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Geographic Data Files (GDF)

Fichiers de données géographiques

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Foreword

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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 Technical Reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.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

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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

1] Working Party to Produce National Standards for the Transfer of Digital Map Data; National Transfer Format, Release 1.1; Ordnance Survey; Southampton, U.K.; January 1989

2] National Committee for Digital Cartographic Data Standards et al.; Spatial Data Transfer Standard; U.S. Geological Survey, National Mapping Division; Columbus, Ohio, USA; June 1990

3] International Federation of Library Associations and Institutions, Joint Working Group on the International Standard Bibliographic Description for Cartographic Materials; ISBD(CM): International Standard Bibliographic Description for Cartographic Materials; IFLA International Office for UBC; London, U.K.; 1977

4] Bibliographic Systems Office, Working Group on Bibliographic Codes; Revised List of Languages and Language Codes; Library of Congress, Bibliographic SystemsOffice; Washington D.C., U.S.A; 1977

5] ISO; International Standard ISO 690, Documentation -Bibliographic references - Content, form and structure; International Organisation for Standardisation; 1987

6] ISO; International Standard ISO 6709, Standard representation of latitude, longitude and altitude for geographic point locations; International Organisation for Standardisation; 1983

7] ISO; International Standard ISO 3166; Codes for the representation of names of countries.; International Organisation for Standardisation; 1993

8] ISO; International Standard ISO 2108, Information and documentation - International Standard Book Numbering (ISBN); International Organisation for Standardisation; 1992

9] ISO; International Standard ISO 3297; Documentation - International Standard Serial Numbering (ISSN); International Organisation for Standardisation; 1986

10] ISO/IEC; International Standard 8859-1, Information processing - 8-bit single-byte coded graphic character sets - Part 1: Latin alphabet No.1; International Organisation for Standardisation; 1987

11] ISO; International Standard 2859, Sampling procedures for inspection by attributes; International Organisation for Standardization; 1985-1995 (all parts)

12] AFNOR; Norme expérimentale: Echanges de donneés informatisées dans le domaine de l'Information Géographique - EDIGéO; Association Française de Normalisation;Paris, 1991;

2.2 Digital Geographic Information Working Group; Digital Geographic Information Exchange Standard (DIGEST); December 1989; Other references

13] FIG; Technical Dictionary, terms and definitions as used in surveying and mappingin Germany; Institute for Applied Geodesy; Frankfurt am Main; 1971

14] ICA; Multilingual Dictionary of Technical Terms in Cartography; InternationalCartographic Association; Wiesbaden; 1973

15] DTV; DTV-Lexikon; Deutscher Taschenbuchen-Verlag; 1975

16] The Shorter Oxford English Dictionary

17] Claude Berge; Graphs; North-Holland Mathematical Library, Volume 6 - Part 1; North Holland; Amsterdam, New York, Oxford; 1985

18] Mehdi Behzad, Gary Chartrand; Introduction to the Theory of Graphs; Allyn and Bacon Inc.; Boston, Massachusetts; 1971

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.

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.

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: $f = (a\text{-}b).a$

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.

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.

3.4.16 Field
A set of characters representing one unit of data

3.4.17 Layer
A certain subset of a section based upon information contents. The collection of level-0 elements present in a layer together should form one planar graph.

3.4.18 Manoeuvre
An ordered sequence of a *Road Element*, a *Junction* and one or more *Road Elements*.

3.4.19 Record
An implementation dependent construct that consists of an identifiable collection of one or more related fields [2]

3.4.20 Semantic Relationship
A characteristic of a feature involving other features.

3.4.21 Section
A certain subset of a dataset based on geographical co-ordinates

3.4.22 Relationship
Semantic relationship

3.4.23 Relationship Code
An alphanumerical identifier for a (Semantic) Relationship.

3.4.24 Relationship Name
A name associated to a relationship type [2]

3.4.25 Relationship Type
A defined characteristic of a feature which is depenedent of ofther features.

3.4.26 Transportation Element
A Road Element, Railway Element, Water Boundary Element, Junction, Rail Junction and Water Boundary Junction

3.4.27 Turn
An ordered sequence of a *Road Element*, a *Junction* and a *Road Element*.

3.4.28 Volume
The smallest physical unit of medium. For example a magnetic tape, a floppy disk etc. A single Volume may contain one or more GDF Datasets depending on Dataset size.

4. GENERAL DATA MODEL

4.1 GDF History

The first version of the draft GDF standard was released in October 1988 (Geographic Data Files Release 1.0; 1988-10-01). A product of the EUREKA project DEMETER, it was designed to specify the data content, means of data representation and structure of data supply for vehicle navigation systems. Based on a comprehensive data model (derived from the UK National Transfer Format [NTF] Model) the first draft standard was used extensively in the EUREKA project CARMINAT and in the DRIVE projects PANDORA and Task Force European Digital Road Map (EDRM). Both the DRIVE-1 projects put forward requests for changes to GDF 1.0.

GDF 2.0 has been developed under work package 3532 of the Task Force EDRM. The GDF 2.0 Working Group consisted of representatives of EDRM partners Daimler Benz (Prime Contractor), Bosch, Philips, Renault, Tele Atlas and Intergraph and MVA Systematica, a participant of the PANDORA project. The other PANDORA project partners were Philips, Bosch, Ordnance Survey and the Automobile Association.

In parallel with DRIVE projects, an informal working group of mapping organizations (both state and private), electronics and vehicle manufacturers, academics and other experts has been developing a conceptual data model upon which to standardize the exchange of geographical data in Europe. Termed the "European Transfer Format" (ETF) model, it diverges from the GDF 1.0 data model in certain key areas. The second release of GDF endorses the ETF conceptual data model, and is therefore the first exchange format to be compliant with the ETF model.

GDF 2.0 differs from GDF 1.0 both in its treatment of the architecture of certain data structures and in its use of terminology. It is also far more extensive in specification. It defines standards for the description, classification and encoding of features of the road environment, suitable to support a family of application areas. These include requirements for Vehicle Navigation Systems, Highway Maintenance Systems, Road Transport Informatics, and Advanced Road Transport Telematics (ATT). RTI and ATT are known in the US as Intelligent Vehicle Highway Systems (IVHS). Accommodation of other applications in the future is envisaged.

GDF 2.1 was released in October 1992 and consists of a revision of Volume 3, the Attribute Catalogue and Volume 9, the Media Record Specifications. The major differences with respect to 2.0 are the introduction of the Segmented Attribute concept and the Time Domain concept.

GDF 2.2 was released in November 1994. The Feature, Attribute and Relationship Catalogue have been considerably extended. The changes mainly consisted of the introduction of new information items. GDF 2.2 was at the time of release , officially submitted to CEN TC278 for approval as a prENV. For this, the CEN member countries reviewed the document during a three months period. The comments received were subsequentely incorporated. The result of this was published in July 1995 as GDF 2.3.

GDF 2.3 was subject to a final editorial review in September 1995.

GDF 3.0 was the result of the incorporation of comments from this review and submitted to CEN TC278 for official approval as ENV in October 1995.

The work was undertaken by EDRM2 project partners and the members of CEN TC278 WG 7 with considerations given to the needs of highway authorities in the later stages.

4.2 Structure of GDF

GDF is divided into 12 chapters :

1,2,3	Scope, Normative References and Definitions
4.	General Data Model
5.	The GDF Feature Catalogue
6.	The GDF Attribute Catalogue
7.	The GDF Relationship Catalogue
8.	The GDF Feature Representation Scheme
9.	Quality Description Specifications
10.	Global Data Catalogue
11.	Logical Data Structures
12.	Media Record Specifications

Throughout each chapter, *Italics* are used to indicate a reserved meaning.

4.3 Contents of GDF

The **Feature Catalogue** provides a definition of the “real world objects” such as Roads, Buildings, Administrative Areas and Settlements that have significance in the broad area of applications for this standard. They all relate to the road environment. Suppliers of data destined for Vehicle Navigation Systems, Highway Maintenance Systems and other applications will find a concise description and classification of features in this catalogue.

The **Attribute Catalogue** defines a number of characteristics of features and possibility of relationships. Some attributes are dedicated to one particular feature class. Other attributes may be more generally applied. Some attributes themselves describe a certain characteristic completely. Others have to be combined to reach this goal.

The **Relationship Catalogue** describes relations between features that may be used to convey information in a realistic manner. For example, a relationship may exist between Road Elements and Buildings such that a Building “is along” a Road Element. This serves to enrich the model to represent the real world.

In the **Feature Representation Scheme**, instruction is given on how to represent an object: as a Point, Line, Area or Complex Feature.

The **Quality Measuring Specifications** describe rules and methods on how to measure the quality of and validate a GDF dataset.

In the **Global Data Catalogue**, a description is given on how meta information such as geodetic references and data sources must be modelled. Data dictionary specifications are also provided in this catalogue so that GDF will be able to meet diverse needs in the future.

The Volume **Logical Data Structures** describe how the information modelled according to the rules described in the previous volumes, can be represented by a nested set of data types. This specification is independent of any particular media record specification.

Finally, information needed to supply GDF data as physical data records is provided in the **Media Record Specification**.

4.4 Data Models in GDF

Many of the concepts relevant to GDF are best expressed diagrammatically. Those concepts concerned with the data models of GDF are represented using a variant of Entity-Relation Modelling referred to as NIAM (see section 4.5).

Where required, detailed sub-schema's are given to reduce the complexity of the figures. The complete data model and views pertinent to each of the volumes are presented and explained in detail in 4.5.

4.5 Understanding the NIAM diagrams

Figure 4.2 gives a diagram of the Conceptual Data Model. The diagram has been constructed according to the conventions of NIAM modelling (Nijssens Information Analysis Method) [20].

Figure 4.1 provides the key to figure 4.2 and all other data models contained in this standard.

In the centre of the model resides "the feature" which is a geographic object that has a location, such as a road or a building. Note that in this diagram with "feature" is meant feature instance, i.e. an individual occurrence of a geographic object, such as the Eiffel Tower in Paris.

Each feature belongs to a certain feature class, i.e. a set of feature instances of the same class. Each feature belongs to not more than one feature class: hybrid features are not allowed. This constraint is indicated by the arrow above "belongs to". Each feature also must belong to a feature class: classless features are not allowed. This constraint is indicated by the black dot at the location where "belongs to" is attached to "feature".

The diagram shows furthermore that each feature may have zero, one or more attributes and may be related to one or more other features.

It can also be seen that each feature is of exactly one feature category (Point, Line, Area or Complex). The consequences of being of a particular category is illustrated in the lower part of the diagram. The single side arrows indicate a subtype constraint: a Point feature is a subtype of a Simple Feature, which in turn is a subtype of Feature.

The diagram shows that a Point feature is always represented by not more than one Node, a Line feature by one or more Edges and an Area feature by one or more Faces. The lowest part of the diagram illustrates how the "cartographic primitives" Face, Edge and Node are mutually related.

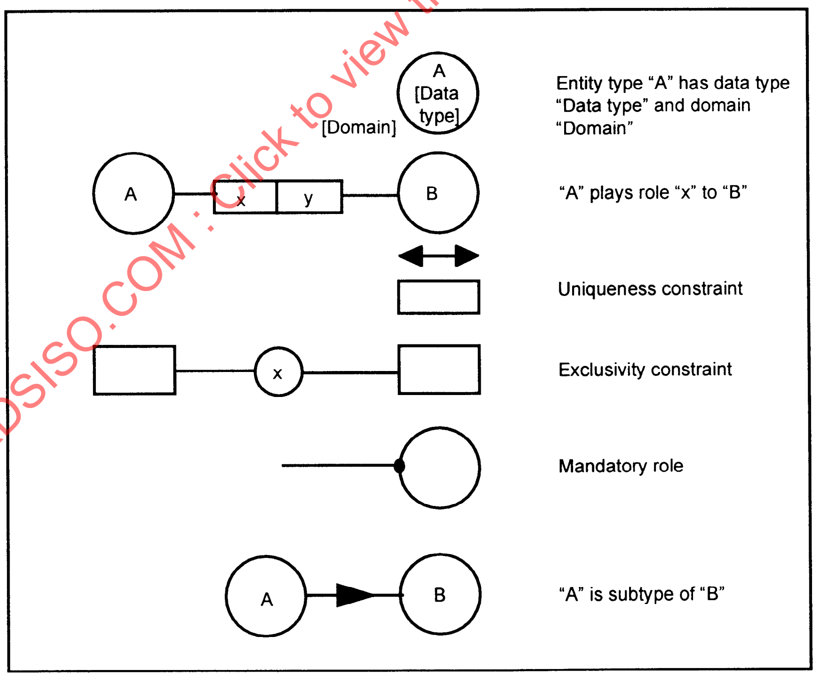


Figure 4.1 Key to NIAM diagrams for GDF data models.

The Feature Catalogue

This Catalogue defines only feature classes, not the individual feature instances. For that reason the Feature Catalogue uses the term "feature" as a synonym for "feature class".

The diagram shows that each feature must belong to exactly one feature class and exactly one feature theme. The diagram also shows that feature classes and feature themes are uniquely referenced by a Name and a Code. The dotted lines around these indicate that they are only used for referencing.

The diagram shows furthermore that certain features are composed of one or more other features. These are called *Complex Features*. For example, a *Road* may contain *Road Elements*.

The Attribute Catalogue

The Attribute Catalogue defines a set of attribute types and a corresponding reference name and code as shown in Figure 4.3. It defines the feature class that a particular attribute type may be attached to.

The diagram shows that an attribute may be an aggregation of other attributes. Such an attribute is called a Composite Attribute. Some Attribute types that are used in a Composite Attribute may never be directly attached to a feature. This is indicated by the exclusion constraint (the "X") between the roles "belongs to" and "is part of" of Attribute Type.

The Relationship Catalogue

A semantic relationship is a meaningful link between two or more features, which are not necessarily of different classes.

Semantic relationships with a common structure (e.g. linking feature A to feature B, where the instances of A are always of the same class and where the instances of B are always of the same class) and with a common meaning, are grouped into a relationship type.

A particular relationship type is uniquely referred to by a relationship name or a relationship code (see figure 4.4).

Relationships are in most cases binary, i.e. involving two features. However there are instances when three or more features are involved in a relationship. For example, the relationship *Prohibited Manoeuvre* requires a *Road Element*, a *Junction* and at least one other *Road Element*. The order in which these feature instances occur is significant. That is why Figure 4.4 shows a "Partner No." which specifies the order in which the individual feature types should occur in the relationship.

The Feature Representation Scheme

The Feature Catalogue, the Attribute Catalogue and the Relationship Catalogue can be considered as being valid for a wide range of applications. With the Feature Representation Scheme however, we enter the world of a more restricted group of applications that share the same representation needs.

In this Feature Representation Scheme for instance, it is defined that a Road Element shall always be considered as a Line feature. Another FRS however, possibly may specify that a Road Element should be considered as an Area feature.

The most important role of the Feature Representation Scheme is to specify two what Feature category or categories a particular feature class must or may belong. Four different categories are distinguished: Point, Line, Area and Complex features.

Figure 4.5 illustrates that two different possibilities exist for a particular feature class:

1) all instances must be of one and the same category

2) some instances may be of one category, other instances of another one.

In the latter case, the FRS describes when a particular instance must be considered as one category and when as the other.

A representation of a feature by means of Points, Lines and Areas, is called a Level-1 representation, where as a representation by means of Complex features is called a Level-2 representation.

Depending to what category it belongs, a simple feature is represented by a Node, one or more Edges or one or more Faces. All Nodes, Edges and Faces of the feature instances of a particular layer form together a so-called Level-0 representation. An important requirement is that this representation must be plane, i.e. should contain Nodes where Edges meet each other in the plane.

Furthermore the FRS gives guidelines how the geometry for a particular feature class has to be constructed and how curved lines have to be represented by Segments.

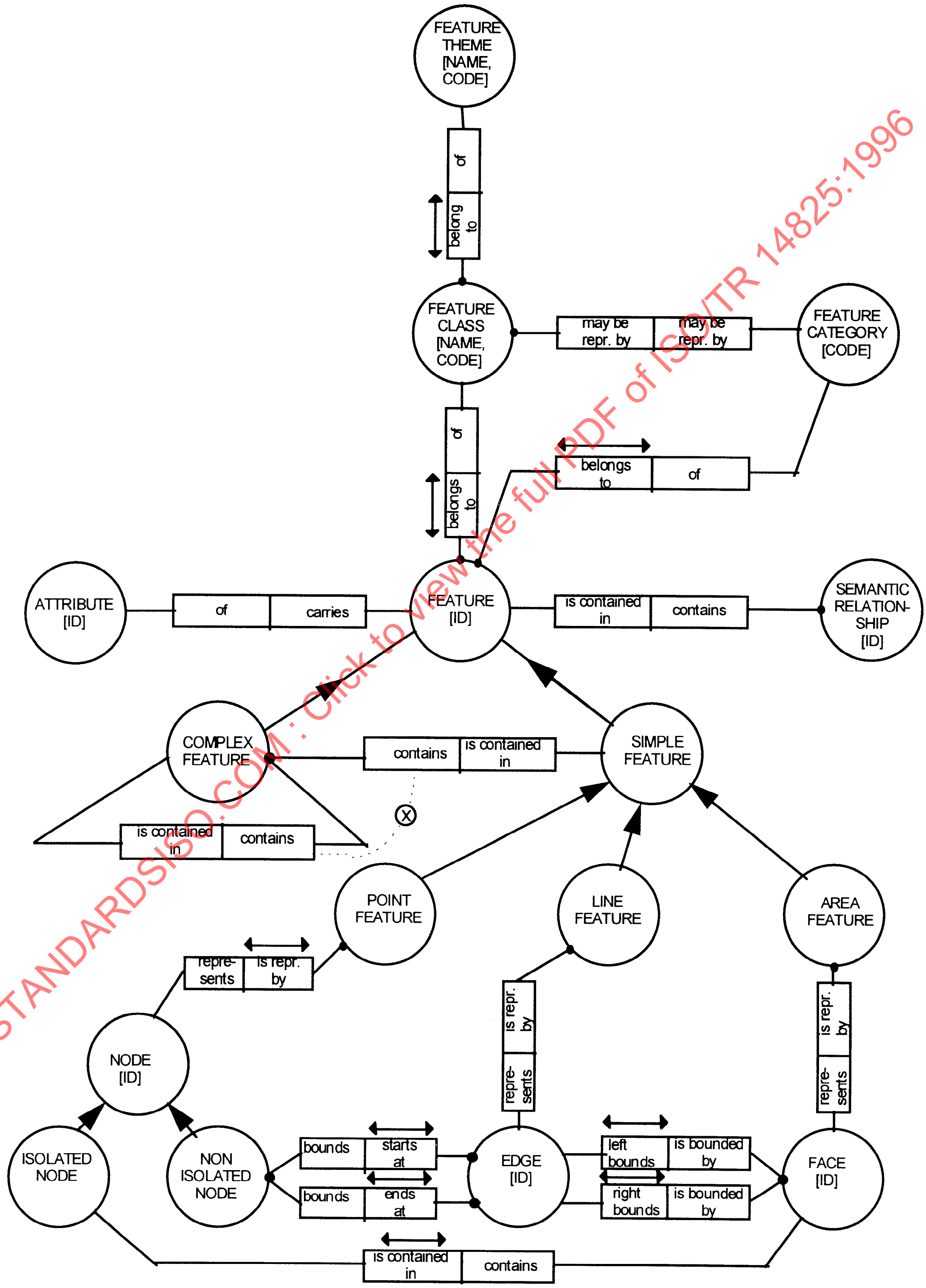


Figure 4.2. The overall Data Model

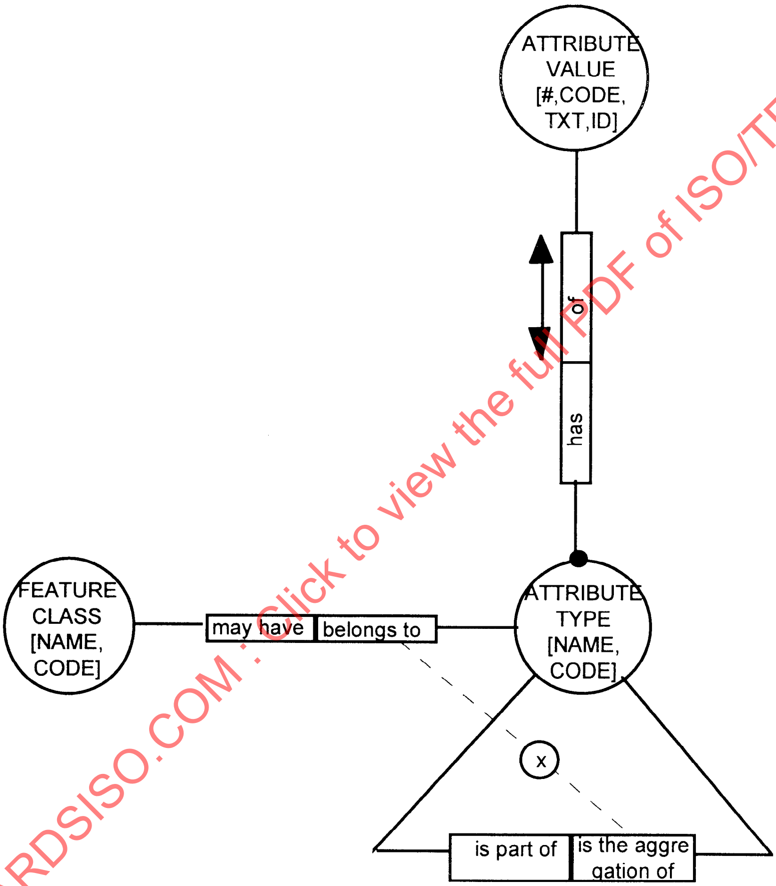


Figure 4.3. The Data Model for Attributes

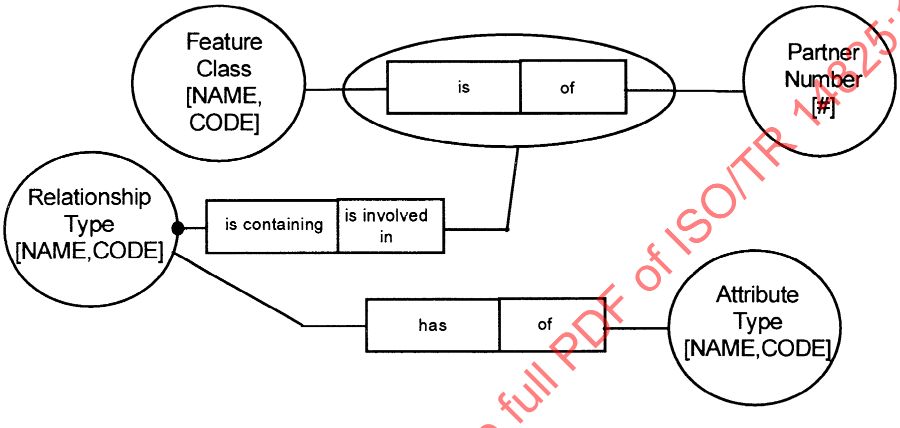


Figure 4.4. The Data Model for Relationships between Features

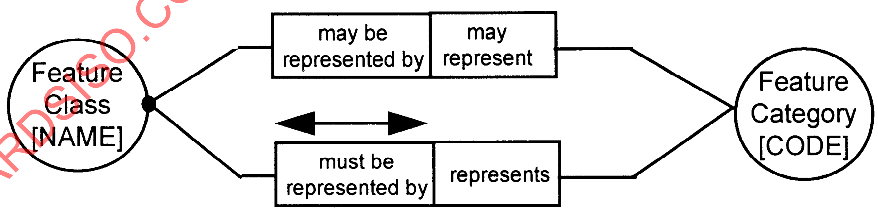


Figure 4.5. The Data Model for Feature Representation

5. FEATURE CATALOGUE

5.1 Generic Specifications

5.1.1 Features and Feature Themes

In GDF, real world objects, such as roads and buildings, are represented by 'features'. Features such as 'Roads' and 'Ferries' may be grouped together into 'feature themes' (for example '*Roads and Ferries*').

All features and feature themes in the GDF are referenced throughout the manual by a feature name or feature theme name. Most of these names are derived from terms commonly used in daily life (for example road, building). In order to distinguish a GDF feature name from these commonly-used terms, the names of the features and feature themes are written in italics with an uppercase character at the beginning of each word (for example '*Road Element*' versus 'road element').

5.1.2 Feature Class Names

For data exchange the features and feature themes are not referenced by their names but by a numeric code. A four digit code is used for features and a two digit code for feature themes. A strict 1:1 relationship exists between feature class name and feature class code and between feature theme names and feature theme codes. A full list of codes is given in Appendix A1.1.

5.1.3 Simple and Complex Features

GDF makes a distinction between simple and complex features. A simple feature is a feature composed only from geometrical primitives. In GDF, these are nodes, edges and faces. A complex feature is composed of other simple or complex features. For example, a '*Road Element*' is a simple feature constructed only of edges, and an '*Intersection*' is a complex feature, made up of a set of features such as '*Road Elements*' and '*Junctions*'.

5.1.4 Data Model for the Feature Catalogue

Figure 5.1 shows that part of the data model which is relevant for the Feature Catalogue. The relations between features and attributes have been left out for simplicity. They will be shown in the sub-schemes of the Attribute Catalogue. Also, there are relationships which exist, which are not part of a feature's definition. These are described in the Relationship Catalogue.

5.1.5 Overview Of Feature Themes

In the current Feature Catalogue the following feature themes are defined:

- Roads and Ferries
- Administrative Areas
- Settlements and Named Areas
- Land Cover and Use
- Brunnels
- Railways
- Waterways
- Road Furniture
- Services
- Public Transport
- General Features

These will be discussed in the following sections.

5.1.6 User-defined Features

The standard supports the ability for a user to define features which are not already defined. For these, special Feature Class Codes have been reserved. (See appendix A 1.1).

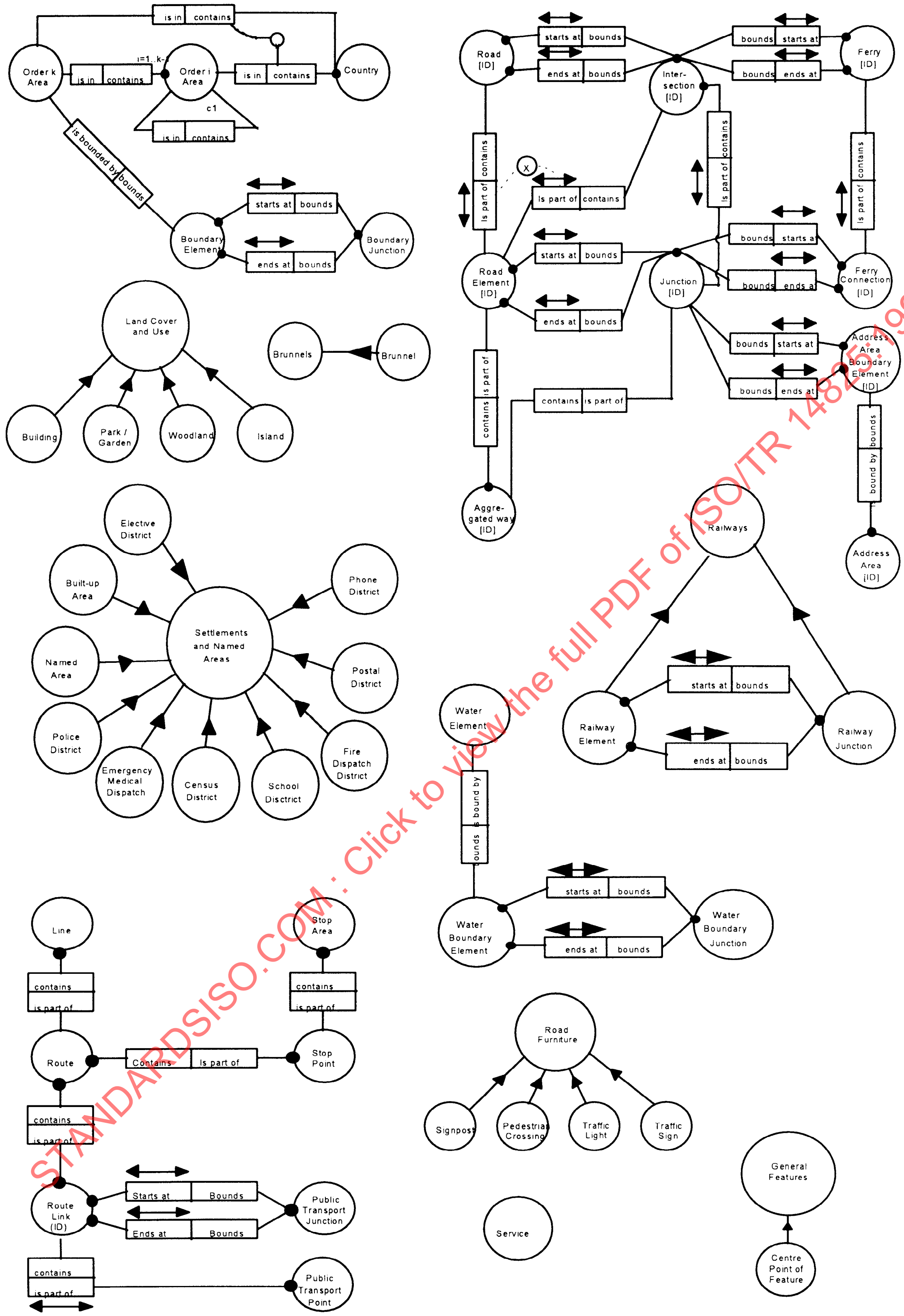


Figure 5.1. Data Model of Feature Catalogue

5.2 Roads and Ferries

5.2.1 General Overview

The road network is seen here primarily from the viewpoint of transportation and traffic. Ferry connections are therefore placed together with road network elements in one theme.

The road network can be represented at two different levels, Level 1 and Level 2. Level 1 describes all the simple features such as *Road Element*, *Junction*, *Ferry Connection, Enclosed Traffic Area, Address area Boundary Element* and *Address Area*, whereas Level 2 describes the complex features *Road*, *Intersection, Ferry* and *Aggregated Way*.

For example, in a vehicle navigation system application Level 1 can be used by the system to calculate routes. Level 2 may be used to give guidance instructions to the driver.

The Data Model for *Roads and Ferries* is given in Figure 5.2 which describes relationships between features within and between Levels 1 and 2.

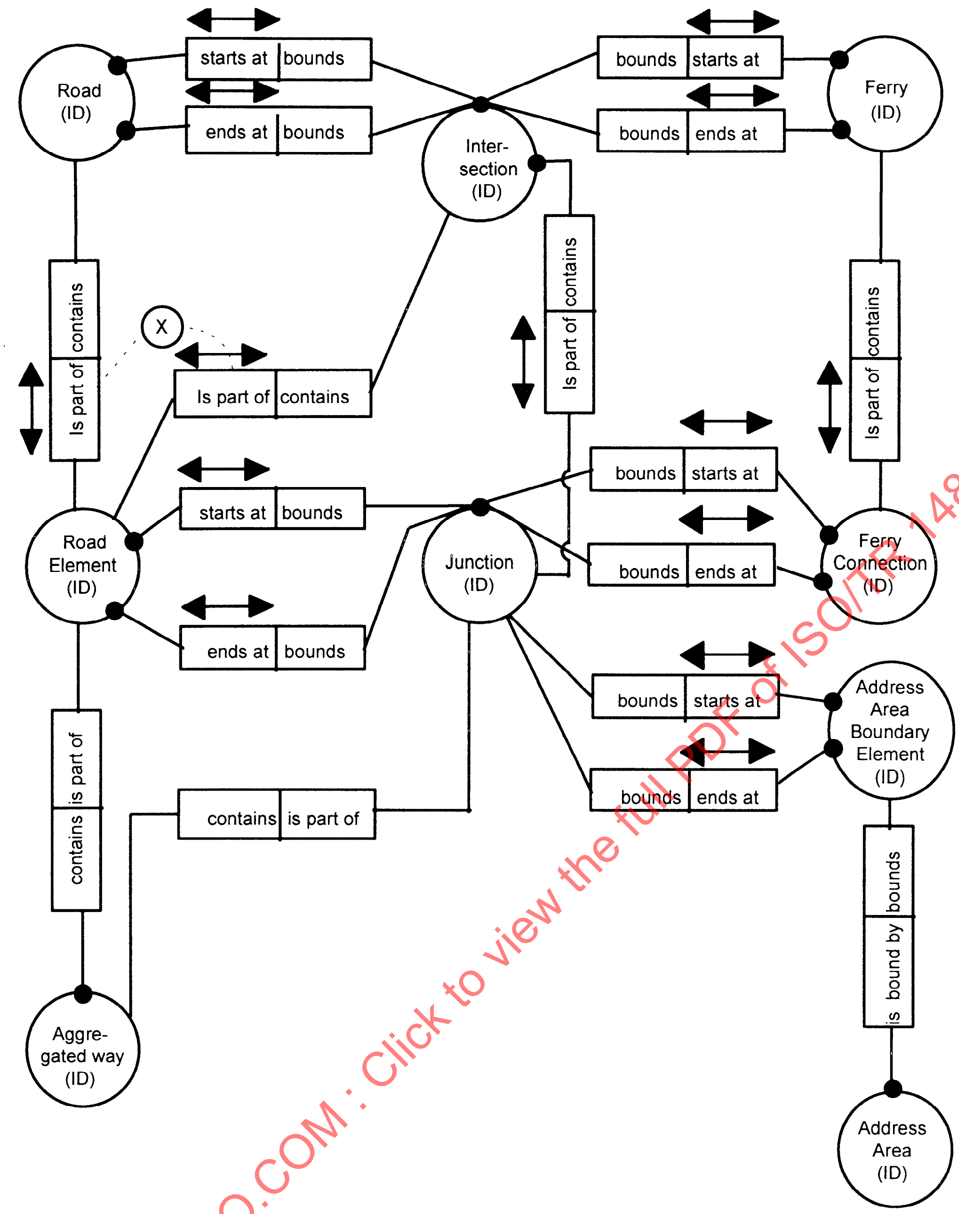


Figure 5.2 Data Model for Roads and Ferries

5.2.2 Road Element

5.2.2.1 Definition

A linear section of the earth which is designed for or the result of vehicular movement. It serves as the smallest unit of the road network at Level 1 that is independent and having a *Junction* at each end.

5.2.2.2 Independence of Road Elements

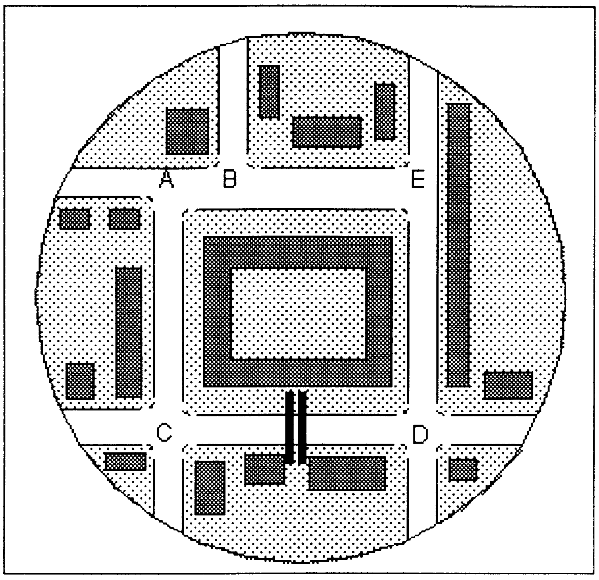
Individual *Road Elements* must be independent of one another. A change in the status of one *Road Element* must not affect a change in another. In Figure 5.3 for example, AB, BE, ED, DC and CA are all *Road Elements*. Their independence is illustrated by the fact that a barrier placed on *Road Element* CD creates a no through road CD, but does not affect the status of the other *Road Elements*.

Road Elements may also have a distinguishing set of attributes. For example, in Figure 5.4, *Road Elements* AF, FB have different names. AD, DE and EC have different restrictions. Within the context of the attributes *Official Name* and *Direction of Traffic Flow*, the elements AF, FB, AD, DE, EC and BC may be considered as being the smallest independent units and can consequently be considered as individual *Road Elements*. Alternatively, changes in attributes along a single road element can be described by stating the starting and ending positions along the road element for which the attribute is valid. This procedure is further described in the Attribute Catalogue (see chapter 6.1.10, Relation between attributes and features: Segmented Attributes)

5.2.2.3 Aggregation Rules

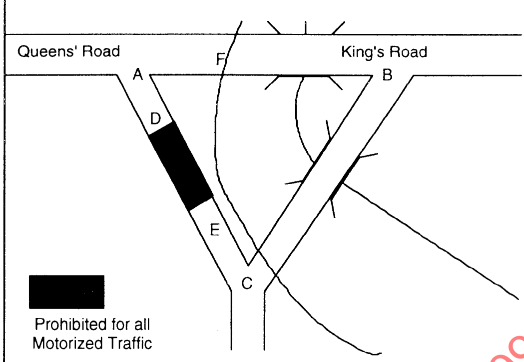
Any additions to the attributes of a *Road Element*, such as a restriction, or another name, may require it to be split into two or more separate *Road Elements*. In the example of Figure 5.4, the addition of a width restriction can cause the *Road Element* BC to be split into three new elements in order to be able to distinguish the influence of the narrow bridge from the other parts of the road. Alternatively, the limits for which attributes are valid along a road element may be described together with the attribute value.

In Figures 5.5 and 5.6, both carriageways are considered as being independent and consequently are treated as two individual *Road Elements*. A road with a physical separation between two parts of a road can be represented by two different *Road Elements*. Alternatively, the physical separation can be indicated by attributes.



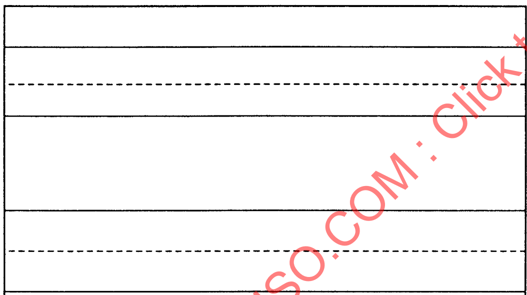
Road Element CD is independent of other *Road Elements.* When CD is blocked, traffic can still flow on other elements

Figure 5.3. Independence of *Road Elements* by function



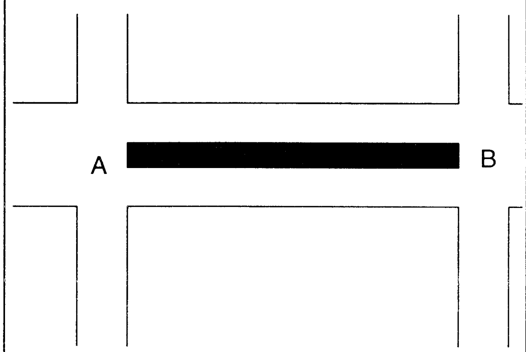
Road Element AF and BF differ in an attribute (their names) and therefore may be independent. AD, DE and EC are differentiated by traffic restrictions.

Figure 5.4. Independence of Road Elements by Attribute



Carriageways are physically separated along their length and so may be represented as two road elements.

Figure 5.5. *Road Elements* as Physically Separated Carriageways



Two separated parts of a road can be represented as separate road elements.

Figure 5.6. *Road Elements* as separated carriageways

5.2.3 Enclosed Traffic Area

5.2.3.1 Definition

Any confined area within which unstructured traffic movements are allowed.

5.2.3.2 Description

Examples of *Enclosed Traffic Areas* are: Industrial Sites, Car Parks, Harbour areas, Camp Sites, Military Areas, Unstructured Traffic Squares

5.2.4 Junction

5.2.4.1 Definition

A feature that bounds a *Road Element* or a *Ferry Connection*. A *Road Element* or *Ferry Connection* always forms a connection between two *Junctions* and, a *Road Element* or *Ferry Connection* is always bounded by exactly two *Junctions*. A *Junction* feature represents the physical connection between it's adjoining *Road Elements* and *Ferry Connections*.

5.2.4.2 Relation between Junction, Road Element, Enclosed Traffic Area, Ferry Connection and Address Area

Road Elements, *Ferry Connections* and *Junctions* are mutually dependent: a change in the first set will cause a change in the second one and vice versa.

A *Junction* is located at the intersection of two or more road centrelines. If the road centrelines intersect in two different points, the situation has to be interpreted as two different *Junctions*.

A *Junction* is also located at the end of a dead end road or at the intersection of a *Road Element* and an *Enclosed Traffic Area*, or a *Road Element* and a *Ferry Element*, or a *Road Element* and an *Address Area*.

5.2.4.3 Valency of a Junction

The number of *Road Elements* or Ferry Connections joining at a *Junction* is termed the Valency of a *Junction*. For example a *Junction* that connects a total of two *Road Elements* is called a two valent *Junction*.

The occurrence of *Junctions* that bound only two *Road Elements* or *Ferry Connections* is generally restricted to the following situations:

- An extra *Junction* may be used if two *Road Elements* have at least one different attribute value or participate in at least one different relationship. Figure 5.7 uses the example of traffic restrictions.
- An extra *Junction* may be used to avoid a *Road Element* having the same *Junction* at the start and at the end, as shown in Figure 5.8.
- An extra *Junction* may be used to form independent complex *Road* features. In Figure 5.9, a *Junction* may be introduced to allow a complex *Road* feature to be formed.

Junctions which bound only two *Road Elements* or bound only two *Ferry Connections* should not exist in the road network if none of the above conditions are fulfilled.

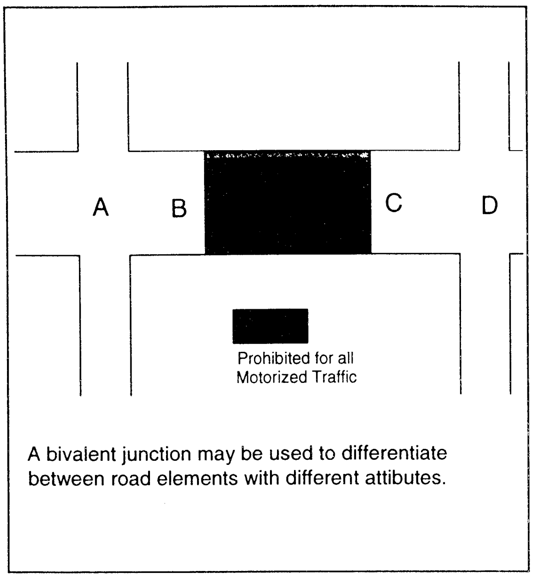


Figure 5.7. A change in attribute values may change the *Road Elements.*

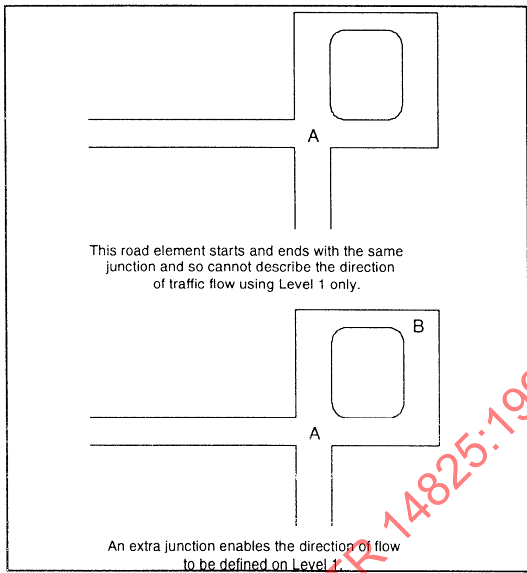


Figure 5.8. *Road Elements* as a Loop in the Road Network.

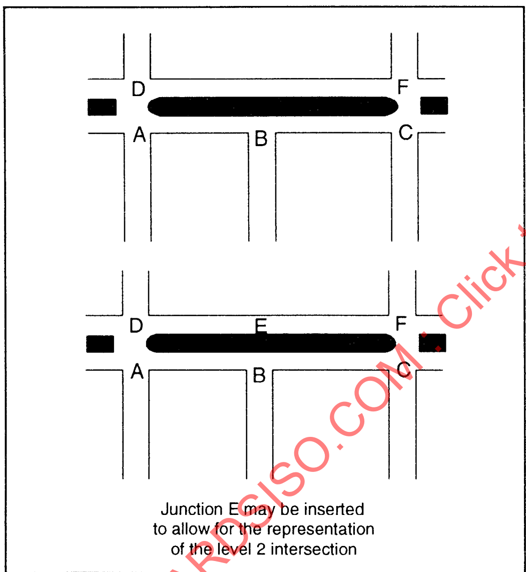


Figure 5.9. Formation of Level 2 *Road.*

5.2.4.4 Topological requirements

The set of *Junctions*, *Road Elements*, *Enclosed Traffic Areas*, *Address Areas* and *Ferry Connections* has to be constructed so it represents the topological relations in the road network correctly.

This important requirement is illustrated in Figure 5.10. This figure shows a T-junction. The correct interpretation is to see it as consisting of three *Road Elements* AB, BC and BD joining at *Junction B*.

5.2.4.5 Grade Separated Crossings

Grade separated crossings in the road network cover objects such as bridges, overpasses, and underpasses. Grade separated crossings are not represented by a *Junction*. An example of this is given in Figure 5.11, where AB and CD are *Road Elements*. Any interpretation of the network which uses a Junction at Z to represent the split level crossing is incorrect (for example {AZ,ZB,CD} or {AB,CZ,ZD} or {AZ,ZB,CZ,ZD}.

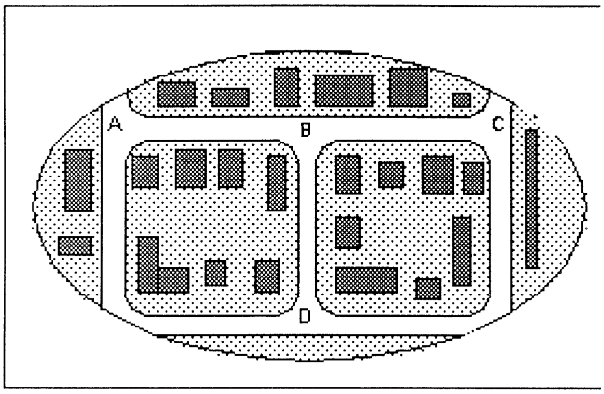
5.2.4.6 Squares

Traffic squares, which are not completely unstructured, but which have some legally defined traffic flow or internal structure (for example a fountain, flower beds, painted lines on the road surface, etc.) which prescribe a traffic flow, have to be considered as being composed of different Road Elements. Figure 5.12 shows a traffic square with a grass bed in its centre. The traffic square is composed of the sequence of Road Elements AB,BC,CD and DA which together form a closed ring.

Figure 5.13 shows an area where traffic movements are not regulated in a strict geometrical sense. These are considered *Enclosed Traffic Areas*. These features are represented as an area at which the incoming *Road Elements* end in a *Junction*. The *Enclosed Traffic Area* itself forms the topological connection between these *Road Elements*. Inside the area, *Road Elements* may be defined which have only topological, and not a geometrical, significance.

5.2.4.7 Parking areas

Parking areas are to be considered *Enclosed Traffic Areas* (see Section 5.2.3).



Junctions and *Road Elements* need to be constructed, so that they represent the road network correctly.

Figure 5.10. Topological Requirements.

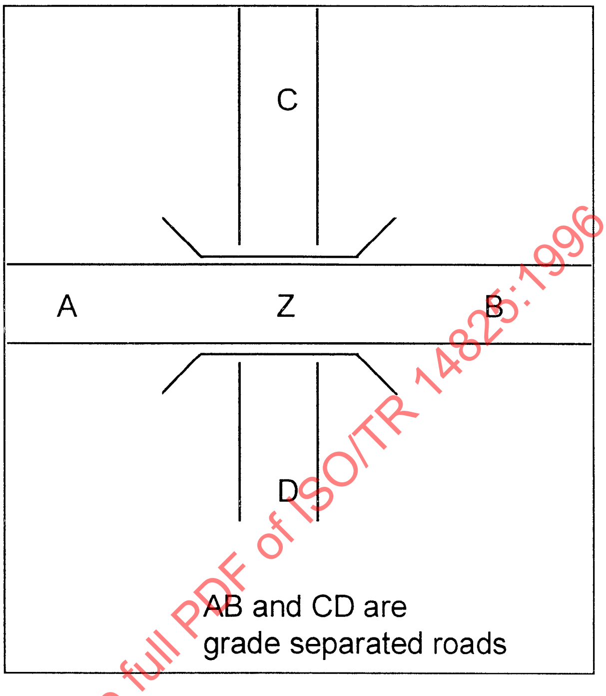
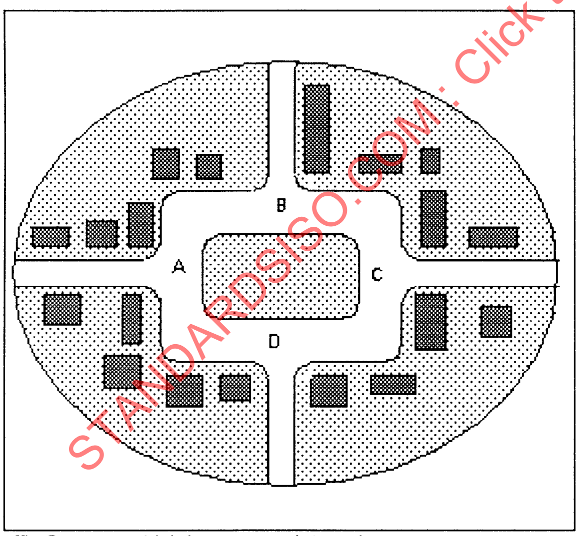


Figure 5.11. Topological Requirements.



Traffic Squares which have some internal structure need to be represented by different *Road Elements*.

Figure 5.12. Topological Requirements for Structured Squares.

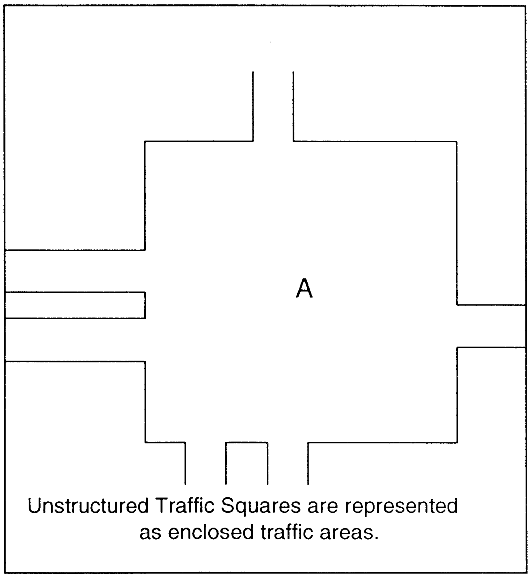


Figure 5.13. An Unstructured Traffic Area.

5.2.5 Ferry Connection

5.2.5.1 Definition

A vehicle transport facility between two fixed locations on the road network and which uses a prescribed mode of transport, for example, ship or train.

5.2.5.2 Characteristics

The feature *Ferry Connection* is the smallest independent unit of the road network operated by a *Ferry* that is represented at Level 1.

Many situations look like Figure 5.14. This is interpreted as one single *Ferry Connection*. But situations exist where one ferry service joins more than two locations as shown in Figure 5.15. This situation has to be interpreted as three different *Ferry Connections*: AB, BC and CA.

5.2.6 Ferry

5.2.6.1 Definition

A set of *Ferry Connections* which describe a single passage of a particular ferry line.

The rules that govern Level 1 *Road Element* and Level 2 *Road* also apply to Level 1 *Ferry Connection* and Level 2 *Ferry*.

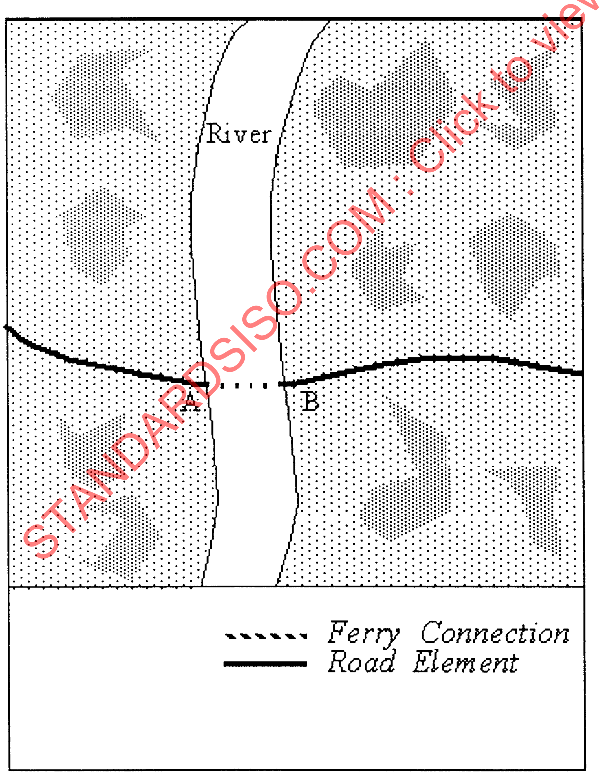


Figure 5.14. Ferry joining two terminals

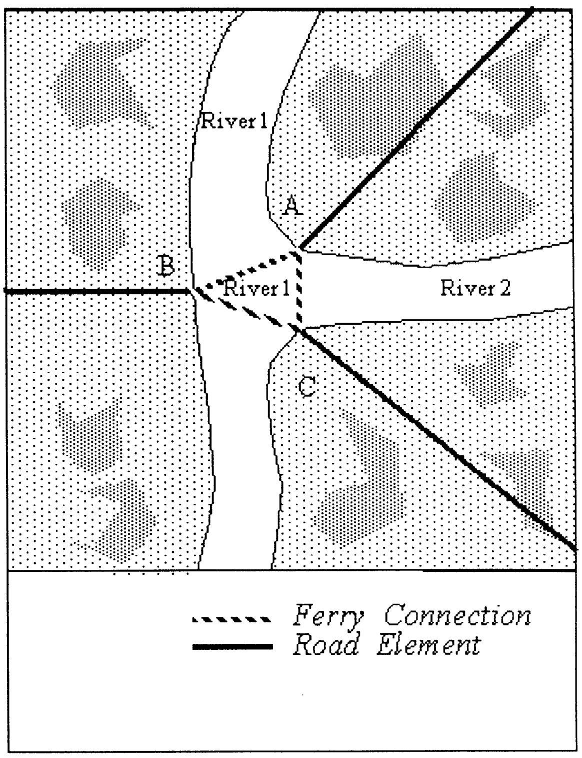


Figure 5.15. Ferry joining three terminals.

5.2.7 Road

5.2.7.1 Definition

A Level 2 feature composed of one, many or no *Road Elements* and joining two *Intersections*. It serves as the smallest independent unit of a road network at Level 2.

