelations are defined.

b) A specification of ways of representation of the information components contained.

c) The specification how to define meta information. An important aspect is the quality of the information defined according to the standard. This aspect is dealt with separately in the sense that the methodology is defined with which the quality of the information components contained can be measured.

d) A specification for an exchange format reflecting the reference model.

2. REFERENCES

2.1 Normative References

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19] Nijssen G.M, Halpin T.A.; Conceptual Schema and Relational Database Design - A fact oriented approach; Prentice Hall, Sydney; 1989

3. DEFINITIONS

The numbers between square brackets refer to the reference documents mentioned in 2.

3.1 General terms

3.1.1 Accuracy

The closeness of results of observations, computations or estimates to the true values or the values as accepted as being true [2]

3.1.2 Cartography

The art, science and technology of making maps, together with their study as scientific documents and works of art[15]

3.1.3 Cartographic Primitive

Atomic construction element in a cartographic representation, i.e. Node, Edge and Face.

3.1.4 Data File

A collection of related data records.[2] The records shall have a homogeneous structure.

3.1.5 Data Record

A record containing feature related data

3.1.6 Data set

A large set of data covering a particular geographic area

3.1.7 Entity

A real world phenomenon that is not subdivided into phenomena of the same kind (e.g. a bridge) [2]

3.1.8 Error Rate

The percentage of falsehoods

3.1.9 Field

A specified part of a record containing a unit of data. The unit of data may be a data element or a data item [1]

3.1.10 Geodesy

Science of determination of the shape and gravity field of the earth and of survey and mapping of the physical surface of the earth [14]

3.1.11 Geography

Science of phenomena of the earth's surface, its being and growing and its manifold relations [16]

3.1.12 Geometry

Science of the characteristics of spatial figures [16]

3.1.13 Global Record

A record that logically precedes the data records and contains control parameters, data definition and documentation necessary to interpret companion data records [ISO 8211]

3.1.14 Information Unit

A collection of information that may be regarded as an undivided whole, e.g. 1 data set, 1 section, 1 layer

3.1.15 Logical Domain

The range of attribute values to which a meaning has been assigned.

3.1.16 Logical Unit

A collection of data that may be regarded as a logically undivided whole, e.g. 1 logical record.

3.1.17 Medium Unit

An object for data storage that can be considered as a physically undivided whole, e.g. 1 floppy disk, 1 magnetic tape etc.

3.1.18 Physical Unit

A unit of data storage that may be regarded as physically undividable.

3.1.19 Precision

The closeness of measurements of the same phenomenon repeated under exactly the same conditions and using the same techniques.

3.1.20 Primitive

Fundamental form from which all other forms can be derived [17]

3.1.21 Repeating Attribute Type

An attribute type that may have multiple values associated to one and the same instance of a particular feature type.

3.1.22 Resolution

The smallest unit which can be detected. It fixes a limit to precision and accuracy.

3.1.23 Spatial Domain

The description of the limits of a geographical area to which a particular set of data spatially belongs to.

3.1.24 Source Material

The origin of data in analogue or digital representation, stored on any kind of data medium.

3.1.25 Topography

The technical and conceptual registration of the terrain, its features and properties of the landscape [14].

3.1.26 Topology

The field of mathematics that deals with characteristics of geometric structures that keep preserved after continual variation [16]

3.1.27 Transcription

Rendering of geographic names from a non-alphabetic script into an alphabetic one or vice versa. The term is also applied to initial recording script of hitherto unwritten names [15]

3.1.28 Up-to-dateness

The closeness in time of the (geographic) data to the present reality.

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3.2 Mathematical terms

3.2.1 Area Feature
A two dimensional feature. An area feature is defined by one or more faces.'

3.2.2 Edge
A directed sequence of non-intersecting line segments with nodes at each end [2]

3.2.3 Enclave
Small part of an area enclosed by another area seen from the area to which that part belongs [14]

3.2.4 Exclave
Small part of an area enclosed by another area seen from the enclosing area [14]

3.2.5 Face
A two-dimensional element bounded by a closed set of edges and zero or more non-intersection inner closed set of edges. The face is the atomic two dimensional element.

3.2.6 Graph
A set of points and a set of arrows, with each arrow joining one point to another. The points are called nodes of the graph, and the arrows are called the edges of the graph [18].