5.2.7.2 Relation Between Road, Road Element And Intersection

A *Road* always forms a connection between two *Intersections*. *Roads* are defined in terms of the *Road Elements* that they contain. Below some basic construction rules are given. For a more elaborated description see Appendix A1.3.

5.2.7.2.1 A Road Containing One Road Element

This is the most common case and is illustrated by Figure 5.16. At Level 1 this road can be seen as consisting of one *Road Element*. At Level 2 the same road can be seen as one *Road*. *Road* CL 573 is bounded by the *Intersections* CS 204 and CS 204, and contains *Road Element* L 203.

5.2.7.2.2 A Road Containing Two Road Elements

Figure 5.17 shows a dual carriageway. Both carriageways are physically separated and can be consequently interpreted as individual *Road Elements*.

At Level 2 however, both carriageways are considered as making up one single *Road*. *Road* CL 583 contains *Road Elements* L 452 and L 854 and is bounded by the *Intersections* CS 723 and CS 721.

The concept of "dual carriageway" is an important one. A dual carriageway will usually contain two parallel *Road Elements*. There are occasions where each carriageway may be divided by an obstruction and the *Road Elements* no longer remain parallel. In these cases, if the *Road Elements* make up one functional unit and there are no *Junctions* involved, these *Road Elements* may be considered as one Level 2 *Road*. Not all *Road Elements* which run parallel to one other, however, are a multi-carriageway.

5.2.7.2.3 A Road Containing More Than Two Road Elements

In occasional cases a *Road* may contain more than two *Road Elements*. Figure 5.18 shows an example: a road has two parts having a single carriageway and one part with separated carriageways. At Level 1, this road can be interpreted as four *Road Elements*. At Level 2 however, the road should be interpreted as one *Road*. *Road* CL 599 is built up by *Road Elements* L 258, L 259, L 260 and L 261.

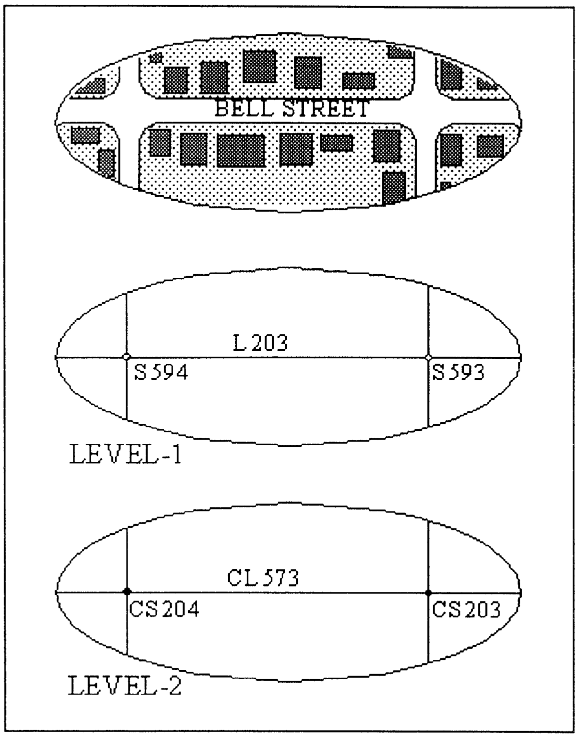


Figure 5.16 A *Road* containing on *Road Element*

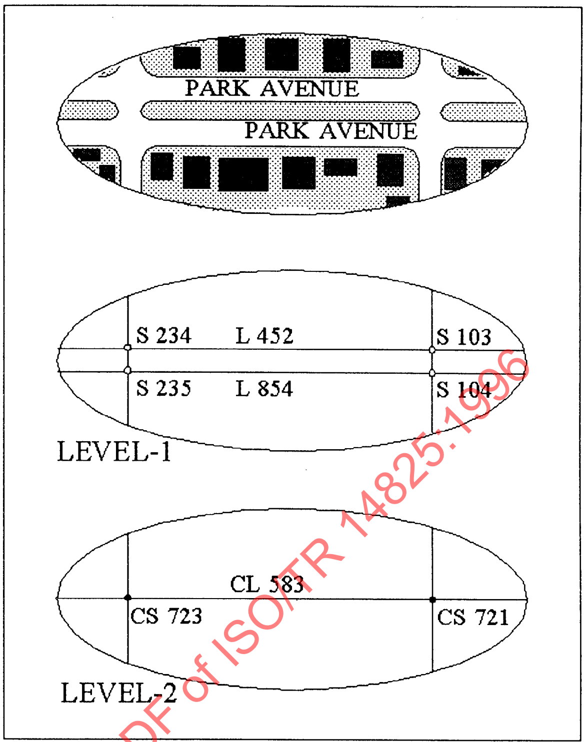


Figure 5.17. A *Road* containing two *Road Elements*

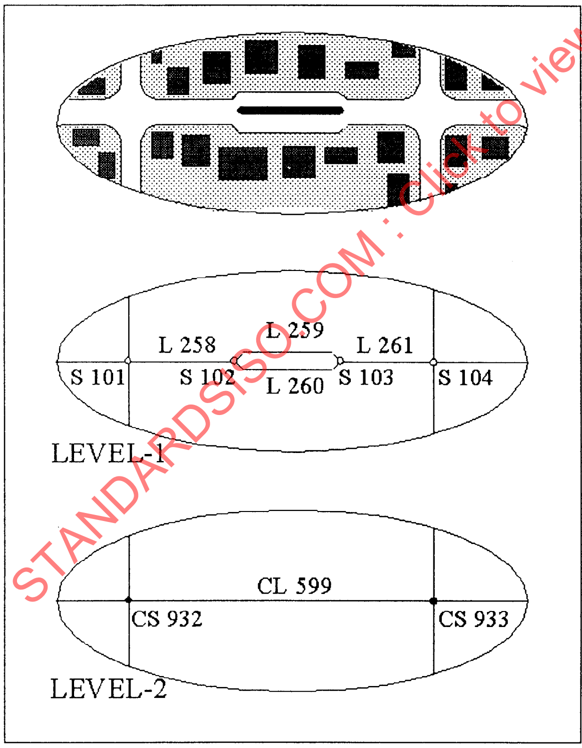


Figure 5.18. A *Road* containing more than 2 *Road Elements*

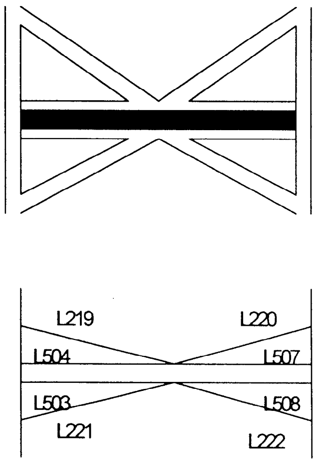


Figure 5.19. A *Road* containing no *Road Elements*

5.2.7.2.4 A Road Containing No Road Elements

In rare cases a *Road* may contain no *Road Elements* at all. Figure 5.19 shows two sequential split-level crossings between a dual carriageway and two single carriageways.

In the example, Level 2 is constructed from Level 1 by:

- The *Road Elements* L 219, L 221, L 504 and L 503 are mapped onto the *Intersection* CS 754.
- The *Road Elements* L 507, L 220, L 508 and L 222 are mapped onto the *Intersection* CS 755.

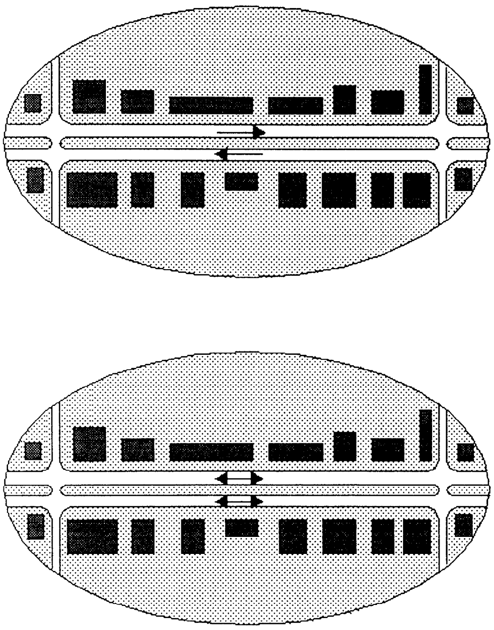
Consequently no *Road Elements* remain that are mapped onto *Road* CL 891. This *Road* contains no *Road Elements* and is bounded by the *Intersections* CS 754 and CS 755.

The basic guideline for formation of a Level 2 *Road* is that when the *Road Elements* in question represent the carriageways of a multi carriageway, these *Road Elements* may be considered to form a *Road*.

In addition, each of the following requirements have to be fulfilled for a multi-carriageway:

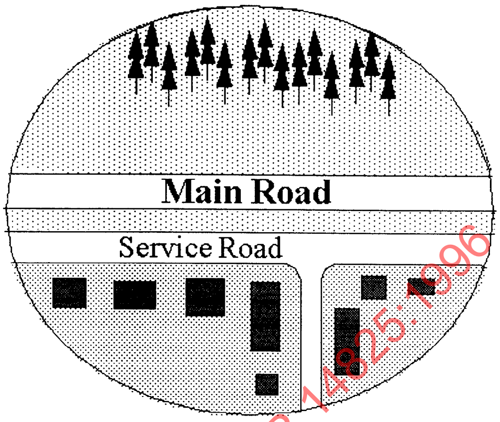
- Each *Road Element* must be a "one way road", as drawn in Figure 5.20.
- The *Road Elements* need to have the same road class. Figure 5.21 shows a situation of a street having a service road at its side. The *Road Element* that represents the service road has a different road class to the *Road Element* representing the main road. Consequently, these two *Road Elements* cannot form a multi-carriageway.
- It must be possible to see the *Road* as one single functional unit. This is often indicated by the fact that the different *Road Elements* have the same road name or road number.

A *Road* may not be formed from *Road Elements* separated by a *Road Element* belonging to a different *Road*. This condition is illustrated in Figure 5.22. A main road is shown having service roads at both sides. Though they fulfil all the other requirements, *Road Elements* representing the service roads may not be considered as forming a *Road* because they are separated by the *Road Element* representing the main road.



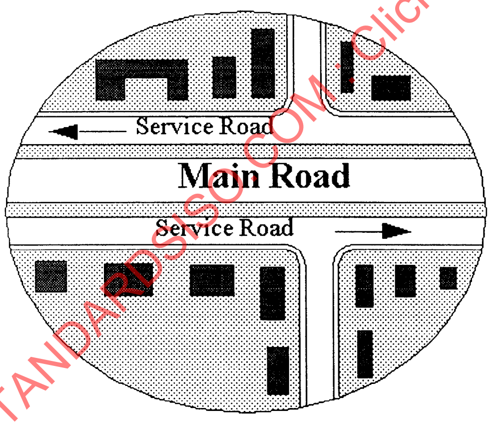
For a road to be considered as a multi-carriageway each *Road Element* must be 'one-way'

Figure 5.20. Guidelines for formation of *Road*.



For a road to be considered as a multi-carriageway and declared as a road, each *Road Element* needs to be of the same classification

Figure 5.21. Guidelines for formation of *Road*.



A road may not be formed from *Road Elements* separated by an element belonging to an other road

Figure 5.22. Guidelines for formation of *Road*.

5.2.8 Intersection

5.2.8.1 Definition

The Level 2 representation of a crossing which bounds a *Road* or a *Ferry*. It is a Complex Feature composed of one or more Level 1 *Junctions*, *Road Elements* and *Enclosed Traffic Areas*.

5.2.8.2 Similarities and differences between Intersection and Junction

At Level 2, the feature *Intersection* plays the same role as the feature *Junction* does as Level 1; it bounds *Roads* and *Ferries* and joins them to other ones.

The difference between an *Intersection* and a *Junction* lies in the degree of generalisation; where a multi-element crossing will be described at Level 1 by many *Road Elements* and *Junctions*, it may be represented at Level 2 by one single *Intersection*.

Note: The number of different *Roads* that are bounded by one single *Intersection* may be any number other than two or zero.

Rules for Formation of *Intersections* may be found in Appendix 1.3.

5.2.9 Aggregated Way

5.2.9.1 Definition

A set of associated *Road Elements* and, optionally, *Junctions* which share a common function or characteristic.

5.2.9.2 Description

An *Aggregated Way* is a feature which has been defined by a user, for example a road authority, for the purpose of identifying and relating features in their user-specified model to level 1 features in the GDF.

A *Road Element* or *Junction* can belong to more than one *Aggregated Way*. *Aggregated Ways* do not have an implied topology, that is, they are not necessarily connected to other *Aggregated Ways*, and do not necessarily form a complete network.

5.2.10 Address Area

5.2.10.1 Definition

An area containing addresses which cannot be related to one or more *Road Element*.

5.2.10.2 Description

In certain situations addresses are defined in such a way that the information cannot be related to one or more *Road Element*. Two different situations can be identified:

1. The addresses are located in a square which has a name which is different from the name of the *Road Element(s)* representing the road network on that square.
2. The addresses are defined according to building blocks. In these cases a building block has a name which differs from the name of an adjacent building block and of the *Road Element* which possibly divides the two building blocks.

An *Address Area* should always have a connection with the road network.

5.2.11 Address Area Boundary Element

5.2.11.1 Definition

A representation of the boundary of an Address Area

5.2.11.2 Description

A *Address Area Boundary Element* describes the outer confinement of an *Address Area*. An *Address Area Boundary Element* is start and end bounded by a *Junction* which is defined where the *Address Area* intersects with the road network.

At least one of the edges defining the complete boundary of an *Address Area* has also to be referenced by a *Road Element* which is connected to the rest of the road network.

5.3 Administrative Areas

5.3.1 General Overview

For administrative purposes, the territory of a country is subdivided in a hierarchy of political units. These units are called *Administrative Areas* in this document. Countries are subdivided into regions, which in turn may be subdivided into sub-regions, which in turn may be subdivided further.

Each of these subsets is said to be of a particular Order. The number of administrative area orders differ from country to country but is fixed (with only some rare exceptions) for the whole territory of a country.

The highest level of *Administrative Areas* is called the *Country*. The sub-divisions of a *Country* are termed *Order-i Areas* where i ranges from 1 (the highest order subdivision) to Order-8 (country-specific equivalent to municipality). A subdivision of Order-8 Areas may also be used for local areas only. This is termed an Order-9 Area and does not apply country-wide.

The Data Model for *Administrative Areas* is shown in Figure 5.23.

Appendix A1.2 shows for a number of European countries how the generic features Order-i Area can be substituted by native terms and languages.

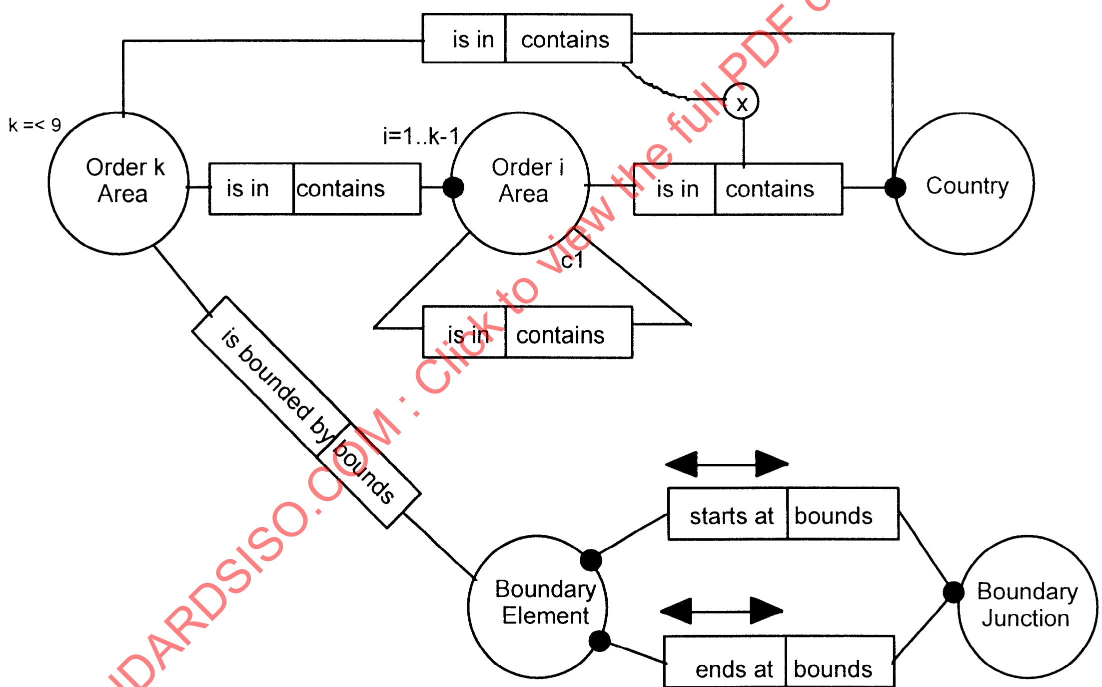


Figure 5.23. Data Model for *Administrative Areas*

5.3.2 Boundary Element

5.3.2.1 Definition

The smallest unit of a boundary which delimits an *Administrative Area*.

5.3.2.2 Explanation of Boundary

A boundary is formed between two adjacent *Administrative Areas* of equal order, or between an *Administrative Area* and a geographical barrier such as a foreign country.

5.3.2.3 Constraints

A *Boundary Element* is bounded by exactly two *Boundary Junctions*. These need not necessarily be different nodes (see Figure 5.24). A *Boundary Element* may never bound the same *Administrative Area* twice (see Figure 5.25).

5.3.3 Boundary Junction

5.3.3.1 Definition

The location where *Boundary Elements* join.

5.3.3.2 Constraints

A *Boundary Junction* joins/connects one, three, or more *Boundary Elements*. It will typically bound three but never two. Figure 5.26 illustrates the case when it joins one single *Boundary Element*.

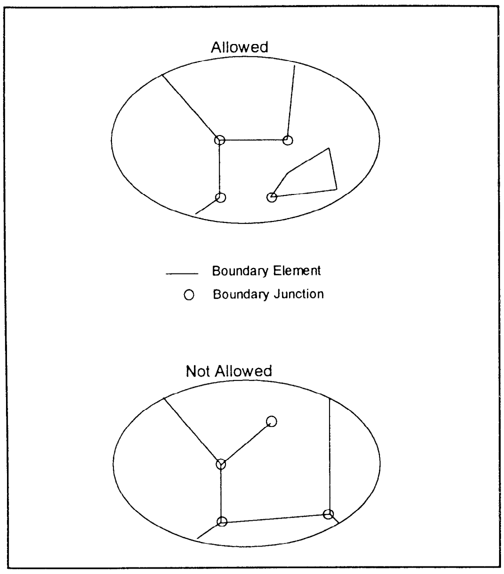


Figure 5.24. *Boundary Elements* and *Boundary Junctions.*

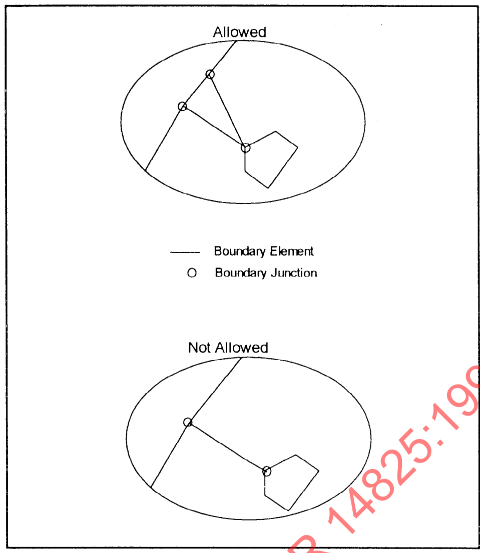


Figure 5.25. *Boundary Elements* and *Boundary Junctions.*

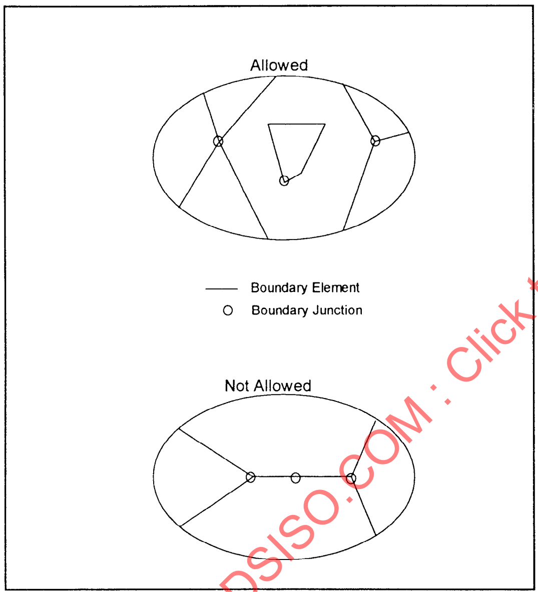


Figure 5.26. *Boundary Elements* and *Boundary Junctions.*

5.3.4 Country

5.3.4.1 Definition

A country as defined by national boundaries.

5.3.4.2 Explanation

A requirement for a *Country* is that it must be subdivided in a uniform manner (i.e. by lower level administrative areas of the same kind).

Some very small *countries* may have no further administrative subdivisions. In such a case the *Country* has to be considered as being composed of one simple area feature, carrying the same name.

5.3.5 Order 1 to 7 Areas

5.3.5.1 Definition

An area defined for administrative purposes governed by a government specially established for that area.

5.3.5.2 Explanation

These areas are intermediate subdivisions of the administrative hierarchy. In some small *countries*, these intermediate layers of the administrative hierarchy may not exist.

Appendix A1.2 lists some examples.

5.3.6 Order 8 Area

5.3.6.1 Definition

The *Administrative Area* level that is the country specific equivalent to municipality.

5.3.6.2 Explanation

Appendix A1.2 lists some examples by country of *Order-8 Area* names.

5.3.7 Order 9 Area

5.3.7.1 Definition

The Administrative Area level that is a subdivision of Order-8 Administrative Areas.

5.3.7.2 Explanation

Some *Order-8 Areas* may be split into smaller units. This may be the case for one single *Order-8 Area* (for example Rotterdam) or for all *Order-8 Areas* in a particular region (for example all municipalities in Hessen).

These smaller units are classed as *Order-9 Areas*.

5.4 Settlements and Named Areas

5.4.1 General Overview

Settlements and Named areas are areas which have a distinguishing functional or physical purpose. These may included areas with a concentration of homes and buildings which designate residential areas, areas with a commonly known name, or areas which are serviced by the same service provider, such as police precincts, or school districts.

The Data Model for *Settlements and Named Areas* is shown in Figure 5.27.

5.4.2 Built-up Areas

5.4.2.1 Definition

An area with a concentration of buildings. In these areas, an inner city speed limit generally applies.

5.4.2.2 Description

No exact relationship exists between a *Built-up Area* and a municipality. In some cases a *Built-up Area* relates to exactly one municipality having the same name. However, in rural areas in particular, one municipality can contain several small *Built-up Areas*. Also situations exist (Paris, Brussels) in which a *Built-up Area*, referenced by most people by one single name, is spread over several municipalities or other kinds of *Administrative Areas.*

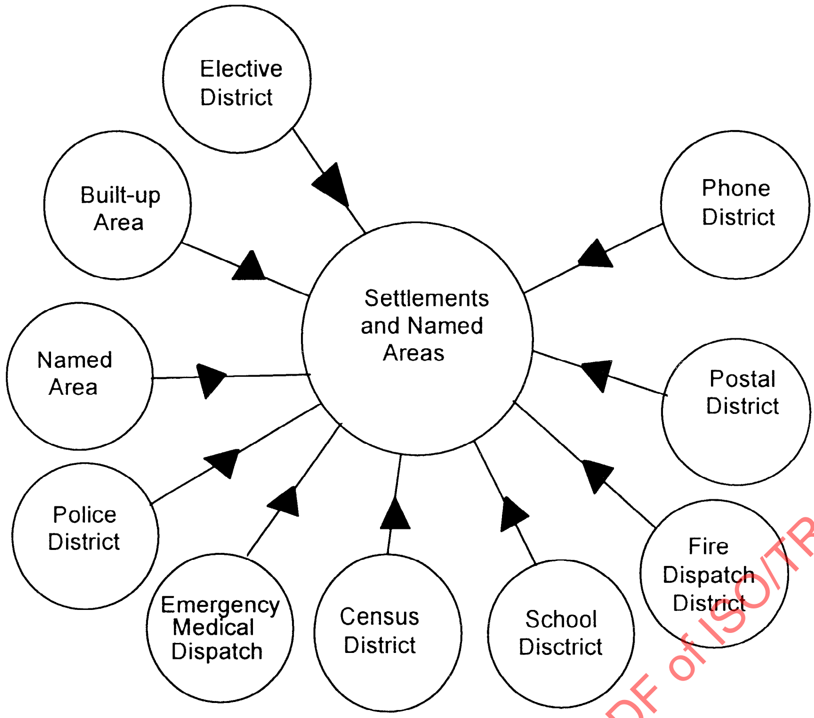


Figure 5.27. Data Model for *Settlements and Names Areas.*

5.4.3 Named Area

5.4.3.1 Definition

A clearly or fuzzy bounded area, covering a region having its own commonly used name to identify this particular region.

5.4.3.2 Description

Examples of *Named Areas* are:

- The Black Forest
- The Alps
- The Riviera

5.4.4 District

5.4.4.1 Definition

An area which is defined by a particular service or function which is available in the area and/or provided by a particular service provider. This service can be public, such as Police or Fire Brigade precincts, or private, such as Cable TV service provided by a particular Cable TV company.

The public subtypes of *District* are:

- Police District
- Emergency Medical Dispatch District
- School District
- Census District
- Fire Dispatch District
- Postal District
- Phone District (Region sharing a common area code)
- Elective District

5.5 Land Cover and Use

5.5.1 Definition

An area of the Earth's surface that has been classified according to its land cover and/or use.

5.5.2 General Overview

Land Cover and Use provide contextual information for visualization of data about the coverage or usage of the earth's surface.

5.5.2.1 Features of Land Cover and Use

The features included as *Land Cover and Use* are:

- Building
- Woodland
- Park/Garden
- Island

The Data Model for *Land Cover and Use* is shown in Figure 5.28.

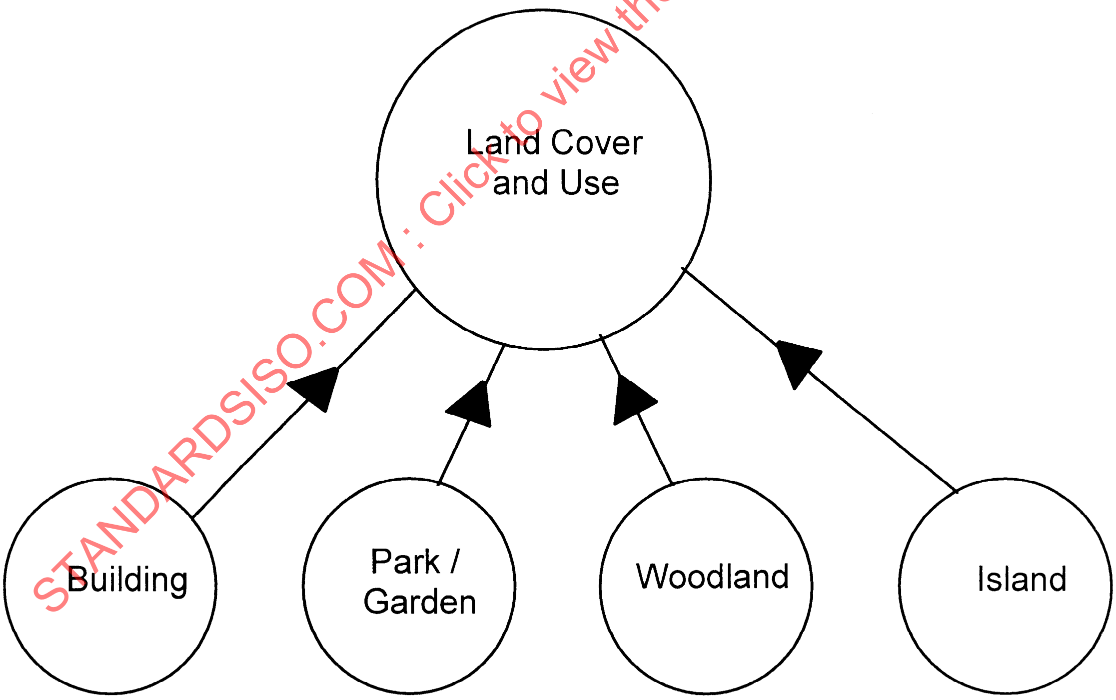


Figure 5.28. Data Model for *Land Cover and Use*.

5.5.3 Building

5.5.3.1 Definition

A man made structure occupied by people or goods.

5.5.3.2 Description

Buildings are included to represent the physical presence of these structures. Neighbouring buildings can be grouped into a single building feature.

5.5.4 Woodland

5.5.4.1 Definition

An area of the earth's surface covered by trees or other dense vegetation, and generally void of residences and other buildings.

5.5.5 Park/Garden

5.5.5.1 Definition

An area covered with (quasi-)natural land cover and designated as such for recreational and/or environmental purposes.

5.5.5.2 Description

Generally, a *Park/Garden* is covered with a natural surface. However, in some cases, particularly urban environments, a *Park/Garden* can be covered with a playing/recreation surface, for example a basketball or handball court.

5.5.6 Island

5.5.6.1 Definition

An area surrounded by water, possibly connected to other land by means of a bridge or tunnel or accessible by ferry.

5.6 Brunnels

5.6.1 General Overview

Brunnels are used to describe significant structures in the road network which form a grade separate crossing, e.g. in the following situations:

- Where a road crosses a railway.
- Where a road crosses a river or canal.
- Where a road, railway or waterway goes through a mountain, under or over an estuary, a valley, etc.
- Where a road crosses another road.
- Where a waterway crosses a railway.

Figure 5.29 illustrates the Data Model for Brunnels

5.6.2 Brunnel

5.6.2.1 Definition

A collective term formed from the words BRidges and tUNNELS to describe a construction which forms a grade separation such as a bridge, tunnel, aqueduct, viaduct etc.

5.6.2.2 Types of Brunnels

A *Brunnel* feature can be classified with the Brunnel Type attribute.

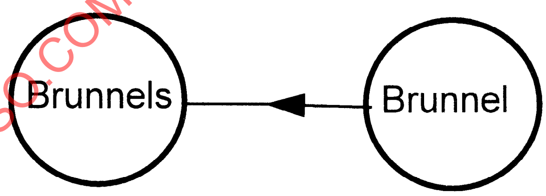


Figure 5.29: Data model for Brunnels

5.7 Railways

5.7.1 General Overview

Railways are similar to roads in that their constituent elements together form a network. A railway network may therefore be considered to be made up of a number of *Railway Elements* that are connected by means of *Railway Element Junctions*. Figure 5.30 illustrates the Data Model for *Railways*

5.7.2 Railway Element

5.7.2.1 Definition

A permanent way having one or more tracks which are or can be used for trains.

5.7.2.2 Explanation

A *Railway Element* is the smallest independent part of the railway network, and is bounded by two *Railway Element Junctions*.

5.7.3 Railway Element Junction

5.7.3.1 Definition

The location where three or more *Railway Elements* meet or where a *Railway Element* ends.

5.7.3.2 Explanation

Railway Element Junctions are located where three or more *Railway Elements* join or where one *Railway Element* ends.

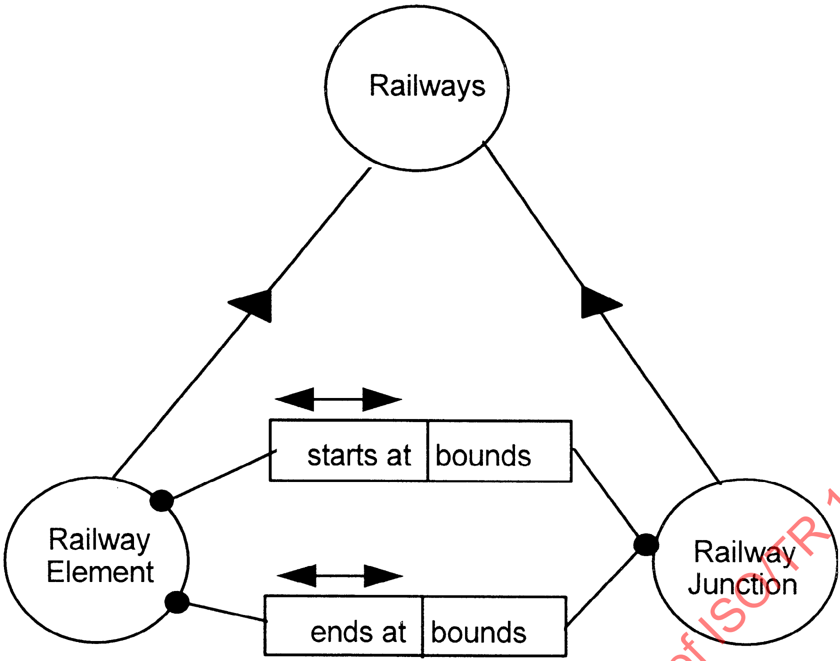


Figure 5.30. Data Model for *Railways*.

5.8 Waterways

5.8.1 General Overview

The Waterway feature theme contains the representation of water bodies. Waterway features are composed of *Water Elements* and waterway boundaries. *Water Elements* may be connected to other *Water Elements* or they may be isolated. Water boundaries are represented by *Water Boundary Elements* and *Water Boundary Junctions*. A *Water Boundary Element* describes the outline of the water surface and connects two *Water Boundary Junctions*.

Figure 5.31 illustrates the Data Model for *Waterways*.

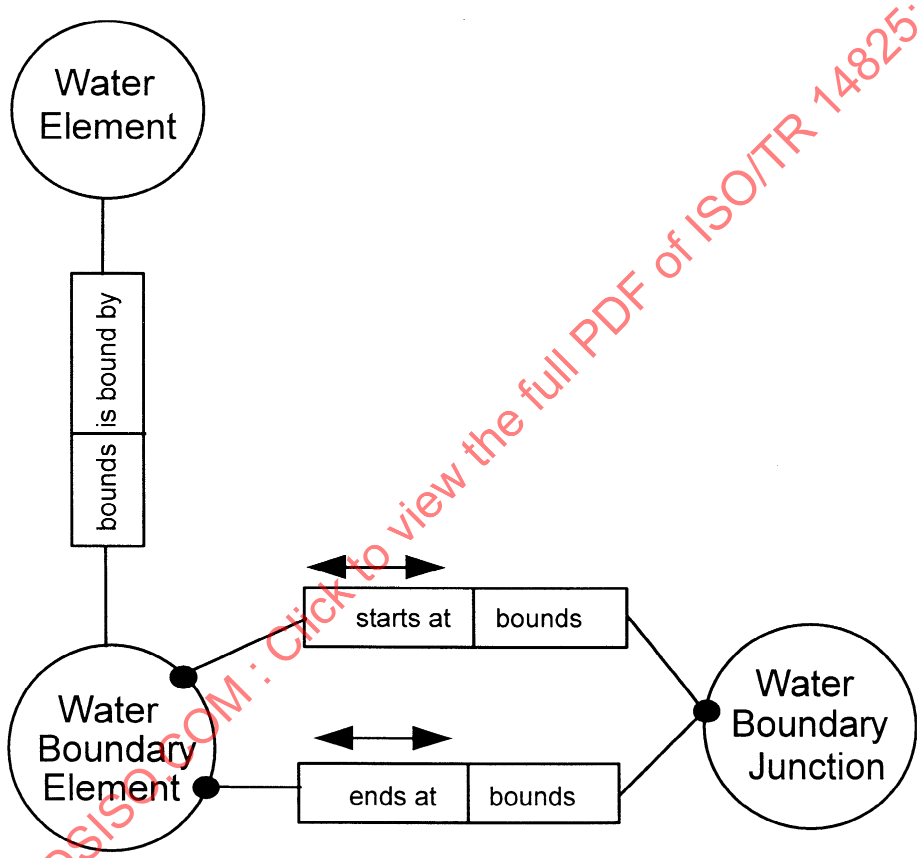


Figure 5.31. Data Model for *Waterways*.

5.8.2 Water Element

5.8.2.1 Definition

A way or course through which water flows, or an area covered by water.

5.8.2.2 Description

A *Water Element* is the representation of the physical areas of the earth's surface which are covered by water. These features can be either connected to each other or isolated. The type of waterway is described by the attribute *Water Element Type*.

5.8.3 Water Boundary Element

5.8.3.1 Definition

The smallest unit of a boundary which describes the edge of a water body.

5.8.3.2 Explanation of Water Boundary Element

A *Water Boundary Element* is a continuous boundary formed between the edge of a water body and the land.

5.8.3.3 Constraints

A *Water Boundary Element* is bounded by exactly two *Water Boundary Junctions*. These need not necessarily be different nodes (see Figure 5.32). A *Water Boundary Element* may never bound the same Water Feature twice.

5.8.4 Water Boundary Junction

5.8.4.1 Definition

The location where *Water Boundary Elements* join.

5.8.4.2 Constraints

A *Water Boundary Junction* joins/connects one, or more *Water Boundary Elements*. Figure 5.32 illustrates the case when it joins one single *Water Boundary Element*.

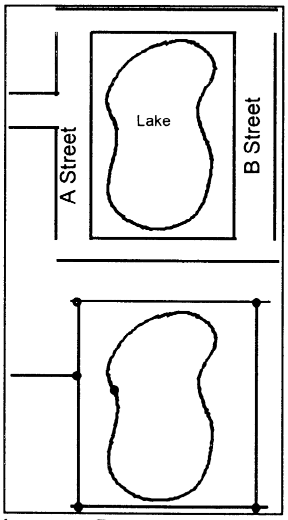


Figure 5.32. An example of *Water Element Boundary* bounded by one *Water Element Junction.*

5.9 Road furniture

5.9.1 General Overview

Road Furniture are items which are categorized by having a fixed location along a *Road Element*, either on the carriageway or the pavement. Examples include features such as *Traffic Lights,* and *Traffic Signs*. Figure 5.33 illustrates the Data Model for *Road Furniture*.

5.9.2 Signpost

5.9.2.1 Definition

A collection of boards and plates that are physically attached and which contain directional information.

5.9.2.2 Explanation

An illustration is given in Figures 5.34 and 5.35. A *Signpost* may represent a set of signposts referring to the same situation.

5.9.3 Traffic Sign

5.9.3.1 Definition

A board containing symbols and (possibly) some additional text, expressing a traffic restriction, recommendation or information.

5.9.4 Traffic Light

5.9.4.1 Definition

A multi colored light governing the traffic flow.

5.9.5 Pedestrian Crossing

5.9.5.1 Definition

A specially marked location of a Road Element where pedestrians are privileged to cross the street, with or without signs or traffic lights and with or without a zebra crossing.

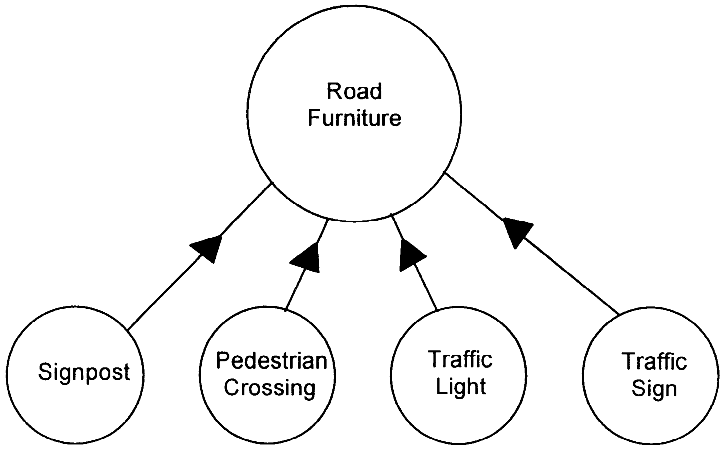


Figure 5.33. Data Model for *Road Furniture*.

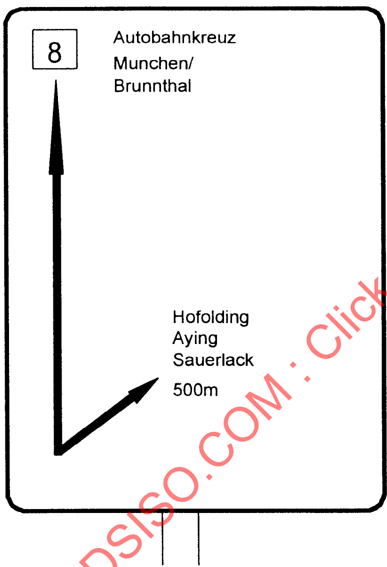


Figure 5.34. A Signpost.

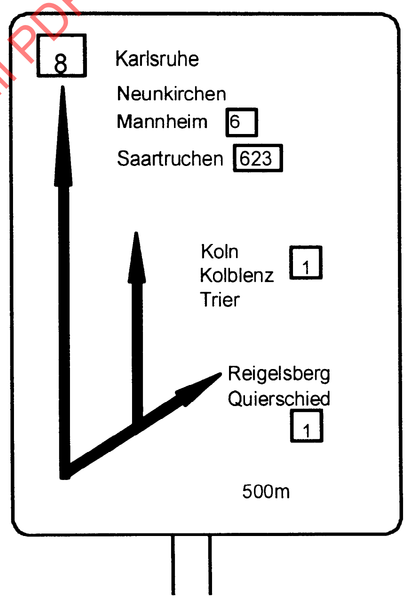


Figure 5.35. A Signpost.

5.10 Services

5.10.1 General Overview

Service is a generic term for an activity at a specific location. It is important to notice that a *Service* represents an activity and not the building in which this activity (possibly) takes place.

Many services are particularly relevant to the road environment, such as recreation, vehicle maintenance, emergency services or cargo, customs and retail services. Each of these services also can be related to a *Road Element* or *Junction* to describe information needed for vehicle access. The *Service* feature can be further characterised by attributes. The data model for *Services* is illustrated in figure 5.36

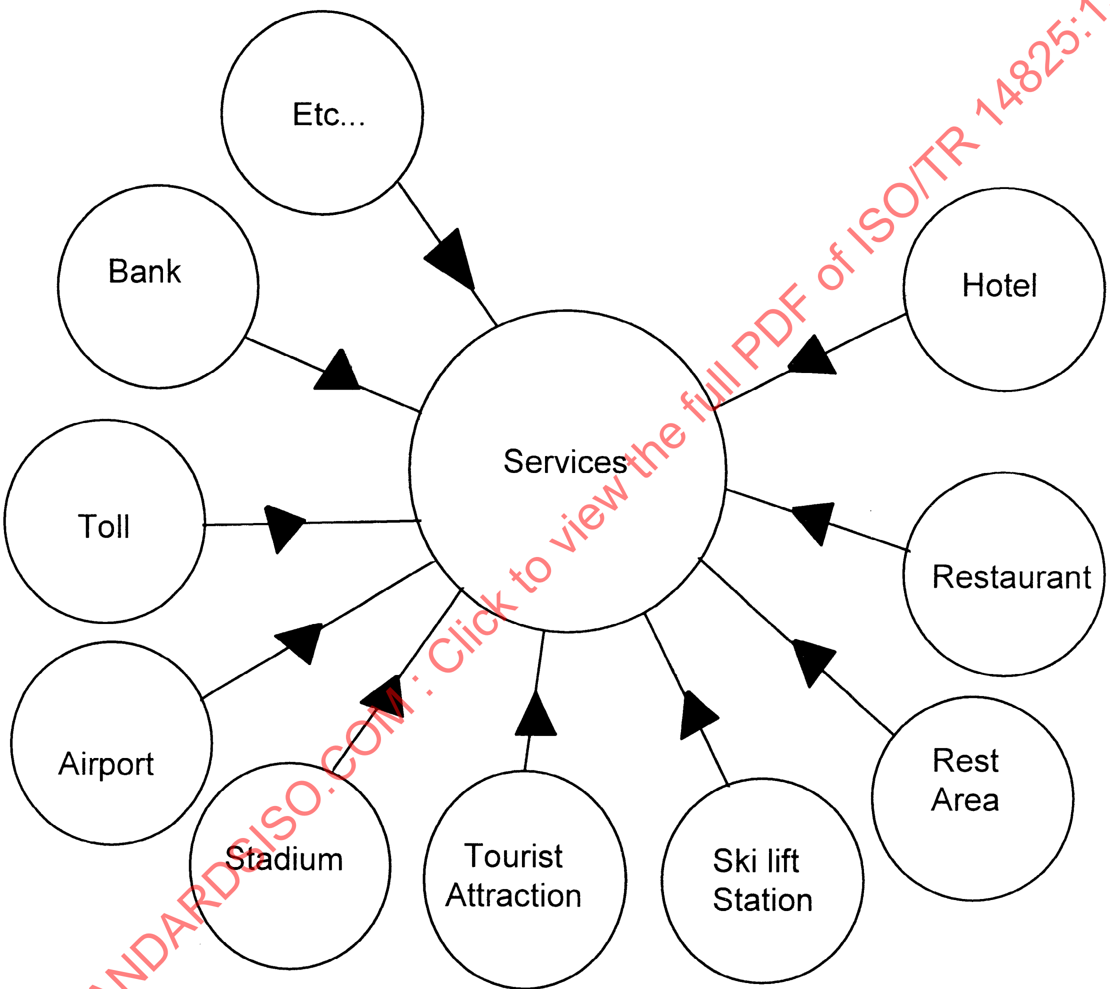


Figure 5.36 Data model for *Services*

The following sections list in alphabetical order the features of *Services*.

5.10.2 Features of Services

5.10.2.1 Airline Access

An airline's check-in area (if there is more than one terminal) at the airport.

5.10.2.2 Airport

An airfield which accommodates either cargo or passenger traffic of a commercial or private nature.

5.10.2.3 Bank

An institution for the transaction of monetary services.

In some countries the building societies and some post offices may be incorporated into this category.

5.10.2.4 Business Facility

Location where the main activities of a particular business activity are concentrated.

5.10.2.5 Bus Station

A terminus where a person may board either a local bus service or a long distance or a national/international coach.

5.10.2.6 Camping

An official site where a tent may be pitched. The site need not be for sole use by tents.

5.10.2.7 Car Shipping Terminal

A location where cars may be loaded onto ferries for car shipping services.

5.10.2.8 Caravan Site

An official site where a caravan may be pitched. The site need not be for sole use by caravans.

5.10.2.9 Cargo Centre

An access point for non-passenger goods, such as within an airport.

5.10.2.10 City Hall

City or Town Council Offices.

5.10.2.11 City Centre

This Position which adequately describes a central activity point of a settlement or administrative area. This point will typically be the town hall, central train station or other central activity centre (i.e. church or pedestrian district.)

5.10.2.12 Coach and Lorry Parking

A car park restricted for Coach and Lorry use only.

5.10.2.13 Community Centre

Facilities and activities for the benefit of the local community only. They typically cater to special interest groups such as youth, elderly, or 'handicapped'.

5.10.2.14 Cultural Centre

A centre for cultural activities.

5.10.2.15 Customs

The customs house offices used for pre-registration or collection of goods. It is not used to position the location of custom points for checking dis-embarking passengers or vehicles.

5.10.2.16 Department Store

A large shop which sells different types of goods all from within the one shop. For example, they may sell clothing, jewellery, household goods, furniture etc.

5.10.2.17 Embassy

The office or residence of the ambassador and entourage of a foreign country.

5.10.2.18 Emergency Call Station

A free emergency telephone with a direct line to an emergency service centre.

5.10.2.19 Emergency Medical Service

A location where mobile medical help is stationed.

5.10.2.20 Exhibition or Conference Centre

Large buildings where large public shows, or large groups of people would meet for consultation or discussion.

5.10.2.21 Ferry Terminal

The access point or check-in area for a given ferry company.

5.10.2.22 Fire Brigade

A location where mobile crews and vehicles for firefighting and rescue operations are stationed.

5.10.2.23 First Aid Post

A location where First-Aid is available.

5.10.2.24 Free Port

A shop or facility where products can be purchased under a reduced tariff structure.

5.10.2.25 Frontier Crossing

A border post between two countries

5.10.2.26 Government Office

An office for local, regional or national government activities.

5.10.2.27 Hospital/Polyclinic

A place where medical and surgical treatment is provided for ill and injured persons.

5.10.2.28 Hotel or Motel

An establishment where lodging is available to all members of the public for one or more nights. The nature of the establishment need not necessarily be strictly a hotel. Places such as public houses, guest houses and inns with available rooms may be included in this feature. It excludes establishments offering accommodation to special needs groups such as socially disadvantaged persons. Also excluded are private rental accommodation establishments and holiday homes.

5.10.2.29 Kindergarten
A location for pre-school education for children.

5.10.2.30 Motoring Organisation Office
A national club or subscription-based organisation offering services and facilities for motorists.

5.10.2.31 Museum
A building or place for the preservation and/or exhibition of artistic, historic or scientific objects.

5.10.2.32 Open Parking Areas
Ground-level car and commercial vehicle parking locations.

5.10.2.33 Parking Garage
A car park typically within a building. May be subterranean or multi-storey.

5.10.2.34 Petrol Station
A garage or service station offering petrol for sale.

5.10.2.35 Pharmacy
Where general drugs and remedies to the general public are sold.

5.10.2.36 Place of Worship
A building where a member of the general public may go for prayer or to take part in a religious service.

5.10.2.37 Police Station
An office or facility for police.

5.10.2.38 Post Office
A public facility which provides postal or telecommunication services.

5.10.2.39 Public Phone
A phone which is available for public use. It may be within a building or on the street. It may be coin-operated or card-operated.

5.10.2.40 Railway Station
A facility for loading and unloading passengers and goods travelling on a rail network.

5.10.2.41 Recreation Facility
An outdoor area of land designated as open to the public for general recreation.

5.10.2.42 Rent-a-Car Facility
A commercial car rental service.

5.10.2.43 Rest Area
A service located along freeways offering one or more recreational facilities or service functions to the car driver.

5.10.2.44 Restaurant

Any establishment offering meals for payment including sit down meals or fast food take-aways. Hotels or Public Houses may be included in this feature.

5.10.2.45 Roadside Diner

A roadside location where parking is available and meals are served.

5.10.2.46 School

A building or location used for instructional classes. (See also University or College).

5.10.2.47 Shopping Centre

A large purpose-built building within which many individual shops trade.

5.10.2.48 Ski Lift Station

The start point of a ski-lift: i.e. the downhill station of a ski-lift.

5.10.2.49 Sports Centre

An indoor sports facility or an outdoor location where any sport such as golf, riding, sailing etc. may be enjoyed.

5.10.2.50 Stadium

An athletic or sports ground with tiers of seats for spectators.

5.10.2.51 Swimming Pool

A facility specially designed for swimming or related water activities.

5.10.2.52 Theatre

A building or an outdoor area where performances of drama are given.

5.10.2.53 Toll

The location where a fee is paid to travel on a road.

5.10.2.54 Tourist Attraction

Any physical or natural feature that may be of interest to a tourist.

5.10.2.55 Tourist Office

A location where advice can be obtained on local or national tourist attractions.

5.10.2.56 Transport Company

A transport company's offices or cargo points where transport services of cargo by road, rail, water or air are offered.

5.10.2.57 Travel Agency

An office which sells tickets for travel by rail, road, air or water for local, national or inter national travel.

5.10.2.58 University or College

An institution of higher education.

5.10.2.59 Vantage Point
A location specifically designated as having a scenic view.

5.10.2.60 Vehicle Repair Facility
A garage or service station open to the public where repairs on a vehicle are carried out.

5.10.2.61 Warehouse
A large building within which any goods or items may be stored for the short or long term.

5.11 Public Transport

5.11.1 General Overview

5.11.1.1 Description

All elements regarding the public transport network are grouped in a feature theme call *Public Transport*. This theme contains all the public transport basic features which can be related with a geometrical position.

5.11.1.2 Features of Public Transport

The features included as *Public Transport* are:

- Route Link
- Public Transport Junction
- Stop Point
- Public Transport Point
- Stop Area
- Route
- Line

The Data Model for *Public Transport* is shown in Figure 5.37.

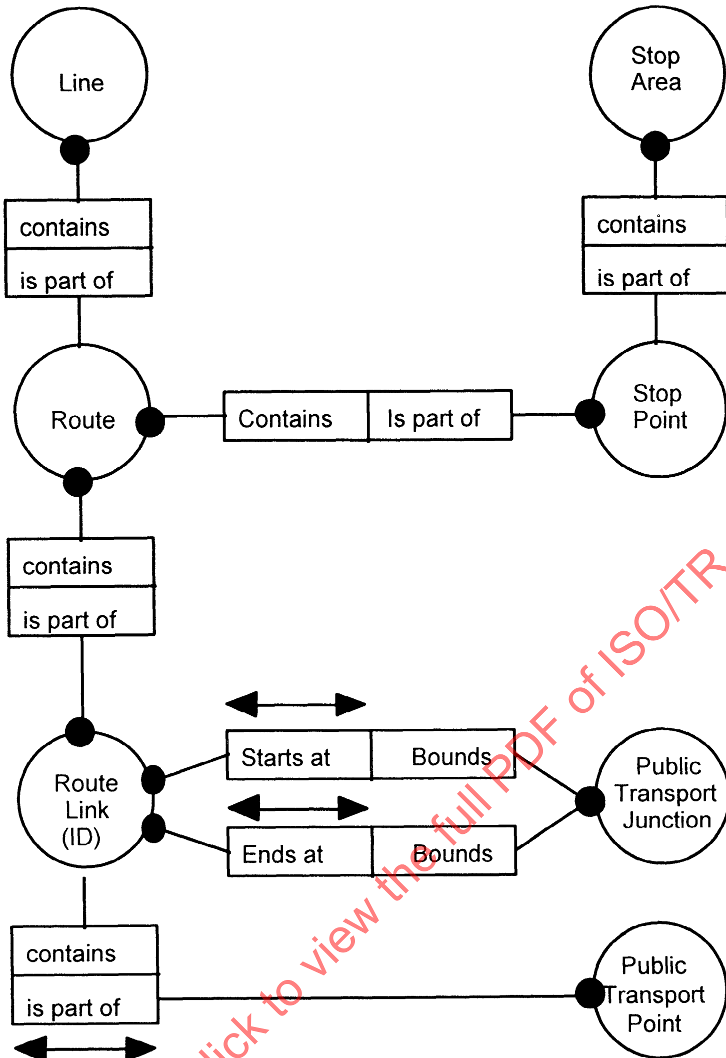


Figure 5.37. Data Model for *Public Transport*.

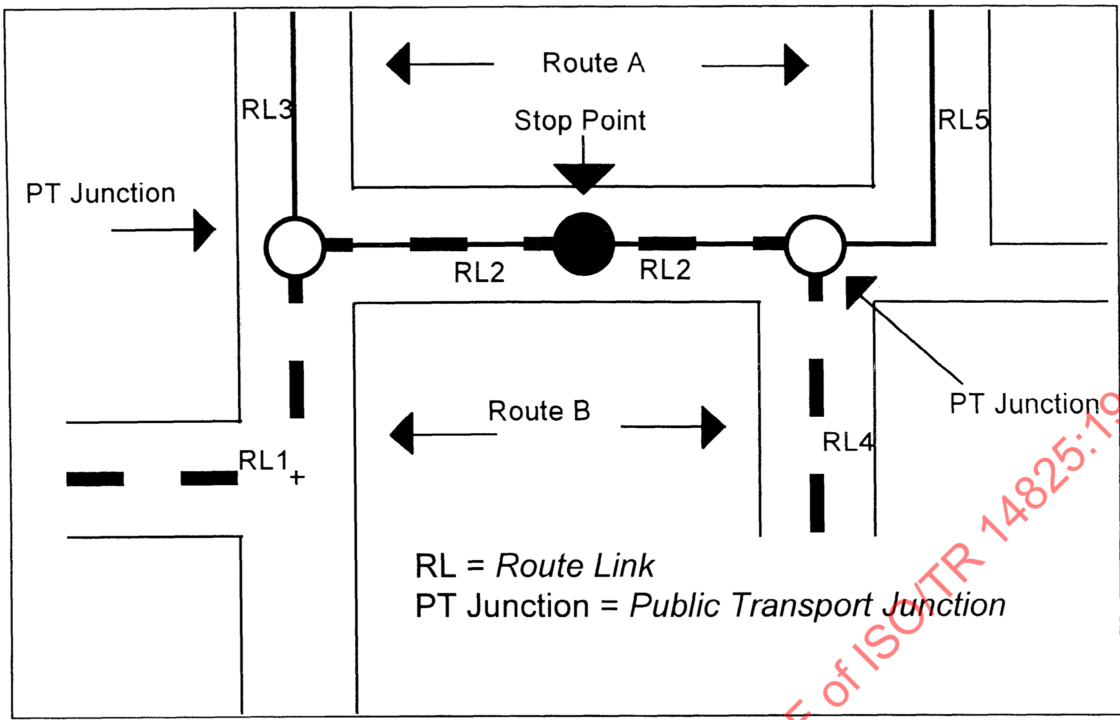


Figure 5.38. An example of *Public Transport* Features.

5.11.2 Route Link

5.11.2.1 Definition

The smallest linear unit of a public transport network, possessing its own identifier and public transport junctions at each end.

5.11.2.2 Description

A *Route Link* can be part of several public transport routes. A *Route Link* has one *Public Transport Junction* at each end. Since *Route Links* are the smallest divisible unit of the Public Transport network, they may not overlap with other *Route Links*. In the case where two or more routes share the same physical path, only one *Route Link* should be defined. This *Route Link* will be shared by multiple *Routes*.

5.11.3 Public Transport Junction

5.11.3.1 Definition

A feature that bounds a *Route Link*. A *Route Link* is always bound by exactly two *Public Transport Junctions*. A *Public Transport Junction* can bound 1 or more *Route Links*.

5.11.3.2 Description

A Public Transport Junction is located at the intersection of two or more *Route Links*, or at the end of a dead end *Route Link*. A *Public Transport Junction* should be introduced at the location where three or more *Route Links meet*. This happens when e.g. two *Routes* branch off. Figure 5.38 shows the example where two *Routes* are intersecting. At the common section there has been a bus stop defined. The two *Routes* share a single *Route Link* where they run together and *Public Transport Junctions* will be introduced where two *Routes* meet. The *Route* will be broken up in *Route Links*. *Route* A will consist of *Route Links* {RL3, RL2, RL5}. *Route* B will consist of *Route Links* {RL1, RL2, RL4}. The stop can be related to either *Route* A, *Route* B, or both.

5.11.4 Public Transport Point

5.11.4.1 Definition

A *Public Transport Point* is an addressable location in a public transport network possessing its own identifier.

5.11.4.2 Description

All public transport point locations can be described by *Public Transport Points*. This point can have a clear physical meaning, like an activation point or a measuring point, but this is not required. The attribute *Public Transport Point Type* will indicate the point type.

5.11.5 Stop Point

5.11.5.1 Definition

A *Stop Point* is a point where passengers can board or alight a public transport vehicle.

5.11.5.2 Description

Stop Points are modelled differently than *Public Transport Points* because of their relation to *Road Elements* and *Services*. This will be the typical place where one can change transport mode in a multi-modal environment.

5.11.6 Route

5.11.6.1 Definition

A *Route* is an ordered list of *Route Links* defining a single path through the public transport network, with a direction.

5.11.6.2 Description

The route is a grouping of *Route Links* in order to form the physical path that a public transport vehicle can follow. A public transport line will normally have one *Route* in each direction. Alternative routes could be defined for the exceptional circumstances (e.g. one day a week when the bus follows a different path).

5.11.7 Line

5.11.7.1 Definition

A group of *Routes* which is know by a common name or number.

5.11.7.2 Description

In most cases, the complex feature *Line* consists of two *Routes*, one for each direction on the *Line*. If alternative routes are defined, a *Line* can have more than two *Routes*.

5.11.8 Stop Area

5.11.8.1 Definition

A *Stop Area* consists of one or more stop points that are close to each other.

5.11.8.2 Description

Stop Areas are defined as a collection of stop points where passengers can change lines at walking distance. Typically stop areas are bus stations or several bus stops at a single intersection.

5.12 General Features

5.12.1 General Overview

General features are features which have properties, attributes or relationships which can apply to all feature themes. These features are defined separately to ease the representation of the common attributes and relationships.

The only general feature currently defined is:

- Centre Point of Feature

5.12.2 Centre Point of Feature

5.12.2.1 Definition

A point which describes an approximate or exact centre of a simple or complex feature.

5.12.2.2 Description

This feature forms a geographical reference point of another (simple or complex) feature. The *Centre Point of Feature* is linked to the corresponding feature of which it represents the centre by means of the relationship type *Centre Point of Feature belonging to Feature*.

The *Centre Point of Feature* can refer to an isolated node or a node of the feature to which it belongs.

6. ATTRIBUTE CATALOGUE

6.1 Generic Specifications

6.1.1 Attribute Types

Properties of real world objects are represented as attributes. Attributes are classified in the form of attribute types. Each attribute type corresponds to a well defined property of a real world object (e.g. colour).

6.1.2 Attribute Values

To each attribute type are assigned one or more Attribute Values, which can be seen as a particular instance of an attribute type (e.g. the colour "green"). Some attribute types may have an infinite number of different Attribute Values (e.g. the values of the attribute type "width"), whereas other attribute types may have only a fixed number of values (e.g. gender, "male" and "female"). The list of permissible values that the attribute can take is called the domain of an attribute. The paragraph "Domain/Unit of Measurement" in the description of the individual attributes in the following chapters specifies the domain for each attribute.

See Appendix A1.5 for the codes defined for attribute values.

6.1.3 Attribute Type Name

Each attribute type is referenced in this document by an Attribute Type Name. These names are written in italics and initial capitals in order to distinguish them from the daily life terms from which they have been derived (e.g. "*Maximum Height Allowed*" versus "maximum height allowed").

See Appendix A1.4 for the codes defined for attribute types.

6.1.4 Simple and composite attributes

Two types of attributes can be distinguished: simple and composite. A simple attribute has only one component, whereas a composite attribute has more than one component. The individual components are called *sub-attributes*.

The sub-attributes of a composite attribute can in their turn be simple or composite. In this way, a composite attribute can be viewed as a hierarchical attribute tree with only simple attributes

Certain sub-attributes of a composite attribute may be absent or contain null values. For others this is not allowed. In the description this is indicated by the word "mandatory".

Some attribute types can be used in combination with more than one attribute to form a composite attribute, each time playing the same role: Restricting the validity of the associated sub-attribute. Because of this they are called restrictive sub-attributes.

Although the use of these restrictive sub-attributes perfectly fit in the model of simple and composite attributes, treating the combinations in which they play a role differently from normal composite attributes is helpful in specifying the allowed combinations of sub-attributes. The following list, in which a Composite Attribute should be considered as not containing a Restrictive Attribute itself, contains these allowed combinations:

- Simple Attribute
- Composite Attribute
- Simple Attribute + Restrictive Sub-attribute [.]..[.]
- Composite Attribute + Restrictive Sub-attribute [.]..[.]

Where [.]..[.] indicates that the sub-attribute may have multiple instances in the framework of the total combination.

The restrictive sub-attributes defined so far are *Validity Period*, *Vehicle Type* and *Lane Dependent Validity*. Because they can in principle be combined with any other attribute they are dealt with here instead of specifying each different combination under its respective Feature Theme.

6.1.5 Composite attributes combined with the restrictive sub-attribute *Validity Period*.

The attribute *Validity Period* can in principle be combined with any other attribute. It expresses the time period for which the attribute with which the *Validity Period* together forms the composite attribute is valid. Combined with any arbitrary attribute *XXXX* this combination forms the composite attribute *XXXX with Validity Period* --- (where XXXX may be any simple or composite attribute).

Figure 6.1 depicts the data model for the attribute *Validity Period* which is also exemplary for other composite attributes.

6.1.5.1 Definition

An attribute which is valid for a restricted period of time.

6.1.5.2 Domain/Unit of Measurement

Composite

6.1.5.3 Sub-attributes

This composite attribute can consist of the following sub-attributes:

Any Attribute Type - Mandatory

Validity Period [.]..[.]

6.1.6 Composite attributes combined with the restrictive sub-attribute *Vehicle Type*.

The attribute *Vehicle Type* can in principle be combined with any other attribute from the theme Roads and Ferries. It defines the kind of vehicle for which the information contained in the associated attribute is valid. Combined with an arbitrary attribute *XXXX* from the theme Roads and Ferries, this combination forms the composite attribute *XXXX for Vehicle Type ---*.

6.1.6.1 Definition

An attribute which is only valid for a restricted number of vehicle types.

6.1.6.2 Domain/Unit of Measurement

Composite

6.1.6.3 Sub-attributes

This composite attribute can consist of the following sub-attributes:

Any Attribute Type from Roads and Ferries- Mandatory

Vehicle Type [.]..[.]

6.1.7 Composite attributes combined with the restrictive sub-attribute *Lane Dependent Validity*.

The attribute *Lane Dependent Validity* can in principle be combined with any other attribute of a *Road Element*. The *Lane Dependent Validity* specifies for which traffic lanes of the associated Road Element the associated sub-attribute holds. Combined with any attribute *XXXX* this combination forms the composite attributes *XXXX for lane ---* (where XXXX may be any simple or composite attribute).

6.1.7.1 Definition

An attribute which is only valid for a restricted number of traffic lanes of the associated *Road Element*.

6.1.7.2 Domain/Unit of Measurement

Composite

6.1.7.3 Sub-attributes

This composite attribute can consist of the following sub-attributes:

Any Attribute Type from Roads and Ferries- Mandatory

Lane Dependent Validity

6.1.8 Names in combination with a Language Code.

The attributes in which a name is specified are language dependent. To specify this dependency, a **Language Code** value should be used in combination with the Name. The Language Code specifies in which language the Name has been defined. Figure 6.3 depicts the general data model for names in combination with language code. Appendix A1.7 contains a survey of the **MARC Language Codes** which should be applied.

6.1.9 Default Attribute Values

In case a certain, appropriate attribute type is not related to a particular feature, this means that, that particular attribute has not been collected for that particular feature. However, it is also possible to specify that the absence of a certain attribute type at a particular feature indicates that a certain default value of that attribute holds. If this is the case, the value 'not collected' no longer is applicable for that attribute.

6.1.10 Relation between attributes and features: Segmented Attributes.

Attributes are related to a feature in such a way that they reference a certain part of it. The attributes therefore are called **Segmented Attributes.**

In case of line features the part which is referenced by the segmented attribute is defined by a **position from** and a **position to** value. These positions represent the curvimetric distance, i.e. the distance along the geometrical representation of the line feature, or the measured distance, i.e. the distance measured along the real-world object, measured either from the start or from the end bounding point feature, expressed in metres. The values of the **position from** and **position to** may be equal to indicate a single position in lieu of an interval. Conversely, the **position from** and **position to** values may be left blank to indicate that the entire feature is subject to the associated sub-attribute.

As was mentioned above, the curvimetric position either is measured from the start or from the end bounding feature. This relates to the fact that in certain cases curvimetric positions that are stored have been defined opposite to the direction of the line feature. Curvimetric positions that have to be stored also can have been defined in either an absolute way or in a relative way. Absolute indicates in this respect that the curvimetric position of the start bounding point feature equals zero while relative indicates that the curvimetric position of the start bounding feature (in the reverse case the end bonding feature) has a value different from zero, i.e. the curvimetric position relates to an (chainage) offset other than zero. To indicate which of these methods have been applied in a particular attribute instance, a flag shall be used. The values of this flag can be the following:

0 absolute segmentation in the orientation of the Line Feature.

1 absolute reverse segmentation, i.e. absolute segmentation in the direction opposite to the orientation of the Line Feature.

2 relative segmentation in the orientation of the Line Feature.

3 relative reverse segmentation, i.e. relative segmentation in the direction opposite to the orientation of the Line Feature.

If relative segmentation is applied, values of the **position from** and **position to** will relate to measured length. Conversely, if absolute segmentation is applied, these values will relate to the length in the geometrical representation.

If the **position from** (which implies also the **position to**) or the **position to** equals the end bounding point feature, or in case of reverse segmentation the start bounding point feature, two possibilities exist to specify this. There is the normal way in which the field(s) specifying the position of the end bounding feature contain(s) the total length of the line feature. Another way to do this is by storing the value '-1' in these fields.

If used in combination with point and area features, the **position from** and **position to** values are meaningless. Therefore they should always be left blank.

The segmented attribute construction may be used in combination with any simple or composite attribute type. The generic construction of a segmented attribute type is illustrated in figure 6.1 and the difference between relative and absolute segmentation is shown in figure 6.2.

6.1.11 Attributes of General Purpose Features

General Purpose Features are features which belong to all Feature Themes. Until now only the *Centre Point of Feature* has been defined as such. The attributes this feature can get are exactly the same as the attribute of the feature it is a centre of can get. This means that the possible attributes differ from case to case.

6.1.12 Attributes of Relationships

Another type of attribute assignment which is not related to Feature Themes is that of Relationships. No separate definition of these attribute has taken place. In principle all attributes which have been defined for the different Feature Themes can be combined with any Relationship.

6.1.13 Attribute Type Codes

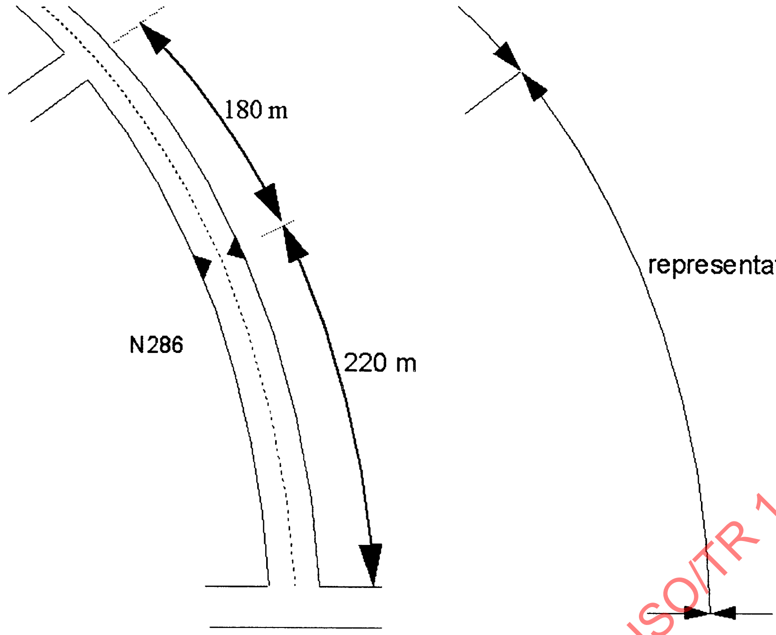
In section 6.1.3 it is described how attributes are referenced by Attribute Type Names. This kind of referencing is applied in this document. In the physical data structure, however, simple attributes are referenced by an Attribute Type Code. Composite attributes are not referenced in the physical structure since they merely form logical constructs. Appendix A1.4 contains a survey of the defined Attribute Type codes.

6.1.14 User-defined Attributes

The standard supports the ability for a user to define attributes which are not already defined. For these, special Attribute Type Codes have been reserved. (See appendix A1.4).

6.1.15 The Data Model for Attributes

The Data Model for many attributes is shown in Figures 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10, 6.11 and 6.12.

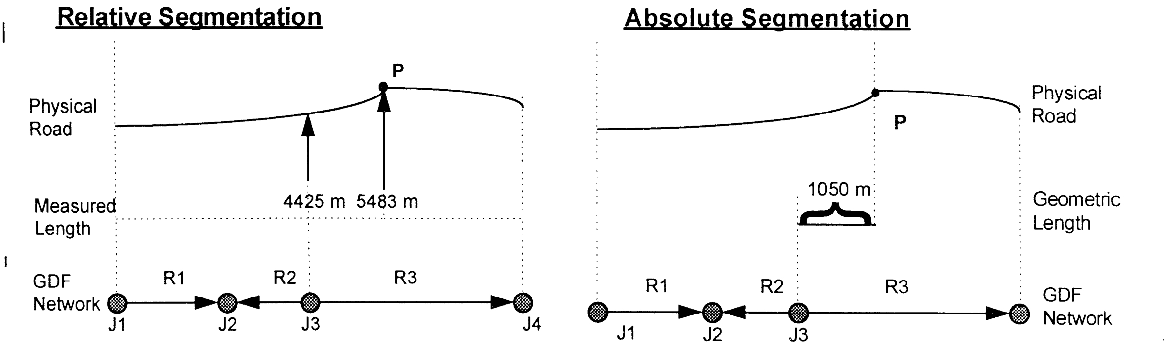


a: A road with a road number N286 and a road width of 15m which narrows at a certain point to 8m after which it gets its original length again.

from pos:	0	from pos:	220	from pos:	220	from pos:	0 (or <S>)
to pos:	220	to pos:	220	to pos:	400(or -1)	to pos:	400 (or <S>)
road width:	15	road width:	8	road width:	15	road number:	N286

b: Associated segmented attributes (<S> indicates blanks)

Figure 6.1: An example of the use of segmented attributes



Representation of P on *Road Element* R3:
Chainage offset = 4425
From position = 5483
To position = 5483
Segmentation flag value = 2

Representation of P on *Road Element* R3:
From position = 1050
To position = 1050
Segmentation flag value = 0
(Chainage offset not applicable)

Note : Measured distance from start of the physical road to point P must be the sum of the measured lengths of R1, R2 and the distance from J3 to P.

Figure 6.2 Difference between relative and absolute segmentation

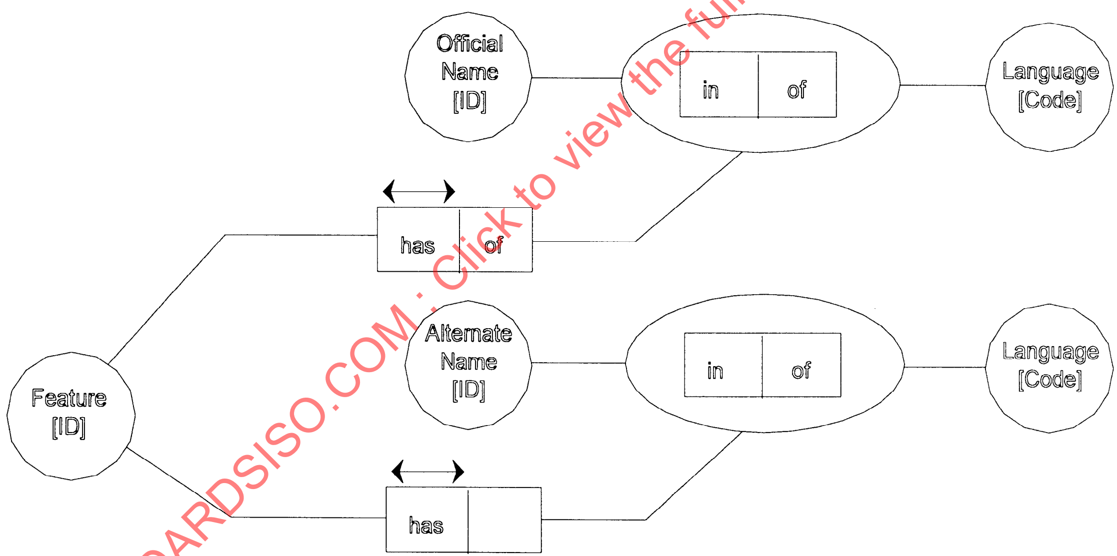


Figure 6.3: The data model of Names in combination with Language Code.

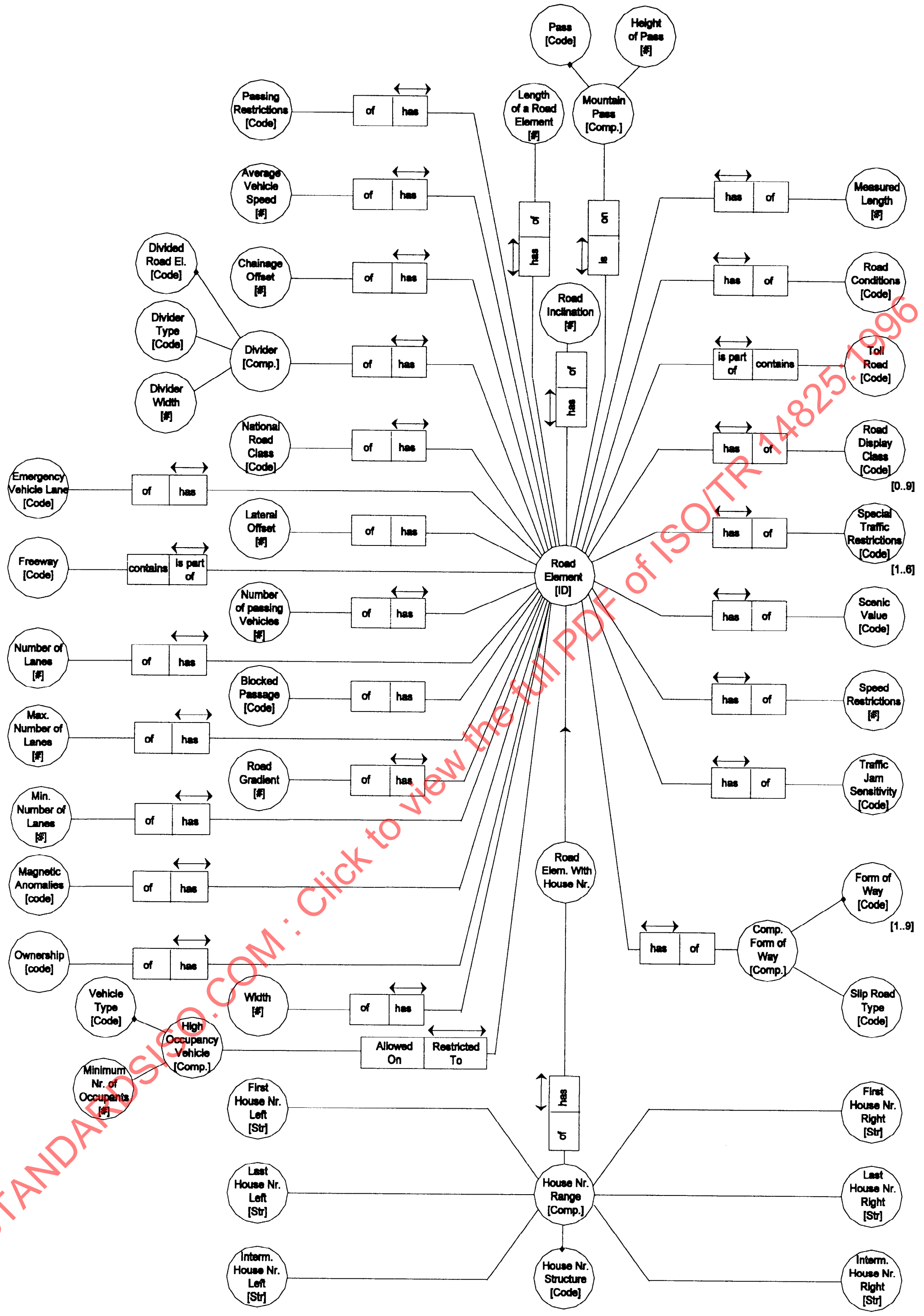


Figure 6.4: The data model for Attributes of Roads and Ferries (to be continued)

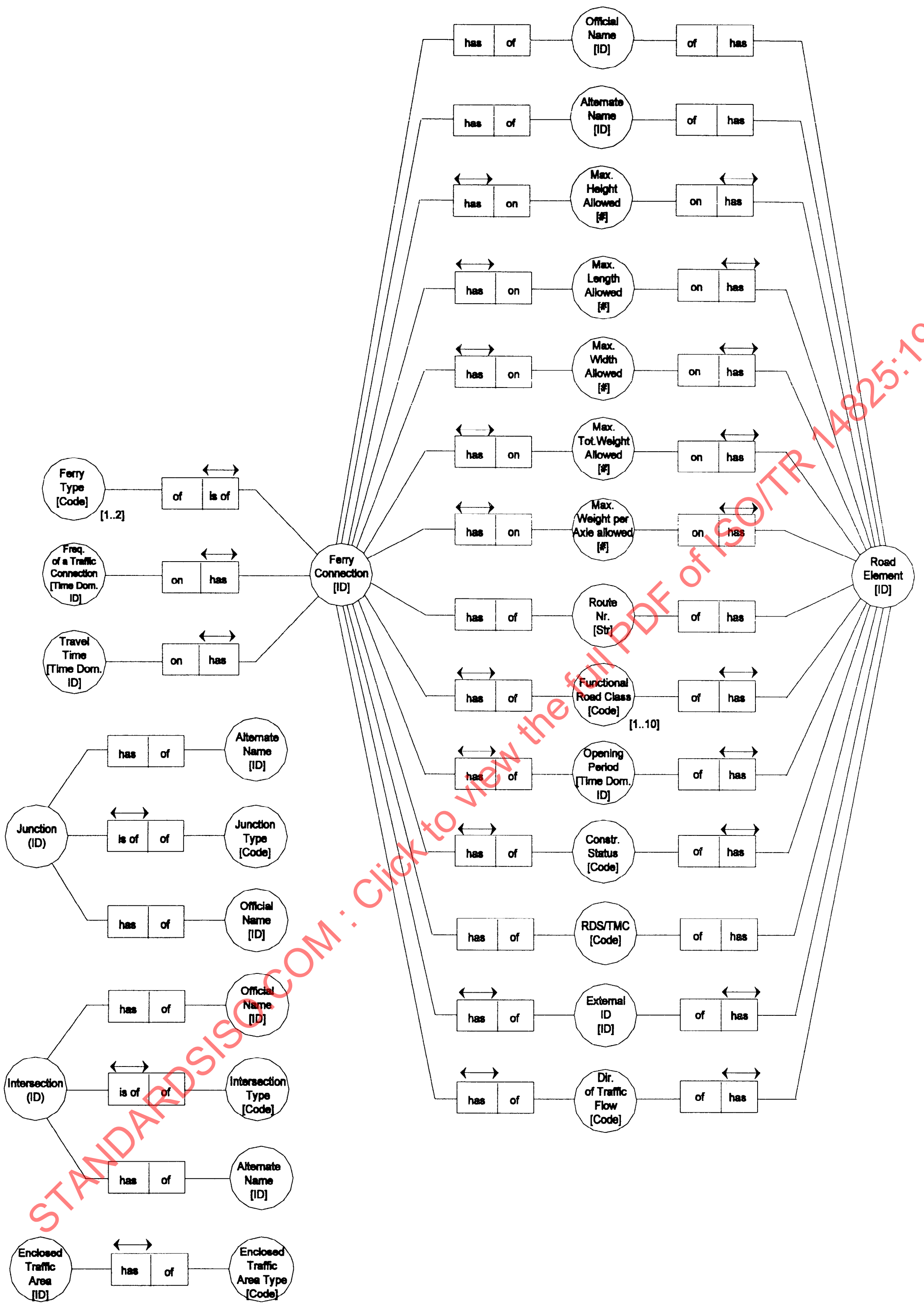


Figure 6.5: The data model for Attributes of Roads and Ferries (continued)

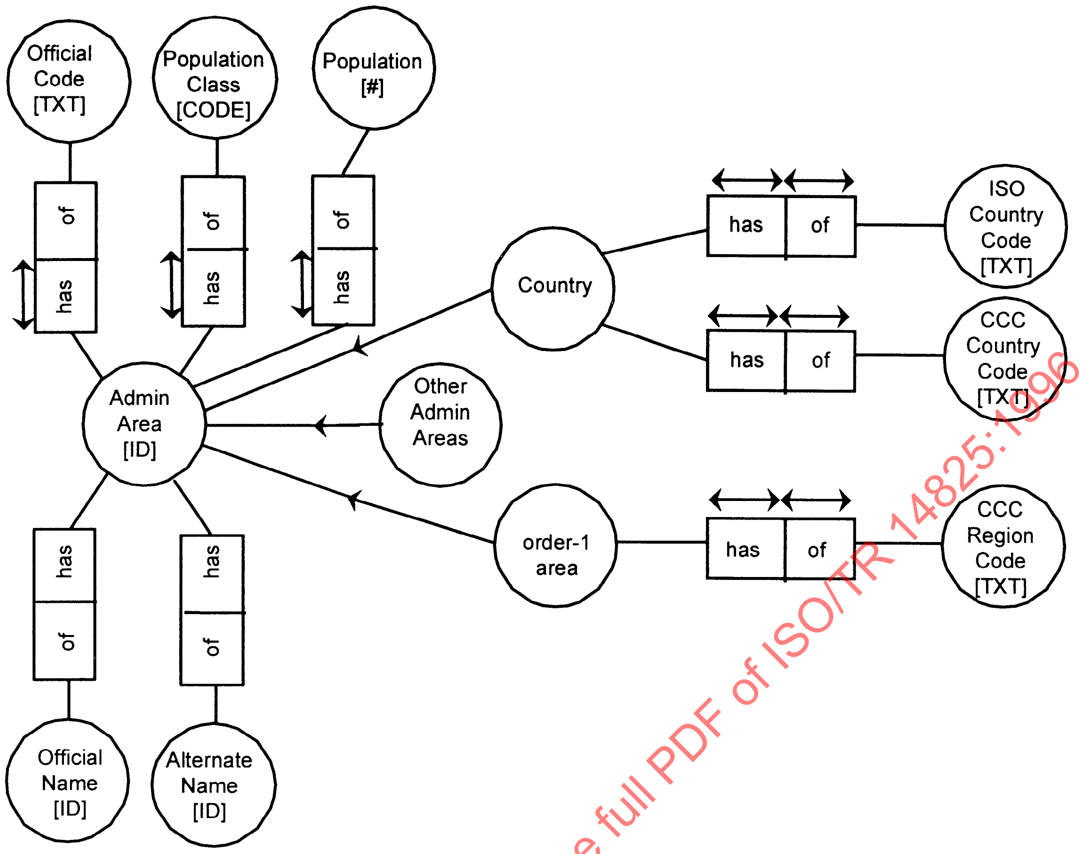


Figure 6.6: The data model for Attributes of Administrative Areas

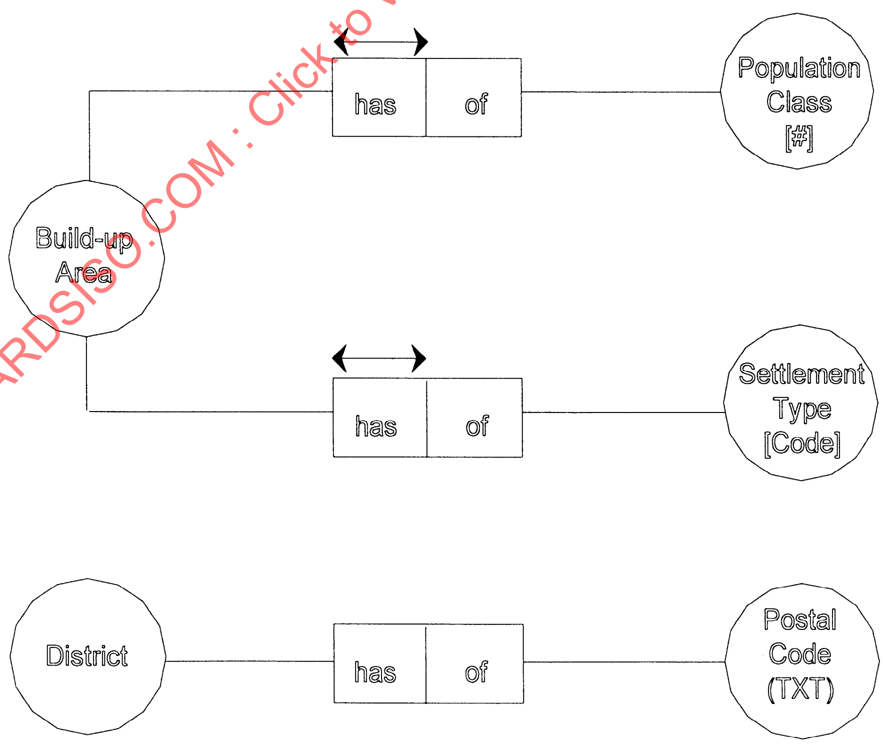


Figure 6.7: The data model for Attributes of Settlements and Named Areas

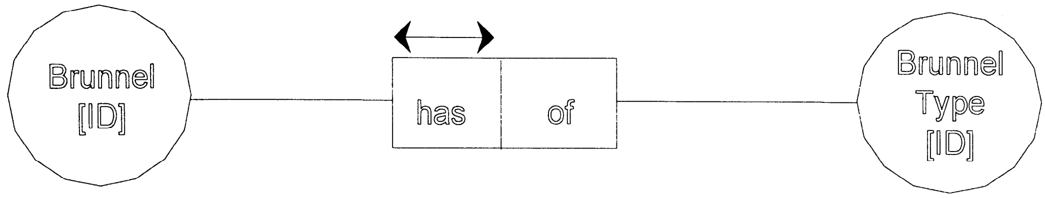


Figure 6.8: The data model for Attributes of Brunnels

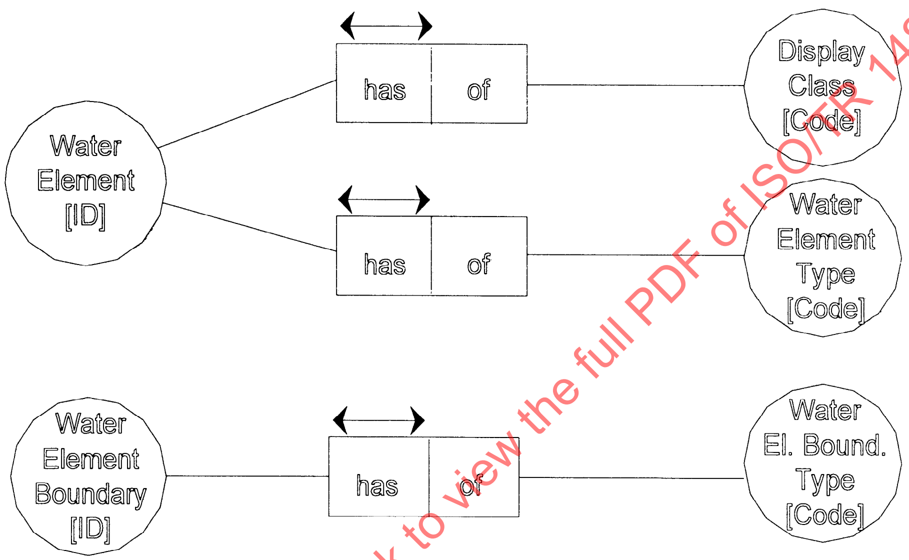


Figure 6.9: The data model for Attributes of Waterways

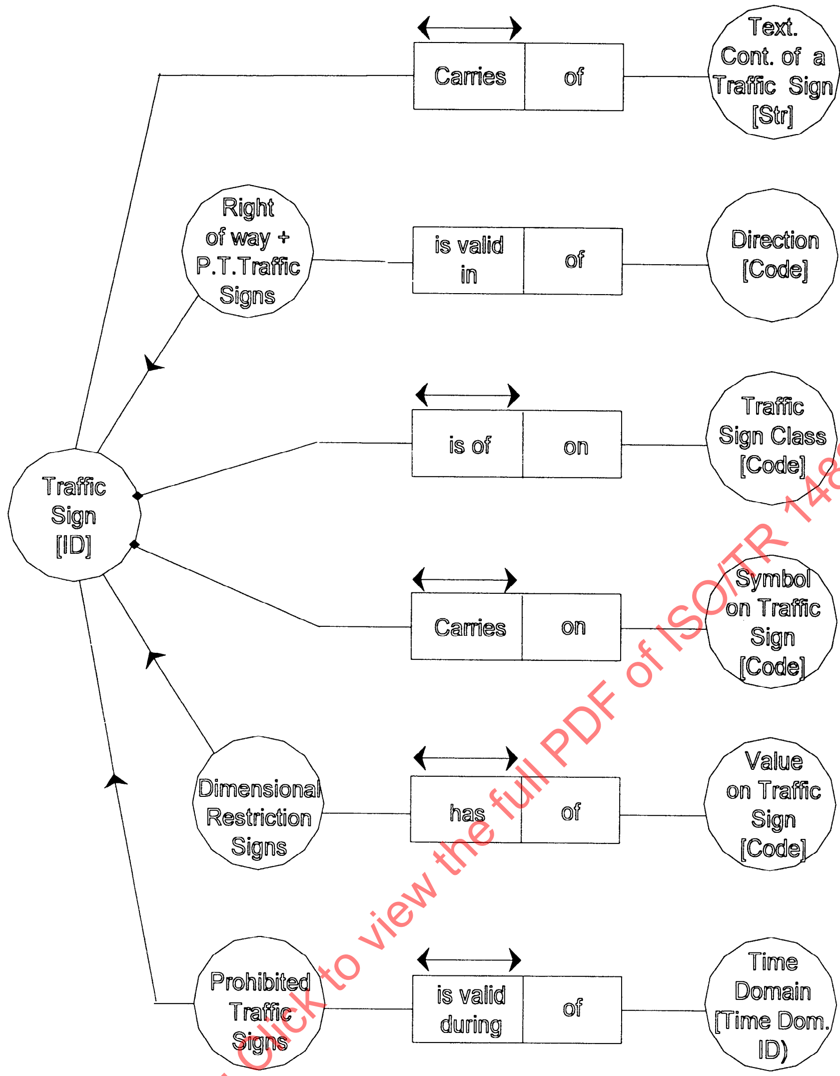


Figure 6.10: The data model for Attributes of Road Furniture

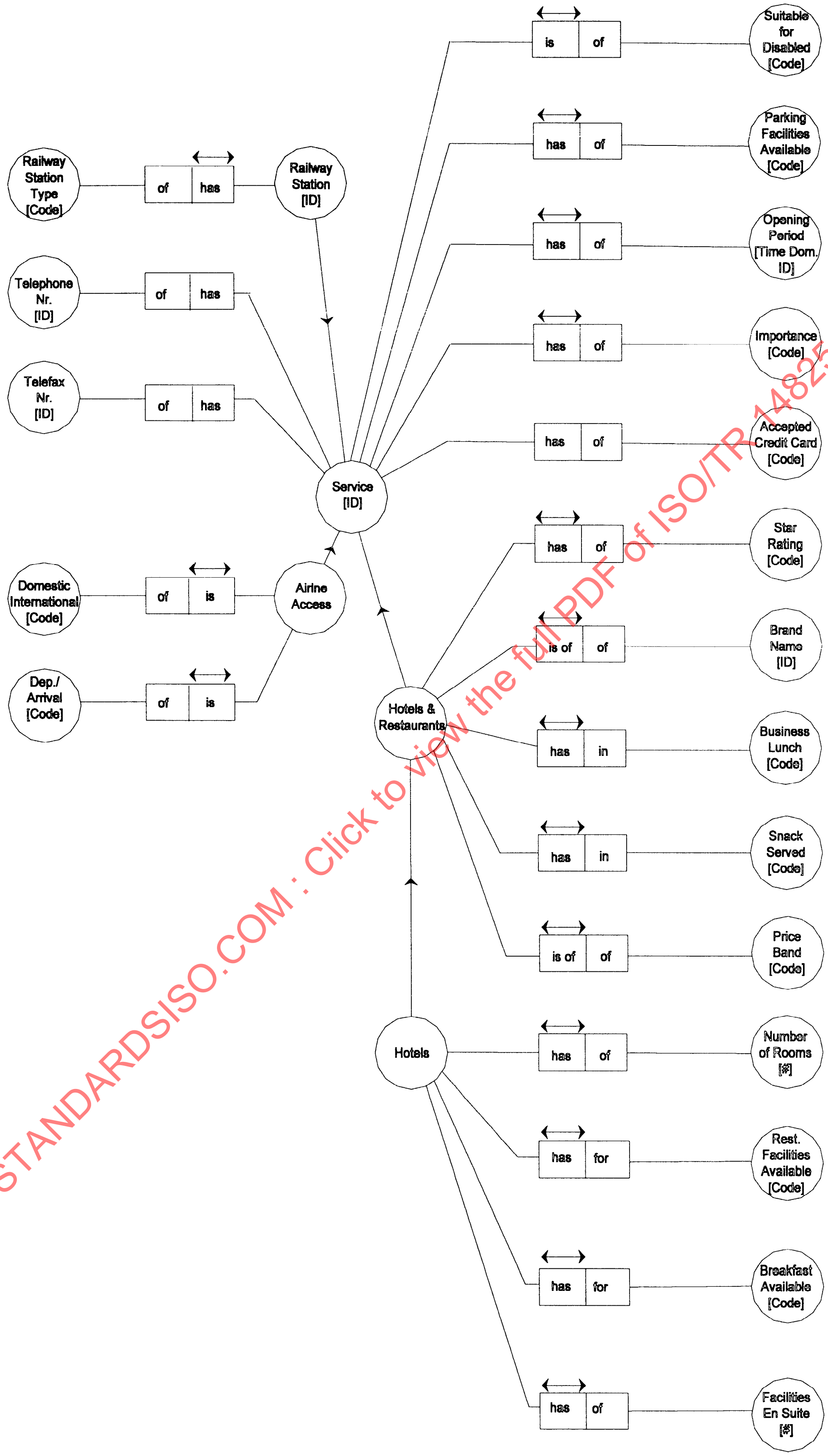


Figure 6.11: The data model for Attributes of Services

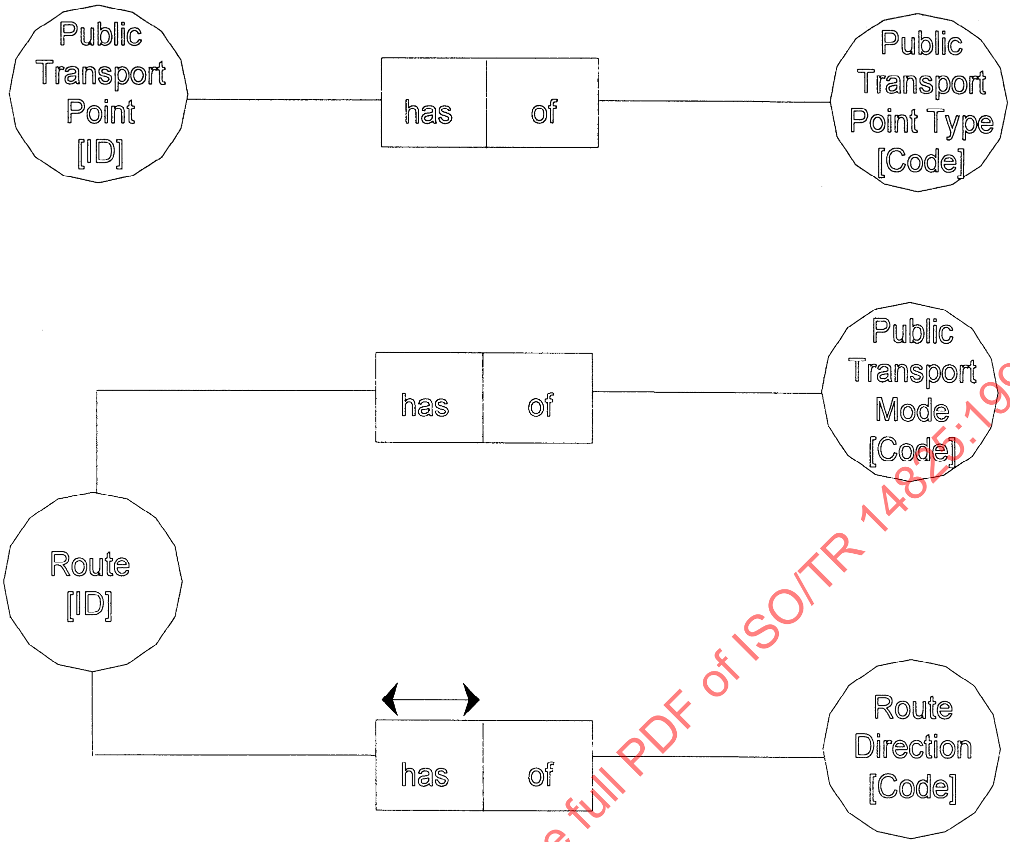


Figure 6.12: The data model for Attributes of Public Transport

6.2 Attributes for all Feature Themes

6.2.1 Official Name

6.2.1.1 Definition

The name assigned to a particular feature by the official organization responsible for the existence and the maintenance of the feature.

6.2.1.2 Domain/Unit of Measurement

A pointer to a Name record which contains any combination of letters, numbers or punctuation which forms a valid name and a language code.

6.2.1.3 Description

A single feature may have more than one *Official Name*. This often is associated with a bilingual situation. E.g. 'Waterloolaan' and 'Boulevard de Waterloo' are the official names of the same street in Brussels according to the Dutch and French language. A language code can be used to specify the applied language.

6.2.2 Alternate Name

6.2.2.1 Definition

The name of a feature which has no official status but is used or known by the general public.

6.2.2.2 Domain/Unit of Measurement

A pointer to a Name record which contains any combination of letters, numbers or punctuation which forms a valid name and a language code.

6.2.2.3 Description

Alternate Names can include abbreviations or commonly used nicknames. A single feature may have more than one *Alternate Name*, often associated with a bilingual situation. A language code can be used to specify the applied language.

6.2.3 Positional Accuracy

6.2.3.1 Definition

An indication of the accuracy of the associated feature.

6.2.3.2 Domain/Unit of Measurement

The value should be expressed in whole metres, whereby 0 should be interpreted as 'unknown'.

6.2.4 Validity Period

6.2.4.1 Definition

The period for which a value defined in an associated sub-attribute, containing a property is valid.

6.2.4.2 Domain/Unit of Measurement

The value of the attribute *Validity Period* should be constructed according to the Syntax for Time Domains rules. This gives the possibility to define any period with any length, starting at any point of time. This implies that it is possible to define a point in time (a period with length 0) or a period without end (a period with infinite length).

6.2.4.3 Description

Any property which has a variable character over time can be expressed as such by combining the attribute expressing the property with the attribute *Validity Period* as sub-attributes in a composite attribute. When this is done the attribute expressing the property is only valid in the period as specified in the *Validity Period* attribute.

When there are no time restrictions on the property, the *Validity Period* attribute should be left out or its value should be left blank.

6.3 Attributes for Roads and Ferries

6.3.1 Average Vehicle Speed

6.3.1.1 Definition

The average speed of vehicles travelling along a *Road Element*.

6.3.1.2 Domain/Unit of Measurement

The value should be expressed in kilometres per hour.

6.3.1.3 Description

This attribute can be used in conjunction with the sub-attribute *Vehicle Type* to indicate for which *Vehicle Type* the speed holds.

6.3.1.3.1 Indication of a particular direction

In most cases the expressed value will refer to both directions on the *Road Element*. If this should not be the case the attribute must be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.2 Blocked Passage

6.3.2.1 Definition

Indication of a physical obstruction on a *Road Element*.

6.3.2.2 Domain/Unit of Measurement

- Physically blocked at Start *Junction*
- Physically blocked at End *Junction*
- Physically blocked between Start and End *Junction*

6.3.2.3 Description

The blockage at the Start or End *Junction* should be interpreted in such a way that in these situations it is not possible to enter the *Road Element* at that point. When the blockage is near one of these locations but it is possible to actually enter the *Road Element,* the value 'Physically blocked between Start and End *Junction*' should be applied.

6.3.3 Chainage Offset

6.3.3.1 Definition

Definition of the offset of curvimetric positions along a *Road Element*.

6.3.3.2 Domain/Unit of Measurement

The value should be expressed in whole metres.

6.3.3.3 Description

For every *Road Element,* the *Chainage Offset* can be defined for the start bounding and for the end bounding feature. If absolute segmentation is applied, the chainage offset will always be zero. If relative segmentation is applied, for both bounding point features a chainage offset can be defined which differs from zero. In this case, the lowest value of these two has to be used in the chainage offset value.

In both cases, the chainage offset will relate to the start bounding point feature if segmentation in the direction of the line feature is applied. Conversely, it will relate to the end bounding point feature if reverse segmentation is applied (see also section 6.1.10).

6.3.4 Composite Form of Way

6.3.4.1 Definition

Certain aspects of the physical form that a *Road Element* takes. It is based on a number of certain physical and traffic properties.

6.3.4.2 Domain/Unit of Measurement

Composite.

6.3.4.3 Sub-attributes

This Composite Attribute can consist of the following sub-attributes:
Form of Way - Mandatory
Slip Road Type

6.3.5 Construction Status

6.3.5.1 Definition

Whether a feature such as a *Road Element* is currently under construction or in the planning stage.

6.3.5.2 Domain/Unit of Measurement

- Under Construction
- Planned
- Under Construction, but open

6.3.6 Direction of Traffic Flow

6.3.6.1 Definition

The direction(s) of traffic flow allowed on a *Road Element* or *Ferry Element*.

6.3.6.2 Domain/Unit of Measurement

- Traffic is allowed in both directions.
- Traffic is closed in the positive direction.
- Traffic is closed in the negative direction.
- Traffic is closed in both directions.

6.3.6.3 Description

6.3.6.3.1 Definition of Traffic

The meaning of the term "Traffic" has to be interpreted as one of several values of the associated sub-attribute *Vehicle Type* or as a logical OR combination of these.

6.3.7 Divider

6.3.7.1 Definition

Information about the existence of a physical or legal divider along a *Road Element* which is not expressed by the individual features.

6.3.7.2 Domain/Unit of Measurement

Composite.

6.3.7.3 Sub-attributes

This composite attribute can consist of the following sub-attributes:

Divided Road Element - Mandatory

Divider Type

Divider Width

Note: This attribute, including all of its sub-attributes should be applied if the presence of a physical divider is not represented by a separate *Road Element* for each carriageway.

6.3.8 Divided Road Element

6.3.8.1 Definition

An Indication of the presence of a physical or legal divider which separates opposing lanes of traffic.

6.3.8.2 Domain/Unit of Measurement

- Divided
- Not Divided

6.3.8.3 Description

This attribute indicates the existence of a physical or legal divider (solid painted (double) line) along the centre line of a single bi-directional *Road Element*. Depending on the geometrical accuracy requirements of the application, a physical divider or legal divider can either be represented by this attribute or by the representation of each individual carriageway by a separate centre line.

This attribute gives no information about the possibility to cross the divider at the start or end *Junction*.

This attribute should be used as a sub-attribute possibly in conjunction with (one of) the sub-attributes *Divider Type* and *Divider Width*. Together they form the composite attribute *Divider*.

6.3.9 Divider Type

6.3.9.1 Definition

Classification of the divider along the *Road Element*.

6.3.9.2 Domain/Unit of Measurement

- Physical divider; Not Crossable
- Physical divider; Crossable
- Legal Divider (not physical)

6.3.9.3 Description

Divider Type should be used as a sub-attribute to indicate the type of Divider present at the associated *Road Element*. It then should be used in conjunction with the sub-attributes *Divided Road Element* and possibly *Divider Width*.

Examples:

- Tram tracks which divide opposing lanes of traffic and which have no curbs should be classified as 'Physical divider; Crossable'
- A solid painted line dividing opposing lanes of traffic should be classified as 'Legal Divider (not physical)
- The divider dividing the carriageways of a Motorway should be classified as 'Physical divider; Not Crossable'

6.3.10 Divider Width

6.3.10.1 Definition

The width of the divider along the *Road Element*.

6.3.10.2 Domain/Unit of Measurement

The value shall be expressed in metres.

6.3.10.3 Description

This attribute should be used as a sub-attribute in conjunction with the sub-attribute *Divided Road Element* and possibly *Divider Type*. Together they form the composite attribute *Divider*.

6.3.11 Emergency Vehicle Lane

6.3.11.1 Definition

Indicates whether the associated *Road Element* has a separate Emergency Vehicle Lane.

6.3.11.2 Domain/Unit of Measurement

- Present
- Not present

6.3.11.3 Description

An emergency vehicle lane is a lane only present for emergency situation. Use is only allowed for emergency vehicles in emergency situations or by vehicles which experience a breakdown.

This attribute can be used in combination with the sub-attribute *Lane Dependent Validity* which then specifies the location of the lane on the *Road element*. Combination with the sub-attribute *Vehicle Type* is not necessary.

6.3.12 Enclosed Traffic Area Type

6.3.12.1 Definition

The type of *Enclosed Traffic Area*

6.3.12.2 Domain/Unit of Measurement

- Parking Place
- Parking Building
- Unstructured Traffic Square
- Another Type of Enclosed Traffic Area

6.3.12.2.1 Unstructured Traffic Square

An unstructured traffic square is an area on the road network which allows for the confluence of traffic from different roads, for the purpose of moving from one road to another, which have no internal structure of legally defined driving directions.

6.3.13 External Identifier

6.3.13.1 Definition

A unique alphanumeric identifier, ascribed to a particular feature.

6.3.13.2 Domain/Unit of Measurement

As specified by the administrating body.

6.3.13.3 Description

At this moment, standard external feature identifiers do not exist for most of the features defined in the Feature Catalogue, apart from *Administrative Areas*.

6.3.14 Ferry Type

6.3.14.1 Definition

The subclass of, or the type of a *Ferry Connection*.

6.3.14.2 Domain/Unit of Measurement

- Operated by a ship or a hovercraft
- Operated by a train

6.3.15 First House Number Left

6.3.15.1 Definition

The first house number on the left side of the *Road Element*.