3.2.7 Intermediate
A Point, not being a Node, that bounds the line segments belonging to an Edge

3.2.8 Line Feature
A one-dimensional feature. A line feature is defined by one or more edges.

3.2.9 Loop
An edge which is bounded at both ends by one and the same node.

3.2.10 Node
A zero-dimensional element that is a topological junction of two or more edges, or an end point of an edge [2]

3.2.11 Non planar graph
A graph which is not planar

3.2.12 Path
A finite, alternating sequence of nodes and edges, such that every arc is immediately preceded and succeeded by the two vertices with which it is incident and in which no vertex is repeated, except (possibly) the first and the last one. [18]

3.2.13 Planar Graph
A graph G is planar if it can be embedded in a plane. That means that it can be drawn on the plane so that edges intersect only at a node mutually incident with them.

3.2.14 Plane Graph

A planar graph embedded in the plane

3.2.15 Point

A zero-dimensional element that specifies geometric location. One coordinate pair or triplet specifies the location [2]

3.2.16 Segment

The direct connection between exactly 2 Intermediate Points

3.2.17 Valency (or Degree)

The number of edges which are incident with a particular Node.

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3.3 Geodetical terms

3.3.1 Control Points
Points in the real world that are identical with points in a map or aerial photograph.

3.3.2 Ellipsoidal Height
The distance between a point and the reference ellipsoid (measured along the ellipsoidal normal).

3.3.3 Geodetic datum
The position and orientation of a particular reference ellipsoid.

3.3.4 Geoid
A model of the figure of the earth, that coincides with the mean sea level over the oceans and continues in continental areas as an imaginary sea level surface, defined by spirit level.

At every place it is perpendicular to the pull of gravity. The shape is irregular, but can for most purposes be approximated by an oblate ellipsoid.

3.3.5 Geoid Ondulation
The difference between the orthometric height and the ellipsoidal height, measured along the ellipsoid normal.

3.3.6 Height
The (vertical) distance between a point and the reference height level or the reference ellipsoid. On land maps the reference level is commonly the mean sea level.

3.3.7 Horizontal Reference System
A reference system for positions

3.3.8 Magnetic Declination
Angle between Magnetic North and True North [14]

3.3.9 Map Projection
The transformation method used to represent the curved earth surface on a plane

3.3.10 Offset
A pair of values, subtracted from all coordinate values in order to shorten these coordinate values.

3.3.11 Orthometric Height
The distance between a point and the geoid (measured along the perpendicular line.

3.3.12 Reference Ellipsoid
An oblate ellipsoid of revolution that is used to approximate the figure of the geoid. It is specified by two parameters: a semi-major axis "a" (equatorial radius of the earth) and a semi-minor axis "b" (polar radius).

The flattening "f" is defined as: $f = (a-b).a$

3.3.13 Reference Height Level
The level to which all terrestrial heights are referred. It changes from country to country and it forms part of the national coordinate system for surveying and mapping.

3.3.14 Reference System

A coordinate system on which a national survey is based [14]

3.3.15 Vertical Reference System

A reference system for elevations

3.3.16 World Geodetic System (WGS)

A three-dimensional Cartesian coordinate system, its origin being the geocentre. WGS is related to a specified gravity model.

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3.4 GDF Terms

Note: All feature classes mentioned below are defined in the Feature Catalogue (Chapter 5)

3.4.1 Album
A collection of related Volumes.

3.4.2 Attribute
A characteristic of a feature which is independent of other features[2]

3.4.3 Attribute Code
An alphanumeric identifier for an attribute type [1]

3.4.4 Attribute Name
A name associated to an attribute type [1]

3.4.5 Attribute Type
A defined characteristic of a Feature, which is independent of the other features.

3.4.6 Attribute Value
A specific quality or quantity assigned to an attribute [2]

3.4.7 Completeness
Extent to which all specified features are present.

3.4.8 Correctness
Indication of whether a data item is correctly recorded according to a specified data catalogue.

3.4.9 Data Set
A collection of related data files

3.4.10 Feature
A database representation of a real world object. (see feature catalogue)

3.4.11 Feature Category
Type of representation of a feature. I.e. Point, Line, Area or Complex Feature.

3.4.12 Feature Class
An alphanumeric identifier for a feature class..

3.4.13 Feature Code
An alphanumeric identifier for a feature class [1]

3.4.14 Feature Name
A name associated with a feature class [2]

3.4.15 Feature Theme
A specified group of related features.