This attribute shall be left blank when there are no numbered houses on the left side of the *Road Element*.

6.3.15.2 Domain/Unit of Measurement

The domain of values is only limited in a physical sense. The value has a maximum size of 10 characters. The characters may be of any kind or combination: digits, alphabetic characters or graphical characters. Typical examples of values are 223, 456, 57-a, 435-II, etc.

6.3.15.3 Description

This attribute is used as a sub-attribute in conjunction with the sub-attributes *House Number Structure, Last House Number Left* and possibly *Intermediate House Number Left*. Together with their counterparts for the right side of the road, these attributes form the composite attribute *House Number Range*.

6.3.15.3.1 Indication of a particular side

The definition of left and right side should take place by applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.16 First House Number Right

6.3.16.1 Definition

The first house number on the right side of the *Road Element*.

This attribute shall be left blank when there are no numbered houses on the right side of the *Road Element*.

6.3.16.2 Domain/Unit of Measurement

The domain of values is only limited in a physical sense. The value has a maximum size of 10 characters. The characters may be of any kind or combination: digits, alphabetic characters or graphical characters. Typical examples of values are 223, 456, 57-a, 435-II, etc.

6.3.16.3 Description

This attribute is used as a sub-attribute in conjunction with the sub-attributes *House Number Structure, Last House Number Right* and possibly *Intermediate House Number Right*. Together with their counterparts for the left side of the road, these attributes form the composite attribute *House Number Range*.

6.3.16.3.1 Indication of a particular side

The definition of left and right side should take place by applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.17 Form of Way

6.3.17.1 Definition

Certain aspects of the physical form that a *Road Element* takes. It is based on a number of certain physical and traffic properties.

6.3.17.2 Domain/Unit of Measurement

- Part of a Motorway;
- Part of a Multiple Carriageway which is not a motorway;
- Part of a Single Carriageway;
- Part of a Roundabout;
- Part of a Traffic Square;
- Part of an *Enclosed Traffic Area*:
- Part of a Slip Road;
- Part of a Service Road;
- Entrance to or exit of Car Park;
- Entrance to or exit to Service
- Part of a Pedestrian Zone;
- Part of a Walkway Not Passable for Vehicles;

6.3.17.3 Description

This attribute is used as a sub-attribute in conjunction with the sub-attribute *Slip Road Type*. Together these sub-attributes form the composite attribute *Compsite Form of Way.*

6.3.17.3.1 Definition of Motorway

A Motorway is defined as a road permitted for motorized vehicles only in combination with a prescribed minimum speed. It has two or more physically separated carriageways and no single level-crossings. This definition can be supported by the requirement that a road is only a motorway when it has the sign as shown in Figure 6.13 along its side.

6.3.17.3.2 Definition of Multiple Carriageway

A multiple carriageway is defined as a road with physically separated carriageways regardless of the number of lanes. If a road is also a motorway, it should be coded as such and not as a multiple carriageway.

6.3.17.3.3 Definition of Single Carriageway

All roads without separate carriageways are considered as roads with a single carriageway.

6.3.17.3.4 Definition of a Roundabout

A Roundabout is a road which forms a ring on which traffic travelling in only one direction is allowed. A sign like the one shown in Figure 6.14 is an indication that the *Road Element* in question is part of a Roundabout.

The *Road Elements* which make up a roundabout have to be connected to one another and they have to form exactly one ring. Figure 6.15 illustrates the formation of a Roundabout from *Road Elements.*

6.3.17.3.5 Definition of a Traffic Square

A Traffic Square is an open area (partly) enclosed by roads which is used for non-traffic purposes and which is not a Roundabout.

6.3.17.3.6 Definition of a Slip Road

A Slip Road is a road especially designed to enter or leave a *Road Element*.

6.3.17.3.7 Definition of a Service Road

A Service Road is a road, running parallel to and connecting to a Road with a relatively high connectivity function, which is especially designed to enable access from the connecting roads to roads with a low connectivity function in its vicinity.

Generally, service roads have the same name as the higher class road it runs parallel to and are only divided from it by small constructions like walkways, traffic islands etc..

6.3.17.3.8 Definition of Entrance to or Exit of Car Park

An Entrance or Exit of a Car Park is a road specially designed to enter or to leave a Parking Area.

6.3.17.3.9 Definition of Entrance or Exit to Service

An Entrance or Exit of a Service is a road used only to enter or to leave a Service.

6.3.17.3.10 Definition of Part of a Pedestrian Zone

A Pedestrian Zone is an area with a road network which is especially designed for use by pedestrians. Pedestrian Zones are usually located in urban areas. Except for emergency vehicles and for delivery vehicles during certain hours no traffic is allowed on the *Road Elements* which are located inside the Zone.

6.3.17.3.11 Definition of walkway Not Passable for Vehicles

A Walkway Not Passable for Vehicles is a part of a the road network which is restricted for access only to pedestrians and which has physical characteristics which prevent vehicles from entering.

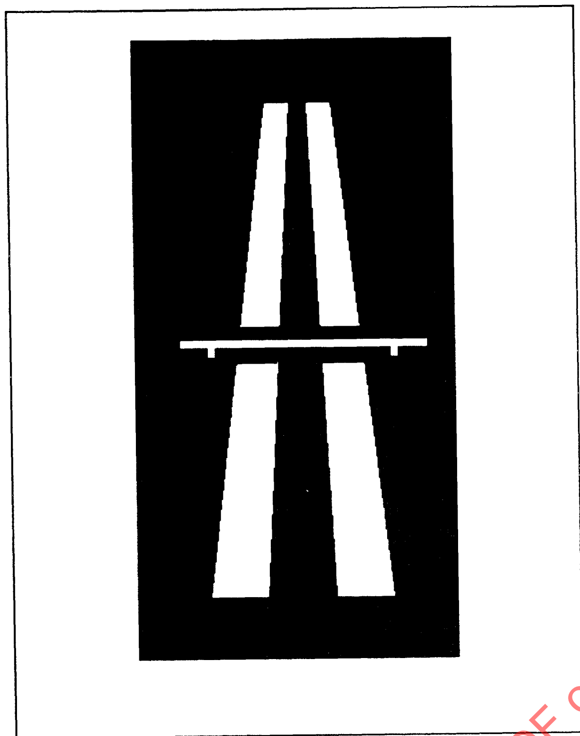


Figure 6.13

Figure 6.14

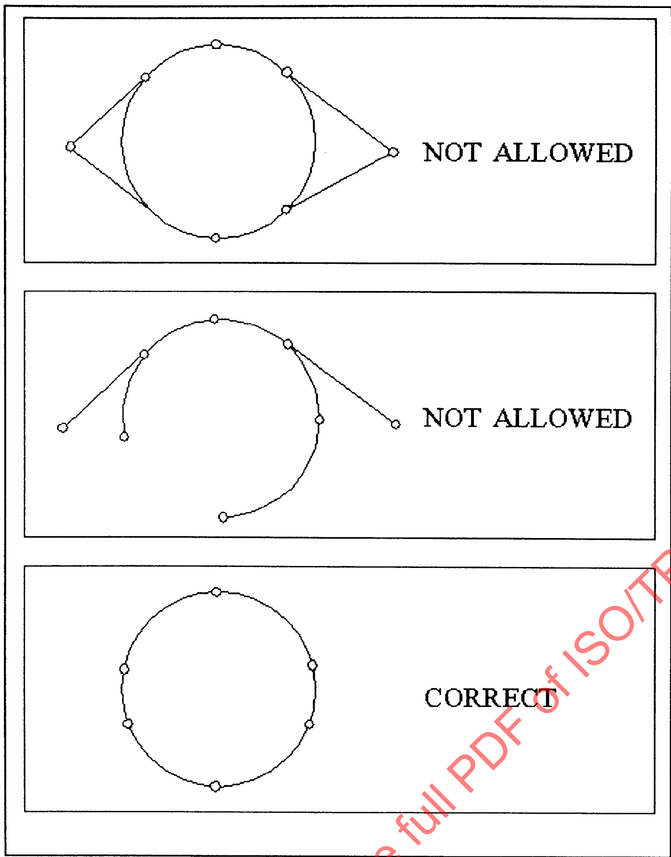


Figure 6.15 Examples for the definition of roundabouts

6.3.18 Freeway

6.3.18.1 Definition

Whether a *Road Element* is part of a Freeway

6.3.18.2 Domain/Unit of Measurement

- Part of a Non-Freeway;
- Part of a Freeway

6.3.18.3 Description

Definition of Freeway

A Freeway is defined as a road having no single level crossings with other roads. This means that connections with other *Road Elements* only consist of Slip Roads and/or Parallel Roads

6.3.19 Frequency of a Traffic Connection

6.3.19.1 Definition

The time interval between two departures of a Traffic Connection.

6.3.19.2 Domain/Unit of Measurement

The value should be expressed using the Time Domain syntax

6.3.20 Functional Road Class

6.3.20.1 Definition

A classification based on the importance of the role that the *Road Element* or *Ferry Connection* performs in the connectivity of the total road network.

6.3.20.2 Domain/Unit of Measurement

- Main roads: the most important roads in a given network.
- First class roads.
- Second class roads.
- Third class roads.
- Fourth class roads.
- Fifth class roads.
- Sixth class roads.
- Seventh class roads.
- Eighth class roads.
- Ninth class roads: the least important roads in a given network.

6.3.20.3 Description

6.3.20.3.1 Number of Road Classes

The number can vary from one country to another and depends on the (map) sources which are available. However, it is required that within one particular road classification the number of classes can be constant.

6.3.20.3.2 Number of Road Class Values

It is allowed in principle that a *Road Element* has more than one *Functional Road Class* value, based on different source documents. In such cases it is an absolute requirement that the source document on which a particular value is based is mentioned explicitly.

6.3.20.3.3 Classification of Ferry Connections

The classification of the feature *Ferry Connection* shall be homogeneous with the road classification. Consequently, a *Ferry Connection* joining two *Road Elements*, each having the same *Functional Road Class* value, must also get that *Functional Road Class* value. A *Ferry Connection*, joining two *Road Elements* with different *Functional Road Class* values, shall get the lowest of these two values.

6.3.20.3.4 Rules for a Free Classification

The following rules have to be taken into account for non-standard classifications.

- Each subset of all *Road Elements* belonging to a particular *Functional Road Class* i or higher shall always form a connected graph.
- In each of these subsets the number of *Road Elements* that are dead end shall be kept to a minimum.

6.3.21 Height of Pass

6.3.21.1 Definition

The maximum altitude of any point along a given *Road Element* if it has been identified as a mountain pass.

6.3.21.2 Domain/Unit of Measurement

The value should be expressed by an integer value, expressing the height in whole metres.

6.3.21.3 Description

This attribute is used as a sub-attribute in conjunction with the sub-attributes *Pass* and possibly *Opening Period.* Together these sub-attributes form the composite attribute *Mountain Pass*

6.3.22 High Occupancy Vehicle

6.3.22.1 Definition

Information concerning the minimum number of occupants of a passenger car allowed on a certain *Road Element* or lane.

6.3.22.2 Domain/Unit of Measurement

Composite.

6.3.22.3 Sub-attributes

This composite attribute can consist of the following sub-attributes:

Vehicle Type - Mandatory

Minimum Number of Occupants

It can only be applied in case the *Vehicle Type* has the value 'High Occupancy Vehicle'.

6.3.23 House Number Range

6.3.23.1 Definition

The set of house numbers that is related to a particular road element.

6.3.23.2 Domain/Unit of Measurement

Composite.

6.3.23.3 Sub-attributes

This composite attribute can consist of the following sub-attributes:

House Number Structure - Mandatory

First House Number Left

Last House Number Left

First House Number Right

Last House Number Right

Intermediate House Number Left [.]..[.]

Intermediate House Number Right [.]..[.]

[.]..[.] indicates that the sub-attribute may have multiple instances in the framework of the composite attribute.

The number of sub-attributes required to define the house number range completely depends on the value given to the *House Number Structure* sub-attribute. The relationships between the two are detailed below:

i. No house numbers at all:

No further sub-attributes are needed or allowed.

ii. Regular with odd and even numbers at different sides:

Depending on whether one or both sides of the streets have house numbers, one or two pairs of sub-attributes are required : A *First House Number Left* value and a *Last House Number Left* value, a *First House Number Right* value and a *Last House Number Right* value or both.

iii. Regular with odd and even numbers at the same side:

Depending on whether one or both sides of the street have house numbers, one or two pairs of sub-attributes are required : A *First House Number Left* and a *Last House Number Left* value, a *First House Number Right* and a *Last House Number Right* value or both.

iv. Irregular :

Two groups of sub-attributes are required :

A First House Number Left value, followed by a repeating subgroup of Intermediate House Number Left values and finally a Last House Number Left value; a First House Number Right value, followed by a repeating subgroup of Intermediate House Number Right values and finally a Last House Number Right value.

6.3.24 House Number Structure

6.3.24.1 Definition

The type of house numbering method that is applied to a particular Road Element.

6.3.24.2 Domain/Unit of Measurement

- No house numbers at all.
- Regular with odd and even at different sides.
- Regular with odd and even numbers at the same side.
- Irregular.

6.3.24.3 Description

6.3.24.3.1 Definition of different House Number Structures

i. No house numbers at all:

There are no houses along the road element or the houses along the road element are not numbered

ii. Regular with odd and even at the same side:

The house numbers appear on one or on both sides in a sequential sorted order (ascending or descending) when moving from one end of the *Road Element* to the other. One side of the street contains both even and odd house numbers (see figure 6.16).
Numeric completeness of the series is not a requirement. A house number series which has missing numbers, but which is sequentially sorted, is considered to be regular.
(5,6,7,9,10,13) and (24,27,30,33,34,36) and (35,36,48,69,71,74,86) are examples.

iii. Regular with odd and even at different sides:

The house numbers appear on one or on both sides in a sequential sorted order (ascending or descending) when moving from one end of the *Road Element* to the other. The even numbers are located all on one side of the street and the uneven on the other (see figure 6.17).
Numeric completeness of the series is not a requirement. A house number series which has missing numbers, but which is sequentially sorted, is considered to be regular. (5,7,9,11,13) and (24,26,28,30,32,34,36) and (35,39,43,69,71,73,85) are examples.
This represents the common situation where buildings with even house numbers are located on one side of the street, while buildings with odd numbers are situated on the opposite side.

iv. Irregular:

Irregular means that house numbers do not occur in any sorted order (see figure 6.18).

6.3.25.3.1 Sorting order

The house numbers need to be stored in the same order as they occur alongside the *Road Element* from the *First* to the *Last House Number*.

6.3.26 Intermediate House Number Right

6.3.26.1 Definition

The house numbers on the right side of the road element, which are not the first or the last house number of that side of the road element.

6.3.26.2 Domain/Unit of Measurement

The domain of values is only limited in a physical sense. The value has a maximum size of 10 characters. The characters may be of any kind : digits, alphabetic characters or graphical characters. Typical examples of values are 223, 456, 57-a, 435-II, etc.

6.3.26.3 Description

This attribute is used as a sub-attribute in conjunction with the sub-attributes *House Number Structure*, *First House Number Right*, possibly *Intermediate House Number Right* and *Last House Number Right*. Together with their counterparts for the left side of the road, these attributes form the composite attribute *House Number Range*. It is used only when the sub-attribute *House Number Structure* is irregular. In such cases, this attribute stores all of the numbers on the left side of the *Road Element* between the *First* and the *Last House Number*.

6.3.26.3.1 Sorting Order

The house numbers need to be stored in the same order as they occur alongside the *Road Element* from the *First* to the *Last House Number*.

6.3.27 Intersection Type

6.3.27.1 Definition

The Classification of an *Intersection*.

6.3.27.2 Domain/Unit of Measurement

- freeway intersection
- roundabout
- crossing

6.3.27.3 Description

6.3.27.3.1 Definition of a Freeway Intersection

A Freeway Intersection is a construction to connect a Freeway to another road via a grade separated crossing. Examples are a Motorway Interchange which connects two or more motorways and a Freeway Exit which connects a Freeway to a non-Freeway.

See figure 6.19 for an example.

6.3.27.3.2 Definition of a Roundabout

See figure 6.19 for an example.

6.3.27.3.3 Definition of a Crossing

A Crossing is a connection at grade between three or more different *Roads*.

See figure 6.19 for an example.

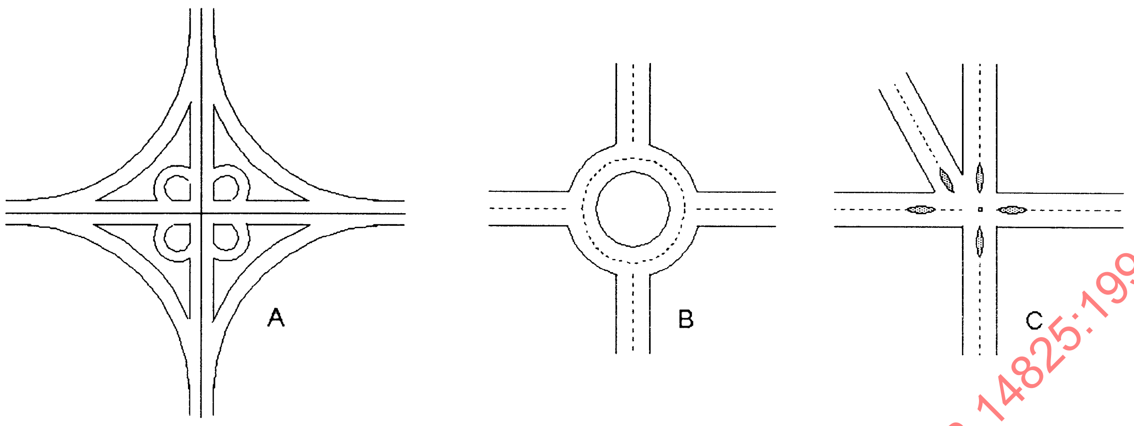


Figure : 6.19 Examples of a Freeway Intersection(A), a Roundabout(B) and a Crossing(C).

6.3.28 Junction Type

6.3.28.1 Definition

The classification of a *Junction*

6.3.28.2 Domain/Unit of Measurement

- Mini-roundabout
- Railway crossing
- Bifurcation
- Border crossing

See figure 6.20 for examples.

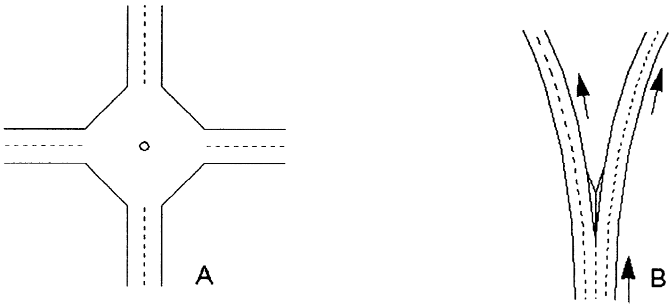


Figure: 6.20 Examples of a Mini-roundabout(A) and a Bifurcation(B)

6.3.28.3 Description

6.3.28.3.1 Definition of a mini roundabout

A mini roundabout is a roundabout mainly designed to reduce the speed of the passing vehicles. When continuing in the same direction it only requires a small direction deviation

6.3.28.3.2 Definition of a bifurcation

A bifurcation is a split of a road into two roads which both can be considered as the continuing road. See figure 6.20.

6.3.28.3.3 Definition of a railway crossing

A railway crossing is a crossing at grade between a road and a railway.

6.3.29 Lane Dependent Validity

6.3.29.1 Definition

For which of the lanes of an associated *Road Element* the associated sub-attribute holds or does not hold.

6.3.29.2 Domain/Unit of Measurement

A string with a length which at maximum equals the number of lanes present on the associated *Road Element* + 1, whereby the character on the (n+1)th position refers to the nth lane. The allowed characters on the first position of the string are:

- L: Indicating that the lanes are counted from the left side of the *Road Element*.
- R: Indicating that the lanes are counted from the right side of the *Road Element*.

The allowed characters on the n th (n>1) position of the string are:

- 0: Indicating that the associated sub-attribute is not valid for that lane.
- 1: Indicating that the associated sub-attribute is valid for that lane.

6.3.29.3 Description

The left and right side of the *Road Element* are defined by considering the orientation of the *Road Element* as defined by the start and end bounding point feature.

The number of characters does not necessarily have to equal the number of lanes of the associated *Road Element* + 1. In this case the not represented lanes should be considered as not collected.

The attribute should be used in conjunction with another sub-attribute which specifies the property which is valid for the lanes specified by the *Lane Validity* attribute.

6.3.30 Last House Number Left

6.3.30.1 Definition

The last house number on the left side of the *Road Element*.

6.3.30.2 Domain/Unit of Measurement

The domain of values is only limited in a physical sense. The value has a maximum size of 10 characters. The characters may be of any kind : digits, alphabetic characters or graphical characters. Typical examples of values are 223, 456, 57-a, 435-II, etc. A blank value indicates that there are no numbered houses on the left side of the *Road Element*.

6.3.30.3 Description

This attribute is used as a sub-attribute in conjunction with the sub-attributes *House Number Structure*, *First House Number Left* and possibly *Intermediate House Number Left*. Together with their counterparts for the right side of the road, these attributes form the composite attribute *House Number Range*.

6.3.31 Last House Number Right

6.3.31.1 Definition

The last house number on the left side of the *Road Element*.

6.3.31.2 Domain/Unit of Measurement

The domain of values is only limited in a physical sense. The value has a maximum size of 10 characters. The characters may be of any kind : digits, alphabetic characters or graphical characters. Typical examples of values are 223, 456, 57-a, 435-II, etc. A blank value indicates that there are no numbered houses on the right side of the *Road Element*.

6.3.31.3 Description

This attribute is used as a sub-attribute in conjunction with the sub-attributes *House Number Structure*, *First House Number Right* and possibly *Intermediate House Number Right*. Together with their counterparts for the left side of the road, these attributes form the composite attribute *House Number Range*.

6.3.32 Lateral Offset

6.3.32.1 Definition

An indication of the lateral position of a Road-Related Object.

6.3.32.2 Domain/Unit of Measurement

Any integer value.

6.3.32.3 Description

Positive values should be used to indicate positions on the right side of the *Road Element*, negative values for positions for the left side. The value zero indicates a position on (or above) the *Road Element.*

The values should be used in an ordinal sense whereby a larger numbers (or in the case of negative numbers, smaller numbers) indicate a lateral position further from the *Road Element.*

6.3.32.3.1 Indication of a particular side

The side of the *Road Element* to which the attribute applies is specified relative to the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.33 Length of a Road Element

6.3.33.1 Definition

The curvimetric 2-dimensional length of a *Road Element.*

6.3.33.2 Domain/Unit of Measurement

The value should be expressed in metres.

6.3.33.3 Description

This attribute should contain the curvimetric length of the horizontal projection of the *Road Element.*

6.3.34 Magnetic Anomalies

6.3.34.1 Definition

An apparent change in the earth's magnetic field due to the presence of a construction and within the local area of that construction.

6.3.34.2 Domain/Unit of Measurement

- Present
- Not Present

6.3.34.3 Description

Constructions that may influence the earth's magnetic field include: bridges, tunnels, power lines, electric railways and tramways.

6.3.35 Maximum Height Allowed

6.3.35.1 Definition

The maximum height limit of a vehicle that may use the *Road Element* or *Ferry Connection*. The limit is normally set by a physical obstruction such as a bridge or tunnel, or a legal restriction.

6.3.35.2 Domain/Unit of Measurement

The value shall be expressed in centimetres.

6.3.35.3 Description

6.3.35.3.1 Indication of a particular direction

In most cases the expressed value will refer to both directions on the *Road Element*. If this should not be the case the attribute must be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.36 Maximum Length Allowed

6.3.36.1 Definition

The legal maximum length of a vehicle that may use the *Road Element* or *Ferry Connection*.

6.3.36.2 Domain/Unit of Measurement

The value shall be expressed in centimetres.

6.3.36.3 Description

6.3.36.3.1 Indication of a particular direction

In most cases the attribute will refer to both directions on the *Road Element*. If this is not the case the attribute can be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.37 Maximum Number of Lanes

6.3.37.1 Definition

The maximum number of lanes existing on a *Road Element*.

6.3.37.2 Domain/Unit of Measurement

Any integer value.

6.3.37.3 Domain/Unit of Measurement

The *Maximum Number of Lanes* attribute refers to the total number of lanes associated with one particular driving direction which are at least present on a certain *Road Element*. If this attribute appears once with one *Road Element* without a side indication it indicates that both driving directions have the same maximum number of lanes or, in case there is only one driving direction, the total maximum number of lanes. In case two different driving directions on a *Road Element* have a different maximum number of lanes, each number can be specified by a different attribute value in combination with a side indication.

6.3.37.3.1 Indication of a particular side

In most cases the attribute will refer to both directions on the *Road Element*. If this is not the case the attribute can be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.38 Maximum Total Weight Allowed

6.3.38.1 Definition

The legal maximum total weight of a vehicle that may use the *Road Element* or *Ferry Connection*.

6.3.38.2 Domain/Unit of measurement

The value shall be expressed in tenths of a metric ton.

6.3.38.3 Description

6.3.38.3.1 Indication of a particular direction

In most cases the expressed value will refer to both directions on the *Road Element*. If this should not be the case the attribute must be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.39 Maximum Weight per Axle Allowed

6.3.39.1 Definition

The legal maximum weight per axle of a vehicle that may use the *Road Element* or *Ferry Connection*.

6.3.39.2 Domain/Unit of measurement

The value shall be expressed in tenths of a metric ton.

6.3.39.3 Description

6.3.39.3.1 Indication of a particular direction

In most cases the expressed value will refer to both directions on the *Road Element*. If this should not be the case the attribute must be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.40 Maximum Width Allowed

6.3.40.1 Definition

The maximum width limit of a vehicle that may use the *Road Element* or *Ferry Connection*. The limit is normally set by a physical obstruction such as a bridge or a legal restriction.

6.3.40.2 Domain/Unit of Measurement

The value shall be expressed in centimetres.

6.3.40.3 Description

6.3.40.3.1 Indication of a particular direction

In most cases the expressed value will refer to both directions on the *Road Element*. If this should not be the case the attribute must be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.41 Measured Length

6.3.41.1 Definition

The 3-Dimensional length of a *Road Element*.

6.3.41.2 Domain/Unit of Measurement

The value should be expressed in whole metres.

6.3.41.3 Description

The value represents the length as it can be measured in reality.

6.3.42 Minimum Number of Lanes

6.3.42.1 Definition

The minimum number of lanes existing on a *Road Element*.

6.3.42.2 Domain/Unit of Measurement

Any integer value.

6.3.42.3 Domain/Unit of Measurement

The *Minimum Number of Lanes* attribute refers to the total number of lanes associated with one particular driving direction which are at least present on a certain *Road Element*. If this attribute appears once with one *Road Element* without a side indication it indicates that both driving directions have the same minimum number of lanes or, in case there is only one driving direction, the total minimum number of lanes. In case two different driving directions on a *Road Element* have a different minimum number of lanes, each number can be specified by a different attribute value in combination with a side indication.

6.3.42.3.1 Indication of a particular side

In most cases the attribute will refer to both directions on the *Road Element*. If this is not the case the attribute can be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.43 Minimum Number of Occupants

6.3.43.1 Definition

The minimum number of occupants of a vehicle which are required by traffic restriction.

6.3.43.2 Domain/Unit of Measurement

Any integer value.

6.3.43.3 Description

This sub-attribute should be used in conjunction with the sub-attribute *Vehicle Type*. This combination only has meaning if the *Vehicle Type* has the value 'High Occupancy Vehicle. Together these sub-attribute form the composite attribute *High Occupancy Vehicle*.

6.3.44 Mountain Pass

6.3.44.1 Definition

The existence, height and opening period of a Road Element which is considered as a Mountain Pass.

6.3.44.2 Domain/Unit of Measurement

Composite

6.3.44.3 Sub-attributes

The composite attribute *Mountain Pass* consists of the following sub-attributes:

Pass - Mandatory

Height of a Pass

Opening Period [.]..[.]

[.]..[.] indicates that the sub-attribute may have multiple instances in the framework of the composite attribute.

6.3.45 National Road Class

6.3.45.1 Definition

The numeric classification equivalencies to the order of the National Road Classification of a *Road Element* or *Ferry Connection*, where 1 equals the highest class of road.

6.3.45.2 Domain/Unit of Measurement

- Main roads: the most important roads.
- First class roads.
- Second class roads.
- Third class roads.
- Fourth class roads.
- Fifth class roads.
- Sixth class roads.
- Seventh class roads.
- Eighth class roads.
- Ninth class roads: The least important roads.

6.3.46 Number of Lanes

6.3.46.1 Definition

The number of lanes existing on a *Road Element*.

6.3.46.2 Domain/Unit of Measurement

The *Number of Lanes* attribute refers to the total number of lanes associated with one particular driving direction which are present on a certain *Road Element*. If this attribute appears once with one *Road Element* without a side indication it indicates that both driving directions have the same number of lanes or, in case there is only one driving direction, the total number of lanes. In case two different driving directions on a *Road Element* have a different number of lanes, each number can be specified by a different Attribute Value in combination with a side indication.

6.3.46.2.1 Indication of a particular side

In most cases the attribute will refer to both directions on the *Road Element*. If this is not the case the attribute can be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.46.3 Description

Any integer value

6.3.47 Number of Passing Vehicles

6.3.47.1 Definition

The average number of vehicles passing along the *Road Element* per time unit.

6.3.47.2 Domain/Unit of Measurement

The value should be expressed in number of vehicles per day.

6.3.47.3 Description

This attribute can be used in conjunction with the sub-attribute *Vehicle Type*.

6.3.47.3.1 Indication of a particular direction

In most cases the expressed value will refer to both directions on the *Road Element*. If this should not be the case the attribute must be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.48 Opening Period

6.3.48.1 Definition

The period in which the function of an associated feature is available to the public.

6.3.48.2 Domain/Unit of Measurement

The value should be expressed according to the Time Domain Syntax.

6.3.49 Ownership

6.3.49.1 Definition

Whether a road element is publicly or privately owned.

6.3.49.2 Domain/Unit of Measurement

- Publicly owned;
- Privately owned;

6.3.50 Pass

6.3.50.1 Definition

Whether a road element is regarded as a mountain pass.

6.3.50.2 Domain/Unit of Measurement

- *Pass*
- Not a *Pass.*

6.3.50.3 Description

This attribute is used as a sub-attribute in conjunction with the sub-attributes *Height of a Pass* and possibly *Opening Period.* Together these sub-attributes form the composite attribute *Mountain Pass.*

6.3.51 Passing Restrictions

6.3.51.1 Definition

Indication of whether it is not allowed to pass other cars on the associated *Road Element*Domain/Unit of Measurement

- Present.
- Not present.

6.3.51.2 Description

This attribute should be used as a sub-attribute in combination with the attribute *Vehicle Type*.

6.3.52 RDS/TMC Code

6.3.52.1 Definition

The RDS/TMC Code belonging to a feature as agreed by the RDS/TMC coding organization.

6.3.52.2 Domain/Unit of Measurement

Any value occurring in the RDS/TMC code list.

6.3.52.3 Description

An RDS/TMC code is used to identify a specific location or section of the road network for traffic messaging purposes.

6.3.53 Road Conditions

6.3.53.1 Definition

Specification of the state of the surface of the associated *Road Element*.

6.3.53.2 Domain/Unit of Measurement

- Paved
- Unpaved.

6.3.54 Road Display Class

6.3.54.1 Definition

A classification of *Road Elements* which enables a meaningful display of the road network.

6.3.54.2 Domain/Unit of Measurement

- First class
- Second Class
- Third Class
- Fourth Class
- Fifth Class
- Sixth Class
- Seventh Class
- Eighth Class
- Ninth Class
- Tenth Class

6.3.54.3 Description

Although the user is free to apply his own classification scheme, it is recommended that classification is assigned according to the importance of the *Road Elements* in such a way that the most important *Road Elements* are classified in the first class. In this way, a relation exists with the attribute *Functional Road Class*. In regions where the *Functional Road Classification* leads to a density of the different *Functional Road Classes* which is fit for meaningful representation, both schemes then will be similar. Conversely, they diverge where the *Functional Road Classification* leads to a distribution which is either too dense or too sparse for display purposes.

6.3.55 Road Gradient

6.3.55.1 Definition

The road gradient percentage value on the *Road Element*.

6.3.55.2 Domain/Unit of Measurement

The gradient shall be expressed in the form of a percentage incline. Negative values describe downhill gradients, positive values describe uphill gradients.

Only the maximum gradient value at any position along the *Road Element* need be stored.

In case the gradient relates to the entire *Road Element*, only the maximum gradient value at any position along the *Road Element* need be stored.

6.3.55.3 Description

6.3.55.3.1 Definition of uphill and downhill

Uphill and downhill should be defined relative to the orientation of the *Road Element* when travelling from start to end point.

6.3.56 Road Inclination

6.3.56.1 Definition

The transverse gradient of a *Road Element*.

6.3.56.2 Domain/Unit of Measurement

The inclination shall be expressed in the form of a permille incline. Negative values describe inclinations from the left to the right side of the road, positive values describe inclination in the reverse direction. The inclination is defined relative to the *Road Element* orientation from start to end *Junction.*

In case the inclination relates to the entire *Road Element,* only the maximum inclination value at any position along the *Road Element* need be stored.

The inclination should rounded of to the nearest integer. The valid range is from -999 to +999.

6.3.56.3 Description

6.3.56.3.1 Indication of a particular side

In most cases the attribute will refer to both directions on the *Road Element*. If this is not the case the attribute can be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.57 Route Number

6.3.57.1 Definition

The route number of a *Road Element* or *Ferry Element*. The *Route Number* is the ID-number of a particular route in a given road network as attributed by a national, sub-national or international organization (e.g. the numbering of the departmental roads in France or the E-roads in Europe).

6.3.57.2 Domain/Unit of Measurement

The Attribute Value can in principle be any combination of printable characters. In most cases however, it will consist of one or two alphabetic characters (one of them possibly between brackets), followed by a space or a hyphen and finally by a number of digits.

6.3.57.3 Description

A particular *Road Element* can belong to more than one numbered route. In such cases a corresponding number of *Route Number* values can be recorded.

6.3.58 Scenic Value

6.3.58.1 Definition

Whether a *Road Element* is regarded as scenic or not.

6.3.58.2 Domain/Unit of Measurement

- Scenic
- Not Scenic

6.3.58.3 Description

Assignment of scenic values is subjective and can be based on a variety of sources.

6.3.59 Slip Road Type

6.3.59.1 Definition

The type of *Slip Road.*

6.3.59.2 Domain/Unit of Measurement

- Parallel Road
- Slip Road of a grade separated crossing
- Slip Road of a crossing at grade

6.3.59.3 Description

This sub-attribute is used to further specify the *Slip Road* which has been specified in the associated sub-attribute *Form of Way.*

6.3.59.3.1 Definition of a Parallel Road

A Parallel Road is a sub-type of a Slip Road which connects to the same road both at its start and at its end. In between its start and end it runs parallel or nearly parallel to the road it connects to and it only gives access to Slip Roads. A parallel road always will be open in only one direction for motorized traffic.

6.3.60 Special Restrictions

6.3.60.1 Definition

Special legal restrictions placed upon the use of a particular *Road Element.*

6.3.60.2 Domain/Unit of Measurement

- Publicly Accessible
- Not publicly Accessible

6.3.60.3 Description

6.3.60.3.1 Indication of a particular direction

In most cases the expressed value will refer to both directions on the *Road Element*. If this should not be the case the attribute must be restricted to one particular direction applying the direction of the *Road Element* as seen from the start bounding Point Feature.

6.3.61 Speed Restrictions

6.3.61.1 Definition

The maximum speed limit allocated to a *Road Element*.

6.3.61.2 Domain/Unit of Measurement

Any whole integer expressing the speed in kilometres per hour.

6.3.61.3 Description

This attribute can be used in conjunction with the sub-attribute *Vehicle Type* to indicate for which vehicles the restriction holds.

6.3.62 Toll Road

6.3.62.1 Definition

A *Road Element* which requires an access toll to be paid.

6.3.62.2 Domain/Unit of Measurement

- *Toll Road*
- Not a *Toll Road*

6.3.63 Traffic Jam Sensitivity

6.3.63.1 Definition

Probability of a traffic jam on a *Road Element*.

6.3.63.2 Domain/Unit of Measurement

- No or low probability
- High probability

6.3.64 Travel Time

6.3.64.1 Definition

The one-way travel time that a ferry connection takes to complete a journey.

6.3.64.2 Domain/Unit of Measurement

The value should be expressed using Time Domain Syntax.

6.3.64.3 Description

The travel time shall represent the average duration of a journey a ferry makes.

6.3.65 Vehicle Type

6.3.65.1 Definition

The type of vehicle for which the information contained in an associated sub-attribute holds.

6.3.65.2 Domain/Unit of Measurement

- All Vehicles
- Passenger Cars
- Delivery Truck
- Transport Truck
- Pedestrian
- Bicycle
- Motorcycle
- Moped
- Emergency Vehicle
- Taxi
- Public Bus
- Residential vehicle
- Private
- High Occupancy Vehicle
- Military Vehicle
- Car with Trailer
- Private Bus
- Farm Vehicle
- Vehicles with an explosive load
- Vehicles with a water-polluting load
- Vehicles with other dangerous loads

6.3.65.3 Description

This restrictive sub-attribute should be used if the restriction to vehicle type is indicated through traffic signs.

6.3.66 Width

6.3.66.1 Definition

The width of a *Road Element*, a lane or a Road-related Object.

6.3.66.2 Domain/Unit of Measurement

The value should be expressed in centimetres.

6.3.66.3 Description

If this attribute is used to specify the width of a *Road Element* it should be attached as a normal attribute to a *Road Element*. If the width of a lane is specified, it should be attached to a *Road Element* in combination width the restrictive sub-attribute *Lane-dependent Validity*. If the width of a Road-related Object is specified, the attribute should be attached to the relationship *Road-related Object related to Road Element*.

6.4 Attributes for Administrative Areas

6.4.1 CCC Country Code

6.4.1.1 Definition

The CCC code of the country in question.

6.4.1.2 Domain/Unit of Measurement

For European countries, the *CCC Country Codes* are listed in Appendix A1.5

6.4.2 CCC Region Code

6.4.2.1 Definition

The CCC Region Code of the region in issue.

6.4.2.2 Domain/Unit of Measurement

For a restricted number of European countries, the CCC region codes are listed in Appendix A1.5

6.4.3 ISO Country Code

6.4.3.1 Definition

The ISO-3166 Alpha-3 code of the country in question.

6.4.3.2 Domain/Unit of Measurement

For European countries, the ISO-3166 Alpha-3 codes are listed in Appendix A1.8

6.4.4 Official Code

6.4.4.1 Definition

The officially statistical code of the *Administrative Area* employed by the national authorities and/or the national statistical bureau.

6.4.4.2 Domain/Unit of Measurement

The domain of values is only limited in a physical sense. The characters making up the *Official code* may be of any kind : blanks, digits, alphabetic characters or graphical characters.

6.4.5 Population

6.4.5.1 Definition

The population figure of an *Administrative Area*.

6.4.5.2 Domain/Unit of Measurement

Any integer.

6.4.6 Population Class

6.4.6.1 Definition

A classified representation of the population figure of an *Administrative Area*.

6.4.6.2 Domain/Unit of Measurement

The classification should be done according to a user defined class division.

6.5 Attributes for Settlements and Named Areas

6.5.1 Population

6.5.1.1 Definition

The population figure of a Settlement or Named Area.

6.5.1.2 Domain/Unit of Measurement

Any integer.

6.5.2 Population Class

6.5.2.1 Definition

A classified representation of the population figure of a Settlement or Named Area.

6.5.2.2 Domain/Unit of Measurement

The classification should be done according to a user defined class division.

6.5.3 Postal Code

6.5.3.1 Definition

The official code of a *Postal Area* as defined by the national postal organisation.

6.5.3.2 Domain/Unit of Measurement

The domain of values is only limited in a physical sense. The characters making up the *Postal Code* may be of any kind : blanks, digits, alphabetic characters or graphical characters.

6.5.4 Settlement Type

6.5.4.1 Definition

The type or character of a *Settlement*.

6.5.4.2 Domain/Unit of Measurement

- Residential
- Recreational
- Industrial
- Military

6.5.4.3 Description

The *Settlement Type* should specify the main activity which takes place in the area inside the *Settlement*. Professional activities should in this respect be classified as industrial.

6.6 Attributes for Land Cover and Use

6.6.1 Building Class Name

6.6.1.1 Definition

The functional or architectural description of the *Building,* for example "Church", "Tower".

6.6.1.2 Domain/Unit of Measurement

Any text.

6.6.1.3 Description

Building Class only applies to the feature *Building* within the feature theme *Land Cover and Use.*

6.6.2 Park Type

6.6.2.1 Definition

An indication of the type of *Park.*

6.6.2.2 Domain/Unit of Measurement

- City Park
- National or Regional Park

6.6.2.3 Description

There is an essential difference between City Parks and National or Regional Parks. City Parks are located in an urban environment, designed for recreational purposes and admissible free of charge. Regional or National Parks generally have a function as a nature reserve and are not always (completely) accessible by the public.

6.7 Attributes for Brunnels

6.7.1 Brunnel Type

6.7.1.1 Definition

The classification of a Brunnel.

6.7.1.2 Domain/Unit of Measurement

- Bridge/underpass
- Viaduct/underpass
- Aqueduct/underpass
- Overpass/tunnel
- Not Classified

6.7.1.3 Description

6.7.1.3.1 Definition of Bridge/Underpass

A bridge/underpass is a construction for grade separation between two separate Transportation Elements (See 3.4 for definition). Any Transportation Element defined can serve as the upper- or the lower element except a *Water Element*, which can only be the lower element.

A construction is classified as a bridge/underpass if the length of the upper Transportation Element exceeds its width. If the width exceeds the length, the construction shall be classified as an overpass/tunnel.

Note: The direction of traffic flow on the upper Transportation Element defines the dimension of the length.

6.7.1.3.2 Definition of Viaduct/Underpass

A viaduct/underpass can relate the same kinds of crossings as a bridge/underpass.

The difference between a bridge and a viaduct is fuzzy and cannot be clearly defined. A *Brunnel* tends to be classified as a Viaduct/Underpass when it carries a Transportation Element over several lower Transportation Elements such as a river and a railway or just over a valley. Bridges tend to overpass a single specific Transportation Element. A "fly-over" is treated as a viaduct.

6.7.1.3.3 Definition of Aqueduct/Underpass

A Brunnel where the upper Transportation Element is a Water Element, whereby its length exceeds its width

6.7.1.3.4 Definition of Overpass/Tunnel

An overpass/tunnel can belong to all crossings with grade separation. A construction is classified as an overpass/tunnel when the tunnel's length exceeds the width.

Should there be no distinct upper Transportation Element (e.g. roads, railways or *Water Elements* passing through a mountain or under a river), the construction is classified as an overpass/tunnel.

Figure 6.21 contains examples of different Brunnel types.

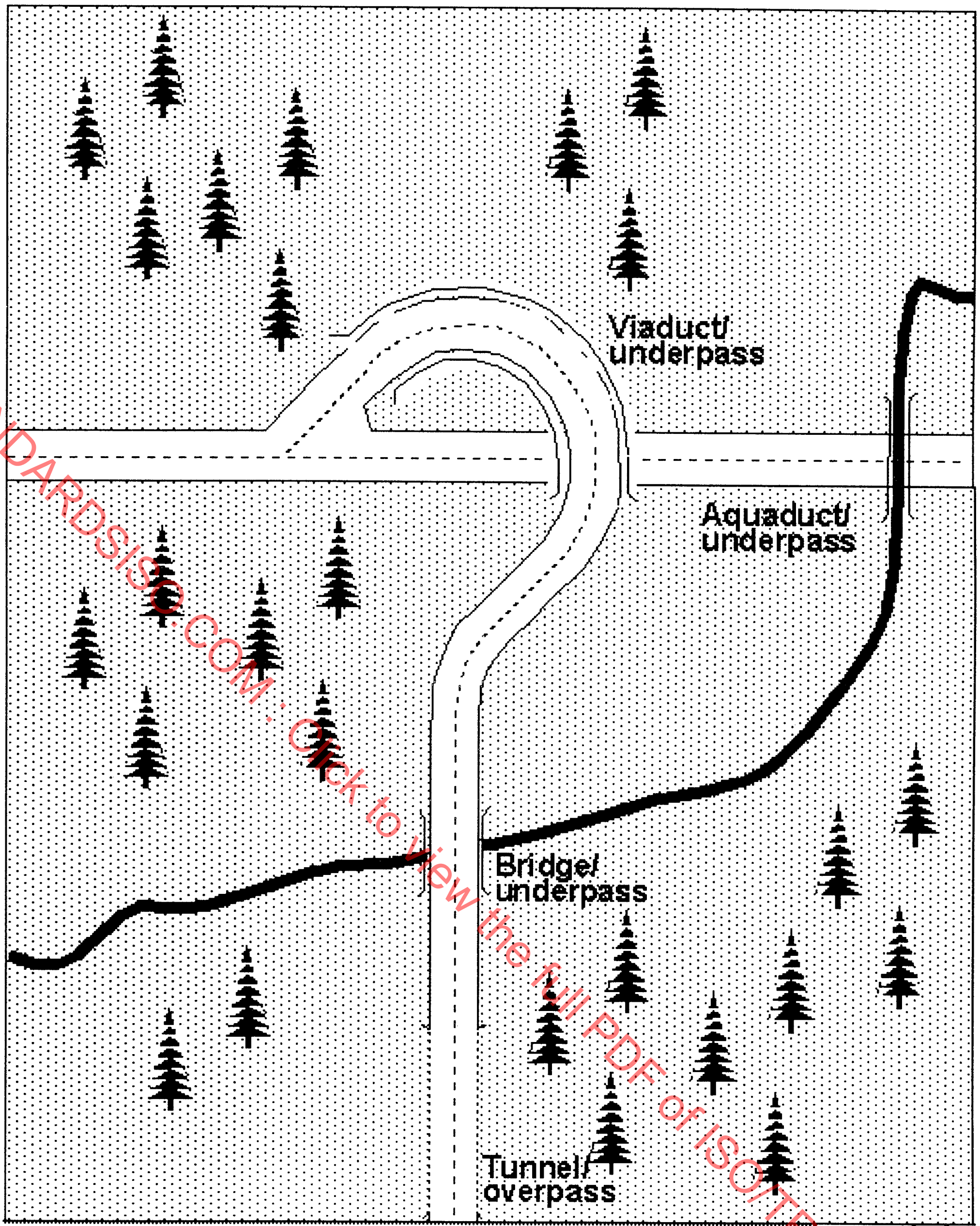


Figure: 6.21 : Attribute Brunnel Type

6.8 Attributes for Railways

No attributes have been defined for *Railways*.

6.9 Attributes for Waterways

6.9.1 Water Display Class

6.9.1.1 Definition

A classification of *Water Elements* or *Water Boundary Elements* which enables a meaningful display of the waterway network.

6.9.1.2 Domain/Unit of Measurement

- First class
- Second Class
- Third Class
- Fourth Class
- Fifth Class
- Sixth Class
- Seventh Class
- Eighth Class
- Ninth Class
- Tenth Class

6.9.1.3 Description

Although the user is free to apply his own classification scheme, it is recommended to classify according to the importance of the *Water Element* or *Water Boundary Element* in such a way that the most important waterways are classified in the first class.

6.9.2 Water Boundary Element Type

6.9.2.1 Definition

The type of *Water Boundary Element*.

6.9.2.2 Domain/Unit of Measurement

- Ocean or Sea shore line
- Lake shore line
- River side
- Canal side
- Wetland side
- Harbour side
- Water side of Pier or Dock
- Others

6.9.2.2.1 Definition of a Shore line.

That part of the land in immediate contact with a waterbody including the areas between high and low water lines.

6.9.2.2.2 Definition of a Pier or Dock.

A Pier or Dock is a structure built out into the water to serve as a landing place for ships.

For other definitions see 6.9.2.2.3, 6.9.3.

6.9.2.2.3 Combination rules

The types of *Water Boundary Element Type* are not mutually excluding. In case of conflicts the following hierarchical order should be applied, in which a higher order type always will be applied instead of a lower order type:

Highest order	•	Water side of Pier of Dock
	•	Harbour side
	•	River or Canal side
Lowest Order	•	Ocean or Sea shore line

6.9.3 Water Element Type

6.9.3.1 Definition

The type of *Water Element*.

6.9.3.2 Domain/Unit of Measurement

- Ocean and Sea
- Lake
- River
- Canal
- Wetland
- Harbour/Port
- Others

6.9.3.2.1 Definition of a Ocean

A body of salt water which divides the Earth's continental plates.

6.9.3.2.2 Definition of a Sea

A body of salt water salt water located above a continental plate which has an open connection to the sea.

6.9.3.2.3 Definition of a Lake

A non-linear body of inland water which has no open connection, except possibly by a river, to the sea or ocean.

6.9.3.2.4 Definition of a River

A linear body of inland water from natural or semi-natural origin.

6.9.3.2.5 Definition of a Canal

A linear body of inland water from human origin.

6.9.3.2.6 Definition of a Wetland

A vegetated area that is inundated or saturated by surface or groundwater.

6.10 Attributes for Road Furniture

6.10.1 Direction

6.10.1.1 Definition

The direction of a banned turn or a right of way.

6.10.1.2 Domain/Unit of Measurement

- Ahead
- Between ahead and right
- Right
- Between right and backward
- Backward
- Between backward and left
- Left
- Between Left and Ahead

6.10.1.3 Description

This attribute is used as a sub-attribute for the composite attribute *Traffic Sign Information.* Its use is only meaningful if it is preceded by a sub-attribute *Traffic Sign Class.*

All references (such as Ahead, Right, etc.) are made in relation to the driving direction of the driver confronted with the sign. Figure 6.22 gives graphical examples for the defined direction values.

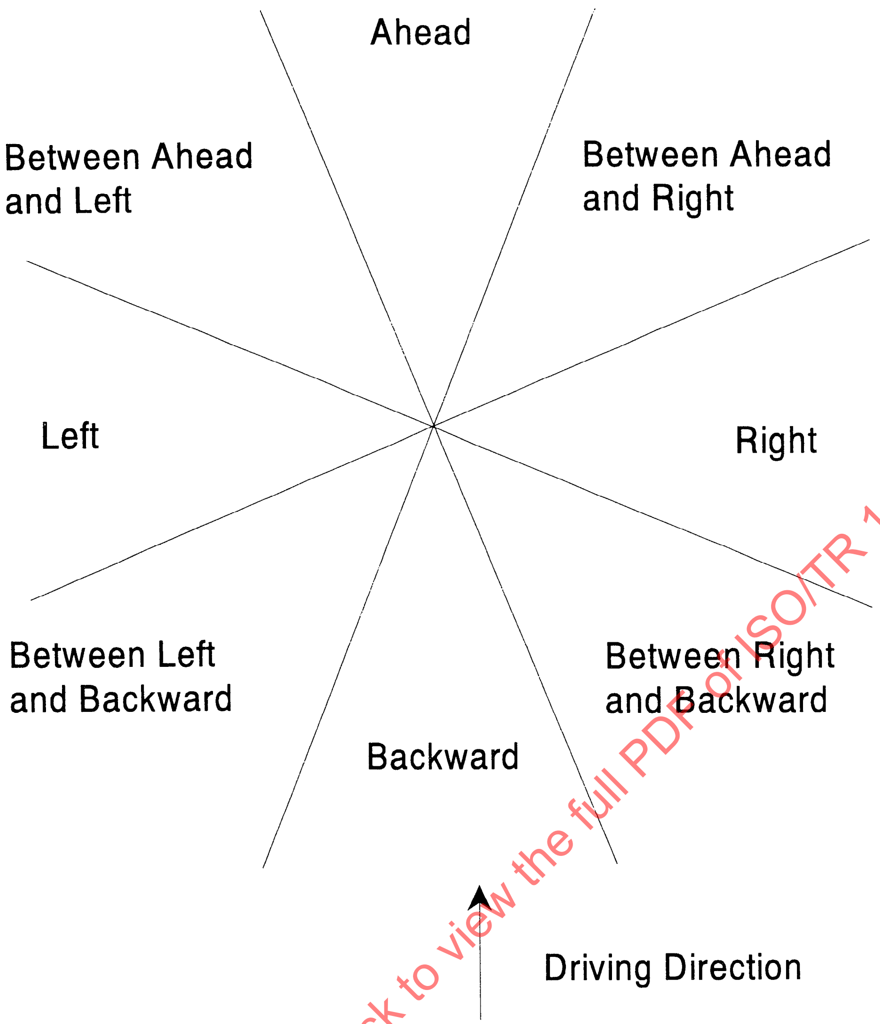


Figure 6.22: Graphical representation of the defined direction values

6.10.2 Symbol on Traffic Sign

6.10.2.1 Definition

A description of the symbol that occurs on the traffic sign.

6.10.2.2 Domain/Unit of Measurement

- All traffic
- Motor cycle
- Private car
- Private car with trailer
- Heavy Goods Vehicle
- Heavy Goods Vehicle with trailer
- Bus
- Motor vehicle, having a maximum speed of 25 km/h
- Vehicle with explosive goods
- Vehicle with water-polluting goods
- Vehicle with other dangerous goods
- Tram
- Train
- Bicycle
- Autobike (moped)
- Horse-drawn vehicle
- Rider
- Pedestrian
- Pedestrian with hand-drawn vehicle
- Speed
- Total weight
- Weight per axle
- Width
- Height
- Length

The values "Speed" to "Length" have to be followed by the Attribute *Value on Traffic Sign.*

6.10.2.3 Description

This attribute is used as a sub-attribute for the composite attribute *Traffic Sign Information.* Its use is only meaningful if it is preceded by the attribute *Traffic Sign Class.*

6.10.3 Textual Content of a Traffic Sign

6.10.3.1 Definition

Information which cannot be represented by means of the attributes *Symbol on Traffic Sign* and/or *Validity Period*.

6.10.3.2 Domain/Unit of Measurement

Any text.

6.10.3.3 Description

This attribute is used as a sub-attribute for the composite attribute *Traffic Sign Information*. The use of this attribute is only meaningful if it is used in conjunction with the sub-attribute *Traffic Sign Class*.

6.10.4 Traffic Sign Class

6.10.4.1 Definition

The classification of traffic sign.

6.10.4.2 Domain/Unit of Measurement

Traffic signs are classified in the following 8 different categories:

- Right of Way
- Directional
- Right of Passage
- Signpost
- Route prohibition
- Stopping prohibition
- Warning sign
- Directional Sign

Figure 6.23 provides graphical examples of the first four categories.

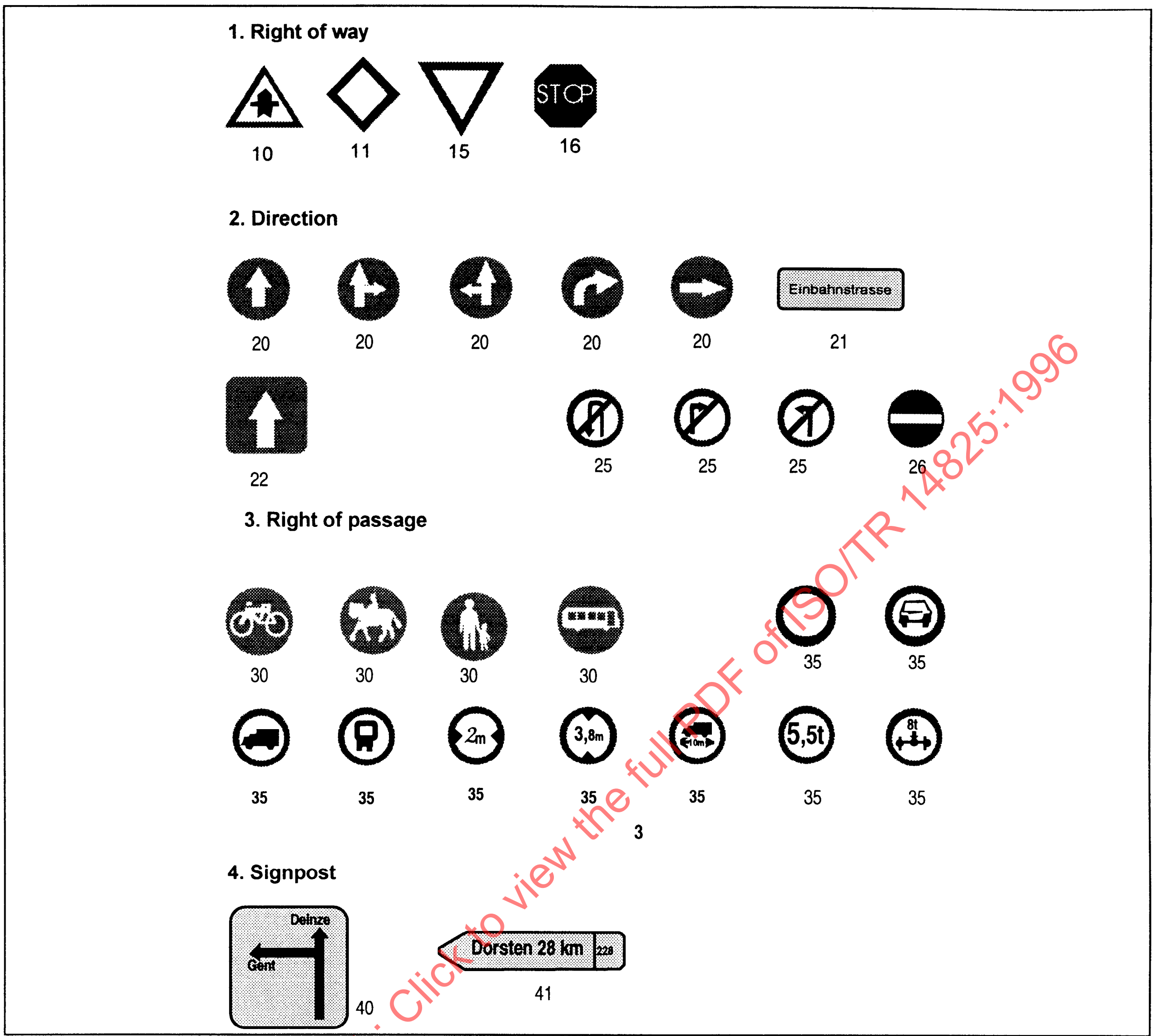


Figure 6.23 Traffic Signs according to Traffic Sign Class

<u>6.10.4.3 Description</u>

This attribute is used as a sub-attribute for the composite attribute *Traffic Sign Information.*

6.10.5 Traffic Sign Information

<u>6.10.5.1 Definition</u>

A description of the information contained in a traffic sign. The information should comprise the information contained in the traffic sign itself, as well as supplementary information present on e.g. additional text plates.

6.10.5.2 Domain/Unit of Measurement

Composite.

6.10.5.3 Sub-attributes

Traffic Sign Class: - Mandatory

Symbol on Traffic Sign [.]..[.]

Direction [.]..[.]

Value on Traffic Sign [.]..[.]

Textual Content of Traffic Sign [.]..[.]

[.]..[.] indicates that the attribute may have multiple different instances in the framework of the composite attribute.

6.10.6 Value on Traffic Sign

6.10.6.1 Definition

A value mentioned on a traffic sign.

6.10.6.2 Domain/Unit of Measurement

The value can be any integer value expressing one of the following units:

Symbol name	**Unit of measurement**
Speed	km/h
Total weight	0.1 t
Weight per axle	0.1 t
Width	0.01 m
Height	0.01 m
Length	1 m

6.10.6.3 Description

This attribute is used as a sub-attribute for the composite attribute Traffic Sign Information. It is used in conjunction with *Symbol On Traffic Sign* and stores the numeric value associated with given traffic signs.

6.11 Attributes for Services

6.11.1 Accepted Credit Cards

6.11.1.1 Definition

A list of recognized credit cards accepted by a *Service*.

6.11.1.2 Domain/Unit of Measurement

For each of the recognized credit cards a value is given as follows:

- Accepted
- Not Accepted

What is considered as a recognized credit card is not specified by the standard.

6.11.2 Airport

6.11.2.1 Definition

The code of the airport from which a flight connection departs.

6.11.2.2 Domain/Unit of Measurement

The value should be expressed in the international standard three letter airport code, followed by a one position indication for a possible terminal. If the airport only has one terminal the last character should be a zero.

6.11.3 Brand Name

6.11.3.1 Definition

The brand name of a *Service*.

6.11.3.2 Domain/Unit of Measurement

Any string of alpha-numeric characters.

6.11.3.3 Description

Renault, Texaco, Q8, Hilton are some examples.

6.11.4 Breakfast Available

6.11.4.1 Definition

Whether breakfast is available as part of the *Service*.

6.11.4.2 Domain/Unit of Measurement

- Available
- Not Available

6.11.5 Business Lunch

6.11.5.1 Definition

Whether a business lunch is available.

6.11.5.2 Domain/Unit of Measurement

- Available
- Not Available

6.11.6 Departure/Arrival

6.11.6.1 Definition

Whether a traffic *Service* is only for departures or arrivals, or both.

6.11.6.2 Domain/Unit of Measurement

- Departure
- Arrival
- Departure and Arrival

6.11.7 Destination of Flight Connection

6.11.7.1 Definition

The destination of the Flight Connection (given by ID of Flight Connection).

6.11.7.2 Domain/Unit of Measurement

The value should be expressed in the international standard three letter airport code, followed by a one position indication for a possible terminal. If the airport only has one terminal the last character should be a zero.

6.11.7.3 Description

This attribute can be used as a sub-attribute of the composite attribute *Flight Info.*

6.11.8 Domestic/International

6.11.8.1 Definition

Whether a traffic *Service* is for Domestic or International traffic, or both.

6.11.8.2 Domain/Unit of Measurement

- Domestic
- International
- Domestic and International

6.11.9 Facilities En Suite

6.11.9.1 Definition

The number of rooms with en suite facilities

6.11.9.2 Domain/Unit of Measurement

Any positive integer within field limits

6.11.10 Flight Info

6.11.10.1 Definition

Information concerning a certain flight connection.

6.11.10.2 Domain/Unit of Measurement

Composite

6.11.10.3 Sub-attributes

The composite attribute *Flight Info* contains the following sub-attributes:

ID of a Flight Connection - Mandatory

Airport

Destination of a Flight Connection

Time of Departure of a Flight Connection

Time of Arrival of a Flight Connection

Time difference of a Flight Connection.

6.11.11 ID of Flight Connection

6.11.11.1 Definition

The flight number of the flight connection.

6.11.11.2 Domain/Unit of Measurement

The value should be expressed in the international airline standard format.

6.11.11.3 Description

This attribute can be used as a sub-attribute of the composite attribute *Flight Info.*

6.11.12 Importance

6.11.12.1 Definition

The level of importance of a *Service.*

6.11.12.2 Domain/Unit of Measurement

- Local
- National

6.11.12.3 Description

"Local" refers to town or municipality. Features of local importance include restaurants, hotels, cinemas, etc. Most towns will have one or more.

"National" refers to national or international importance, for example, archaeological monuments (Stonehenge), memorials, theme parks (EuroDisney).

6.11.13 Number of Rooms

6.11.13.1 Definition

The number of rooms available to the public.

6.11.13.2 Domain/Unit of Measurement

Any positive integer within the field limits.

6.11.14 Opening Period

6.11.14.1 Definition

The period in which a Service is open for the public.

6.11.14.2 Domain/Unit of Measurement

The value should be expresses according to the Time Domain Syntax.

6.11.15 Parking Facilities Available

6.11.15.1 Definition

The number of parking places available.

6.11.15.2 Domain/Unit of Measurement

Any positive integer within field limits.

6.11.16 Priceband

6.11.16.1 Definition

The cost category of a service.

6.11.16.2 Domain/Unit of Measurement

- highest cost category
- second highest cost category
- third highest cost category
- fourth highest cost category
- fifth highest cost category
- sixth highest cost category
- seventh highest cost category
- eighth highest cost category
- lowest cost category

6.11.17 Restaurant Facilities Available

6.11.17.1 Definition

Whether restaurant facilities are available

6.11.17.2 Domain/Unit of Measurement

- Available
- Not Available

6.11.18 Railway Station Type

6.11.18.1 Definition

A classification reflecting the importance of a *Railway Station.*

6.11.18.2 Domain/Unit of Measurement

- Main Railway Station;
- Minor Railway Station;
- Underground/Metro Station;

6.11.18.3 Description

The difference between *Main/Minor Railway Stations* and *Underground/Metro Station* is whether the station gives access to the national railway network (or to one of the networks making up the national network) or to an (sub)urban network. Whether it is located underground or on ground level is of no importance. Consequently a *Main/Minor Railway Station* can be located underground and an *Underground Station* on ground level.

A *Railway Station* can have only one type. Consequently if a Railway Station both gives access to the national and to the urban railway network, it should be represented by two different *Railway Stations*.

6.11.19 Snack Served

6.11.19.1 Definition

Whether snacks or light refreshments are available

6.11.19.2 Domain/Unit of Measurement

- Available
- Not Available

6.11.20 Rating

6.11.20.1 Definition

The quality category of a *Service*. This may be based on any classification scheme such as the Automobile Association (UK), or Michelin (France) etc.

6.11.20.2 Domain/Unit of Measurement

- Unclassified
- 5th (Lowest) category
- 4th category
- 3rd category
- 2nd category
- 1st (highest) category

6.11.20.2.1 Number of Quality Classes

The number of classes and therefore also the class which represents the highest quality, will vary from one classification scheme to another.

6.11.21 Suitable for Disabled

6.11.21.1 Definition

Whether the *Service* is suitable for a disabled person, or people confined to a wheelchair.

6.11.21.2 Domain/Unit of Measurement

- Suitable
- Not Suitable

6.11.22 Telefax Number

6.11.22.1 Definition

The telefax number of the *Service*.

6.11.22.2 Domain/Unit of Measurement

The number should be specified according to the following standard syntax:

+(*country code*)-(*area code without leading zero*)-*local telefax number*
Example : +(44)-(171)-1234567
The value is a pointer to a name record.

6.11.23 Telephone Number

6.11.23.1 Definition

The telephone number of the *Service*.

6.11.23.2 Domain/Unit of Measurement

The number should be specified according to the same syntax as the telefax number. See 6.11.22.2.

6.11.24 Time Difference of Flight Connection

6.11.24.1 Definition

The difference in time between the destination and starting point of a flight connection, given by *ID of a Flight Connection*.

6.11.24.2 Domain/Unit of Measurement

The value should be expressed by Time Domain preceded with a "+" or a "-" sign depending on whether the destination is ahead or behind.

6.11.24.3 Description

This attribute can be used as a sub-attribute of the composite attribute *Flight Info.*

6.11.25 Time of Arrival of Flight Connection

6.11.25.1 Definition

The arrival time at the *Destination of Flight Connection* of a flight connection, given by *ID of Flight Connection.*

6.11.25.2 Domain/Unit of Measurement

Any point in time expressed according to the "Syntax for Time Domain" rules.

6.11.25.3 Description

This attribute can be used as a sub-attribute of the composite attribute *Flight Info.*

6.11.26 Time of Departure of Flight Connection

6.11.26.1 Definition

The departure time for a flight connection, given by *ID of Flight Connection*

6.11.26.2 Domain/Unit of Measurement

Any point in time expressed according to the "Syntax for Time Domain" rules.

6.11.26.3 Description

This attribute can be used as a sub-attribute of the composite attribute *Flight Info*

6.12 Attributes for Public Transport

6.12.1 Type of Public Transport Point

6.12.1.1 Definition

The functional significance of a *Public Transport Point*.

6.12.1.2 Domain/Unit of Measurement

- Timing Point
- Traffic Control Point
- Activation Point
- Turn Station
- Break Facility
- Parking Point
- Relief Point

6.12.2 Public Transport Mode

6.12.2.1 Definition

The type of public transport that is serving the *Route Link*.

6.12.2.2 Domain/Unit of Measurement

- Bus
- Light Rail
- Underground
- Rail

6.12.2.3 Description

It should be noted that a *Route Link* can be served by more than one Public Transport Mode.

6.12.3 Route Direction

6.12.3.1 Definition

Indication of whether the *Route* is in the positive or negative direction of the *Route Link*

6.12.3.2 Domain/Unit of Measurement

- Negative
- Positive

6.12.3.3 Description

Route Direction is only necessary if the *Route* consists of one *Route Link*. If a *Route* consists of more than one *Route Link* the direction of the *Route* already is indicated by the order of the *Route Links*.

6.12.3.3.1 Indication of a particular direction

The direction of the *Route Link* should be defined as seen from the start bounding Point Feature.

7. RELATIONSHIP CATALOGUE

7.1 Generic Specifications

7.1.1 Features and their Relationships

Some information related to real world objects needs to be modelled in the form of a relationship between features. For example "*Is Capital of*" is the relationship between "*Paris*" and "*France*". This chapter documents the relationships included in GDF.

The Data Model for the Relationship Catalogue is given in figure 7.1a, 7.1b and 7.1c.

All relationships are referenced by a particular relationship name. These names are written in *italics* in order to distinguish them from the daily life common usage terms from which they have been derived (e.g. : "*Service along Road Element*" versus "service along road element").

A feature may be involved in more than one relationship. Two different relationships may relate identical feature instances as with the relationships "*is seat of government of*" and "*is capital of*" to the feature instances "Paris" and "France".

7.1.2 Relationship types

All identical relationships between features belonging to the same feature class are said to belong to the same relationship type. E.g. the facts that Paris is the capital of France and Madrid is the capital of Spain can both be seen as instances of the relationship type "Is capital of" between two instances of the feature type "*Settlement*" and "*Country*" respectively.

7.1.3 Arity of a Relationship

Most information can be modelled in the form of binary relationships, i.e. relationships with only two partners, as in the above given examples of country capitals. However, cases exist that facts cannot be split into binary relationships with impunity. If one wants to express the fact that London Bridge leads High Street over the Thames, this can only be represented correctly by means of a ternary relationship between the three features "Brunnel", "Road Element" and "Waterway Element". Trying to split this fact into two binaries would cause loss of information.

The number of feature types in a relationship is called the arity of that relationship.

7.1.4 Partners of a Relationship

The feature types involved in a particular relationship are called the partners in the relationship. In the above mentioned example "City" and "Country" are the partners in the relationship "Is capital of".

A feature may be involved in more than one relationship. Two different relationships may relate identical feature instances as with "Is seat of government of" and "Is capital of" to the feature instances "Paris" and "France".

7.1.5 Relationship Type Names and Codes

In the digital data the relationship types will be referenced by a 4 digit, relationship type code. Appendix A1.6 lists the relationship type names and their associated codes.

7.1.5.1 User-Defined relationships

The standard supports the ability for a user to define relationships which are not already defined. For these, special Relationship Type Codes have been reserved (See appendix A1.6).

7.1.6 Homogeneous Relationships and their constraints

A relationship is called homogeneous if and only if at least two partners in that relationship are of the same feature type. Examples are the relationship *Prohibited Manoeuvre*, where each relationship involves at least two Road Elements. Another example is the relationship Grade Separated Crossing, where each relationship involves two Transportation Elements. Homogeneous relationships can be characterised according to the fact whether they are reflexive, symmetric, transitive or not. What these constraints mean is explained in the following sections by mathematical definitions.

7.1.6.1 Reflexivity

A relationship R is called reflexive over A if and only if for all x in A, (x,x) is an element of R. A relationship R is called irreflexive if and only if for all x, (x,x) is not an element of R Relationships that do not meet one of these conditions are called non reflexive. (Note that this not the same as irreflexive).

7.1.6.2 Symmetry

A relationship R is called symmetric if and only if for all x_i (x_n,x_1) is an element of R when (x_1,x_n) is an element of R.

A relationship R is called asymmetric if and only if for all x (x_1,x_n) and (x_n,x_1) are not both an element of R.
Relationships that do not satisfy one of these conditions are called non symmetric. (Note that this not the same as asymmetric).

7.1.6.3 Transitivity

A relationship R is called transitive if and only if for all x, y and z, (x,z) is an element of R when both (x,y) and (y,z) are elements of R. A relationship R is called intransitive if and only if for all x, y and z, (x,z) is not an element of R when both (x,y) and (y,z) are elements of R.

Relationships that do not meet one of these conditions are called non transitive. Note that this is not the same as intransitive.

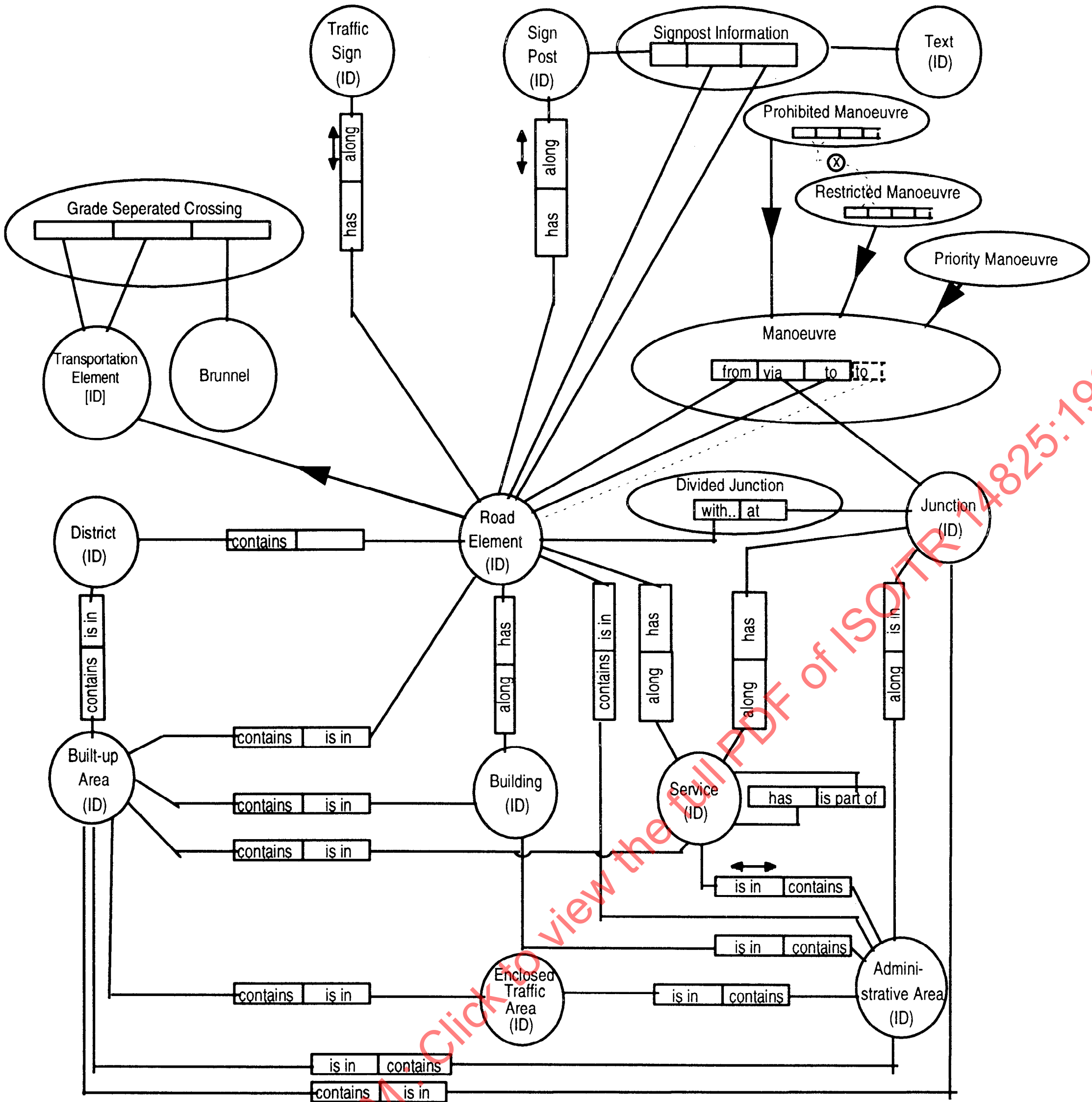


Fig. 7.1a: The Data Model for the Relationship Catalogue (Level 1, features)

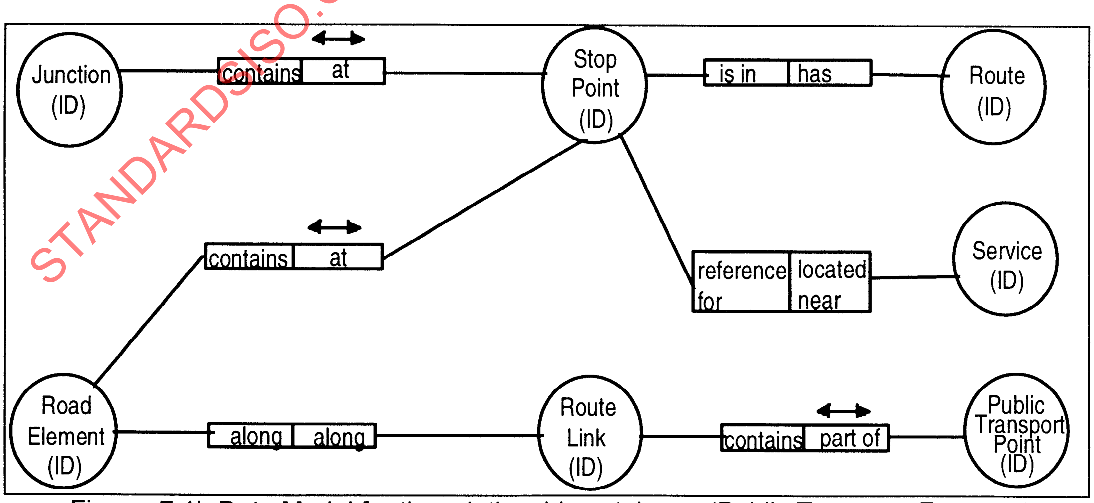


Figure. 7.1b Data Model for the relationship catalogue (Public Transport Features)

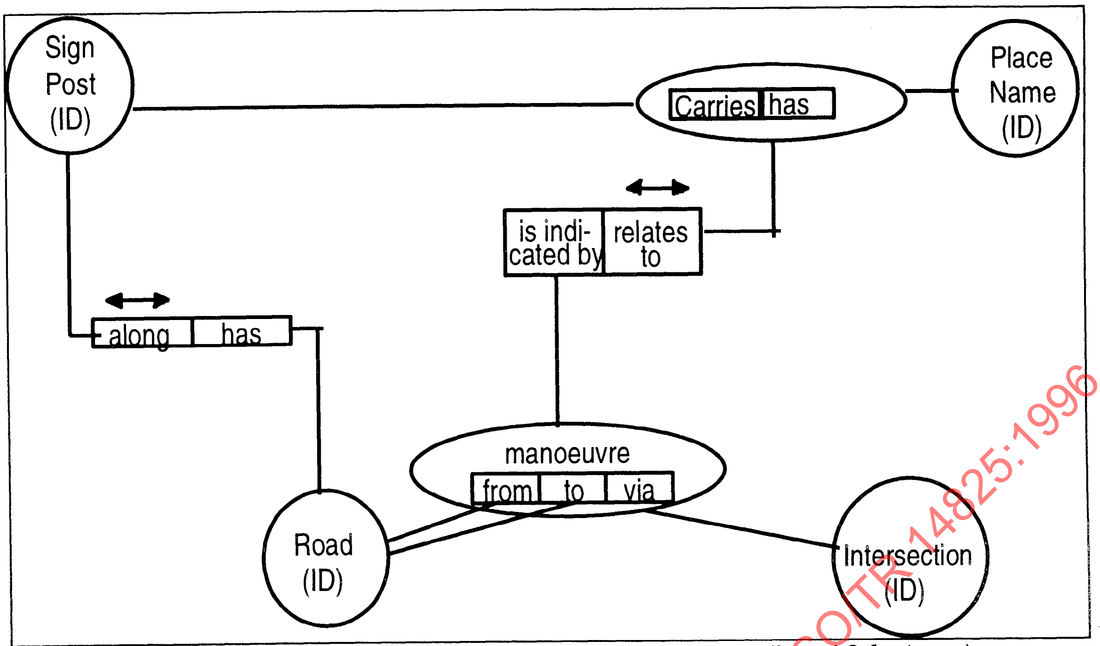


Figure. 7.1c Data Model for the relationship catalogue (Level 2 features)

7.2 Relationship Types

7.2.1 Road Element in Administrative Area

7.2.1.1 Definition

Which *Road Elements* belong to a particular *Order-8 Area.*

7.2.2 Junction in Administrative Area

7.2.2.1 Definition

Which *Junctions* belong to a particular *Order-8 Area*.

7.2.3 Building in Administrative Area

7.2.3.1 Definition

Which *Buildings* belong to a particular *Order-8 Area*.

7.2.4 Service in Administrative Area

7.2.4.1 Definition

Which *Services* belong to a particular *Order-8 Area*.

7.2.5 Built-up Area in Administrative Area

7.2.5.1 Definition

Which *Built-up Areas*, or parts of *Built-up Areas* , belong to a particular *Order-8 Area*.

7.2.5.2 Description

The relationship between *Built-up Areas* and *Administrative Areas* is many to many. That means that one *Administrative Area* may contain many different *Built-up Areas* and that one *Built-up Area* may belong to many different *Administrative Areas* because it may cross more than one boundaries.

7.2.6 District in Administrative Area

7.2.6.1 Definition

Which *Districts*, or parts of *Districts*, belong to a particular *Order-8 Area*.

7.2.6.2 Description

The relationship between *Districts* and *Administrative Areas* is many to many. That means that one *Administrative Area* may contain many different *Districts* and that one *District* may belong to many different *Administrative Areas* because it may cross more than one boundaries.

7.2.7 Enclosed Traffic Area in Administrative Area

7.2.7.1 Definition

Which Enclosed Traffic Areas belong to a particular Administrative Area.

7.2.8 Road Element in Built-up Area

7.2.8.1 Definition

Which *Road Elements* belong to a particular *Built-up Area*.

7.2.9 Junction in Built-up Area

7.2.9.1 Definition

Which *Junctions* belong to a particular *Built-up Area*.

7.2.10 Building in Built-up Area

7.2.10.1 Definition

Which *Buildings* belong to a particular *Built-up Area*.

7.2.11 Service in Built-up Area

7.2.11.1 Definition

Which *Services* belong to a particular *Built-up Area.*

7.2.12 Enclosed Traffic Area in Built-up Area

7.2.12.1 Definition

Which Enclosed Traffic Areas belong to a particular Built-up Area.

7.2.13 District in Built-up Area

7.2.13.1 Definition

Which *Districts* belong to a particular *Built-up Area*.

7.2.14 Road Element in District

7.2.14.1 Definition

Which *Road Elements* belong to a particular *District*.

7.2.15 Building along Road Element

7.2.15.1 Definition

Which *Buildings* are situated along a particular *Road Element*.

7.2.15.2 Description

This relationship identifies the *Road Element* along which the entrance of the *Building* is situated. It is also the *Road Element* that carries the street name that corresponds to the postal address of the *Building*.

In most cases the *Road Element* to which a *Building* logically “belongs”, will be the closest. However, this will not always be the case. See Figure 7.2.

One *Building* may belong to two or more different *Road Elements* if the *Building* has several entrances located at different *Road Elements*.

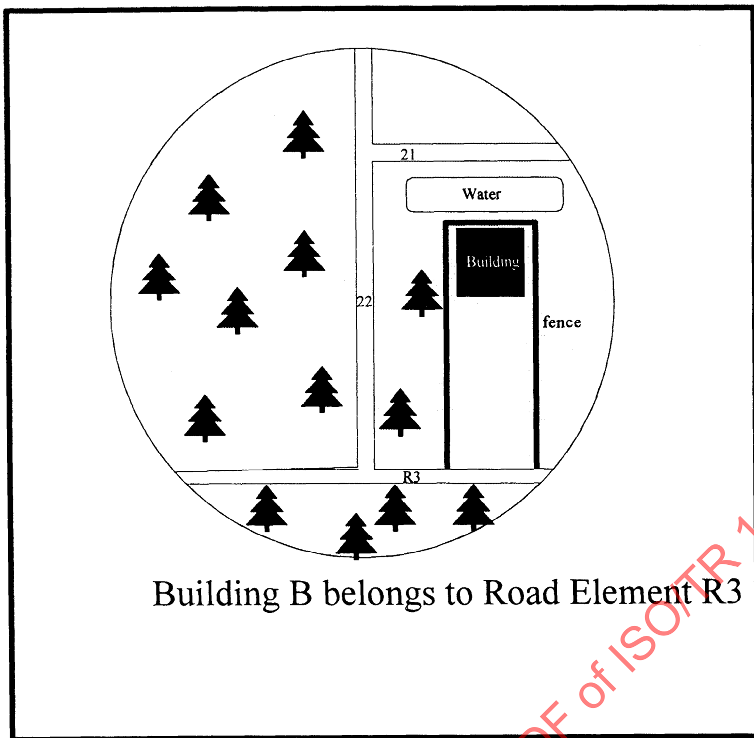


Figure 7.2 Building along Road Element

7.2.16 Service along Road Element

7.2.16.1 Definition

Which *Services* are situated along a particular *Road Element*.

7.2.17 Service along Road

7.2.17.1 Definition

Which *Services* are situated along a particular *Road*.

7.2.18 Service at Junction

7.2.18.1 Definition

Which *Services* are situated at a particular *Junction*.

7.2.19 Service at Intersection

7.2.19.1 Definition

Which *Services* are situated at a particular *Intersection*.

7.2.20 Service belonging to Service

7.2.20.1 Definition

Which *Services* functionally belong or are related to a particular *Service*.

7.2.21 Road Element leading to Enclosed Traffic Area

7.2.21.1 Definition

Which Road Elements lead to a particular Enclosed Traffic Area.

7.2.22 Road Element belonging to Service

7.2.22.1 Definition

Which *Road Elements* belongs to a particular *Service*.

7.2.23 Centre Point of Feature belonging to Feature

7.2.23.1 Definition

Which *Centre Point of Feature* is the centre of a Feature.

7.2.24 Divided Junction

7.2.24.1 Definition

A divided *Junction* is a description of a junction which has a physical or legal divider, that prevents crossing it in a particular direction. A *Road Element* is included in this relationship to indicate along which *Road Element* the *Junction* is divided. This implies that certain manoeuvres are prevented.

7.2.25 Road related object related to Road Element

7.2.25.1 Definition

A specification of the relation between a *Road Element* and a Road Related Object, a *Brunnel* or a *Road Furniture* feature

7.2.25.2 Description

This relationship specifies the fact that an object is located along, above or on a certain *Road Element*. The information contained can be further specified by attributes like *Width* and *Lateral Offset*.

Curvimetric positions of road-related objects are specified using attribute segmentation.

7.2.26 Prohibited Manoeuvre

7.2.26.1 Definition

A *Manoeuvre* which is physically possible but which is "prohibited" by means of legal measures, as denoted by traffic signs.

7.2.26.2 Description

Three different forms of prohibited manoeuvres can be distinguished. Examples are given in Figure 7.4a. These are:

- Prohibited because of one-way traffic flow on one of the *Road Elements* of the *Manoeuvres*. These are not required to be modelled as *Prohibited Manoeuvres*.
- All prohibited manoeuvres, indicated by traffic signs and not resulting from one-way situations on one of the *Road Elements* of the *Manoeuvres*. These are required to be modelled as *Prohibited Manoeuvres*. Examples for traffic signs indicating these situations are given in Figure 7.3.
- All prohibited manoeuvres, neither resulting from one way situations nor explicitly indicated by traffic signs, but resulting from the road network. These are required to be either modelled as *Prohibited Manoeuvres* or as *Restricted Manoeuvre*.

An example of the construction of a *Prohibited Manoeuvre* is given in Figure 7.4b.

Note that a *Prohibited Manoeuvre* relationship is not necessarily symmetrical: i.e. the reverse direction manoeuvre need not be prohibited.

Attributes may be added to this relationship for further description. For example, it may be used in conjunction with the attribute *Validity Period* to define changing circumstances through time. For example peak period only *Prohibited Manoeuvre*. The *Prohibited Manoeuvre* may also be used in conjunction with the attribute *Vehicle Type* for which the manoeuvre is prohibited.

7.2.26.3 Constraints

If a *Road Element* and *Junction* serve as the first two elements in a *Prohibited Manoeuvre,* it is not allowed that these have the same role in a *Restricted Manoeuvre* (see section 7.2.28) and vice versa.

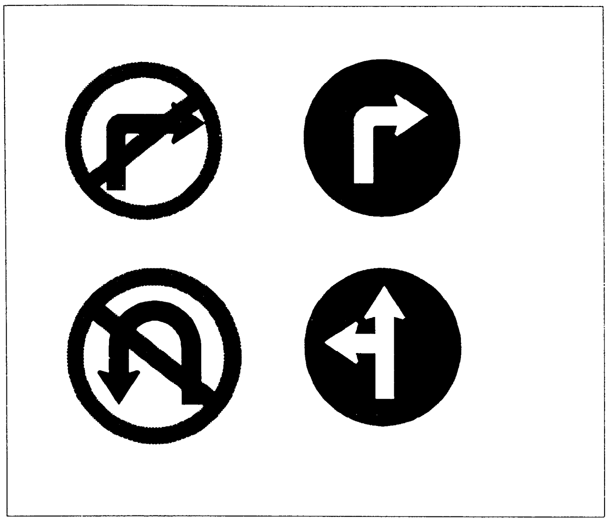


Fig. 7.3: Traffic Signs for *Prohibited Manoeuvre* and *Restricted Manoeuvre.*

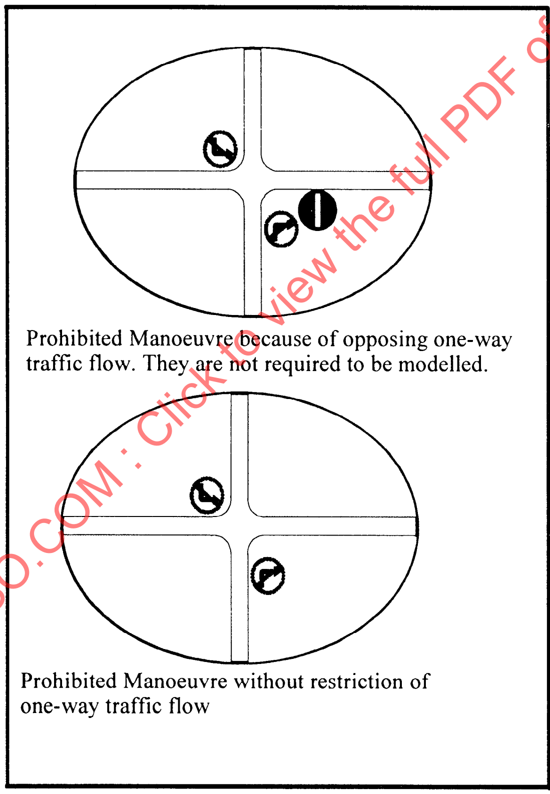
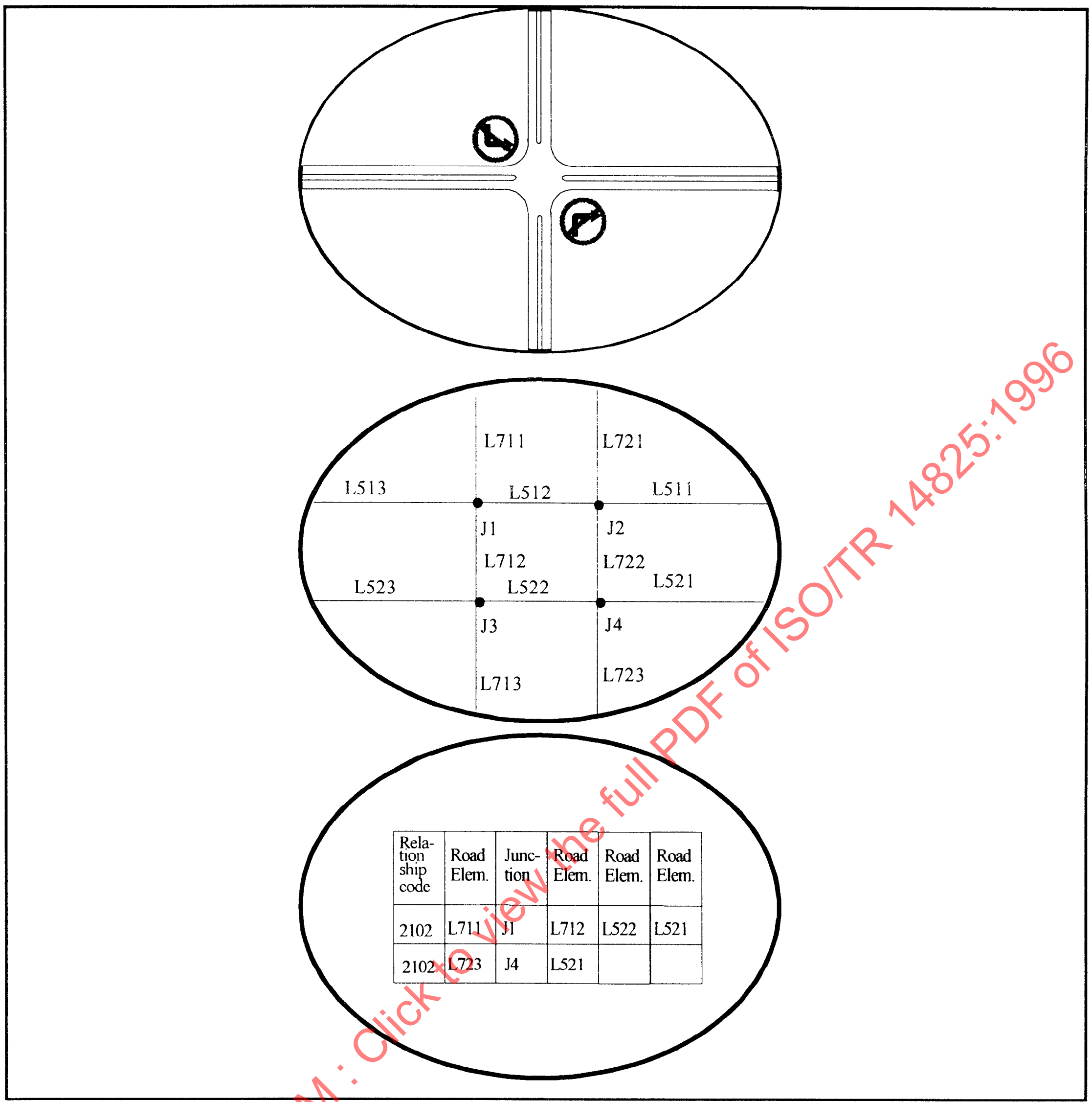


Fig. 7.4a: Examples of *Prohibited Manoeuvres*



Relationship code	Road Elem.	Junction	Road Elem.	Road Elem.	Road Elem.
2102	L711	J1	L712	L522	L521
2102	L723	J4	L521		

Fig. 7.4b: Representation of a *Prohibited Manoeuvre*

7.2.27 Priority Manoeuvre

7.2.27.1 Definition

The relationship *Priority Manoeuvre* describes a *Manoeuvre* which has priority.

7.2.27.2 Description

Two different forms of *Priority Manoeuvre* exist:

- An implicit form, implied from general traffic rules. For example “traffic coming from the right (or left) has right of way”.
- An explicit form, at a particular *Intersection* where right-of-way is indicated by means of traffic signs and which overrule the general traffic rules.

An example of a *Priority Manoeuvre* is given in Figure 7.5. Note that the relationship *Priority Manoeuvre* is not symmetric.

The relationship can only be used to describe static right of way situations. Priorities governed by traffic lights should not be described.

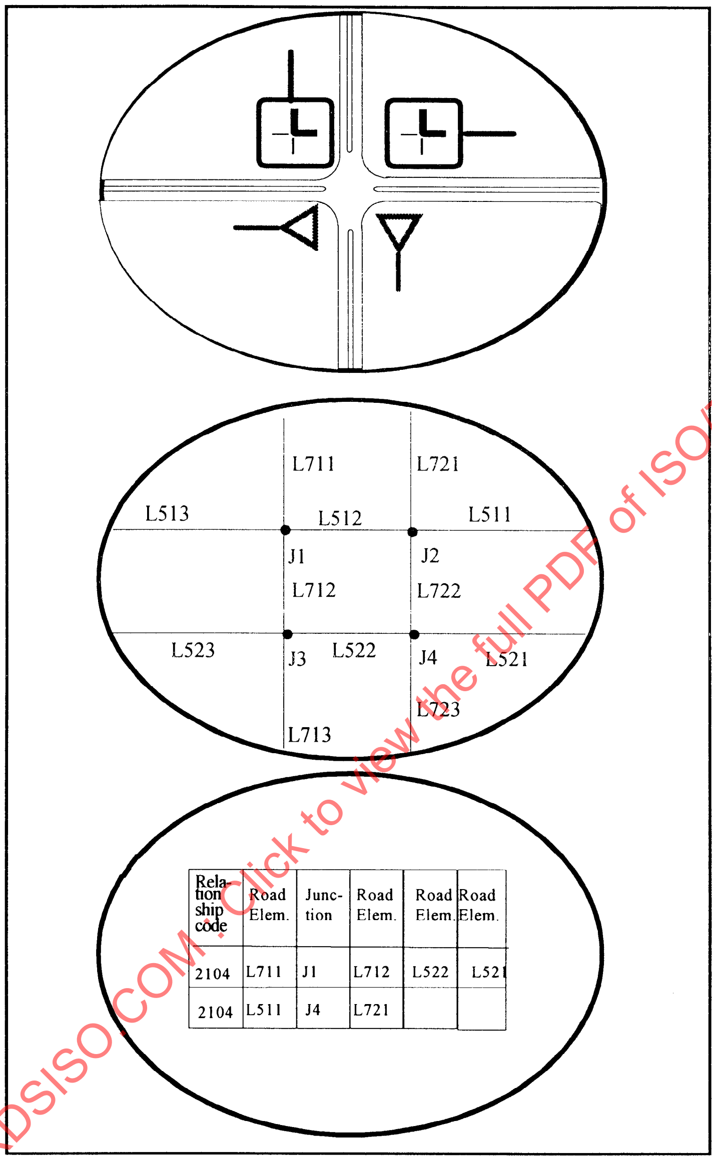


Fig. 7.5: Priority Manoeuvre

7.2.28 Restricted Manoeuvre

7.2.28.1 Definition

A manoeuvre which is explicitly permitted by means of legal measures, as denoted by traffic signs.

7.2.28.2 Description

The fact whether the Restricted Manoeuvre is the only possibility to manoeuvre from the specified *Road Element* via the specified *Junction* cannot be concluded from the relationship. The full description can be derived by taking all relationships *Restricted Manoeuvre* where the first specified *Road Element* and the *Junction* play the same role.

Three different forms of restricted manoeuvre can be distinguished:

- Restricted because of one-way traffic flow on one of the roads not belonging to the restricted manoeuvre but accessing the junction of this restricted manoeuvre. These situations are not required to be modelled as *Restricted Manoeuvre*.
- All restricted manoeuvres, indicated by traffic signs and not resulting from one-way traffic flow on one of the roads not belonging to the restricted manoeuvre but accessing the junction of this restricted manoeuvre. These are required to be modelled as *Restricted Manoeuvres*. Examples for traffic signs indicating these situations are given in Figure 7.3.
- All restricted manoeuvres, neither resulting from one-way situations nor explicitly indicated by traffic signs, but resulting from the road network. These are required to be either modelled as *Restricted Manoeuvres* or as *Prohibited Manoeuvre*.

Note that a *Restricted Manoeuvre* relationship is not necessarily symmetrical: i.e. the reverse direction manoeuvre need not be restricted.

Attributes may be added to this relationship for further description. For example, it may be used in conjunction with the attribute *Validity Period* to define changing circumstances through time. For example peak period only *Restricted Manoeuvre*. The *Restricted Manoeuvre* may also be used in conjunction with the attribute *Vehicle Type* for which the manoeuvre is restricted.

7.2.28.3 Constraints

If a *Road Element* and *Junction* serve as the first two elements in a *Restricted Manoeuvre,* it is not allowed that these have the same role in a *Prohibited Manoeuvre* (see section 7.2.26) and vice versa.

7.2.29 Grade Separated Crossing

7.2.29.1 Definition

A relation between exactly two *Transportation Elements* and one *Brunnel* representing parts of the road, railway or waterway network that passes **directly** over each other.

7.2.29.2 Constraint

The relationship is intransitive on its two components. This implies that when A passes over B and B passes over C via the same Brunnel, it is not allowed that A passes over C

The upper Transportation Element should always be referred to before the lower.

7.2.30 Signpost Information

7.2.30.1 Definition

A single or set of related signposts situated on a particular *Road Element* which correspond to a particular manoeuvre and describe in textual or graphical form the signpost information (For example, a place name or road number etc.)

7.2.30.2 Description

The logical information on a (set of) signpost(s) is expressed as a relationship between:

the (set of) signpost(s) itself,

- the *Road Element* on which the (set of) *Signpost(s)* is located,
- the first *Road Element* which leads exclusively to the destination indicated on the signpost and
- the *Text* information on the sign.

In practice the number of "physical" signposts referring to the same situation is of no importance. All the information can be considered as one "logical" signpost, belonging to this particular manoeuvre.

The following data-items on signposts are of interest:

- names of towns, villages or other names (e.g. names of industrial areas, conference centres, tourist attractions),
- route numbers and
- directional arrows.

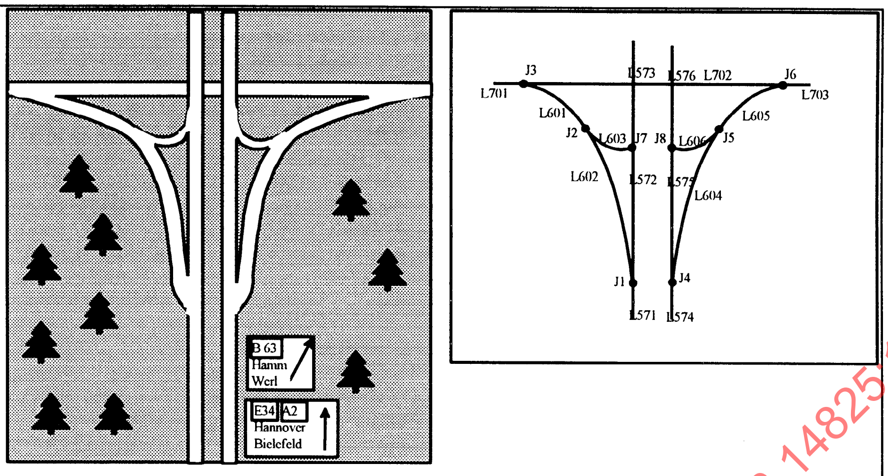
7.2.30.3 Notes

Text string and attributes describing the information on the sign as follows:

Each destination name should appear in a physically separated name record. These names should be assigned to the *signpost information* relationship in the order they appear on the sign.

Destination route numbers should appear as a route number attribute of the relationship record.

Some examples are given in Figure 7.7.



Relationship code	Road Elem.	Junction	Road Elem.	Attribute Value
2128	L574	J4	L604	Hamm
				Werl
				B63

Relationship code	Road Elem.	Junction	Road Elem.	Attribute Value
2128	L574	J4	L575	Hannover
				Bielefeld
				E 34
				A 2

Fig. 7.7: Signpost Information

7.2.31 Traffic Sign in + Direction of Road Element

7.2.31.1 Definition

A *traffic sign* that is relevant for traffic moving in a positive direction of the *Road Element* i.e. from Start point to End point.

7.2.32 Traffic Sign in - Direction of Road Element

7.2.32.1 Definition

A *traffic sign* that is relevant for traffic moving in a negative direction of the *Road Element* i.e. from End point to Start point.

7.2.33 Traffic Light in + Direction of Road Element

7.2.33.1 Definition

A *traffic light* that is relevant for traffic moving in a positive direction of the *Road Element* i.e. from Start point to End point.

7.2.34 Traffic Light in - Direction of Road Element

7.2.34.1 Definition

The type code of a *traffic light* that is relevant for traffic moving in a negative direction of the *Road Element* i.e. from End point to Start point.

7.2.35 Route Link along Road Element

7.2.35.1 Definition

Which *Route Links* , or part of *Route Links* belonging to a particular *Road Element*.

7.2.35.2 Description

This relation between *Route Link* and *Road Element* is many to many. One *Road Element* can contain more *Route Links* and one *Route Link* can contain more than one *Road Element*.

7.2.36 Stop Point along Route

7.2.36.1 Definition

Which *Stop Points* belong to a particular *Route*.

7.2.37 Stop Point along Road Element

7.2.37.1 Definition

Which *Stop Points* are located near a *Road Element*.

7.2.37.2 Description

This relation is use to indicate in which street the *Stop Point* is located. The segmented attribute value of the relationship record could be used to give a more accurate position of the *Stop Point*.

7.2.38 Stop Point at Junction

7.2.38.1 Definition

Which *Stop Points* are located near a *Junction*.

7.2.38.2 Description

In most cases a *Stop Point* has a relation with a *Road Element*. In the case where a bus stop is located on a *Junction* between two *Road Elements*, the *Stop Point* could be related to the *Junction*.

7.2.39 Stop Point located near Service

7.2.39.1 Definition

Which *Stop Points* are located near or is a reference point for a *Service*.

7.2.39.2 Description

This relation will be typically used to indicate which public transport stops are in the neighbourhood of a service. An example is: "Which bus stop or tram stops could be used to travel to a *theatre* (7318) or *museum* (7317)." This relation is many to many, a bus stop could be the reference location for more than one service and a service could have more than one bus or tram stops.

7.2.40 Public Transport Point along Route Link

7.2.40.1 Definition

Which Public Transportation Points belong to a particular Route Link.

8. FEATURE REPRESENTATION

8.1 Generic Specifications

8.1.1 Introduction

The objective of the feature Representation Scheme is to specify how the individual features should be represented by Nodes, Edges and Faces - the cartographic primitives.

8.1.2 Feature Categories

The Data Model (Figure 8.1) illustrates how features are divided into Complex features and Simple features. It also shows that Simple features can be either Point features, Line features, or Area features. A Point feature is a feature represented by one Node, a Line feature is a feature represented by one or more Edges and an Area feature is a feature represented by one or more Faces.

For the sake of simplicity, the terms “Point features, Line features, Area features and Complex features” are often abbreviated to “Points, Lines, Areas and Complexes”. These together form the four feature categories.

Features belonging to the same feature class (for example *Buildings*) need not all belong to the same feature category. For example, one *Building* may be seen as a Point feature, represented by an (isolated) Node, whereas another *Building* may be an Area feature, represented by a Face.

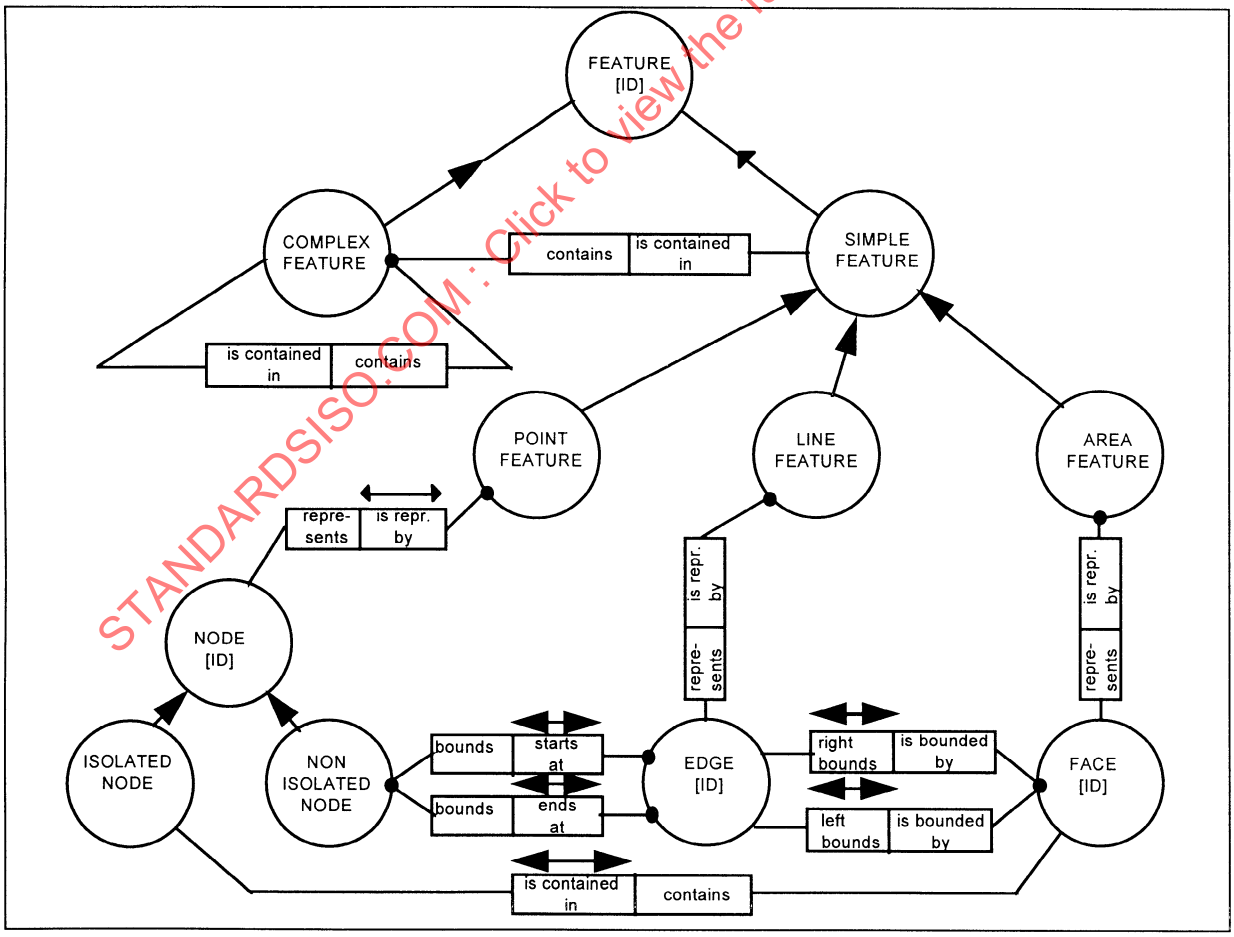


Figure 8.1 The Data Model illustrating how features are represented by the cartographic primitives Node, Edge and Faces

8.1.3 Levels of Representation

8.1.3.1 Level 0 : The Geometry

Level 0 describes the geometry of the map in terms of the cartographic primitives. It breaks the map down into its most basic form for representation. All elements of the map must therefore be represented in two dimensions on a single plane, i.e. as "planar".

Curved shapes have to be represented by a series of segmented straight lines. These segments, however, are not represented in an explicit form. Instead, a segmented shape is described by an ordered sequence of Intermediate Points. Each pair of consecutive Intermediate Points bounds exactly one Segment.

8.1.3.2 Level 1 : The Simple Features

Level 1 describes the map in terms of Simple features. These may take the form of either Points, Lines or Areas. For example a *Road Element* is a Simple Line feature, a *Junction* a Simple Point feature. On level 1, the level 0 elements receive a "real world" significance.

Level 1 representations may be non-planar (i.e. in three dimensions for example a grade-separated junction).

The following relationships exist between Level 1 and Level 0:

- Each Point in Level 1 must correspond to one Node from Level 0. A Node of Level 0 will be represented by 0, 1 or more Points at Level 1.
- Each Line in Level 1 must correspond to one or more Edges from Level 0. However, not every Edge in Level 0 corresponds to a Line in Level 1.
- Each Area must correspond to one or more Faces from Level 1.
- Each Edge either corresponds to (a part of) a Line or bounds a Face.

8.1.3.3 Level 2 : The Complex Features

Some features can be regarded as being composed of a group of Simple features, for example, an *Intersection* is a group of *Road Elements* and *Junctions*.

These composite features are called Complex features. They form Level 2 of the GDF.

Level 2 representations may be non-planar.

8.1.3.4 Symbolization

In this chapter, a fixed set of symbols is used for the visualisation of Level 2, Level 1 and Level 0 representations. These symbols are shown in Figures 8.2-8.4 .

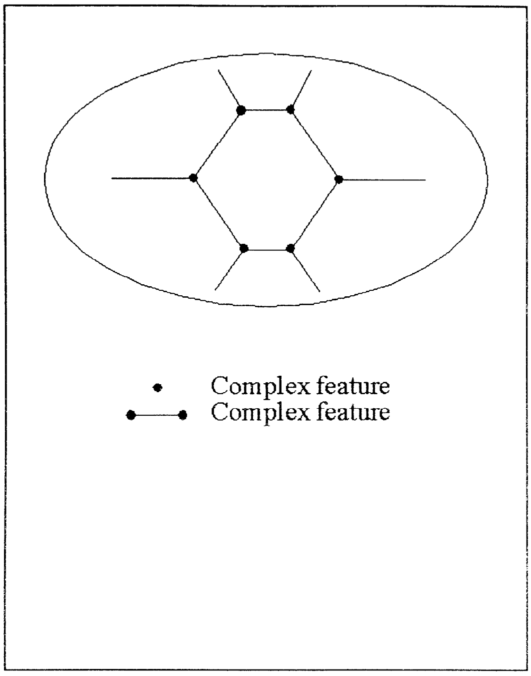


Figure 8.2 Symbols in a Level-2 representation

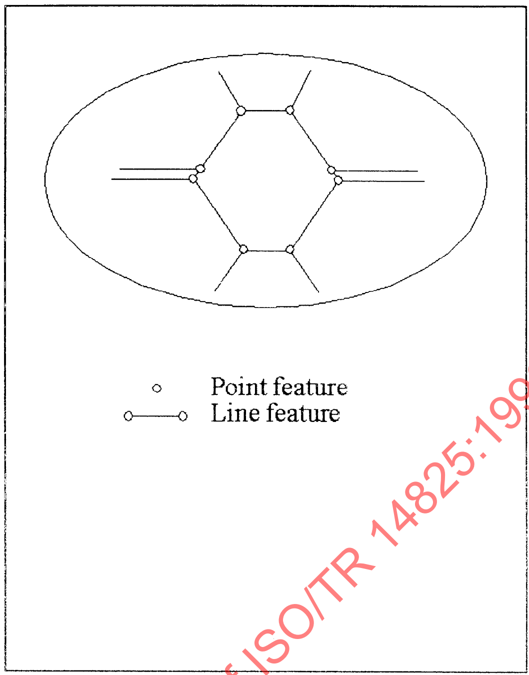


Figure 8.3 Symbols in a Level-1 representation

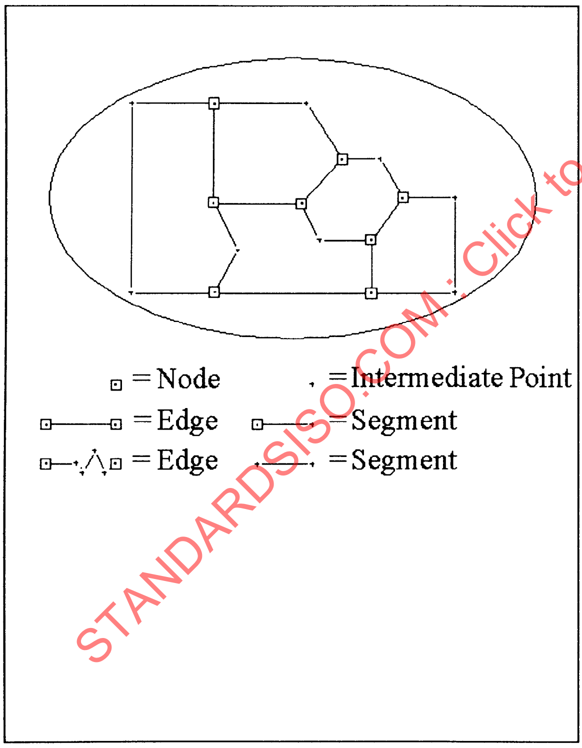


Figure 8.4 Symbols in a Level-0 representation

A generic overview of the concept of representation in three levels is given in figure 8.10.

8.1.4 Layers on Level 0

A layer contains the set of level-0 elements of a GDF which are fully topologically integrated. If two level-0 features are present in two different layers no topological integration has to take place.

Constraint : A feature theme shall always be represented completely within one layer.

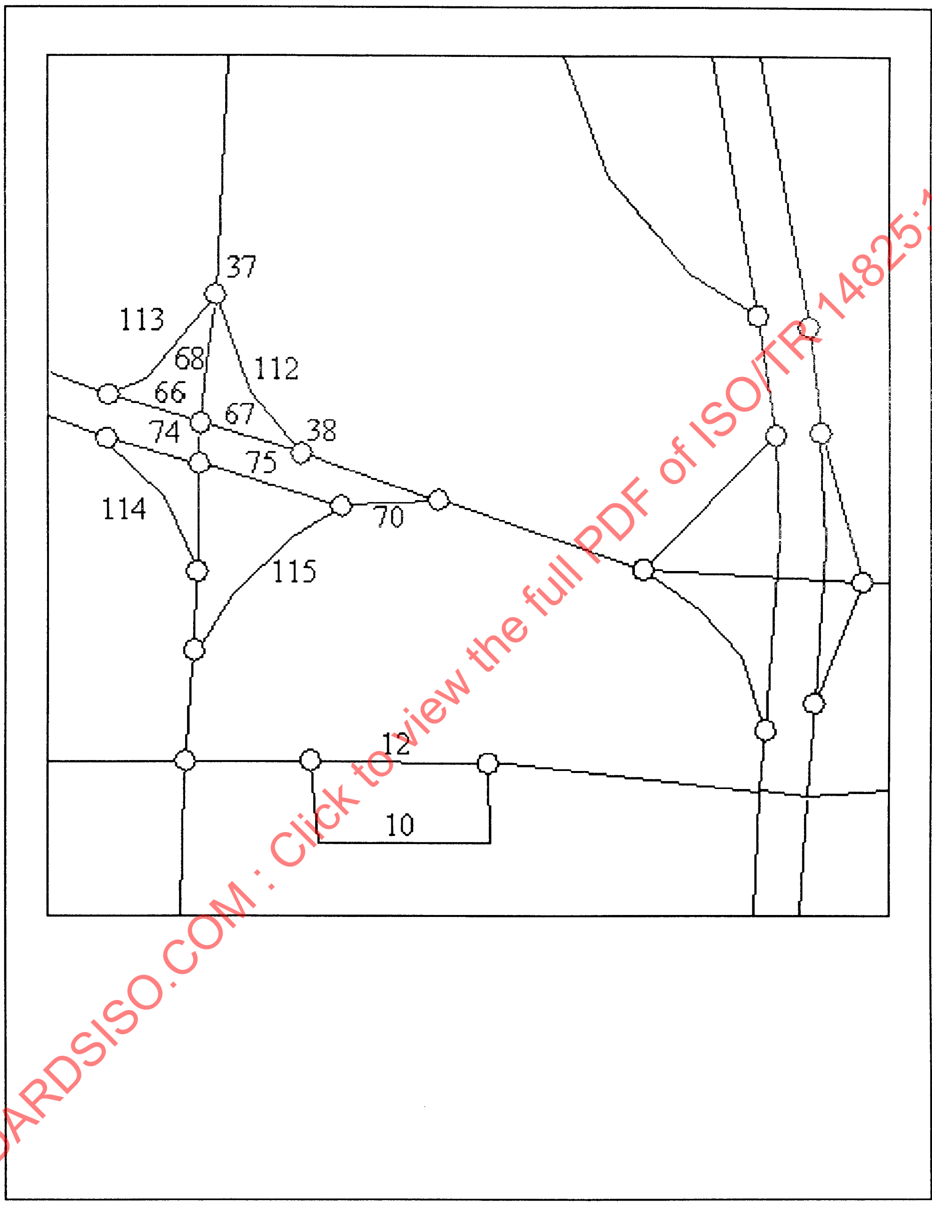


Figure 8.5 Level-1 representation of Roads and Ferries

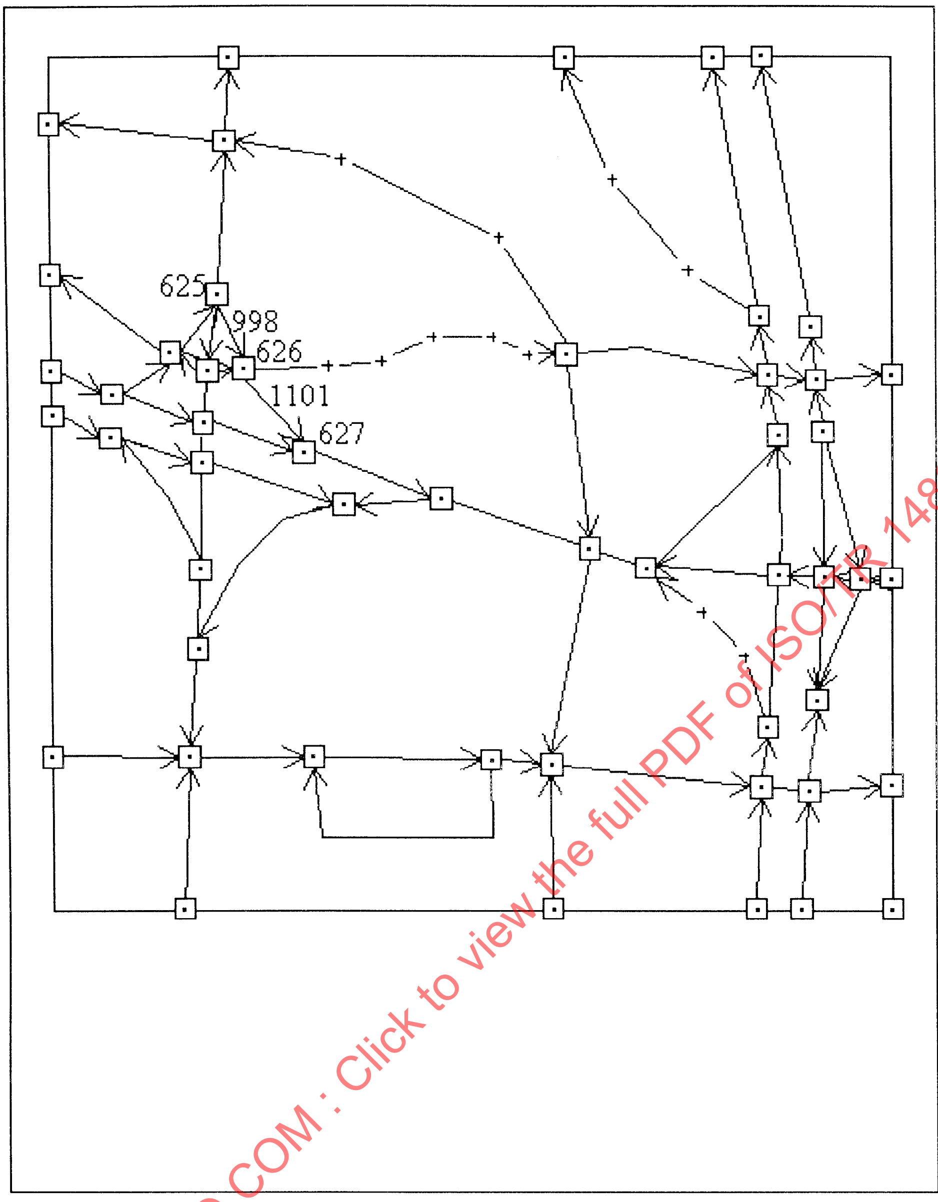


Figure 8.6 Level-0 representation of Roads and Ferries, Administrative Areas and Waterways

8.1.5 General Rules for Level 0 Representation

The process is illustrated by Figures 8.5 and 8.6. Figure 8.5 shows the representation of a theme (*Roads and Ferries*) in terms of Points and Lines. Figure 8.6 shows the corresponding representation in terms of Nodes, Edges, Segments and Intermediate Points.

For the construction of the Level 0 from the corresponding Level 1 representation, the following general rules apply:

- Each Level 1 Point feature shall be represented by a Node at Level 0. If two or more different Point features of the same feature theme share the same position, they should be represented by one single Node.

- Each intersection between a Level 0 Edge and the section border shall be represented by a Node. Nodes at the border of a section and Edges which coincide with the section border will have a status value of 1.
- Level-0 within one layer shall form a planar graph, i.e. no intersections of edges of the same layer are allowed.
- Different themes can be combined in one layer in which case a Level 0 element can be shared by Level 1 elements from different themes.
- Each Line feature shall be represented by one or more Edges.

The shape of an Edge is described by one or more Segments. The Segments are used only to represent the shape of the Edge. Below rules for a correct representation of different kinds of object shapes are given.

8.1.5.1 Straight Linear Objects

A Straight Line feature is represented by an Edge that contains only one single Segment. The location of this Segment is fixed by means of two pairs of coordinates which form the bounding Nodes of the Edge. Intermediate Points are not needed. An example is given in Figure 8.7.

8.1.5.2 Linear Objects with Kinks

Some Line features are not straight, but can be split into a distinct number of straight parts. These Lines can be represented by means of one or more Edges containing several Segments where each Segment corresponds exactly to one straight part of the Line feature. Intermediate Points bounding the Segments represent the Kinks. An example is given in Figure 8.8.

8.1.5.3 Curved Linear Objects

An approximated representation of a curved Line feature also will need to be made using straight Line Segments and Intermediate Points. In this case however, the positions of the intermediate points and thus their density will depend on how close an approximation is needed. An example is given in Figure 8.9.

The density of intermediate points is determined by the accuracy requirements.

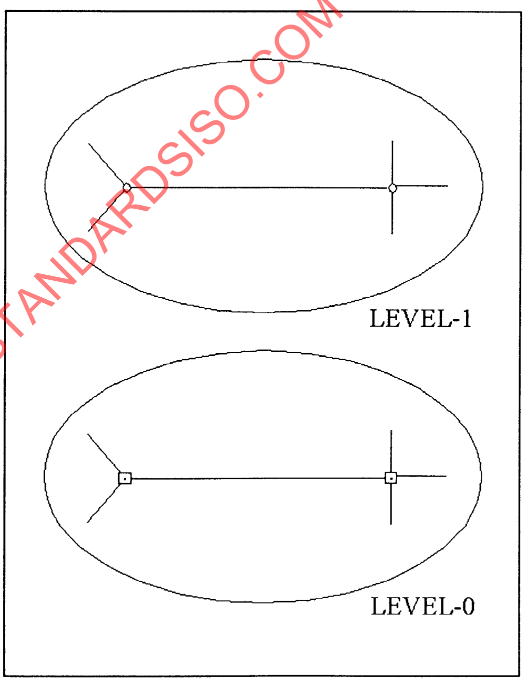


Fig. 8.7 Representation of straight lines

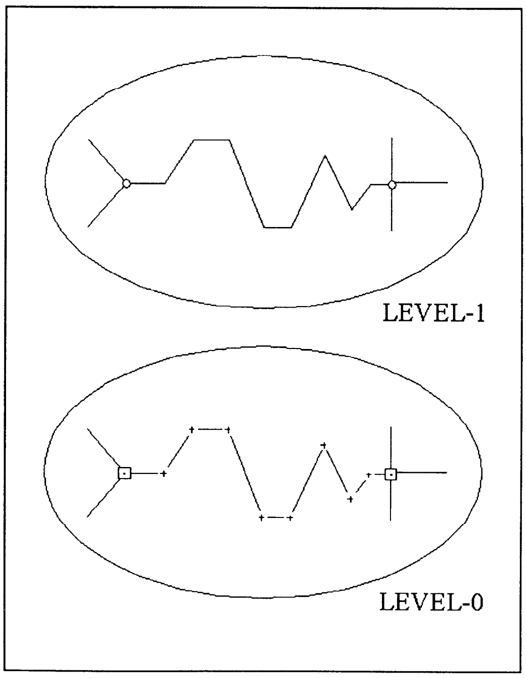


Fig 8.8 Representation of a segmented line

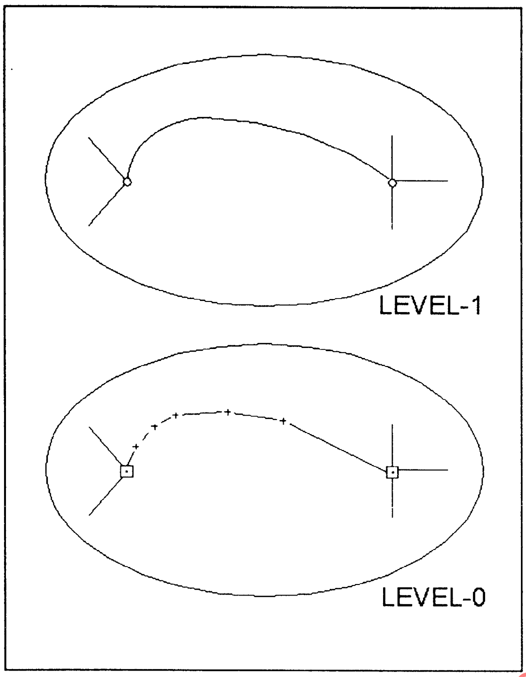


Figure 8.9 Representation of curved linear objects.

8.1.5.4 Angles between Curved Linear Objects

The representation of the angle between two intersecting Line features can only be approximated using Segments and Intermediate Points.

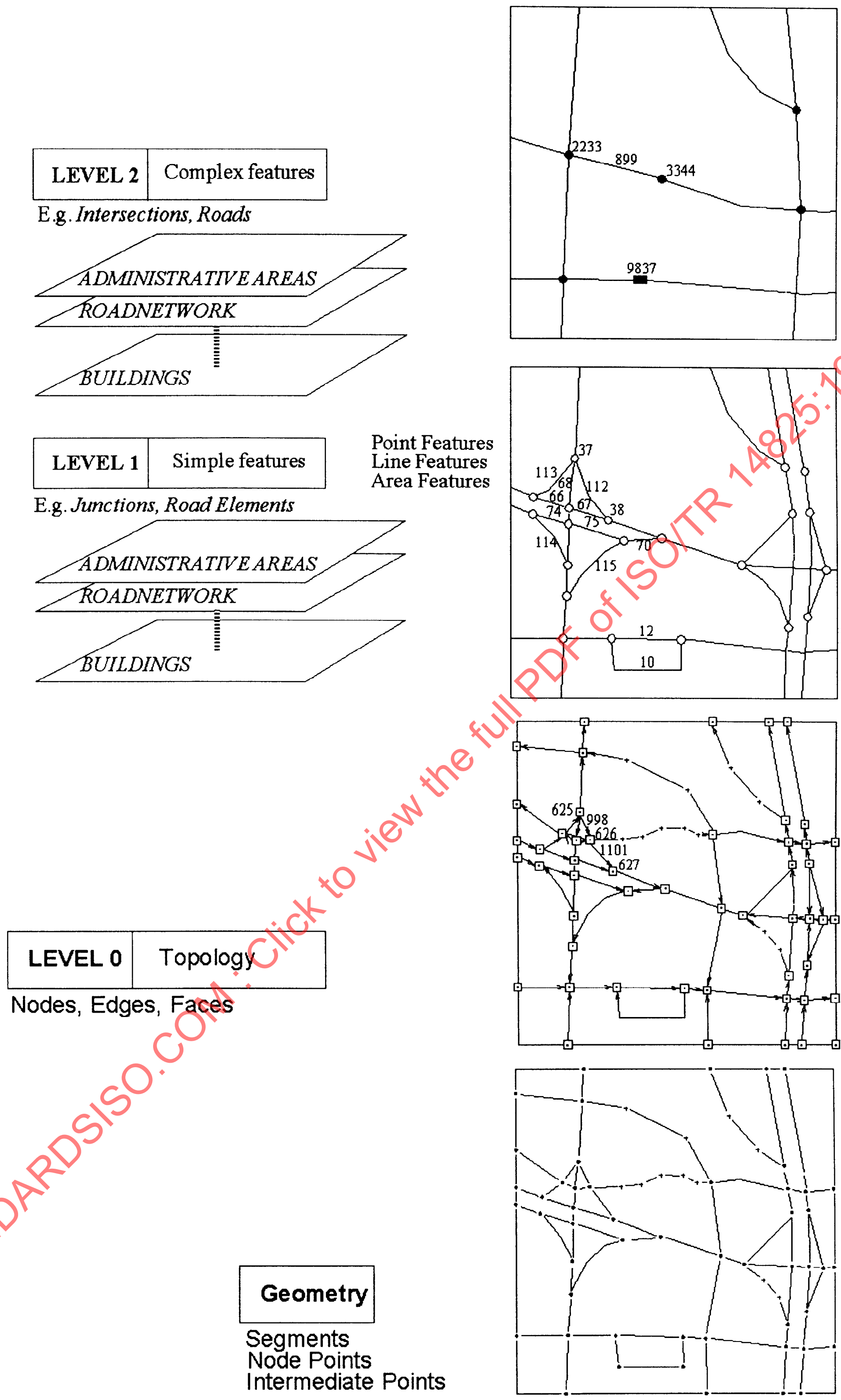


Figure 8.10 The building blocks of the three levels of representation

8.2 Roads and Ferries

This chapter describes the three different levels of representation (Level 0, Level 1, Level 2) for the feature theme *Roads* and *Ferries*.

8.2.1 Level 2 Representation

A *Road*, a *Ferry,* an *Intersection* or an *Aggregated Way* are Complex features.

8.2.2 Level 1 Representation

- A *Road Element* is always a Line feature, represented by one or more Edges at Level 0.
- A *Ferry Connection* is always a Line feature represented by one or more Edges at Level 0.
- A *Junction* is always a Point feature, represented by one single Node at Level 0.
- An *Address Area* is always an Area feature, represented by one or more Faces at Level 0.
- An *Address Area Boundary Element* is always a Line feature, represented by one or more Edges at Level 0.
- An *Enclosed Traffic Area* is always represented by an Area feature, represented by one or more Faces at Level 0.

8.2.2.1 Road Element

Road Elements are line features and are represented by one or more Edges at Level 0. They are represented by the centrelines of a road. In case the centreline of the road is ambiguous or discontinuous the general flow of traffic should be used as a guideline for defining the shape of the *Road Element*.

The Edges should fall within the kerb lines.

8.2.2.2 Junction

A *Junction* is always a Point feature, represented by one single Node at Level 0. The location of the *Junction* either corresponds to

- the connection point between two or more *Road Elements* or
- the intersection point between one or more *Road Elements* and the outline of an *Enclosed Traffic Area* or *Address Area*.

8.2.2.3 Enclosed Traffic Area

Within *Enclosed Traffic Areas*, the identification of a road centreline is an unrealistic task. Also a general flow of traffic is non-existent. These objects are therefore not represented by a Line feature but by an Area feature.

The connectivity of all *Road Elements* leading to one *Enclosed Traffic Area* can be described in two ways:

- by means of a number of bivalent Relationships defined between the *Enclosed Traffic Area* in question and each *Road Element* linked to it;
- by means of (artificial) *Road Elements* inside the *Enclosed Traffic Area* connecting the *Junctions* situated on the outline with an (artificial) centre point *Junction* somewhere inside the traffic area.

In the latter case, the Attribute Type *Form of Way* can be attached to the additional Road Elements in order to indicate their special status.

8.2.2.4 Ferry Connection

A *Ferry Connection* is always a Line feature represented by one or more Edges at Level 0.

8.2.2.5 Address Area

An *Address Area* is always an Area feature, represented by one or more Faces at Level 0.

8.2.2.6 Address Area Boundary Element

An *Address Area Boundary Element* is always a Line feature, represented by one or more Edges at Level 0.

8.2.3 Level 0 Representation

The general rules for the construction of a Level 0 representation are described in an earlier section. This section contains some worked examples and detailed rules relevant for *Roads and Ferries*.

8.2.3.1 Enclosed Traffic Area

The Face or Faces representing the *Enclosed Traffic Area* shall describe the maximum extent of the permitted area for vehicle use.

Special attention has to be paid to those situations where an *Enclosed Traffic Area* shares one or more of its outlines with the centrelines of a "normal" *Road Element*.

Figure 8.11 describes the situation where a parking area is directly situated along the side of a road. At Level 0 Edge C 203 is used for representation of both the centreline of the *Road Element* and the outline of the parking area.

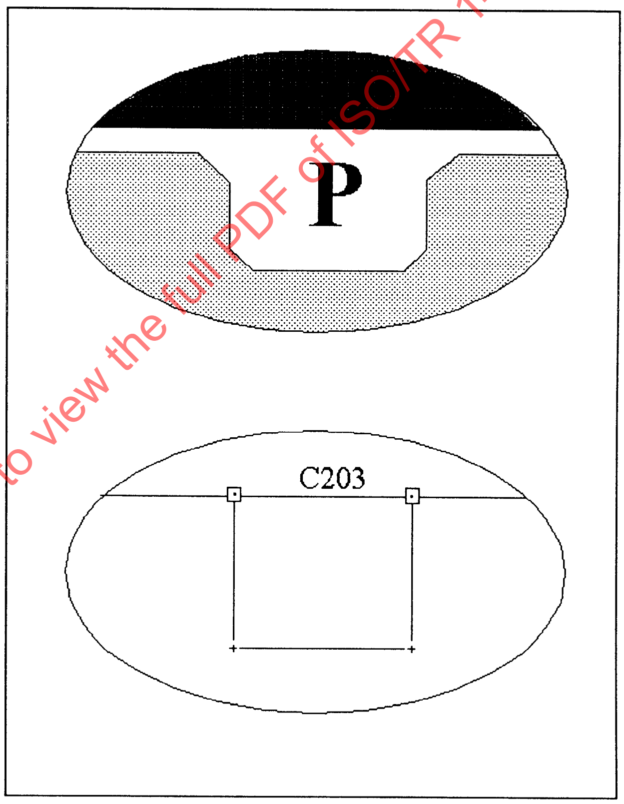


Figure 8.11 The Level-0 representation of a parking area

8.2.3.2 Ferry Connection

The Edge or Edges that represent(s) a *Ferry Connection* need to mirror the average route of the ferry boats. A detailed representation is not practical as the route may vary by season or by tide.

8.3 Administrative Areas

8.3.1 Level 1 and Level 2 Representation

8.3.1.1 Boundary Element

A *Boundary Element* is always treated as a Line feature. Every *Boundary Element* should be part of a set of *Boundary Elements* which together form a closed polygon, which means that "dead ends" or "dangling nodes" are not allowed.

To avoid dead ends at the borders of a particular map the border has to be represented as a *Boundary Element* as well, so that closed polygons can always be formed. See Figures 8.12 and 8.13.

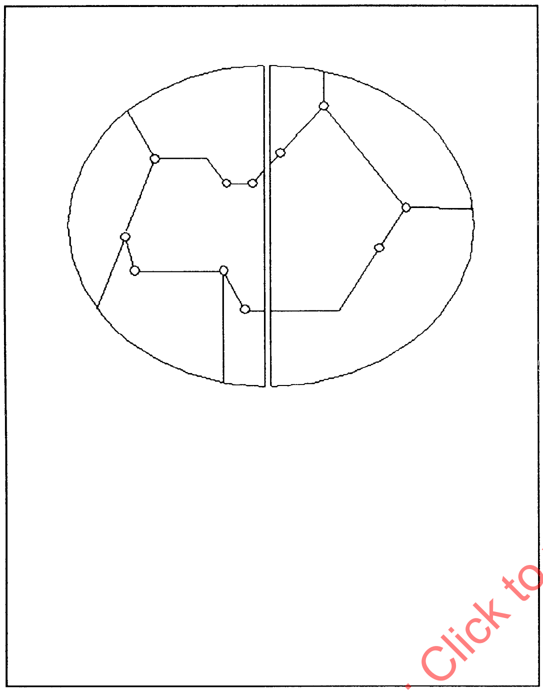


Figure 8.12 *Boundary Elements* are represented by one or more edges

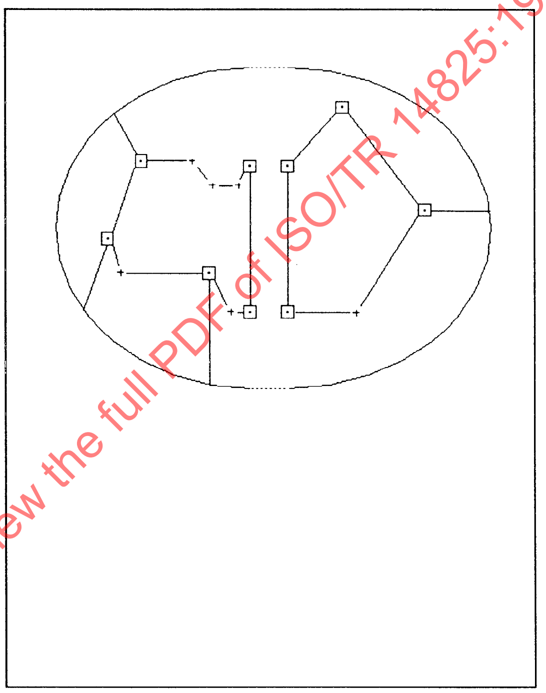


Figure 8.13 Map sheet borders have to be represented as *Boundary Elements* to avoid dangling nodes.

8.3.1.2 Boundary Junction

A *Boundary Junction* is always a Point feature represented by one single Node.

If a boundary of a particular *Administrative Area* (or parts of that Area) is not connected with any other boundary (in the case of enclaves or isolated parts), a *Boundary Junction* has to be introduced somewhere along its length in order to define at least one *Boundary Element*. (See Figure 8.14).

8.3.1.3 Order 9 Area and higher, Country

The lowest occurring order of *Administrative Areas* is generally an Area Feature represented by one or more Faces. If not, they should be represented as a Point Feature.

All *Administrative Areas* of higher order have to be seen as Complex features. They are composed of lower order *Administrative Areas*, either Area, Complex or Point features.

8.3.2 Level 0 Representation

The general rules for the Level-0 representation apply.

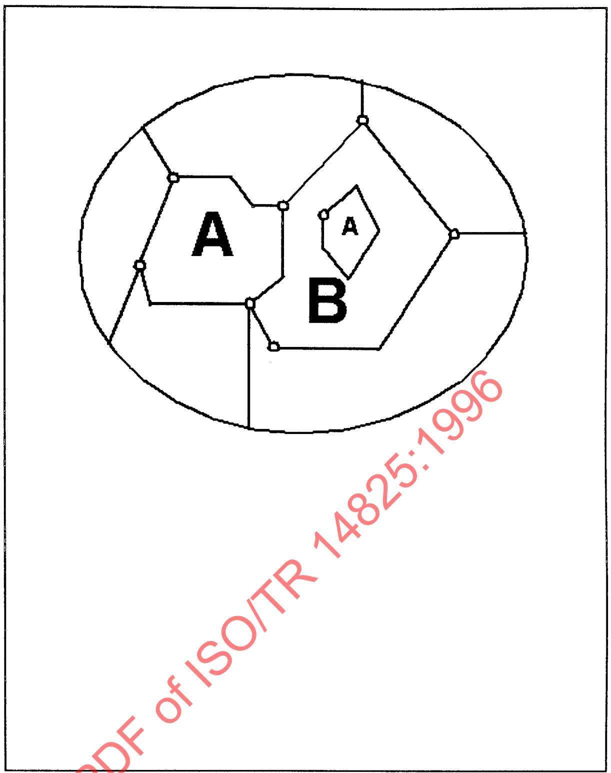


Figure 8.14 For an enclosed Area, a boundary junction must be introduced to define one boundary element

8.4 Settlements and Named Areas

8.4.1 Level 2 Representation

There are no Level 2 features in the *Settlements and Named Areas* theme.

8.4.2 Level 1 Representation

Settlements and Named Areas are generally represented as Area Features. If not, they should be represented as Point Features.

8.4.3 Level 0 Representation

The general rules for the Level-0 representation apply.

8.5 Land Cover and Use

8.5.1 Level 2 Representation

There are no Level 2 features in the *Land Cover and Use* theme.

8.5.2 Level 1 Representation

Features of *Land Cover and Use* are generally represented as Area Features. If not, they should be represented as Point Features.

8.5.3 Level 0 Representation

The general rules for the Level-0 representation apply.

8.6 Brunnels

8.6.1 Level 2 Representation

There are no Level 2 features in the *Brunnels* theme.

8.6.2 Level 1 Representation

Brunnels may be treated as Point features, Line features, or Area features.

Normally use can be made of existing geometry created for other features. New geometry may be created to more accurately represent the physical brunnel construction. Only in rare cases (e.g. a bridge over a valley), it is required to create Level 0 elements for the representation of a *Brunnel*.

Below rules are given for the representation of *Brunnels*

8.6.2.1 Brunnels as Point Features

In most cases, *Brunnels* will be seen as Point features, for example *Brunnels* situated on the crossing between two single carriageway *Road Elements*, as illustrated in Figure 8.15. The Level 0 representation of such a crossing will have one single Node. The same Node shall also be used to describe the location of the *Brunnel*, as shown in Figure 8.16.

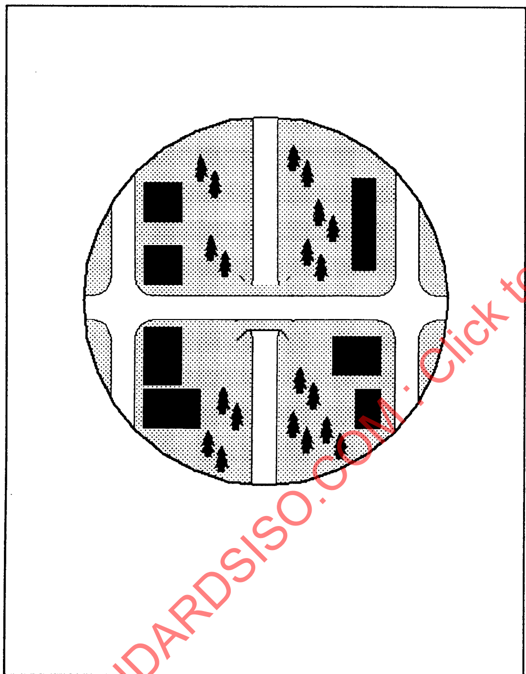


Figure 8.15 A *Brunnel* at the crossing of two single carriage roads

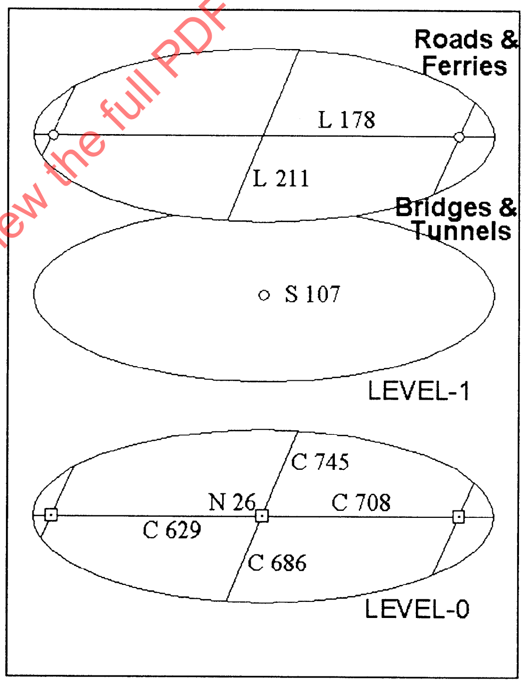


Figure 8.16 *Brunnel* as a point feature

8.6.2.2 Brunnels as Line Features

Brunnels related to a crossing between a single and a dual carriageway (see Figure 8.17) are treated as Line features as shown in the example in Figure 8.18.

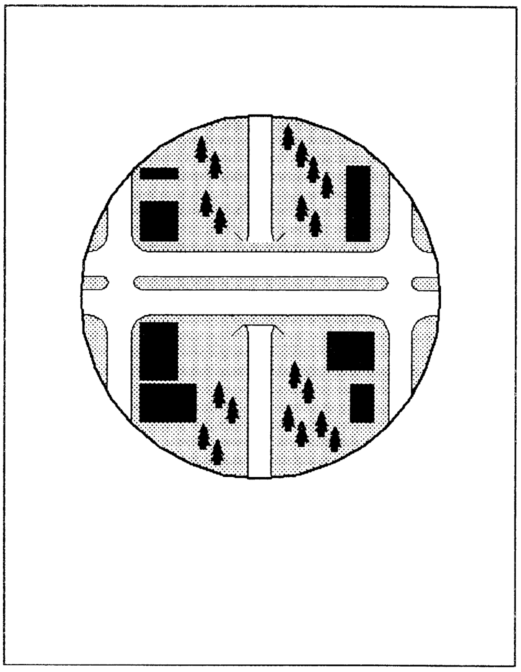


Figure 8.17 A *Brunnel* at the crossing of a single and dual carriageway road

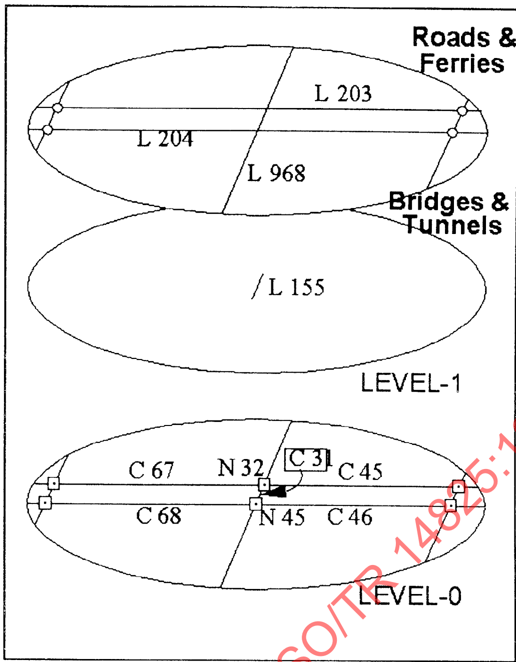


Figure 8.18 *Brunnel* as a line feature

In some cases (for example a tunnel through a mountain, or a very long viaduct), additional geometrical elements may need to be introduced for an accurate representation as illustrated in Figures 8.19 and 8.20.

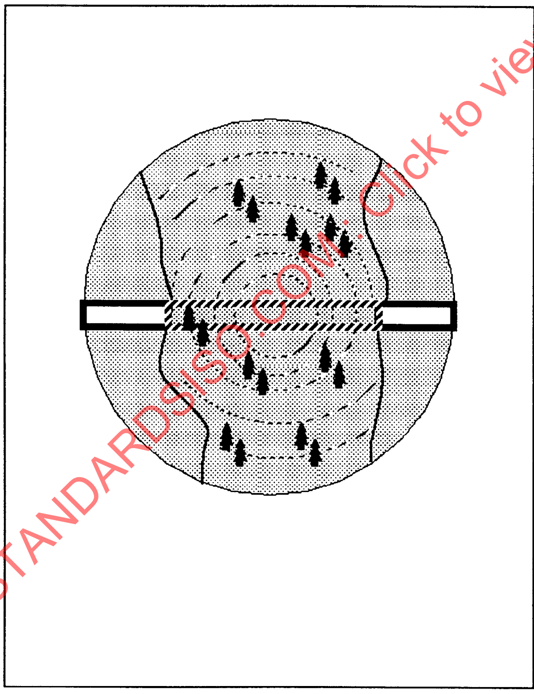


Figure 8.19 A *Brunnel* as a tunnel through a mountain

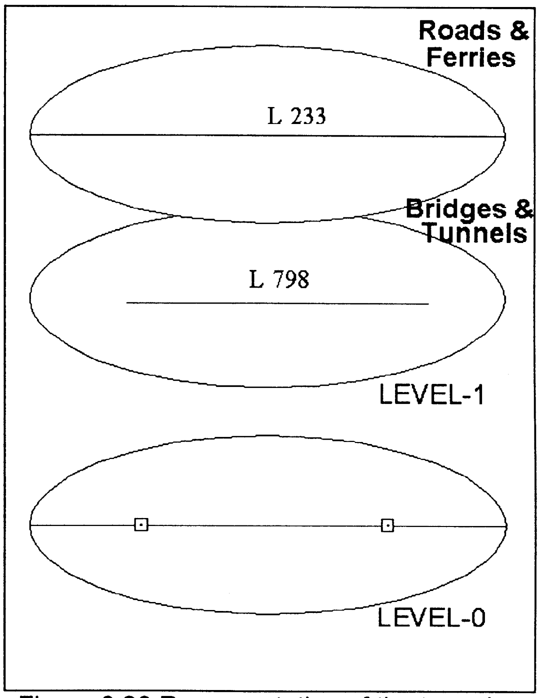


Figure 8.20 Representation of the tunnel at Level-0 and Level-1

8.6.2.3 Brunnels as Area Features

Brunnels related to a crossing between two dual carriageways (see Figure 8.21) can be treated in two ways, depending on whether it should be considered as one or two separate brunnel constructions:

- Representation as Area features, as shown in Figure 8.22.
- Representation as two (parallel) Line Features. Depending on the construction, either two bridges or two tunnels are created, both represented according to above Line Feature *Brunnels*.

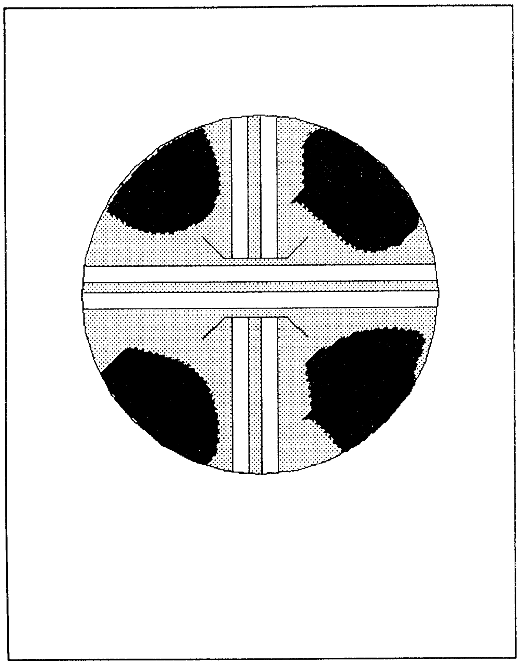


Figure 8.21 A *brunnel at the crossing of 2 dual carriageways*

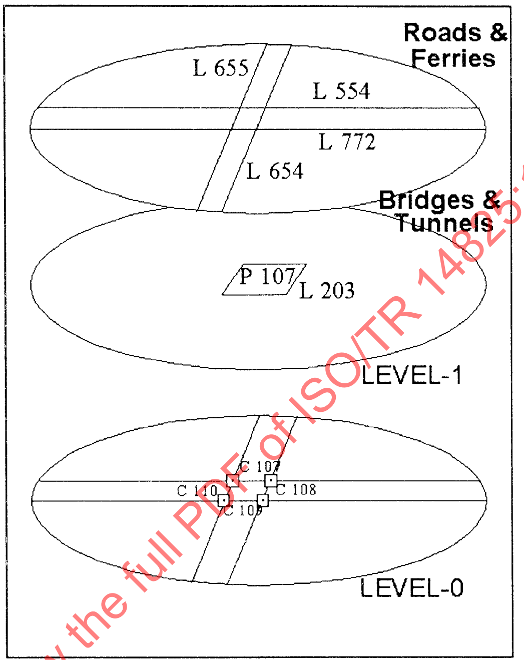


Figure 8.22 A *Brunnel* represented as an area feature

8.6.3 Level 0 Representation

The general rules for the Level-0 representation apply.

8.7 Railways

8.7.1 Level 2 Representation

There are no Level 2 features in the *Railways* theme.

8.7.2 Level 1 Representation

8.7.2.1 Railway Element
A *Railway Element* is always represented as a Line feature.

8.7.2.2 Railway Element Junction
A *Railway Junction* is always represented as a Point feature.

8.7.3 Level 0 Representation

The general rules for the Level-0 representation apply.

8.8 Waterways

8.8.1 Level 2 Representation

There are no Level 2 features in the *Waterway* theme.

8.8.2 Level 1 Representation

Water bodies can either be represented in three ways:

- by describing the outline of the water body;
- by describing the water itself, i.e. the area which is covered by water
- a combination of above methods

The representation of the second case (i.e. the coverage representation by means of *Water Elements*) considers whether the water body is of linear (e.g. rivers) or areal (e.g. lakes, wide rivers) nature or a landmark (spring, pond, etc.).

8.8.2.1 Water Element

A *Water Element* is either a Point Feature, a Line Feature or an Area Feature depending on its size and the defined accuracy. In the case of Point Features, the centre point of water bodies is represented. With Line Features, the centreline is described. In case of Area Features, the physical extent is represented.

When the width of a *Water Element* does not exceed xx meters, it should be treated as a Line feature. Otherwise, it forms an Area feature. If along a river or canal the width varies around yy meters, so that the representation changes very often between line and area, one of these representations shall be chosen for a longer distance. Transitions between line and area representations should be kept to a minimum.

When the length or diameter of a *Water Element* does not exceed zz meters, it should be treated as a Point feature. This Point shall correspond to the centre point of the cartographic representation in the source map.

The values for xx, yy and zz is user and/or application dependent.

8.8.2.2 Water Boundary Element

A *Water Boundary Element* is always represented as a Line feature. It is directed to describe to which side of the boundary the water exists (see Feature Catalogue).

8.8.2.3 Water Boundary Junction

A *Water Boundary Junction* is always represented as a Point feature.

8.8.3 Level 0 Representation

The general rules for the Level-0 representation apply.

8.9 Road Furniture

8.9.1 Level 2 Representation

There are no Level 2 features in the *Road Furniture* theme.

8.9.2 Level 1 Representation

A *Road Furniture* feature is always represented as a Point feature.

8.9.3 Level 0 Representation

The general rules for the Level-0 representation apply, except that it is not required to collect the position (i.e. the coordinates) of the Road Furniture features.

8.10 Services

8.10.1 Level 1 and Level 2 Representation

All *Service* classes are represented as either being Point or Area features.

8.10.2 Level 0 Representation

The general rules for the Level-0 representation apply, except that it is not required to collect the position (i.e. the coordinates) of Service features.

8.11 Public Transport

8.11.1 Level 2 Representation

Lines, *Routes* and *Stop Areas* are represented as Complex features.

8.11.2 Level 1 Representation

A Stop Point, a Public Transport Point and a Public Transport Junction are always Point features.
A Route Link is represented as a Line feature.

8.11.3 Level 0 Representation

The general rules for the Level-0 representation apply.

8.12 General Purpose Features

8.12.1 Level 1 and Level 2 Representation

Centre Point of Feature is always represented as a Point feature.

8.12.2 Level 0 Representation

The general rules for the Level-0 representation apply.

9. QUALITY DESCRIPTION SPECIFICATIONS

9.1 Introduction

9.1.1 Scope of this document

This specification is limited to generic definitions of terms and methods related to the description and measurement of quality. Based on this foundation, one can define individually determined quality levels. However, applying this common quality description scheme ensures that different digital map databases can be assessed on their quality and compared. Dedicated application data content and quality requirements can be based on this chapter.

Data Content and Data Quality depend mainly on application requirements, i.e. different applications need individually composed datasets with a particular content and quality. However, even within one application area such as car navigation, the required map information might differ governed by the functionality of a certain system or the services supported by an application.

In order to provide an indication of what could be contained in a dataset, Appendix B1.1 includes examples of possible compositions of GDF datasets. Sample data content and quality requirements are given for car navigation systems and fleet and freight management systems.

9.1.2 Subject to which this Specification applies

Within the GDF context only topological-structured vector maps are *digital maps* in the sense referred to in the following chapters.

The specified quality measurements focus on the "large scale" domain of geographic databases, as this kind of *digital maps* is specified in the related GDF catalogues (i.e. the Feature Catalogue, the Attribute Catalogue, the Relationship Catalogue and the Feature Representation Scheme).

9.2 Quality Description and Measuring Methods

9.2.1 Description of Data Quality

9.2.1.1 Introduction

In order to describe *quality* of a digital map, the content of a data set must be compared to the real world situation which the digital map represents. Depending on the purpose of the digital map, conformance to reality must be achieved within defined limits.

A quality checking process requires

- the definition of standardized quality measuring methods

and

- the assignment of quality levels to each measurement.

The measuring methods enable a reasoned assessment of whether the quality of a digital map is sufficient. The checking process will help the evaluator decide whether to accept or reject datasets based on the assigned level.

9.2.1.2 Descriptive Terms for Data Quality of Geographic Databases

The definitions made below are used in the following sections to indicate which quality aspects are treated by certain quality measuring methods and quality checks.

The definitions are also used in the GDF Global Data Catalogue where several quality records are specified.

9.2.1.2.1 Resolution

The smallest unit of measurement which can be described by means of attribute values or coordinate values (e.g. if coordinates are rounded to within 0.5 m the spatial resolution will be 0.5 m). The resolution provides a limit to precision and accuracy. It can be used to qualify attributes and coordinates.

9.2.1.2.2 Precision

The closeness of measurements of the same phenomenon repeated under essentially the same conditions and using the same technique (calculation as standard deviation of a single observation).

Precision is used to qualify a specific digitizing operation or any kind of elementary operation of data capturing.

9.2.1.2.3 Accuracy

The deviation from the results of observations, computations, or estimates to true values or the values which are accepted as being true.

In a GDF, accuracy is used for the qualification of coordinate values and quantitative attribute values.

9.2.1.2.4 Correctness

Whether a real world data item is correctly recorded according to a specified data catalogue.

9.2.1.2.5 Completeness

The percentage of data items which are actually in the dataset compared with the items that should be in it.

9.2.1.2.6 Up-to-dateness (Currency)

This is specified by:

- The date of survey (not date of publication);
- The ageing rate of the elements in that dataset.

The ageing rate of a particular data item is the percentage, that appear disappear, or change in one or more of its relevant characteristics within a given period. The ageing rate has an effect on the Completeness and Correctness. Therefore, Up-to-dateness is measured within Completeness and Correctness.

9.2.2 Methods for Quality Measurement

The quality measurement of a data set consists of two different parts:

- *Format Quality Checking*

The extent to which the information contained is stored in the correct way.

- *Semantical Quality Checking*

The extent to which the information contained corresponds to reality. This cannot be checked before the format is error free.

9.2.2.1 Format Quality Checking

This part can be implemented in an automatic way because the reference is clearly specified, i.e. the GDF format specification.

The checking process should consider the following:

Error groups	Examples
Syntax errors	Use of characters not defined in a character set Incorrect record length Incorrect field length Field Type violation Incorrect record padding Justification errors
Value errors	Incorrect Record Descriptors Incorrect Record Codes Incorrect Feature Codes Incorrect Attribute Codes Incorrect Relationship Codes Incorrect Split identifier Value outside Min/Max range
Database integrity errors	Incorrect Pointers Incorrect Field Counter values
Topology errors	Level-0 objects sharing geometry Incorrect Face definition Point Features sharing nodes Disconnected Line Features
Value integrity errors	Incorrect Feature - Attribute relation Incorrect Feature - Relationship relation Incorrect Relationship - Attribute relation Co-ordinates outside Section Boundary

Note: In a software implementation of format checking, the checks may be structured differently, i.e. functionally.

Semantical quality checking of GDF datasets is only meaningful, if applied on a GDF with an error free data format..

9.2.2.2 Semantical Quality Checking

Semantical quality checking is the essential quality aspect of map-based applications which are designed to operate in reality. At the same time, it is the more complex task compared with format quality checking, because the reference (i.e. reality) is more complex. Each data object is referenced to its own corresponding object in the real world.

Semantical quality checking in turn employs two methods:

- *direct quality checking*

  The data itself or a significant sample from the data will be compared with reality or another valid reference.

- *indirect quality checking*

  The quality of a data set is defined indirectly by checking whether the aspects of the data set production (such as used geometrical source material, organization of field work, organization of production) meet criteria as defined in ISO 9000.

Direct quality checks are more relevant to *Digital Maps*. This standard gives specifications of how *direct quality checks* should be implemented. The implementation of *indirect quality checking* is not specified.

9.2.3 Direct Semantical Quality Checking

9.2.3.1 Sampling Method

Only the checking of significant samples from a database is reasonable. Taking the necessary expenditure for checking all items of a database into account, the sampling technique yields results with a sufficient rate of certainty.

The sampling process consists of several steps:

- First the acceptable rate of uncertainty must be defined.
- Based on this and on the total number of items in the lot (see 9.2.3.2) to be checked, the sample size is defined.
- Then the values of characteristics of the items contained in the taken sample will be checked.
- The result will be compared with some standard error rate and the set of items will be either completely accepted or rejected.

The ISO standard 2859 which covers the above topic is to be applied.

9.2.3.2 ISO 2859 "Sampling procedures and tables for inspection by attributes"

ISO 2859 provides mathematically founded criteria for the determination of sampling-decisive parameters (sample sizes, inspection levels, etc.) and gives guide-lines for the installation of an inspection procedure. Originally, it was developed to meet the needs of industrial production where products consist of clearly identifiable components.

The following definitions are given in ISO 2859:

- The resulting flow of new products is subdivided into *Batches* or *Lots* which form the sets of items to be checked on their quality.

- The items within a *Lot* are called *(Production) Units*.

- A quality test of a representative sample taken from the *Lot* will be carried out by inspecting the *Attributes* of the *Units* contained in the sample (contrary to the meaning in GDF, *Attributes* are components, aspects or characteristics of an object which can be checked on their quality).

- An incorrect *Attribute* (compared with reality) is called a *Defect*. A *Unit* is called a *Defective Unit* if one or more *Defects* occur. A *Unit* without *Defects* is *correct*.

- The maximum acceptable value for the average error rate is the "*Acceptable Quality Level*" (AQL). The definition of AQLs is user-specified depending on external quality requirements.

ISO 2859 presumes that products are the results of a continuous and stable production process. With respect to map databases, this means:

- stable production environment (hardware, software, operators);
- consecutive production;
- source material of homogeneous scales for whole coverage of database;
- internal quality checking procedures for whole coverage of database.

9.2.3.3 Applying ISO 2859 on Digital Map Databases

With respect to digital maps, the sampling and inspection procedures proposed in ISO 2859 must be adapted. The defined terms need to be translated into GDF terms regarding their application on the checking of GDF data sets. The main task is to determine what should be considered as the unit of production of road databases. From this, the basis for all percentages on quality follows.

For GDF maps the following definitions are made:

ISO term	Meaning with respect to GDF quality specifications
Lot	Data set with contiguous coverage without holes, resulting from consecutive production under stable production conditions.
Unit	"Sample Feature" (*definition below*)
Attributes	• Geometry • Existence and Topology for GDF Level-1 [1] • Existence and Topology for GDF Level-2 [1] • GDF Attribute values • GDF Relationship values
Nominator	Number of Defects
Denominator	Inspected Number of respective "Sample Features"
Error Rate	Number of Defects per 100 inspected Units

[1] The reason for considering Existence and Topology as one Attribute (i.e. checking them in one test) is that these aspects are highly interrelated and in erroneous situations often cannot be distinguished.

9.2.3.3.1 Sample Features

What should be considered as a Sample Feature and which Attributes should be checked depends on which GDF features are subject of the check. Only those checks where the Attribute is meaningful for a Sample Feature are applicable.

The relation between the GDF features of the database to be checked and Sample Features which is considered as the unit of checking is the following:

GDF Feature	respective Sample Feature
Point Feature	Point Feature
Line Feature	Composite Line Feature
Area Feature	either Face or Area Feature [2]
Complex Feature	Complex Feature

Composite line features should be considered as a full topological link within the Level-1 network, i.e. one or more consecutive GDF line features, start and end bounded by a point feature which has a valency of three or more.[3] If the contained number of line features is more than one, they have to be connected to each other by bivalent point features. In the current GDF, the difference between Line features and composite line features only concerns *Road Elements*.

The meaning of the Sample Features 'Point Feature', 'Face' and 'Complex Feature' is identical to their meaning according to GDF.

[2] By taking 'Faces' as Sample Features, a better discrimination can be made between geometry and existence problems. However, attributes and relationships can only be checked for 'Area Features'.

[3] By taking composite line features as Sample Features instead of the composing line features themselves, possible conflicts between Existence and Attribute Value checks can be avoided. By this means, changes or errors in GDF attribute values (i.e. possibly resulting in creation or deletion of line features) do not affect the number of Sample Features and thus not the inspection result of line features.

9.2.3.3.2 Checks resulting from Attributes

Each Attribute mentioned in the table above leads to one check:

Check	Content of Check	Corresponding Quality Aspect
Geometry Check	• whether a Sample Feature is geometrically correct	Positional Accuracy
Existence Check and Topology Check on Level-1	• whether a Level-1 Sample Feature is correctly present • whether a Level-1 Sample Feature has correct topology	Completeness and Logical Consistency
Existence Check and Topology Check on Level-2	• whether a Level-2 Sample Feature is composed of correct Level-1 and/or Level-2 features	Completeness and Logical Consistency
Attribute Value Check	• whether a Sample Feature has correct attribute values	Attribute Completeness and Accuracy
Relationship Check	• whether a Sample Feature is involved in the correct relationships	Relationship Completeness and Correctness

9.2.3.4 Definition of Checks

9.2.3.4.1 Geometry Check

- A Sample Feature is considered as having incorrect geometry if one of its positions of the underlying Level-0 edges has incorrect geometry. However, not only nodes and intermediate points are considered, but also all positions along the segments between intermediate points. A position is considered as having incorrect geometry if the deviation from the real position is not within the required geometrical accuracy limit. In the example showed in figure 9.1, all intermediate points of an edge representing a Road Element are accurate, whereas some positions along the segments of the edge are not.
- A Sample Feature is not considered as having incorrect geometry if it is only partly present in the GDF dataset. If the existing part has correct geometry, the whole Sample Feature will be considered as having correct geometry. The fact that the Sample Feature is only partly present will be considered in the existence check.

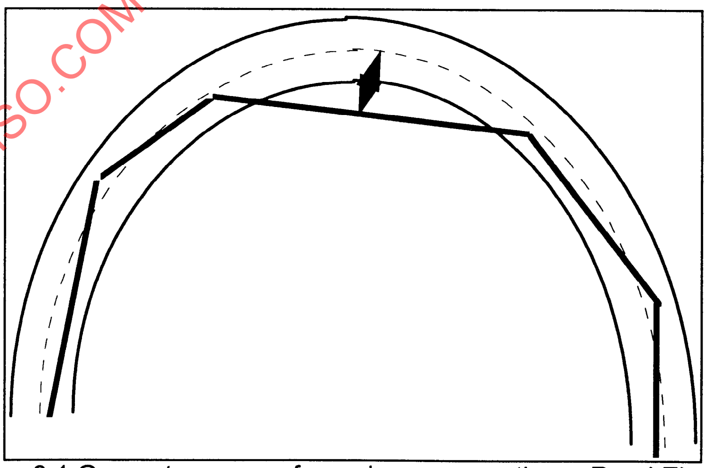


Figure 9.1 Geometry errors of an edge representing a *Road Element*

9.2.3.4.2 Existence and Topology Check on Level-1

- A Level-1 Sample Feature is considered as having incorrect existence or topology if it is missing completely or partly in the GDF dataset, if it is partly or completely surplus or if it has a incorrect topological role in the Level 1 network. Since missing or surplus Sample Features are at the same time affecting the topology (and incorrect topology can have existence implications), these errors are dealt within one check.
- The number of existence and topology errors shall be equal to the number of predefined actions necessary to repair the Level-1 graph. Predefined actions are (to be applied in order):
  1. restore grade separations.
  2. extend a dead end Sample Feature into a non-dead end without changing other topological aspects;
  3. shrink a non-dead end Sample Feature into a dead end without changing other topological aspects;
  4. delete minimum number of Sample Features needed to restore correct topology;
  5. add necessary Sample Features to complete Level-1 graph.
- Whether identified deviations between sample and reference source (e.g. a Sample Feature occurs in the digital map but not in the source map or vice-versa) are to be handled as existence errors depends on user-defined requirements on necessary objects contained in the digital map (e.g. if only road classes 1-4 are recorded in a database, lower-class roads in the reference map do not cause existence errors).

9.2.3.4.3 Existence and Topology Check on Level-2

- A Level-2 feature is considered as having incorrect composition if one or more Level-1 and/or Level-2 features are missing or surplus.
- A completely missing or surplus Level-2 feature is also considered as having incorrect composition (one existence error).

9.2.3.4.4 Attribute Value Check

- A Sample Feature is considered as having one attribute value error if one or more of its attribute values of the same attribute type are incorrect, that is a maximum of one defect per attribute type and Sample Feature.
- A Sample Feature is also considered as having one attribute value error if one or more of its attribute values are missing or surplus.
- Names are considered as incorrect if their spelling is incorrect compared to a specified reference.

9.2.3.4.5 Relationship Check

- A Sample Feature (the first mentioned in a relationship) is considered as having as many relationship errors as related features are wrong or missing. Each incorrect or missing feature within one relationship leads to one error.
- A missing relationship, a surplus relationship or a relationship of the wrong type leads to one defect each.
- In general, the number of relationship errors shall be equal to the minimum number of add and delete actions (adding/deleting either relationships or features within relationships) necessary to repair the incorrect relationships.

9.2.3.4.6 Hierarchy of Checks

In case of conflicts when the placement of a certain error amongst the 5 checks is unclear or ambiguous, the error shall be ascribed to the highest class of the classes in question according to the following hierarchy:

1. Existence and/or Topology error on Level-1;
2. Existence and/or Topology error on Level-2;
3. Geometry error;
4. Relationship error;
5. Attribute value error.

9.2.3.5 Checking Procedure

9.2.3.5.1 Inspection Level

The checking process itself is a straightforward task. ISO 2859 provides tables where the sample size can be extracted based on the lot size. The relation between lot size and sample size defines the seven Inspection Levels with different sampling risks.

Normally, Inspection Level II (normal inspection level) shall be applied.

9.2.3.5.2 Sample Taking

According to ISO 2859 the Sample Feature should be taken randomly from the lot. This means that the sample size might be affected in case of existence errors. This is considered allowable if the applied AQL is (> 95%). Provided that the number of areas from which the Sample Features are taken is not less than 5 (five), this procedure is allowed.

Samples are to be taken from the GDF dataset (i.e. not from geographic objects in reality or other reference source material). This means that the sample size might be affected in case of existence errors. This is considered allowable if the applied AQL is high (> 95%).

9.2.3.5.3 Execution of Checks, Determination of Error Rates

For each check from the table mentioned in 9.2.3.3.2 (for each attribute and relationship one test), the error rate is calculated by counting the number of defects occurring. Each check will be performed for every Sample Feature (if applicable).

9.2.3.5.4 References for Checking

Each Sample Feature can either be checked against the real world situation or against defined reference sources.

9.2.3.5.5 Inspection of Samples: Acceptance and Rejection

The inspection procedure follows a certain strategy which is given in ISO 2859 (single or multiple sampling; normal, tightened or reduced inspection). Briefly described, the single error rates are checked against the acceptance or rejection parameters which are derived from the AQL externally defined by the user.

1. A lot is accepted (or rejected) if the sample taken from the lot is accepted (or rejected).
2. All Sample Features of a certain kind in the lot are accepted (or rejected) if that Sample Feature in the sample is accepted (or rejected).
3. The Attribute of a certain kind of Sample Features in the lot is accepted (or rejected) if the Attribute of that kind of Sample Feature in the sample is accepted (or rejected).

10. GLOBAL DATA CATALOGUE

10.1 Generic Specification

10.1.1 Introduction

A set of data in GDF format should be as self descriptive as possible, so that a recipient can interpret the data without the need for copious volumes of documentation. This self descriptive information is called "global data" and contains the following main items:

- The identification and description of the different logical and physical units.
- The definition of field and record types.
- The table of contents.
- The description of external data sources that have been used.
- The specification of the spatial reference system that has been used.
- The description of the quality of the object data.

10.1.2 Syntax of the Global Data Description

This is described in detail in Chapter 8, Media Record Specifications.

10.1.3 Partitioning of a Dataset

Each GDF is split up into subparts in order to keep the dataset manageable. This is called partitioning. A GDF is partitioned into Information Units and Medium Units.

10.1.4 Information Units

These describe the characteristics of the data. There are three levels of information unit: the dataset, the section, and the layer.

<u>10.1.4.1 Dataset</u>

The highest level of an Information Unit. The term designates a large set of data of a particular geographic area, created at a particular moment and delivered by a particular data supplier.

<u>10.1.4.2 Section</u>

A section is a geographical subset of a dataset.

10.1.4.3 Layer

A subset of a Section. It comprises all Nodes, Edges and Faces that together from one planar graph. A Layer may represent one or more feature themes.

It is common practice- though not a requirement- that after defining a Section in GDF, all Layers within that Section are described before a second Section is defined.

10.1.5 Medium Units

The physical medium upon which the GDF is stored. Two types of Medium Units are defined: the Volume and the Album.

10.1.5.1 Volume

The smallest physical unit of medium. For example a magnetic tape, a floppy disk etc. A single Volume may contain one or more GDF Datasets depending on Dataset size.

10.1.5.2 Album

A collection of related Volumes.

10.1.6 Data Quality

See "GDF Quality Description Specifications" for definitions.

10.2 Headers and Terminators

The information and medium units into which a data set has been partitioned can be identified by use of headers.

According to the names of the units, these headers are called Volume Header, Dataset Headers, Section Headers and Layer Headers.

A Volume is also terminated by a Volume Terminator.

10.2.1 Volume Header

Each volume starts with a Volume Header. This header specifies to the Album to which the Volume belongs, and it specifies the links to the datasets to which it belongs or which it contains.

A Volume Header contains the following items:

- Data Supplier Name
- Standard Name
- Version Number
- Creation Date
- Volume Size
- Album Identifier
- Number of Volumes
- Volume Identifier
- Character Set
- Associated Datasets
- Date of Copyright
- Copyright Owner

10.2.1.1 Data Supplier Name

The name of the main producer and/or deliverer of the Volume.

The producer is taken to mean the company with the responsibility for the production of the Volume, not the company responsible for the source material, if they are different.

Where there is more than one major producer of the volume, a combination of names can be given, under the condition, that the total length of the combination is not longer than 20 characters. Abbreviations may be used.

All other producers involved will be described in detail in the Dataset Header.

10.2.1.2 Standard Name

The name of the standard to which the volume confirms.

10.2.1.3 Version Number

The number of the version or release of the standard to which the Volume confirms.

10.2.1.4 Creation Date

The date of creation of the physical copy of the Volume.

10.2.1.5 Volume Size

The size of the present volume expressed in bytes.

10.2.1.6 Album Identifier

The unique identification number of the Album to which the Volume belongs.

Each physical occurrence of an Album gets its own identification number, even when the Album is an exact copy of another one.

The first three digits of this number contain a numeric code of the data supplier. The assignation of this code to companies has to be co-ordinated by contract or by an independent organization.

10.2.1.7 Number of Volumes

The total number of Volumes in the Album. This number will be the same for each individual Volume in that Album. The maximum number of Volumes in an Album is 9999.

10.2.1.8 Volume Identifier

The sequence number of the present Volume within the context of an Album. It may range from 1 to 9999. In combination with the Album Identifier it serves as an unique identification number of the Volume in issue.

10.2.1.9 Character Set

The name of the ISO/IEC 8859 character set which is used in the present Volume.

The ISO/IEC 8859 character set contains the specification for 9 different character sets. Depending on the characters used one of these sets should be applied. If it fulfils the requirements, the set ISO/IEC 8859-1: Latin alphabet No. 1 should be applied.

<u>10.2.1.10 Associated Datasets</u>

Specifies which Datasets or parts of Datasets can be found in the present Volume. It consists of a Dataset Identifier and Foreign Volume Identifier where the Dataset Header is stored.

10.2.1.10.1 Dataset Identifier

The identification number of a dataset header which is related to the Volume.

10.2.1.10.2 Foreign Volume Identifier

The identification number of the Volume where the Dataset Header specified in the Dataset Identifier can be found. This may be the same value.

<u>10.2.1.11 Date of Copyright</u>

The date that the (possible) copyrights of the present Volume, if any, were registered.

<u>10.2.1.12 Copyright Owner</u>

The name of the owner of the (possible) copyrights of the present Volume, if any.

10.2.2 Volume Terminator

Indicates that the present Volume is terminated and specifies whether it is followed by another Volume or not. It consists of Volume Termination Comments and a Volume Continuation Mark.

<u>10.2.2.1 Volume Termination Comments</u>

Any kind of relevant information concerning the present Volume.

<u>10.2.2.2 Volume Continuation Mark</u>

A mark expressing one of the two following values:

- The present Volume is the last one of the Album.
- The present Volume is not the last and will be followed by another one

10.2.3 Dataset Header

This marks the beginning of a new Dataset and the end of the previous one.

When a dataset contains more than one physical Volume, it is not allowed, to repeat the Dataset Header in each particular Volume.

The Dataset Header contains the following items:

- International Dataset Identification Number
- Supplier Dataset Identification Number
- Edition Date
- Dataset Language
- Country Involved
- Dataset Title
- Production Info
- Creation Year
- Dataset Geographical Coverage
- Thematical Coverage
- Dataset Quality

10.2.3.1 International Dataset Identification Number

An identification number that is unique world wide. To guarantee the uniqueness of these identification numbers, the distribution has to be co-ordinated by an international organization. This item will be left empty until such agreements are made.

10.2.3.2 Supplier Dataset Identification Number

An identification number that is unique within the system of a data supplier or within the system of a group of suppliers. The same technique can be followed as for the assignment of Album Identifiers.

A dataset is an information unit, in contrast with an Album or a Volume which are media units. In consequence, the identification number of a dataset remains the same no matter how many physical copies there are in circulation.

10.2.3.3 Edition Date

Date and hour that this particular version of the Dataset has been created.

When a Dataset is changed completely or changed on essential points, it will be considered as a new Dataset and receive a new Dataset identification number. When there have been only minor changes (e.g. corrections and additions), the Dataset can keep its former identification number. In such cases the Edition Date is used to denote the version number of the dataset.

10.2.3.4 Dataset Language

The MARC language code of a language which is used in the Dataset Header, and Layer Headers or in the data. Appendix A 1.7 gives an overview of MARC language codes.

10.2.3.5 Countries Involved

The ISO-3166 Alpha-3 code of the countries involved in the production of the dataset in issue. Appendix A 1.8 gives an overview of ISO-3166 codes.

10.2.3.6 Dataset Title

The title and subtitles of a Dataset. The item may have multiple instances in case a Dataset Title is given in more than one language.

It is composed of a Dataset Title Language, a Dataset Main Title, and a Dataset Subtitle.

10.2.3.6.1 Dataset Title Language

The MARC-language code (see Appendix A 1.7) of the language in which the Dataset Title is written.

10.2.3.6.2 Dataset Main Title

The proper title of a Dataset. It must not be longer than 70 characters.

10.2.3.6.3 Dataset Subtitle

A possible subtitle of the Dataset. There is no restriction on length.

The language used should be the same as that used in Dataset Main Title.

10.2.3.7 Production Information

Information about the producers and the production places of the dataset. The item may repeat as many times as needed to list all producers and places of production.

Production Information lists the Production Country, the Production Place, and the Producer Name.

10.2.3.7.1 Production Country

The ISO-3166 Alpha-3 country code (see Appendix A 1.8) of the country in which the place of production is situated.

10.2.3.7.2 Production Place

The place name of the location of the producer such as a city, town or village.

Should the producer have more than one office location state only the location of the company's headquarters and/or the location of the real production division.

The name of the location shall be written in the major national language at that location. For example, "London" and not "Londres", "Mons" and not "Bergen", "Antwerpen" and not "Anvers".

In complete bilingual cases, both names may be specified, as for example in "Bruxelles"/"Brussel". This requires the use of two different Production Information instances.

10.2.3.7.3 Producer Name Language

The MARC language code (see Appendix A 1.7) of the language used to specify the Producers Name.

10.2.3.7.4 Producer Name

The name of a producer of the Dataset. In case a producer is known by different names (multinationals, in multilingual countries), each of these names must be specified in a separate Production Information.

The producer is the organization which has entirely or partly the intellectual property of the dataset.

10.2.3.8 Creation Year

The year of creation of the intellectual and logical content of the Dataset.

10.2.3.9 Dataset Geographical Coverage

The name of a geographical area that is representative for the area covered by the dataset. For example a political or economical area (e.g. a state or community), or a landscape unit.

10.2.3.10 Thematic Coverage*

This describes a feature theme code and a feature theme name.

10.2.3.10.1 Feature Theme Code

The code of a feature theme contained in the present Dataset.

10.2.3.10.2 Feature Theme Name

The name of a feature theme contained in the present Dataset.

10.2.3.11 Dataset Quality

The values for resolution, accuracy, up to dateness, completeness and correctness are all worst case values. The goal of this is to guarantee a certain minimum quality to the customer.

Data Quality contains the following sub-items:

- Dataset XY Resolution
- Dataset XY Accuracy
- Dataset Z Accuracy
- Dataset Relative Accuracy
- Dataset Mean Survey Date
- Dataset Maximum Age
- Dataset Feature Completeness
- Dataset Attribute Completeness
- Dataset Correctness

10.2.3.11.1 Dataset XY Resolution

The worst case planimetric resolution anywhere in the dataset, expressed in meters.

The worst case resolution has to be expressed in metres as whole numbers. Non integer values have to be rounded off upwards: e.g. a resolution of 1.25 m has to be rounded to 2m.

The determination of this worst case has to be based on the corresponding resolution values in the Section Headers. The worst case resolution corresponds with the maximum of the values found in the Section Headers.

10.2.3.11.2 Dataset XY Accuracy

The worst case planimetric accuracy value anywhere in the dataset. This value has to be expressed in metres and rounded upwards to the next integer. It should also be based on the accuracy values in the section header records.

10.2.3.11.3 Dataset Z Accuracy

The worst case height accuracy within the Dataset expressed in whole metres. In case there are no Z-values in the Dataset, this item remains empty.

10.2.3.11.4 Dataset Relative Accuracy

The worst case relative attribute accuracy anywhere in the Dataset. This worst case shall be derived from the values in the Section Headers. The use of this item is optional.

10.2.3.11.5 Dataset Mean Survey Date

The average survey date of the dataset as a whole. With "average" is meant the weighted mean value.

Example: 80 % of the data in a Dataset was surveyed in 1985, 20 % in 1980. The mean survey date of the dataset is 1984.

10.2.3.11.6 Dataset Maximum Age

The maximum age of any item in the entire Dataset. This maximum has to be derived from the corresponding values in the Section Headers.

The use of this item is optional.

10.2.3.11.7 Dataset Feature Completeness

The worst case value of feature completeness anywhere in the dataset, derived from the corresponding values in the Section Headers.

10.2.3.11.8 Dataset Attribute Completeness

The worst case value of the attribute completeness anywhere in the Dataset.

10.2.3.11.9 Dataset Correctness

The minimum correctness rate in the attribute values derived from the corresponding values in the Section Headers.

10.2.4 Section Header

The Section Header indicates the start of a new Section and the end of the previous one. It contains information and the parameters which are essential for interpretation and processing of some of the fields in the data records.

A Section Header contains the following items:

- Section Identification Number
- Section Geographic Coverage
- Section Quality
- Source Document
- Geodetical Datum
- Reference Ellipsoid
- Horizontal Reference Type
- Projection Method
- National Map Grid
- Magnetic Declination
- Height Reference Type
- Geoid Ondulation
- Coordinate Offset
- Planimetric Control Point
- Height Control Point

10.2.4.1 Section Identification Number

This number must be unique within the set of all Section Identification Numbers for a particular Dataset.

10.2.4.2 Section Geographic Coverage

The name of a geographical area that is representative for the area covered by the Section. Rules are as for Dataset Geographic Coverage Section.

10.2.4.3 Section Quality

Comprehensive information about the quality of the Section. The values which have to be specified for resolution, accuracy, up to dateness, completeness and error rate are all worst case values. The aim is to create the possibility to specify a minimal quality level in the Section.

Section Quality contains the following components:

- Section XY Resolution
- Section XY Accuracy
- Section Z Accuracy
- Section Relative Accuracy
- Section Mean Survey Date

- Section Maximum Age
- Section Feature Completeness
- Section Attribute Completeness
- Section Correctness
- Feature Quality
- Attribute Quality

10.2.4.3.1 Section XY Resolution

The worst case planimetric resolution anywhere in the Section. The determination of this worst case value must be based on the corresponding resolution values in the Layer Headers.

Rules are as for Dataset XY Resolution.

10.2.4.3.2 Section XY Accuracy

The worst case planimetric accuracy anywhere in the Section. This value must be based on the corresponding values in the Layer Header belonging to a Section.

Rules as for Dataset XY Accuracy.

10.2.4.3.3 Section Z Accuracy

The worst case height accuracy within the Section. This value must be based on the corresponding values in the Layer Header belonging to a Section.

Rules as for Dataset Z Accuracy.

10.2.4.3.4 Section Relative Accuracy

The worst case accuracy value of any attribute type of any feature class in an entire Section. This value must be based on the corresponding values in the Layer Header belonging to a Section.

10.2.4.3.5 Section Mean Survey Date

The average date of the survey of the whole Section.

10.2.4.3.6 Section Maximum Age

The maximum age of any item in the entire section. This maximum must be derived from the values of the corresponding values in the Layer Headers.

Rules as for Dataset Maximum Age.

10.2.4.3.7 Section Feature Completeness

The worst case feature completeness value anywhere in the Section.

This value must be derived from the corresponding values in the Layer Header.

Rules as for Dataset Feature Completeness.

10.2.4.3.8 Section Attribute Completeness

The worst case attribute completeness value in any part of the Section.

This value must be based on the corresponding values in the Layer Headers.

10.2.4.3.9 Section Correctness

The worst case correctness rate in an entire Section. This value has to be based on the corresponding values in the Layer Headers.

10.2.4.4 Feature Quality

See Section 10.8.1, Feature Quality

10.2.4.5 Attribute Quality

See Section 10.8.2, Attribute Quality

10.2.4.6 Source Document

See Section 10.8, Source Document

10.2.4.7 Geodetical Datum

See Section 10.7.1, Geodetical Datum

10.2.4.8 Reference Ellipsoid

See Section 10.7.2, Reference Ellipsoid

10.2.4.9 Horizontal Reference Type

An indicator which specifies whether the coordinate values in the Section must be interpreted as **geographical** coordinates (latitude and longitude), or as X- and Y-values within a **rectangular** plane coordinate system (with linearly divided axes and equal length units along these axes).

The indicator can express two different values:

- Geographical coordinates
- Rectangular Plane coordinates

10.2.4.10 Projection Method

See Section 10.7.3, Projection Method

10.2.4.11 National Map Grid

See Section 10.7.4, National Map Grid

10.2.4.12 Magnetic Declination

See Section 10.7.6, Magnetic Declination

10.2.4.13 Height Reference Type

An indicator which specifies whether the Z-values in this Section must be interpreted as ellipsoidal heights or as orthometric heights.

The indicator may have one of two values:

- Ellipsoidal heights
- Orthometric heights

10.2.4.14 Geoid Ondulation

See Section 10.7.5, Geoid Ondulation

10.2.4.15 Coordinate Offset

Contains the following components:

- XY Multiplication Factor
- Z Multiplication Factor
- X Offset
- Y Offset
- Z Offset

10.2.4.15.1 XY Multiplication Factor

The multiplication factor (M) of the X and Y coordinate values in the data records in this Section, expressed as 10logM. This makes it possible to specify coordinates which have a higher resolution than the length unit, or to delete non relevant zero's at the end of coordinate values with a coarse resolution.

Only integer values of 10logM are allowed. Positive values must be preceded by a plus sign (+); negative values by a minus sign (-)

Examples:

- a value of -2 means a multiplication factor of 0.01
- a value of -1 means a multiplication factor of 0.1
- a value of 0 means a multiplication factor of 1
- a value of 1 means a multiplication factor of 10
- a value of 2 means a multiplication factor of 100 etc.

10.2.4.15.2 Z Multiplication Factor

A multiplication factor of the Z-values in a particular Section, expressed as 10 logM.

10.2.4.15.3 X Offset

The offset value for all the X-coordinates in the data records in this Section. This value must be added to all the X-coordinate values in the data records to obtain national grid coordinate values.

Use of the X-offset reduces the length of the coordinate values in the individual data records.

10.2.4.15.4 Y Offset

Contains the offset value for all the Y-coordinates in a particular Section. Rules as for X Offset.

10.2.4.15.5 Z Offset

Contains the offset value for all the Z-coordinates in a Section. Rules as for X Offset.

When a section does not contain Z-values, Z Offset shall remain blank.

10.2.4.16 Section Border

Contains the following components:

Note: In the specification of the maximum and minimum values. X Offset and Y Offset values should not be added or included in these attributes.

10.2.4.16.1 Maximum X

The maximum value of any X-coordinate in the Section.

10.2.4.16.2 Maximum Y

The maximum Y-value in the Section.

10.2.4.16.3 Minimum X

The minimum value of any X-coordinate in the Section.

10.2.4.16.4 Minimum Y

The minimum value of any Y-coordinate in the Section.

Note: In the specification of the maximum and minimum values, X Offset and Y Offset values should not be added or included in these attributes.

10.2.4.17 Planimetric Control Point

A Point feature with highly accurate X and Y coordinates. May be used to check the accuracy of coordinates obtained from digitizing. The Planimetric Control Point contains the following components:

10.2.4.17.1 Point Name

An identifier for the Point feature. This can be the name or number, or a combination of both, by which the Point is known in the catalogue of a local organization for land surveying.

If the uniqueness of the identifier cannot be guaranteed within a larger context, it must preceded by the name of the town to which it belongs, or by the name of the survey organization responsible for its delivery.

10.2.4.17.2 X Digitized

The value of the X-coordinate, expressed in centimetres,.as obtained by digitizing a paper map or by another indirect method of data capture, such as photogrammetry.

10.2.4.17.3 Y Digitized

The value of the Y-coordinate expressed in centimetres of the point in issue as obtained by digitizing a paper map or by another method of indirect surveying.

Rules as for X Digitized.

10.2.4.17.4 X Surveyed

The value of the X-coordinate expressed in centimetres as delivered by a land survey organization.

10.2.4.17.5 Y Surveyed

The value of the Y-coordinate expressed in centimetres as delivered by the land survey organization.

10.2.4.18 Height Control Point

A Point feature with highly accurate coordinates. May be used to check the accuracy of coordinates obtained from photogrammetry.

A Height Control Point contains the following components:

10.2.4.18.1 Point Name

As for Planimetric Control Point.

10.2.4.18.2 X Reference

The X-coordinate of the point specified in the same length unit as used in the data records in this Section.

10.2.4.18.3 Y Reference

The Y-coordinate of the point specified in the same length unit as used in the data records in this Section.

10.2.4.18.4 Z Digitized

The value of the Z-coordinate of the point obtained by means of the same technique by which the Z-values in the data records have been determined (e.g. interpolation of contour lines on a paper map or obtained by stereo restitution).

The Z-value shall be expressed in centimetres.

10.2.4.18.5 Z Surveyed

The value of the Z-coordinate, expressed in centimetres, as delivered by a survey organization.

10.2.5 Layer Header

The Layer Header indicates the beginning of a new Layer and the end of the previous one.

It contains the following data items:

- Layer Identifier
- Layer XY Resolution
- Layer XY Accuracy
- Layer Z Accuracy
- Layer Relative Accuracy
- Layer Mean Survey Date
- Layer Maximum Age
- Layer Feature Completeness
- Layer Attribute Completeness
- Layer Correctness

10.2.5.1 Layer Identifier

Indication of the Themes that belong to a particular Layer.

10.2.5.2 Layer XY Resolution

The worst case planimetric resolution anywhere in the Layer expressed in metres.

Rules as for Dataset XY Accuracy.

10.2.5.3 Layer XY Accuracy

The value of the worst case planimetric accuracy anywhere in the Layer, expressed as the higher whole metre.

The accuracy values must be determined by means of a number of sampling points (with a minimum of 4). For this calculation the values of a number of digitized coordinates shall be compared with values derived from a source with a higher accuracy level.

Layer XY Accuracy must be determined independently from the determination of the control points included in the Section.

10.2.5.4 Layer Z Accuracy

The worst case height accuracy in the Layer to be expressed to the next highest whole metre. When there are no Z-values in the Layer, this item may remain empty.

For the determination of the worst case value, the same procedure can be followed as for the determination of the XY-accuracy.

10.2.5.5 Layer Relative Accuracy

The worst case relative accuracy value of any (quantitative) attribute type in any part of the Layer.

This value must be based on the corresponding values in Attribute Quality of the Layer in issue.

10.2.5.6 Layer Mean Survey Date

An average date of the survey of the Layer as a whole.

10.2.5.7 Layer Maximum Age

The maximum age of any item in the entire Layer. This value must be based on the values of Feature Mean Survey Date and Attribute Mean Survey Date in Feature Quality and Attribute Quality respectively.

10.2.5.8 Layer Feature Completeness

The worst case value of the feature completeness anywhere in the Layer. This minimum must be derived from the corresponding values in Feature Quality belonging to this Layer.

10.2.5.9 Layer Attribute Completeness

The worst case value of the attribute completeness anywhere in the Layer. This minimum must be derived from the corresponding values in Attribute Quality of this Layer.

10.2.5.10 Layer Correctness

The maximum error rate in a Layer. This value must be the maximum of all the corresponding values in Feature Quality and Attribute Quality of this Layer.

10.3 Data Dictionary

All the field, record, feature and attribute types that are used in a particular GDF have to be defined explicitly at the beginning of a dataset.

The definition is split into four parts: Field Definition, Record Definition, Feature Definition and Attribute Definition. These definitions immediately follow the Dataset header in the order stated.

10.3.1 Field Definition

The field types which are used in a particular dataset. Each occurrence of a field-type will be represented by one occurrence of a Field Definition. Therefore, there should be as many occurrences of Field Definition in the file as there are field types. The fields of the implementation record that represents Field Definition shall also be described by Field Definition.

Field Definition contains the following items:

- Field Name
- Field Size
- Data Type
- Data Unit
- Unit Exponent
- No Data
- Value Domain
- Field Description

10.3.1.1 Field Name

The name of a particular field type. This may be any string of printable ISO-8859 characters, excluding the Space character.

The maximum length of non-repeating fields is 10 characters. The maximum length of repeating fields or fields which participate in a repeating field group is 8 characters.

10.3.1.2 Field Size

The length of a particular field expressed as the number of character positions (bytes) that have been reserved for that field.

The length of a fixed length field is specified by a positive integer value which can range from 1 to 87.

A variable length field is indicated by means of the value = 99.

10.3.1.2.1 Data Type

The subset of ISO/IEC 8859 characters allowed in a particular field type. The Valid Data Type values are:

G ::= <space>|<printable character> {<printable character>| Space character}

A ::= <space>|<alphabetic character> {<alphabetic character>| Space character}

AN::= <space>|<alphanumeric character> {alphanumeric character>| Space character}

N ::= {Space character} {<digit>}

I ::= {Space character} [<sign character> <digit> {digit}]

where

<printable character> ::= <alphanumeric character> |<graphic character>|<sign character>

<alphanumeric character> ::= <alphabetic character>|<digit>

<alphabetic character> ::= A| B| C| ..Z| a| b| c|...... z| < ISO/IEC 8859 character 12/0 - 15/15>

<digit> ::= 0| 1| 2| 3| 4| 5| 6| 7| 8| 9|

<graphic character> ::= ! | "| #| $| %| &| '| (|)| *| ,| /| :| ;| <| =| >| ?|
@| [| \|]| ^| _| `| {| || }| ~| < ISO/IEC 8859 character 10/01 - 10/12>| < ISO/IEC 8859 character 10/14 - 11/15>

<sign character> ::= +| -

<space> ::= Space character {Space character}

Space character ::= the ISO/IEC 8859 character 2/0

The symbols used in the above mentioned production rules have the following meaning:

::= is replaced by, produces, consists of

| exclusive or

[] term enclosed is optional (used zero or one times)

{} term enclosed is optional (used zero, one or more times)

<> term enclosed is non-terminal

, exists together with (no order implied)

.... indicates a repetitive lists of similar items

10.3.1.3 Data Unit

Indication of the unit of measurement in which the values in the field type in question are expressed.

Only SI-units and the units as specified in the list below, are allowed. Units using decimal prefixes (cm, km etc.) have to be split into a basic unit and an exponent value. The exponent shall be represented by means of Unit Exponent.

The following units of measurement and their corresponding codes have been fixed:

DEG	=	Degree
GRD	=	Grad
MTR	=	Metre
FET	=	Feet
KGR	=	Kilogram
SEC	=	Second (of time)
MIN	=	Minute (of time)
HOR	=	Hour
WAT	=	Watt
VLT	=	Volt
MPS	=	Meters per second
KPH	=	Kilometres per hour
MPH	=	Miles per hour
YMD	=	Year, month, day
MDH	=	Month, day, hour
DHM	=	Day, hour, minutes
WHM	=	Weekday, hour, minutes
YXM	=	Year, month, day, hour, minutes
YXH	=	Year, month, day, hour
OTH	=	Other SI-unit, to be described in Field Description

In case the field type in question does not contain a value that is expressed in a particular unit of measurement (e.g. when the field-type contains a text or a percentage or a code value), Data Unit shall be left empty.

10.3.1.4 Unit Exponent

The multiplication factor to be applied to the values in a particular field type in order to convert them to the unit of measurement as specified in Data Unit.

The Unit Exponent is expressed as an exponent of 10.

The exponent shall be preceded by a plus (+) or minus (-) sign, and can range from -9 to +9.

In case the values do fit directly with the unit of measurement as specified in Data Unit, Unit Exponent shall contain the value = 0 (which corresponds to a multiplication factor of 1).

Examples of the use of Data Unit and Unit Exponent

Value	Data Unit	Unit Exponent	Value in field
2.65 m	MTR	-2	265
377 mm	MTR	-3	377
7.3 tons	KGR	+2	73
75 km/h	KMH	0	75
45 %	<S>[1]	-2	45
30 October 1986	YMD	<S>	861030

10.3.1.5 No Data

The kind of ISO 8859 characters the field will contain in the case that the field is "empty", i.e. has "no data". There are the following possibilities:

0 The empty field will contain one Zero character and for the rest Space characters.

000000 The empty field will contain six sequential zero's. This possibility is used in fields containing dates

<S> The empty field will contain Space characters

This is needed in fields of Data Type N and I, where 0 is a meaningful value.

Obl The field is not allowed to be empty as a correct interpretation of the data would be impossible.

10.3.1.6 Value Domain

A logical domain of the values in a particular field type. This may be quite different from the physical domain.

[1] see 10.3.1.5

10.3.1.7 Field Description

Textual description of the content and use of a particular field type.

10.3.2 Record Definition

The specification of a record type that is used in the dataset. Each of the record types in a particular data set must be represented by one Record Definition. There will be as many occurrences of Record Definition in the dataset at there are record types. Also the record types that represent Field Definition and Record Definition must be described by a Record Definition.

Record Definition contains the following items:

- Record Type Code
- Record Subtype Code
- Record Name
- Field Name List

10.3.2.1 Record Type Code

The reference code of a particular record type. This code value will be found at the beginning of each occurrence of a record of that particular type.

Only numerical codes containing 2 digits are allowed. The code containing two Space characters shall be assigned to the null record.

10.3.2.2 Record Subtype Code

A possible record subtype code of a record.

It is possible to subdivide a particular record type into 99 different subtypes by building in a Record Subtype Code. It is a digit code the value of which will be found in each occurrence of that record subtype. In case a record type is not subdivided into subrecords, the Record Subtype Code shall remain empty.

10.3.2.3 Record Name

The name by which a record type is referred to in a specification document.

Any string of printable ISO 8859-9 characters up to a maximum length of 10 is allowed.

10.3.2.4 Field Name List

A list of field names defined by means of Field Name in Field Name Definition. The different instances of Field Name in Field Name List, must occur in the same order as the corresponding data fields do in any occurrence of the record type itself.

Repeating fields or repeating field groups in a particular record type are defined by enclosing the corresponding field name or field name group in parentheses. Nesting is possible.

10.3.3 Feature Definition

The definition of an additional feature class, with corresponding feature class name and feature class code or an alias feature class name in a particular language.

Feature Definition consists of the following items:

10.3.3.1 Feature Class Code

A four digit code of the feature class in question.

10.3.3.2 Feature Class Name

An English name for the feature class. Feature class names shall have an uppercase character at the beginning of the individual words. The other characters should be lowercase.

10.3.3.3 Language Code

The MARC language code of the language used in feature class alias (for codes, see appendix A1.7).

10.3.3.4 Feature Class Alias

A name of the feature class in a language other than English.

10.3.4 Attribute Field Definition

Parameters of the attribute subfields that belong to a particular attribute type.
Attribute Definition contains the following items:

- Attribute Type Code
- Attribute Value Field Size
- Data Type
- Data Unit
- Unit Exponent
- No Data
- Value Domain
- Attribute Description

10.3.4.1 Attribute Type Code

The code of a particular attribute type. The code consists of two alphabetic characters. The code has to be unique within the context of a particular feature code.

The code value must correspond to the code value as used in the individual occurrences of the attribute field in issue.

10.3.4.2 Attribute Value Field Size

The length of the attribute value sub-field that belongs to the attribute type in question. Expressed as the number of character positions (bytes) that have been reserved for the field.

The field length is specified by a positive integer which may range from 0 up to 87.

10.3.4.3 Data Type

See Section 10.3.1.2.1 .

10.3.4.4 Data Unit

See Section 10.3.1.3 .

10.3.4.5 Unit Exponent

See Section 10.3.1.4 .

10.3.4.6 No Data

See Section 10.3.1.5 .

10.3.4.7 Value Domain

See Section 10.3.1.6 .

10.3.4.8 Attribute Description

A textual description of the content and use of the attribute type in question.

10.4 Table of Contents

The Dataset Header, the Field, Record and Attribute Field Definitions are followed by information that briefly describes what can be found in the dataset. Concise information is also given about the geographic coverage of each particular Section.

The Table of Contents contains a Directory and the Spatial Domain.

10.4.1 Directory

How many instances of one particular record type (or subtype) occur within a particular layer, within a particular section and on a particular volume.

The Directory contains the following parts:

10.4.1.1 Volume Identifier

The Identification Number of a particular Volume in the Dataset. This number must correspond to the value of Volume Identifier in the Volume Header of that particular volume. See Section 10.2.1.8.

10.4.1.2 Section Identification Number

The identification number of a Section which occurs within the Volume in question.

In the Directory records of Dataset records the value of Section Identification Number shall be left empty because the Dataset records do not belong to any particular Section. See also Section 10.2.4.1.

10.4.1.3 Layer Identifier

The Identification number of a particular Layer in a Section. See Section 10.2.5.1. In the Directory records of Dataset records, the value of Layer Type Identification shall be left empty.

10.4.1.4 Record Type Code

The record type code of a record type which occurs within the Section and Layer in question. See Section 10.3.2.1. Only codes of logical record types will be mentioned.

10.4.1.5 Record Subtype Code

See Section 10.3.2.2.

10.4.1.6 Record Quantity

The number of logical record instances of the record type and subtype in question.

10.4.2 Spatial Domain

A description of the geographic coverage of a particular Section. It is described both in mathematical terms (latitude and longitude values) and in linguistic terms. The geometry will be described in a coarse form (200 metres ground resolution) so that information of the geodetic datum is not needed.

Note: At the Section level the geographic coverage will be described in a more detailed way, together with all the geodetical parameters belonging to it. The Spatial Domain description shall contain a Section Identification Number, Geographical Extent and an Area Name.

10.4.2.1 Section Identification Number

The ID-number of a particular Section. See Section 10.2.4.1.

10.4.2.2 Geographical Extent

The geographical extent is described by means of Maximum and Minimum Longitude and Latitude.

10.4.2.2.1 Maximum Latitude

The geographical latitude of the most northern part of the Section. This value is specified in decimal degrees with a resolution of millidegrees, so the latitude of e.g. the North Pole will be : +90000. The value shall be preceded by a plus sign (+) for latitudes in the Northern hemisphere, and a minus sign (-) for those in the South. See also ISO standard 6709, reference[6].

10.4.2.2.2 Maximum Longitude

The geographical longitude of the most eastern part of the Section. This value shall be specified in decimal degrees referring to the Prime Meridian of Greenwich. Longitudes east of Greenwich shall be designated by use of the plus sign (+), longitudes west of Greenwich shall be designated by use of the minus sign (-). See also ISO 6709, reference[6]..

10.4.2.2.3 Minimum Latitude

The value of the geographical latitude of the most southern part of the section. Rules are as for Maximum Latitude.

10.4.2.2.4 Minimum Longitude

The geographical longitude of the most western point in the Section. Rules are as for Maximum Latitude.

10.4.2.3 Area Name

The name of a geographical area. This name must be representative for the area covered by the Section.

Rules are as for Dataset Geographical Coverage Section 10.2.3.9.

10.5 Default Attribute Values

By default, the default attribute value in a GDF specifies the not-known/not-collected case. In case, it is desired that the default attribute value specifies a different value (i.e. an attribute value defined for a certain attribute type), the Default Attribute Value Record can be used. However, the information that a certain attribute value has not been captured or is unknown, now no longer can be defined.

10.5.1 Attribute Type

The attribute type for which the default value is defined.

10.5.2 Default Attribute Value

The attribute value of the attribute type specified which is considered default in a dataset.

10.6 Source Material

Each instance of a Dataset will be based, to a certain degree, on information which already existed in the form of documents. These documents can be a map, a book, report or other monographic document, both in printed and in digitized form. Each Dataset shall contain short descriptions of the source documents that have been used for its creation. These references are needed for reasons of copyright, but they are also useful as tools for quality control.

In the description of the source documents, the standard rules as formulated by the International Federation of Library Associations (IFLA) shall be followed. These rules are found in the standards ISBD(G) and ISBDN(CM).

The descriptions of the source documents will be situated immediately after the spatial domain descriptions. These descriptions concern all reference documents of the entire dataset. It is possible to refer on the Section level to those descriptions which are relevant for that particular Section.

10.6.1 Source Document

The description of the Source Document material used in the creation of a dataset. Each single document will in principle be represented by one Cartographic Source description.

A description of the cartographic sources shall contain the following items:

- Description Level
- Level of Completeness
- Source Description Identifier
- International Standard Book Number
- International Standard Serial Number
- Document Language(s)
- Country(ies) Involved
- Year of Survey
- Date of Survey
- Map Scale (for cartographic documents only)
- Author Name
- Document Title
- Document Title Language
- Volume Name
- Edition Number
- Impression Number
- Year of Publication
- Place of Publication
- Name of Publisher
- Year of Distribution
- Place of Distribution
- Name of Distributor
- Host Document Relation

10.6.1.1 Description Level

Indicates whether the description is "stand alone" or whether it forms a "description tree" with host documents. The relations to possible host document shall be specified.

It may contain one of four different values which indicates the level of description that applies to the subsequent Source description.

1 The first level in a multilevel description or an independent (single level) description.

2 The second level in a multi level description.

3 The third level in a multi level description.

4 The fourth level in a multi level description.

Single level descriptions will always have the value 1. Parents in a two level description will have a value 1, the child 2. Codes 3 and 4 are only used in exceptional cases of descriptions with three and for different levels.

10.6.1.2 Level of Completeness

This code may only have the value 1 indicating the 1st level of completeness. Codes 2 or 3 are currently reserved .

10.6.1.3 Source Description Identifier

An identification number of this particular Source description. This number must be unique for all Source Material descriptions covering all Datasets.

10.6.1.4 International Standard Book Number

The ISBN-number of the source document. In case the document in question has no ISBN-number, this field shall be left empty.

10.6.1.5 International Standard Serial Number

The ISSN-number of the source document. For a non serial numbered document, or for documents not having an ISSN-number, this field shall be left empty.

10.6.1.6 Document Language(s)

The MARC language code of the main language(s) used in the source document. See Appendix A 1.7 for MARC language codes.

10.6.1.7 Country(ies) Involved

The ISO-3166 Alpha-3 country code of a country or countries which have been involved in the production, publication or distribution of a document.

10.6.1.8 Year of Survey

The year of the primary field survey of the real world situation as represented in the document. Surveys performed for updating purposes are not considered. When the primary survey cannot be fixed on one year (because the survey has lasted more than one year), a mean value can be taken.

10.6.1.9 Date of Survey

The actual date of the survey expressed in the form of month, day and hour. This exact information will only be required for documents having a very precise moment of survey: e.g. aerial photographs or satellite images.

10.6.1.10 Map Scale (for Cartographic Document only)

The scale denominator of the cartographic document given without punctuation.

Example: A scale of 1 : 25,000, will be treated as 25000.

10.6.1.11 Author Name

The name(s) of the author(s) of a document according to the rules given in ISO/DIS 690, reference[5]., clause 10.1.1 to 10.1.5

The name of the author shall be recorded as given on the source, but with the family name first. If the name of more than one author appears on the source, the name appearing most prominently shall be recorded first. If the names are given equal prominence, the name appearing first shall be recorded first. If not more than three authors share principle responsibility for the work, the names of both or all three shall be included. If four or more authors share responsibility for the work, only the name of the first, or the names of the first two or three need to be recorded; the names of the others may be omitted, the abbreviation "et al." or its equivalent shall be added following the last name recorded.

10.6.1.12 Document Title

The main title of the document in issue. When the title is specified in more than one language, a corresponding number of repeating Document Title descriptions have to be used. Parts of the title which differ from Volume to Volume are considered as subtitles and must be described by Volume Name.

In a multilevel description, Document Title will be used to specify the general title. The general title is that part of the title that belongs to a series of documents as a whole and that is present in all (or almost all) the individual titles.

Document Title contains two sub elements:

- Document Title Language
- Document Title Text

10.6.1.12.1 Document Title Language

The MARC-language code of the language used in the Document Title Text. See Appendix A 1.7 for MARC language codes.

10.6.1.12.2 Document Title Text

The main title of a document.

Any string of words which can be used for the identification of a document or a series of documents and which is present on the document itself. If a document has no title in the sense of the definition in the foregoing sentence, a title is devised and recorded in square brackets.

In the case of a multilevel description, the main title shall only contain that part of the title which is common to all volumes. The individual volume titles and volume numbers are given in Volume Name. In single level descriptions, a document having a long title that consists of two or more clearly distinguishable parts, of which only the first part is required for identification purposes and of which the secondary part(s) gives only a more detailed description, may be split into two parts: a main title and a sub-title. The subtitle shall be represented in Volume Name.

In case the title is not self explanatory, a General Comment shall be included, which explains in one or two lines the content of a document. This General Comment shall immediately follow the Document Title Text.

10.6.1.13 Volume Name

The subtitle elements within a one level description or those parts of a title within a multilevel description that are not common for all volumes and will differ from one volume to the other. Also volume numbers are considered to be (part of) a subtitle.

If the document contains parallel subtitles in different languages, a corresponding number of repeating Volume Name descriptions must be created. These records repeat independently from Document Title.

Volume Name contains two elements:

- Volume Name Language
- Volume Name Text

10.6.1.13.1 Volume Name Language

The MARC-language code of the language used in Volume Name Text. When Volume Name Text contains only a Volume Number, the Volume Name Language may remain empty.

10.6.1.13.2 Volume Name Text

That part of the title which is not included in the main title. Also volume numbers are considered to be a part of the sub title and are handled as such.

10.6.1.14 Edition Number

The edition number of a particular document. When there is no edition number mentioned on the document, it is assumed to be the first edition.

10.6.1.15 Impression Number

The impression number of the document.

10.6.1.16 Year of Publication

The year (according to the international "Gregorian" calendar) of the publication or distribution of the document.

10.6.1.17 Place of Publication

Contains two sub-items: Country of Publication and Place of Publication.

10.6.1.17.1 Country of Publication

The ISO-3166 Alpha-3 code of the country to which the place, specified in Place Name belongs.

10.6.1.17.2 Place of Publication

Rules as for production, place of production and information for a Dataset Header.

10.6.1.18 Name of Publisher

The name of a publisher of the document, or the organisation, (legal person) who has been entirely or partly financially responsible for the publication of a document. The name of the publisher is mandatory in every document description.

10.6.1.19 Year of Distribution

The year (according to the international -Gregorian- calendar) of the distribution of the document.

10.6.1.20 Place of Distribution

Contains two items: Country of Distribution and Place of Distribution.

10.6.1.20.1 Country of Distribution

The ISO-3166 Alpha-3 code of the country to which the place belongs which is described in Place of Distribution.

10.6.1.20.2 Place of Distribution

The name of the location of a distributor.

10.6.1.21 Name of Distributor

The name of a distributor of the document.

As for Name of Publisher.

10.6.1.22 Host Document Relation

The relations that exist between the document or the document series in issue and the host documents. A Host Document description contains 5 different elements:

- Host Description Identifier
- Kind of Relationship
- From Page
- To Page
- General Comment

10.6.1.22.1 Host Description Identifier

The Description Identifier of the host document.

10.6.1.22.2 Kind of Relationship

The type of relation between the document in issue and the host document. The following values have been fixed:

11. = Descended from
12. = Appendix to
13. = Published together with
14. = Additional map to
15. = Inset map to
16. = Is part of

10.6.1.22.3 From Page

The page number within the host document where the document in question starts.

10.6.1.22.4 To Page

The page number within the host document where the document in question ends.

10.6.1.22.5 General Comment

Any free text to represent a short comment.

10.7 Geodetical Parameters

In a Dataset, all the geodetical parameters needed for the correct interpretation of the X, Y and Z coordinates have to be described explicitly so that the coordinates can be transformed into any other coordinate system.

The descriptions of the geodetical parameters are given at the Dataset level, and are provided with an identification number so that they can be referred to by the Section Headers for which they are relevant.

Geodetical Parameters contains the following parts:

- Geodetical Datum
- Reference Ellipsoid
- Projection Method
- National Map Grid
- Geoid Ondulation
- Magnetic Declination

10.7.1 Geodetical Datum

A description of the geodetical datum that underlies a particular national grid. It is needed in order to be able to shift from one geographical coordinate system into another. This description consists of the following items:

- Datum Origin
- Datum Rotation
- Scale Factor
- Datum Name

10.7.1.1 Datum Origin

The origin of the datum in question in WGS'84 coordinates. It contains the following elements:

10.7.1.1.1 X-Origin

The value of the X-coordinate of the origin of the geodetical datum, relative to WGS-84 and expressed in decimeters.

10.7.1.1.2 Y-Origin

The value of the Y-coordinate of the datum's origin, in WGS-84 and expressed in decimeters.

10.7.1.1.3 Z-Origin

The value of the Z-coordinate of the datum's origin, in WGS-84 and expressed in decimeters.

10.7.1.2 Datum Z Rotation

The rotation parameters of the datum in relation to WGS '84.

The angle of the rotation around the Z-axis in WGS '84, expressed in hundredths of milligons (gon E-5). This rotation is defined as the angle between the direction of the x-axis of the datum in question minus the direction of the x-axis of the WGS-datum.

10.7.1.3 Scale Factor

The quotient between a distance between two points expressed in the length unit of the local datum divided by the same distance expressed in the length unit of WGS-'84.

Assuming that the length units in both systems are based on meters, this factor always will have values of almost 1. Values of 0.9999995 or 1.0000005 will be a common example.

In Scale Factor not the value of Mo itself, but the value of (1 - Mo)* 10 E+9 will be stored. These values shall be rounded at an integer and preceded by their sign.

In the examples mentioned above, this will lead to values of +500 and -500 respectively.

10.7.1.4 Datum Name

Name of the geodetic datum.

A list of datum names is given in Appendix A 1.9.

10.7.2 Reference Ellipsoid

The reference ellipsoid is described by the following elements:

- Semi Major Axis
- Semi Minor Axis
- Ellipsoid Code

10.7.2.1 Semi Major Axis

The length of the semi-major axis of the reference ellipsoid expressed in metres.

10.7.2.2 Semi Minor Axis

The length of the semi-minor axis of the reference ellipsoid expressed in metres.

10.7.2.3 Ellipsoid Code

The reference code of the ellipsoid. A list of ellipsoid codes is given in Appendix A 1.13.

10.7.3 Projection Method

Information about the projection used in a particular national grid is needed to be able to transform XY-coordinates into geographical coordinates. In case all the coordinates in the sections are directly given in the form of geographical coordinates, Projection Method can be left empty.

Each description of the projection shall contain the following items:

- Projection Type Code
- Projection Parameter

10.7.3.1 Projection Type Code

A reference code of the projection used by a Dataset.

A list of projection codes is given in Appendix A 1.14.

10.7.3.2 Projection Parameter

The longitude and/or latitude values of the base lines, together with a point scale factor which define the projection.

10.7.3.2.1 Latitude Longitude*

This record may repeat up to 3 times. The value of the geographical latitude and longitude values have to refer to the same datum and reference ellipsoid described in Geodetical Datum and Reference Ellipsoid.

Latitude

The value of the latitude depending on the projection type.

The latitude shall be expressed in microdegrees (degrees E-6). It should be preceded by a plus sign (+) for latitudes on the Northern hemisphere and a minus sign (-) for latitudes on the Southern hemisphere.

The latitude of the equator shall be expressed as +0000000. The latitude of the North Pole will be +90000000. See also ISO 6709

Longitude

The value of the longitude depending on the projection type.

Longitudes shall be expressed in microdegrees. The longitudes shall refer to the Prime meridian of Greenwich. Longitudes east of Greenwich shall be designated by use of the plus sign (+), longitudes west of Greenwich shall be designated by use of the minus sign (-). The prime Meridian shall be designated by use of the plus sign (+). The 180th meridian shall be designated by use of the minus sign (-). See also ISO 6709, reference[6]..

10.7.3.2.2 Point Scale Factor

The scale factor in a defined point or along a defined parameter line depending on the projection type.

The scale factor (Mo) is defined as the quotient between the value of a distance between two infinitesimal adjacent points calculated from the XY-coordinates of the projection system and the other value calculated from the geographical latitude and longitude and the corresponding reference ellipsoid.

In Point Scale Factor not the value of Mo itself, but the value of (1 - Mo)* 10 E+7 will be specified. These values shall be rounded at an integer and preceded by a plus (+) or minus (-) sign.

Example 1: For a projection of the type "Transverse Mercator", the geographical longitude of the central meridian and the point scale factor along the central meridian has to be known.

The longitude of the central meridian is specified in the first Latitude Longitude group which is directly followed by Point Scale Factor.

Example 2: For a projection of the type "Lambert Conformal Conic with two standard parallels", the following parameters are required:

- latitude of the Northern standard parallel,
- latitude of the Southern standard parallel,
- latitude of the central parallel at which the point scale factor is specified
- the point scale factor

The latitude of the Northern parallel shall be given in the first Longitude Latitude group, the latitude of the Southern parallel in the second and the latitude to which the pointscale factor belongs in the third one, followed by a Point Scale Factor.

The value of the geographical latitude and longitude values must refer to the same datum and reference ellipsoid described in Geodetical Datum and Reference Ellipsoid.

10.7.4 National Map Grid

The characteristics of the national grid to which the coordinates of a particular section refer are needed to interpret correctly the X- and Y- coordinate values, and to be able to transform from XY- coordinates into geographical coordinates.

The description contains three items:

- Indication whether the grid axes are left- or right turning.
- Description of the origin of a "help" grid in terms of latitude and longitude.
- Description of the origin of the national grid relative to the help grid.

The help grid is supposed to be normal Cartesian and to have its + Y- axis northwards and tangential to the projection of the meridian in the origin. The length unit used in the help grid shall be the metre.

In case the real grid is rotated with respect to the help grid, this shall be specified by means of Grid Rotation.

A description of the national grid shall contain the following items:

- Grid Axes Orientation
- Help Grid Latitude
- Help Grid Longitude
- X Origin
- Y Origin
- Grid Rotation

10.7.4.1 Grid Axes Orientation

An indicator of whether the grid in issue (the national grid) is normal Cartesian or reverse Cartesian.

0 normal Cartesian

1 reverse Cartesian

For the rest, grids are supposed to be rectangular and have orthogonal coordinate axes, both using the same length unit.

Normal Cartesian means that the clockwise counted angle between the +Y-axis and the +X-axis (Yr - Xr) is 300 gon. Reverse Cartesian means that this angle is 100 gon.

10.7.4.2 Help Grid Latitude

The latitude of the origin of the "help" grid.

This value shall be expressed in microdegrees (degrees E-6).

Rules as for Latitude.

10.7.4.3 Help Grid Longitude

This field shall contain the value of the longitude of the origin of the "help" grid.

Rules as for Longitude.

10.7.4.4 X Origin

The X-coordinate of the origin of the national grid expressed in the "help" grid. This value shall be expressed in decimeters. Positive coordinate values shall be preceded by a plus sign (+) and negative values by a minus sign (-). In case the origin of the national grid coincides with the origin of the "help" grid (which will be often the case), this field shall contain the value: +00.

10.7.4.5 Y Origin

The Y-coordinate of the origin of the national grid expressed in the "help" grid. Rules as for X Origin.

10.7.4.6 Grid Rotation

The clockwise counted angle between the + Y-axis of the national grid and the + Y-axis of the "help" grid, expressed in microgons (gon E-6).

Expressed in symbols: Rot = Yn - Yh

where Yn is the direction of the +Y-axis of the national grid and Yh is the direction of the +Y-axis of the help grid.

If the Y-axes of both grids coincide (or are parallel to each other), which will be often the case, this field shall contain: +0000000.

10.7.5 Geoid Ondulation

The height of the geoid above the reference ellipsoid in some particular reference points has to be described.

A description of Geoid Ondulation is needed when Z-values are used in the data records.

Each Section shall refer to 4 different geoid ondulation reference points which surround the Section, so that the local geoid height in the section can be calculated by means of interpolation.

Each description of a geoid ondulation reference point shall contain the following items:

- Reference Point Latitude
- Reference Point Longitude
- Ellipsoidal Height

10.7.5.1 Reference Point Latitude

The value of the latitude of the point in question.

Rules as for Latitude.

10.7.5.2 Reference Point Longitude

The value of the longitude of the point in question.

Rules as for Longitude.

10.7.5.3 Ellipsoidal Height

The ellipsoidal height of the local geoid.

The height above the reference ellipsoid (the same as that described in Reference Ellipsoid) shall be expressed in decimeters. Positive values shall be preceded by a plus sign (+), negative values by a minus sign (-).

10.7.6 Magnetic Declination

Information about the magnetic declination and the annual deviation is needed to be able to correct for this declination in the heading of a navigation compass.

The magnetic declination shall be specified in the centre point of a Section or in 4 different points that surround the Section so that the local value can be calculated by means of interpolation.

Each description of a magnetic declination reference point shall contain the following items:

- Reference Point Latitude
- Reference Point Longitude
- Validity Date
- Magnetic Variation
- Annual Change
- Horizontal Magnetic Field Intensity
- Vertical Magnetic Field Intensity

10.7.6.1 Reference Point Latitude

See Section 10.7.5.1.

10.7.6.2 Reference Point Longitude

See Section 10.7.5.2.

10.7.6.3 Validity Date

The year, month and day which correspond to the value of the magnetic declination which is specified in Magnetic Variation.

10.7.6.4 Magnetic Variation

The angle between the direction of the Magnetic North (Nm) and the Geographic North (Ng), in symbols: Dec = Nm - Ng.

The angle shall be expressed in milligons (gon E-3) and shall be preceded by a plus sign for eastward declinations and by a minus sign for westward declinations.

10.7.6.5 Annual Change

The annual change in the magnetic declination. This change is defined as: the clockwise counted angle between the direction of the Magnetic North in year i (Nm(i)) and the direction of Nm in the preceding year i-1 (Nm(i-1)).

In symbols: Dev(An) = Nm(i) - Nm(i-1).

The angle shall be expressed in milligons (gon E-3).

Eastward annual changes are preceded by a plus (+) sign. Westward annual changes are preceded by a minus sign (-).

10.7.6.6 Horizontal Magnetic Field Intensity

Horizontal Magnetic Field Intensity expressed in nano Tesla.

10.7.6.7 Vertical Magnetic Field Intensity

Vertical Magnetic Field Intensity expressed in nano Tesla.

10.8 Quality Descriptions

Apart from the description of the quality of a Dataset, a Section or a Layer as a whole, it is possible to describe the quality of a particular group of feature instances or attribute values. This is done by means of the items Feature Quality and Attribute Quality.

10.8.1 Feature Quality

In the feature quality descriptions, a completeness value may be specified for a particular feature class in a particular Section. The feature quality descriptions themselves are situated at the data set level so that they can be referred to by all Sections for which the information is valid.

Each Feature Quality description shall contain the following items:

10.8.1.1 Feature Class Code

The code of the feature class handled by Feature Quality.

10.8.1.2 Feature Completeness

The completeness value of the feature class in question. This value shall be expressed as a percentage.

10.8.2 Attribute Quality

Quality aspects of a particular attribute type, or of a particular subset of attribute values, can be specified in an attribute quality description.

The attribute quality information can be specified at the Section level, but the descriptions themselves are situated at the Dataset level so that one description can be used by all the Sections for which the information is valid.

Every attribute type as defined by means of Attribute Definition, must be represented by at least one occurrence of an attribute quality record. The attribute quality of a particular attribute type is not necessarily homogeneous for all the Sections of a dataset or for all the subsets of values within that type. As a result, the specification of only one quality value is not sufficient, and each homogeneous group of Sections, and each homogeneous subset of values, will require its own Attribute Quality description

Each attribute quality description shall contain the following items

- Feature Class Code
- Attribute Type Code
- Attribute Value Code
- Survey Date
- Attribute Resolution
- Attribute Accuracy
- Relative Attribute Accuracy
- Attribute Completeness
- Attribute Correctness

10.8.2.1 Feature Class Code

The code of the feature class to which the information belongs.

10.8.2.2 Attribute Type Code

The code of a particular attribute type.

10.8.2.3 Attribute Value Code

A particular attribute value within the range of possible values of the attribute type as specified by Attribute Type Code.

The specification of a particular value by means of this field is only required when the overall quality value for the attribute type as a whole is not representative for a particular subset of attribute values.

In an overall quality description, Attribute Value Code will remain empty. It will be considered as being valid for all the individual subsets of attribute values, unless specified otherwise by means of an individual Attribute Quality description for that value. In that case, the overall value will be overwritten by the more specific value.

10.8.2.4 Survey Date

The date of the survey of a particular attribute type or value.

10.8.2.5 Attribute Resolution

The resolution of the values of the attribute type in question. The specification of the resolution is only required for quantitative attribute types.

The resolution shall be expressed in the same dimensional unit as the attribute values.

10.8.2.6 Attribute Accuracy

This field allows for the specification of the attribute accuracy of the attribute type or value in question. This is only required in the case of quantitative attributes. (i.e. attributes whose possible range of values is a subset of the real numbers.

The accuracy is specified in the same dimensional unit and with the same resolution as the attribute value itself. That means that Attribute Accuracy itself has an integer value and an I interpretation, but that the actual interpretation depends on the Data Unit and Unit Exponent in the corresponding Attribute Definitions.

10.8.2.7 Relative Attribute Accuracy

The worst case relative attribute accuracy anywhere in the Dataset. This worst case shall be derived from the values in the Section Headers.

10.8.2.8 Attribute Completeness

The completeness value of the attribute type or value in question. The degree of completeness is the percentage of entities (having this attribute type or value) that should be present in the dataset but actually are not.

10.8.2.9 Attribute Correctness

The error rate of the attribute type or value in question. See the GDF Quality Description Specifications for more details.

10.9 General Comment

A free text allowing any necessary comment to other items.

11. GDF LOGICAL DATA STRUCTURES

11.1 Introduction

This document specifies the GDF data structures that have to be used for the transfer and exchange of data. These data structures can be considered as independent of any specific record structure in which they are implemented.

11.1.1 Data Descriptive Language ESN

To describe the data structures, use is made of a Data Descriptive Language, called ESN. This language enables data types to be constructed of any complexity from a set of elementary types. This can be illustrated by means of the following example:

PROJECTION TYPE =

[

Projection Identifier	:	UNSIGNED LONG	11.1.4.38
Projection Type	:	PROJECTION TYPE CODE	11.1.4.26
Projection Parameters	:	PROJECTION PARAMETERS	11.3.7.3.3

]

The name written entirely in uppercase letters ("PROJECTION TYPE" in the example) is the proper name of the data type. This name is used to identify just this particular data structure so that it can be referenced in the definition of data types of higher complexity. The name may not be used for any other data type. Furthermore, it is recommended that one particular data type (i.e. with exactly that particular specification, constraints included) carries just one name.

Each data type definition begins with the symbol "[" and ends with the symbol"]". Each line between these square brackets describes a particular component of the data type in question. At the right hand side, the data type of that particular component is mentioned. In the example above, the datatype of the first component is "UNSIGNED LONG". This name is followed by the number of the section where that data type is described (11.1.4.38 in the example)

The example shows that the data type "UNSIGNED LONG" has the role of a Projection Identifier. Therefore "Projection Identifier" is called a "role name". Role names are always found in the left column and are always written in lowercase with initial caps. Role names correspond to the names used in the Global Data Catalogue and the Media Record Specifications.

It often occurs that role name and data type name are identical (apart from the different use of uppercases). This indicates that the data type has been especially constructed for the role in question. If the data type is used for more than one role, the names will be different.

The order in which the individual components are listed is significant. When the same components are listed in another order, this implies that the data type defined is different.

See Figure 11.1 for a graphical illustration what is written in this section.

11.1.2 Lists, elements and ranges

A particular data type used in ESN is the List. A List is simply a set of one or more elements (instances) of the same data type and is specified in the following form:

L = [T]*, where the * indicates that T may have multiple elements.

The elements of T in a particular instance of list L will have a particular order.

However, this order is not meaningful, unless specified otherwise (as, for example the order of Intermediate Points in GEOMETRY, - see 11.5.1.3).

A datatype may be constrained by saying that its domain must be a subset of the elements of a particular list. This is done by means of the constructs ELEMENT(L) or RANGE(L).

ELEMENT(L) means that the component refers to not more than one element of List L.

RANGE(L) means that the component refers to zero, one or more elements of a List L. The order in which these elements are referred to is not relevant, unless otherwise specified.

Each List must have one or more candidate identifiers: i.e. a component (or a combination of components), that contains a different value (resp. combination of values) for each individual element of a List.

If a List has more than one candidate identifier, one of these candidates must be nominated as the primary identifier. In the definition of datatypes that can be used to form Lists, it is indicated which component (or combination of components) must be used as the primary identifier.

When a component refers to a particular element of a List (or a range of elements), that component must use the primary identifier. The role name of that component must match with the role name of the primary identifier of the elements of a List.

Example: The data type FACE (11.5.4.2) which can be used to form the data type FACE LIST, contains a component with the role name Face Identifier, which is nominated as the primary identifier. In the data type NODE (11.5.2.2) the third component must be an element of FACE LIST. The role name of this component, Node Identifier, which identifier must be used to refer to that particular List.

11.1.3 Summary of the syntax notation

e	: T	Component with role e is of data type T
T	= [a|b]	an instance of data type T can have either the value a or the value b.
T	=	an instance of data type T contains two components:
[		
	e1: T1	- a component of data type T1 playing role e1
	e2: T2	- a component of data type T2 playing role e2
]		
L	= [T]*	an instance of data type L is a sequence of zero or more instances of data type T (an instance L is called a "list")
T	= (i...j)	an instance of data type T is an integer in the range i <= t <= j
NULL		denotes the absence of a value
ELEMENT(L)		denotes a reference to one instance of list L
RANGE(L)		denotes a reference to one or more instances of list L.

11.1.4 Elementary data types

This section contains a list of data types that are not decomposed into other data types and therefore can be considered as the elements from which other data types are composed. These elementary data types are frequently used in the construction of more aggregated data types.

<u>11.1.4.1 Attribute type code</u>

A value from the set of Attribute Type Codes.

See Attribute Catalogue Appendix 1.4 for a list of Attribute Type Codes

<u>11.1.4.2 Attribute value code</u>

A value from the set of Attribute Value Codes.

See Appendix A1.5

11.1.4.3 Boolean

=[0|1]

11.1.4.4 Character

A printable character from the ISO/IEC 8859-9 character set

11.1.4.5 Data type code

=[G|A|N|AN|I]

This data type is used to designate a particular subset of the used character set. G stands for any printable character, A for letters, N for digits, AN for letters and digits and I for integers. See the Global Data Catalogue for a more detailed description.

11.1.4.6 Data unit code

A value from the Data Unit Code List.

See the Global Data Catalogue for a list of assigned Data Unit Codes

11.1.4.7 Datum name

A value from the Horizontal Datum List

See Global Data Catalogue Appendix A 1.9 for a list of Horizontal Datums in Europe

11.1.4.8 Day code

=[01|02|03|..........|29|30|31]

11.1.4.9 Day in month code

=(1......31)

Note

The difference of this data type with Day Code is that the numbers < 10 are written without leading zero's.

11.1.4.10 Day in week code

=(1...7)

11.1.4.11 Ellipsoid code

A value from the list of ellipsoid codes

See Appendix A 1.13 for a list of ellipsoid codes

11.1.4.12 Feature Class Code

A value from the set of Feature Class Codes.

See Appendix A 1.1 for a list of Feature Class Codes

11.1.4.13 Feature Class Names

A value from the set of Feature Class Names.

See Appendix A 1.1 for a list of Feature Class Codes

11.1.4.14 Feature Theme Codes

A value from the set of Feature Theme Codes.

See Appendix A 1.1 for a list of Feature Theme Codes

11.1.4.15 Feature Theme Name

A value from the set of Feature Theme Names.

See Appendix A 1.1 for a list of Feature Theme Names

11.1.4.16 Height level name

A name from the list of Vertical Datums

See Appendix A 1.11 for a list of Vertical Datums in use in Europe.

11.1.4.17 Hour code

=[00|02|03|............|22|23|23]

11.1.4.18 Hour in day code

=(0.....23)

The difference between this data type and Hour Code is that no leading zero's are used to write the numbers which are < 10

11.1.4.19 ISO country code

A value from the set of ISO-3166 Alpha-3 Country Codes

See Appendix A 1.8 for a list of ISO Country Codes

11.1.4.20 Marc Language code

A value from the set of MARC Language Codes

See the Global Data Catalogue Appendix A 1.7 for a list of MARC codes

11.1.4.21 Month code

=[01|02|03|...........|10|11|12]

11.1.4.22 Month in year code

=(1....12)

The difference of this data type with Month Code is that the numbers < 10 are written without leading zero's.

11.1.4.23 No data mark

=[OBL|<S>|0|000000]

11.1.4.24 Null

=No value

<u>11.1.4.25 Percentage</u>

=(0......100)

<u>11.1.4.26 Projection type code</u>

A value from the list of Projection Codes

See Appendix A 1.14 for a list of Projection Codes

<u>11.1.4.27 Relationship kind code</u>

=[11|12|13|14|15]

See the Global Data Catalogue for the meaning of these codes

<u>11.1.4.28 Relationship code</u>

A value from the set of Relationship Codes.

See Relationship Catalogue Appendix A 1.6 for a list of Relationship Codes

<u>11.1.4.29 Set 1</u>

=[1]

<u>11.1.4.30 Set 1-3</u>

=(1...3)

<u>11.1.4.31 Set 1-4</u>

=(1...4)

<u>11.1.4.32 Set 0-59</u>

=(0....59)

<u>11.1.4.33 Set 00-59</u>

=[00|01|...........|58|59]..

<u>11.1.4.34 Set 00-99</u>

=[00|01|...........|98|99]

<u>11.1.4.35 Signed double</u>

=(-2.........2 -1)

<u>11.1.4.36 Signed long</u>

=(-2147483648........+2147483647)

<u>11.1.4.37 Signed short</u>

=(-32768.............+32767)

<u>11.1.4.38 Unsigned long</u>

=(0.............4294967295)

<u>11.1.4.39 Unsigned short</u>

=(0............65535)

11.1.4.40 Year code

=(1900.........2099)

11.1.4.41 Week Code

=(1...52)

11.1.4.42 Week in Month Code

=(1....5)

11.1.4.43 +-

= [+|-]

11.1.5 Other basic data types

The data types defined in this section are not elementary but first level composites (uniquely composed of elementary data types) and second level composites (composed of elementary data types and first level composites). They are very frequently used in the composition of other more aggregated data types and are therefore listed in this section.

11.1.5.1.1 Coordinate pair

[

First Coordinate	:SIGNED LONG	11.1.4.36
Second Coordinate	:SIGNED LONG	11.1.4.36

]

11.1.5.1.2 Coordinate triplet

[

First Coordinate	:SIGNED LONG	11.1.4.36
Second Coordinate	:SIGNED LONG	11.1.4.36
Third Coordinate	:SIGNED LONG | NULL	11.1.4.36

]

11.1.5.2 Country code list

[ISO COUNTRY CODE]* 11.1.4.19

11.1.5.3 Date

[

Year	:SET 00-99	11.1.4.34
Month	:MONTH CODE	11.1.4.21
Day	:DAY CODE	11.1.4.8

]

11.1.5.4 Date/hour

[

Year	:YEAR CODE	11.1.4.40
Month	:MONTH CODE	11.1.4.21
Day	:DAY CODE	11.1.4.8
Hour	:HOUR CODE	11.1.4.17

]

11.1.5.5 Free text

=[CHARACTER]* 11.1.4.4

11.1.5.6 Language code list

:[MARC LANGUAGE CODE]* 11.1.4.20

11.1.5.7 Month/Hour

[

Month	:MONTH CODE	11.1.4.21
Day	:DAY CODE	11.1.4.8
Hour	:HOUR CODE	11.1.4.17

]

11.1.5.8 Short string

	=[CHARACTER]*	11.1.4.4

Constraints

C1: The characters Left Parenthesis, Right Parenthesis and Space are not allowed.

C2: The length of SHORT STRING may not exceed 10 characters.

11.1.5.9 Value domain

[

Minimum Value Allowed	: SIGNED LONG	11.1.4.36
Maximum Value Allowed	: SIGNED LONG	11.1.4.36

]

11.1.5.10 Place

[

Country	:ISO COUNTRY CODE	11.1.4.19
Place-Name	:FREE TEXT	11.1.5.5

]

11.1.5.11 Place list

	=[PLACE]*	11.1.5.10

11.1.5.12 Proper name

[

Proper Name Language	= MARC LANGUAGE CODE	11.1.4.20
Proper Name	= FREE TEXT	11.1.5.5

]

11.1.5.13 Quality description

[

XY Resolution	:SIGNED SHORT	11.1.4.37
XY Accuracy	:SIGNED SHORT	11.1.4.37
Z Accuracy	:SIGNED SHORT	11.1.4.37
Relative Accuracy	:PERCENTAGE	11.1.4.25
Mean Survey Date	:DATE	11.1.5.3
Maximum Age	:DATE	11.1.5.3
Feature Completeness	:PERCENTAGE	11.1.4.25
Attribute Completeness	:PERCENTAGE	11.1.4.25
Correctness	:PERCENTAGE	11.1.4.25

]

11.2 Album and Dataset

The aggregation of all the information pertaining to a particular geographical area, created at a particular moment by a certain supplier, is called an Album.

An Album may contain one or more Datasets which each consists of exactly one set of Dataset Global Data followed by one or more Sections.

See the Global Data Catalogue for more details.

11.2.1 Album

	=[DATASET]*	11.2.2

11.2.2 Dataset

[

Dataset Global Data	: DATASET GLOBAL DATA	11.3
Sections	: SECTION LIST	11.4.1.1

]

Constraint

C1: A Dataset must belong to exactly one Album

The relations between Album, Datasets, Sections and Layers are illustrated in figure 11.2

11.3 Data Set Global Data

Each Dataset starts with global data: data about the feature data needed to interpret these data in the right context.

For a more narrative description of the global data items, the reader is requested to consult the Global Data Catalogue (Volume 7).

Dataset global data =
[

Dataset Header	:DATASET HEADER	11.3.1
Data Dictionary	:DATA DICTIONARY	11.3.2
Directory	:DIRECTORY LIST	11.3.3.1
Spatial Domain	:SPATIAL DOMAIN LIST	11.3.4.1
Source(s)	:SOURCE LIST	11.3.5
Default Attribute(s)	:DEFAULT ATTRIBUTE LIST	11.3.6
Geodetical Parameters	:GEODETICAL PARAMETERS	11.3.7
Feature Quality	:FEATURE QUALITY LIST	11.3.8
Attribute Quality	:ATTRIBUTE QUALITY LIST	11.3.9

]

11.3.1 Dataset Header

The Dataset Header occurs exactly once in a Dataset and indicates the beginning of both the entire Dataset and the Dataset Global Data.

DATASET HEADER =
[

International Dataset ID	:FREE TEXT	11.1.5.5
Supplier Dataset ID	:UNSIGNED LONG	11.1.4.38
Edition Date	:DATE/HOUR	11.1.5.4
Dataset Language(s)	:LANGUAGE CODE LIST	11.1.5.6
Country(ies) Involved	:COUNTRY CODE LIST	11.1.5.2
Dataset Title(s)	:DATASET TITLE LIST	11.3.1.1
Production Information	:PRODUCTION INFORMATION LIST	11.3.1.3
Creation Year	:YEAR CODE	11.1.4.40
Dataset Geographical Coverage	:FREE TEXT	11.1.5.5
Thematic Coverage	:THEME LIST	11.3.1.5
Dataset Quality	:QUALITY DESCRIPTION	11.1.5.13

]

Constraints

C1: The Supplier Dataset Identification Number is an identifier of the Dataset which is unique within the set of Datasets supplied by a particular supplier.

11.3.1.1 Dataset title list

= [DATASET TITLE]* 11.3.1.2

11.3.1.2 Dataset title

[

Dataset Main Title	:PROPER NAME	11.1.5.12
Dataset Subtitle	:FREE TEXT	11.1.5.5

]

<u>11.3.1.3 Production information list</u>

	=[PRODUCTION INFORMATION]*	11.3.1.4

<u>11.3.1.4 Production information</u>

[

Production Place	:PLACE	11.1.5.10
Producer Name	:PROPER NAME	11.1.5.12

]

<u>11.3.1.5 Theme list</u>

	= [THEME]*	11.3.1.6

<u>11.3.1.6 Theme</u>

[

Feature Theme Code	:FEATURE THEME CODE	11.1.4.14
Feature Theme Name	:FEATURE THEME NAME	11.1.4.15

]

11.3.2 Data Dictionary

The Data Dictionary contains the explicit documentation of a number of implementation -and application- dependent constructs: field and record definitions and definitions of the feature and attributes used in a particular Dataset.

Data dictionary =

[

Field Definitions	:FIELD DEFINITION LIST	11.3.2.1
Record Definitions	:RECORD DEFINITION LIST	11.3.2.3
Feature Definitions	:FEATURE DEFINITION LIST	11.3.2.5
Attribute Definitions	:ATTRIBUTE DEFINITION LIST	11.3.2.7

]

<u>11.3.2.1 Field definition list</u>

	= [FIELD DEFINITION]*	11.3.2.2

<u>11.3.2.2 Field Definition</u>

[

Field Name	:SHORT STRING	11.1.5.8
Field Size	:UNSIGNED SHORT	11.1.4.39
Data Type	:DATA TYPE CODE	11.1.4.5
Data Unit	:DATA UNIT CODE	11.1.4.6
Unit Exponent	:SIGNED SHORT	11.1.4.37
No Data	:NO DATA MARK	11.1.4.23
Value Domain	:VALUE DOMAIN	11.1.5.9
Field Description	:FREE TEXT	11.1.5.5

]

Constraints

C1: The Field Name is an identifier of a Field which is unique within the field definitions of GDF

11.3.2.3 Record definition list

	=[RECORD DEFINITION]*	11.3.2.4

11.3.2.4 Record definition

[

Record Type Code	:SET 00-99	11.1.4.34
Record Subtype Code	:SET 00-99 | NULL	11.1.4.34
Record Name	:SHORT STRING	11.1.5.8
Field Name(s)	:RANGE(FIELD DEFINITION LIST)	11.3.2.1
Record Comments	:FREE TEXT	11.1.5.5

]

Constraints

C1: The Record Type Code is an identifier of a record type which must be unique within a particular Dataset.

C2: The Record Subtype Code is an identifier of a subrecord type which must be unique within a particular record type.

C3: The Record Name is an identifier of a record type or record subtype which must be unique within a particular Dataset.

C4: The fields referred to by Field Name must belong to the same Dataset as the record type in question.

11.3.2.5 Feature definition list

	=[FEATURE DEFINITION]*	11.3.2.6

11.3.2.6 Feature definition

[

Feature Class Code	:FEATURE CLASS CODE	11.1.4.12
Feature Class Name	:FEATURE CLASS NAME	11.1.4.13
Feature Class Alias	:PROPER NAME	11.1.5.12

]

Constraints

C1: A Feature Class Alias is a name of a feature class which must be unique within a Dataset.

11.3.2.7 Attribute definition list

	=[ATTRIBUTE DEFINITION]*	11.3.2.8

11.3.2.8 Attribute definition

[

Attribute Type Code	:ATTRIBUTE TYPE CODE	11.1.4.1
Attribute Value Field Size	:UNSIGNED SHORT	11.1.4.39
Data Type	:DATA TYPE CODE	11.1.4.5
Data Unit	:DATA UNIT CODE	11.1.4.6
Unit Exponent	:SIGNED SHORT	11.1.4.37
No Data	:NO DATA MARK	11.1.4.23
Value Domain	:VALUE DOMAIN	11.1.5.9
Field Description	:FREE TEXT	11.1.5.5

]

11.3.3 Directory

The Directory lists the number of records stored in a particular Dataset, sorted according to Volume, Section, Layer and record type.

11.3.3.1 Directory list

	= [DIRECTORY]*	11.3.3.2

11.3.3.2 Directory

[

Volume Identifier	:ELEMENT(ALBUM)	11.8.1
Section Identification	:ELEMENT(SECTION LIST)	11.4.1.1
Layer Identification	:ELEMENT(LAYER LIST)	11.4.2.1
Record Type Code	:ELEMENT(RECORD DEFINITION LIST)	11.3.2.3
Record Quantity	:UNSIGNED LONG	11.1.4.38

]

Constraints

C1: The Volume referred to by Volume Identifier must contain at least a part of the Dataset in which the Directory in question belongs.

C2: The Section referred to by Section Identification must belong to the Volume as referred to by the preceding Volume Identifier.

C3: The Layer referred to by Layer Identification must belong to the Section as referred to by the preceding Section Identification.

C4: The record type referred to by Record Type Code must belong to the same Dataset as the Directory.

C5: The set of record instances referred to by Record Type Code must belong to the Layer as referred to by the preceding Layer Identification.

11.3.4 Spatial Domain

This datatype describes the geographical coverage of a Dataset. See the Global Data Catalogue for more details.

11.3.4.1 Spatial domain list

	= [SPATIAL DOMAIN]*	11.3.4.2

11.3.4.2 Spatial domain

[

Section Identification	:ELEMENT(SECTION LIST)	11.4.1.1
Maximum Latitude	:SIGNED LONG	11.1.4.36
Minimum Latitude	:SIGNED LONG	11.1.4.36
Maximum Longitude	:SIGNED LONG	11.1.4.36
Minimum Longitude	:SIGNED LONG	11.1.4.36
Area Name	:FREE TEXT	11.1.5.5

]

Constraints

C1: The Section referred to by Section Identification must belong to the same Dataset as Spatial Domain in question.

11.3.5 Source

"Source" is the general term for the documents (books, reports, maps, aerial photo's etc.) that is used in the establishment of the Dataset. See the Global Data Catalogue for more details.

11.3.5.1 Source list

	= [SOURCE]*	11.3.5.2

11.3.5.2 Source

[

Description Level	:SET 1-4	11.1.4.31
Level of Completeness	:SET 1-3	11.1.4.30
Source Description Identifier	:UNSIGNED SHORT	11.1.4.39
Parent Description Identifier	:ELEMENT(SOURCE LIST)	11.3.5.1
Internat. Standard Book Nr.	:FREE TEXT	11.1.5.5
Internat. Standard Serial Nr.	:FREE TEXT	11.1.5.5
Document Language(s)	:LANGUAGE CODE LIST	11.1.5.6
Country(ies)Involved	:COUNTRY CODE LIST	11.1.5.2
Year of Survey	:YEAR CODE	11.1.4.40
Date of Survey	:MONTH/HOUR	11.1.5.7
Authors	:FREE TEXT	11.1.5.5
Map Scale(s)	:UNSIGNED LONG	11.1.4.38
Document Title(s)	:DOCUMENT TITLE LIST	11.3.5.3
Volume Name(s)	:VOLUME NAME LIST	11.3.5.5
Edition Number	:FREE TEXT	11.1.5.5
Impression Number	:FREE TEXT	11.1.5.5
Year of Publication	:YEAR CODE	11.1.4.40
Site(s) of Publication	:PLACE LIST	11.1.5.11
Name of Publisher	:FREE TEXT	11.1.4.40
Site(s) of Distribution	:PLACE LIST	11.1.5.11
Name of Distributor	:FREE TEXT	11.1.5.5
Host Document Relation	:HOST DOCUMENT RELATION	11.3.5.6

]

Constraint

C1: The Source Description Identifier is an identifier of the description of a source document which is unique within a particular Dataset.

C2: The source document referred to by Parent Description Identifier must belong to the same Dataset as the source referred to by Source Description Identifier.

11.3.5.3 Document title list

	=[DOCUMENT TITLE]*	11.3.5.4

11.3.5.4 Document title

[

Document Title	:PROPER NAME	11.1.5.12
General Comment	:FREE TEXT	11.1.5.5

]

11.3.5.5 Volume name list

	=[PROPER NAME]*	11.1.5.12

11.3.5.6 Host document relation

[

Host Description Identifier	:ELEMENT(SOURCE LIST)	11.3.5.2
Kind of Relationship	:RELATION KIND CODE	11.1.4.27
From Page	:UNSIGNED SHORT	11.1.4.39
To Page	:UNSIGNED SHORT	11.1.4.39
General Comments	:FREE TEXT	11.1.5.5

]

Constraints

C1: The source document referred to by Host Description Identifier must belong to the same Dataset as the source to which the Host Document Relation refers.

11.3.6 Default Attribute

A Default Attribute provides a technique to assign a particular attribute value to a set of features instead of a single feature. Declaring a particular value as the default value of an attribute, implies that the absence of that attribute for a particular feature instance means that that particular feature has the default value. The use of Default Attribute is only allowed under the following conditions: It must be absolutely clear for which feature classes the attribute is relevant and for which it is not. The attribute must be applicable for all instances of the features for a given class. The attribute must have been collected for 100% of the relevant features.

11.3.6.1 Default attribute list

= [DEFAULT ATTRIBUTE]*	11.3.6.2

11.3.6.2 Default Attribute

[

Attribute Type	:ATTRIBUTE TYPE CODE	11.1.4.1
Attribute Value	:ATTRIBUTE VALUE CODE | NULL	11.1.4.2

]

11.3.7 Geodetical Parameters

The Geodetical Parameters section contains general information about geodetical items, such as datums, ellipsoids, geoid ondulation, projection methods and grid systems. It includes data which is needed in order to interpret the metric data in a correct way.

See the Global Data Catalogue for more details.

Geodetical parameters =

[

Geodetical Datum(s)	:DATUM LIST	11.3.7.1.1
Orthometric Height Reference(s)	:HEIGHT LEVEL LIST	11.3.7.2.1
Projection Method(s)	:PROJECTION TYPE LIST	11.3.7.3.1
National Map Grid(s)	:MAP GRID LIST	11.3.7.4.1
Geoid Ondulation(s)	:ONDULATION LIST	11.3.7.5.1
Magnetic Declination(s)	:DECLINATION LIST	11.3.7.6.1

]

11.3.7.1 Geodetical Datum

11.3.7.1.1 Datum list

=[GEODETICAL DATUM]*	11.3.7.1.2

11.3.7.1.2 Geodetical datum

[

Datum Description Id.	:UNSIGNED SHORT	11.1.4.39
Datum Origin	:DATUM ORIGIN	11.3.7.1.3
Datum Z Rotation	:UNSIGNED SHORT	11.1.4.39
Scale Factor	:SIGNED SHORT	11.1.4.37
Datum Name	:DATUM NAME	11.1.4.7
Reference Ellipsoid	:ELLIPSOID	11.3.7.1.4

]

Constraints

C1: The Datum Description Identifier is an identifier of the datum which must be unique within the Dataset.

11.3.7.1.3 Datum origin

[

X-Origin	:SIGNED SHORT	11.1.4.37
Y-Origin	:SIGNED SHORT	11.1.4.37
Z-Origin	:SIGNED SHORT	11.1.4.37

]

11.3.7.1.4 Ellipsoid

[

Semi Major Axis	:UNSIGNED LONG	11.1.4.38
Semi Minor Axis	:UNSIGNED LONG	11.1.4.38
Ellipsoid	:ELLIPSOID CODE	11.1.4.11

]

<u>11.3.7.2 Orthometric Height Reference</u>

11.3.7.2.1 Height level list

= [HEIGHT LEVEL]* 11.3.7.2.2

11.3.7.2.2 Height level

[

Vertical Datum Descr. Id.	:UNSIGNED SHORT	11.1.4.39
Relevant Country	:ISO COUNTRY CODE	11.1.4.19
Height Level Name	:HEIGHT LEVEL NAME	11.1.4.16
Adjacent Levels	:ADJACENT LEVEL LIST	11.3.7.2.3

]

Constraints

C1: The Vertical Datum Description Identifier is an identifier of the vertical datum which must be unique within a Dataset.

C2: The combination of Relevant Country and Height Level Name is a identifier of a vertical datum which must be unique within a particular Dataset.

11.3.7.2.3 Adjacent level list

:[ADJACENT LEVEL]* 11.3.7.2.4

11.3.7.2.4 Adjacent level

[

Used in Country	:ISO COUNTRY CODE	11.1.4.19
Height Level Name	:HEIGHT LEVEL NAME	11.1.4.16
Height Difference	:SIGNED SHORT	11.1.4.37

]

Constraints

C1: The combination of Used in Country and Height Level Name is a identifier of a vertical datum which must be unique within a particular Dataset.

11.3.7.3 Projection Method

11.3.7.3.1 Projection list

	=[PROJECTION TYPE LIST]*	11.3.7.3.2

11.3.7.3.2 Projection type

[

Projection Description Id.	:UNSIGNED SHORT	11.1.4.39
Projection Type	:PROJECTION TYPE CODE	11.1.4.26
Projection Parameters	:PROJECTION PARAMETERS	11.3.7.3.3

]

Constraints

C1: The Projection Description Identifier is a identifier of a (description) of a Projection which must be unique within a particular Dataset.

11.3.7.3.3 Projection parameters

[

First Latitude Parameter	:SIGNED LONG | NULL	11.1.4.36
First Longitude Parameter	:SIGNED LONG | NULL	11.1.4.36
Second Latitude Parameter	:SIGNED LONG | NULL	11.1.4.36
Second Longitude Parameter	:SIGNED LONG | NULL	11.1.4.36
Third Latitude Parameter	:SIGNED LONG | NULL	11.1.4.36
Third Longitude Parameter	:NULL	11.1.4.24
Point Scale Factor	:SIGNED SHORT	11.1.4.37

]

11.3.7.4 National Map Grid

11.3.7.4.1 Map grid list

	=[NATIONAL GRID]*	11.3.7.4.2

11.3.7.4.2 National grid

[

Grid Description Identifier	:UNSIGNED SHORT	11.1.4.39
Grid Axis Orientation	:BOOLEAN	11.1.4.3
Help Grid Origin	:COORDINATE PAIR	11.1.5.1
National Grid Origin	:COORDINATE PAIR	11.1.5.1
Grid Rotation	:SIGNED LONG	11.1.4.36

]

Constraints

C1: The Grid Description Identifier is a identifier of grid description which must be unique within a Map Grid List.

11.3.7.5 Geoid Ondulation

11.3.7.5.1 Ondulation list

	=[ONDULATION REFERENCE]*	11.3.7.5.2

11.3.7.5.2 Ondulation reference

[

Geoid Description Id.	:UNSIGNED SHORT	11.1.4.39
Reference Point Position	:COORDINATE PAIR	11.1.5.1
Ellipsoidal Height	:SIGNED SHORT	11.1.4.37

]

Constraints

C1: The Geoid Description Identifier is an identifier of the of an geoidal ondulation description, which is unique within a particular Dataset.

11.3.7.6 Magnetic Declination

11.3.7.6.1 Declination list

	= [DECLINATION REFERENCE]*	11.3.7.6.2

11.3.7.6.2 Declination reference

[

Declination Description Id.	:UNSIGNED SHORT	11.1.4.39
Reference Point Position	:COORDINATE PAIR	11.1.5.1
Validity Date	:DATE	11.1.5.3
Magnetic Variation	:SIGNED SHORT	11.1.4.37
Annual Change	:SIGNED SHORT	11.1.4.37
Hor. Magnetic Field Int.	:SIGNED SHORT	11.1.4.37
Ver. Magnetic Field Int.	:SIGNED SHORT	11.1.4.37

]

Constraints

C1: The Declination Description Identifier is an identifier of an magnetic declination description, which is unique within a particular Dataset.

11.3.8 Feature Quality

The feature quality descriptions give the possibility to describe the completeness of the instances of a particular feature class.

11.3.8.1 Feature quality list

	=[FEATURE QUALITY]*	11.3.8.2

11.3.8.2 Feature quality

[

Feature Quality Descr. Id.	:UNSIGNED SHORT	11.1.4.39
Feature Class	:FEATURE CLASS CODE	11.1.4.12
Feature Completeness	:PERCENTAGE	11.1.4.25

]

Constraints

C1: The Feature Quality Description Identifier is an identifier of a particular feature quality description which must be unique within a particular Dataset.

11.3.9 Attribute Quality

The attribute quality descriptions give the possibility to describe the accuracy, completeness and correctness of sets of attributes.

11.3.9.1 Attribute quality list

	=[ATTRIBUTE QUALITY]*	11.3.9.2

11.3.9.2 Attribute Quality

[

Attribute Quality Descr. Id.	:UNSIGNED SHORT	11.1.4.39
Feature Class	:FEATURE CLASS CODE	11.1.4.12
Attribute Type	:ATTRIBUTE TYPE CODE	11.1.4.1
Attribute Value	:ATTRIBUTE VALUE CODE	11.1.4.2
Survey Date	:DATE	11.1.5.3
Aging Rate	:PERCENTAGE	11.1.4.25
Attribute Resolution	:UNSIGNED SHORT	11.1.4.39
Absolute Attribute Accuracy	:UNSIGNED SHORT	11.1.4.39
Relative Attribute Accuracy	:PERCENTAGE	11.1.4.25
Attribute Completeness	:PERCENTAGE	11.1.4.25
Attribute Correctness	:PERCENTAGE	11.1.4.25

]

Constraints

C1: The Attribute Quality Description Identifier is an identifier of a particular feature quality description which must be unique within a particular Dataset.

11.4 Section and layer

A Dataset is subdivided into one or more Sections, which division is based upon geographical criteria. Each Section is subdivided into one or more Layers. A Layer is the set of all Nodes, Edges and Faces that form one single planar (Level-0) graph which is related to one or more feature themes.

Relations between Section, Layers and Primitives are illustrated in figure 11.4

11.4.1 Section

11.4.1.1 Section list

	= [SECTION]*	11.4.1.2

11.4.1.2 Section

[

Section Header	:SECTION HEADER	11.4.1.3
Layers	:LAYER LIST	11.4.2.1
Conversions	:CONVERSION LIST	11.6.1
Relationships	:RELATIONSHIP LIST	11.7.1

]

11.4.1.3 Section header

[

Section Identifier	:UNSIGNED SHORT	11.1.4.39
Section Geographical Coverage	:FREE TEXT	11.1.5.5
Section Quality	:QUALITY DESCRIPTION	11.1.5.13
Feature Quality Desc. Id.(s)	:RANGE(FEATURE QUALITY LIST)	11.3.8.1
Attribute Quality Desc. Id.(s)	:RANGE(ATTRIBUTE QUALITY LIST)	11.3.9.1
Source Descr. Identifier(s)	:RANGE(SOURCE LIST)	11.3.5.1
Datum Desription Identifier	:ELEMENT(DATUM LIST)	11.3.7.1.1
Horizontal Reference Type	:BOOLEAN	11.1.4.3
Projection Descr.Identifier	:ELEMENT(PROJECTION TYPE LIST)	11.3.7.3.1
Grid Description Identifier	:ELEMENT(MAP GRID LIST)	11.3.7.4.1
Declination Descr. Id.(s)	:RANGE(DECLINATION LIST)	11.3.7.6.1
Height Reference Type	:BOOLEAN	11.1.4.3
Vertical Datum Description Id.	:ELEMENT(HEIGHT LEVEL LIST)	11.3.7.2.1
Geoid Description Identifier(s)	:RANGE(ONDULATION LIST)	11.3.7.5.1
XY Multiplication Factor	:SIGNED SHORT	11.1.4.37
Z Multiplication Factor	:SIGNED SHORT	11.1.4.37
XY Offset	:COORDINATE PAIR	11.1.5.1.1
Maximum XY	:COORDINATE PAIR	11.1.5.1.1
Minimum XY	:COORDINATE PAIR	11.1.5.1.1
XY Control Point(s)	:XY CONTROL POINT LIST	11.4.1.4
Z Control Point(s)	:Z CONTROL POINT LIST	11.4.1.6

]

Constraints

C1: The Section Identifier is an identifier of a Section which must be unique within a particular Section.

C2: The feature quality list referred to by Feature Quality Description Identifier must belong to the same Dataset as the Section in question.

C3: The attribute quality list referred to by Attribute Quality Description Identifier must belong to the same Dataset as the Section in question.

C4: The data source(s) referred to by Source Description Identifier must belong to the same Dataset as the Section in question.

C5: The geodetical datum(s) referred to by Datum Description Identifier must belong to the same Dataset as the Section in question.

C6: The projection(s) referred to by Projection Description Identifier must belong to the same Dataset as the Section in question.

C7: The map grid(s) referred to by Grid Description Identifier must belong to the same Dataset as the Section in question.

C8: The magnetic declination values referred to by Grid Description Identifier must belong to the same Dataset as the Section in question.

C9: The orthometric height reference system referred to by Vertical Datum Description Identifier must belong to the same Dataset as the Section in question.

C10: The geoid height values referred to by Geoid Description Identifier must belong to the same Dataset as the Section in question.

11.4.1.4 XY Control point list

	=[XY CONTROL POINT]*	11.4.1.5

11.4.1.5 XY Control point

[

Point Name	:FREE TEXT	11.1.5.5
X Digitized	:SIGNED DOUBLE	11.1.4.35
Y Digitized	:SIGNED DOUBLE	11.1.4.35
X Surveyed	:SIGNED DOUBLE	11.1.4.35
Y Surveyed	:SIGNED DOUBLE	11.1.4.35

]

Constraints

C1: The Point Name is an identifier of a control point which must be unique within a particular Section.

11.4.1.6 Z Control point list

	= [Z CONTROL POINT]*	11.4.1.7

11.4.1.7 Z Control point

[

Point Name	:FREE TEXT	11.1.5.5
XY Reference	:COORDINATE PAIR	11.1.5.1.1
Z Digitized	:SIGNED LONG	11.1.4.36
Z Surveyed	:SIGNED LONG	11.1.4.36

]

Constraints

C1: The Point Name is an identifier of a control point which must be unique within a particular Section.

11.4.2 Layer Header

11.4.2.1 Layer list

	=[LAYER]*	11.4.2.2

11.4.2.2 Layer

[

Layer Header	:LAYER HEADER	11.4.2.3
Feature Data	:FEATURE DATA	11.5
Comments	:FREE TEXT	11.1.5.5

]

11.4.2.3 Layer header

[

Layer Identifier	:UNSIGNED SHORT	11.1.4.39
Layer Quality	:QUALITY DESCRIPTION	11.1.5.13
Layer Themes	:THEME CODE LIST	11.4.2.4

]

Constraints

C1: The Layer Identifier is an identifier of a Layer which must be unique within a particular Section.

11.4.2.4 Theme code list

	:[FEATURE THEME CODE]*	11.1.4.14

11.5 Feature Data

Feature Data =

[

Geometry	:GEOMETRY LIST	11.5.1.1
Nodes	:NODE LIST	11.5.2.1
Edges	:EDGE LIST	11.5.3.1
Faces	:FACE LIST	11.5.4.1
Names	:NAME LIST	11.5.5.1
Time Domains	:TIME DOMAIN LIST	11.5.6.1
Attributes	:ATTRIBUTE SET LIST	11.5.7.1
Point Features	:POINT FEATURE LIST	11.5.8.1
Line Features	:LINE FEATURE LIST	11.5.9.1
Area Features	:AREA FEATURE LIST	11.5.10.1
Complex Features	:COMPLEX FEATURE LIST	11.5.11.1

]

11.5.1 Geometry

<u>11.5.1.1 Geometry list</u>

= [GEOMETRY]* 11.5.1.2

<u>11.5.1.2 Geometry</u>

[

Geometry Identifier	:UNSIGNED LONG	11.1.4.38
Geometry Type Code	:SET 1	11.1.4.29
Quality Code	:SIGNED SHORT	11.1.4.37
Source Description Identifier	:ELEMENT(SOURCE LIST)	11.3.5.1
Intermediate Points	:COORDINATE LIST	11.5.1.3

]

Constraints

C1: The Geometry Identifier is an identifier of a set of coordinates which must be unique within a particular Section.

<u>11.5.1.3 Coordinate list</u>

= [COORDINATE TRIPLET]* 11.1.5.1.2

Constraints

C1: The order of the Coordinate Triplets in a Coordinate List is meaningful. The order must correspond to the topological order of the Intermediate Points of the Edge and must correspond to the orientation of the Edge of which these points are a part.

11.5.2 Nodes

<u>11.5.2.1 Node list</u>

= [NODE]* 11.5.2.2

11.5.2.2 NODE

[

Node Identifier	:UNSIGNED LONG	11.1.4.38
Geometry Identifier	:ELEMENT(GEOMETRY LIST)	11.5.1.1
Node in Face	:ELEMENT(FACE LIST)	11.5.4.1
Status	:SET 1-4	11.1.4.31
Incident Edges	:INCIDENT EDGE LIST	11.5.2.3

]

Constraints

C1: The Node Identifier is an identifier of a Node which must be unique within a particular Section.

C2: The coordinate string referred to by Geometry Identifier must be belong to the same Layer as the Node in question.

C3: The Face referred by Node in Face must belong to the same Layer as the Node in question.

11.5.2.3 Incident edge list

= [INCIDENT EDGE]* 11.5.2.4

11.5.2.4 Incident edge

[

Edge Identifier	:ELEMENT(EDGE LIST)	11.5.3.1
Start or End	:BOOLEAN	11.1.4.3

]

Constraints

C1: The Edge referred to by Edge Identifier must be belong to the same Layer as the Node that refers to that Edge.

11.5.3 Edges

11.5.3.1 Edge list

=[EDGE]* 11.5.3.2

11.5.3.2 Edge

[

Edge Identifier	:UNSIGNED LONG	11.1.4.38
Geometry Identifier	:ELEMENT(GEOMETRY LIST)	11.5.1.1
From Node Identifier	:ELEMENT(NODE LIST)	11.5.2.1
To Node Identifier	:ELEMENT(NODE LIST)	11.5.2.1
Left Face Identifier	:ELEMENT(FACE LIST)	11.5.4.1
Right Face Identifier	:ELEMENT(FACE LIST)	11.5.4.1
Status	:SET 1-3	11.1.4.30

]

Constraints

C1: The Edge Identifier is an identifier of an Edge which must be unique within a particular Section.

C2: The coordinate string referred to by Geometry Identifier must belong to the same Layer as the Edge in question.

C3: The Nodes referred to by From Node Identifier and To Node Identifier must belong to the same Layer as the Edge in question.

C4: The Faces referred to by Left Face Identifier and Right Face Identifier must belong to the same Layer as the Edge in question.

11.5.4 Face

11.5.4.1 Face list

	=[FACE]*	11.5.4.2

11.5.4.2 Face

[

Face Identifier	:UNSIGNED LONG	11.1.4.38
Bounding Edges	:BOUNDING EDGE LIST	11.5.4.3

]

Constraints

C1: The Face Identifier is an identifier of a Face which must be unique within a particular Section

11.5.4.3 Bounding edge list

	= [BOUNDING EDGE]*	11.5.4.4

11.5.4.4 Bounding edge

[

Edge Identifier	:ELEMENT(EDGE LIST)	11.5.3.1
Edge Orientation	:BOOLEAN	11.1.4.3

]

Constraints

C1: The Edge referred to by Edge Identifier must belong to the same Layer as the Face referring to that Edge.

11.5.5 Name

11.5.5.1 Name list

	:[NAME]*	11.5.5.2

11.5.5.2 Name

[

Name Identifier	:UNSIGNED LONG	11.1.4.38
Description Identifier	:ELEMENT(SOURCE LIST)	11.3.5.1
Feature Proper Name	:PROPER NAME	11.1.5.12

]

Constraints

C1: The Name Identifier is an identifier of a Name which is unique within a particular Section.

C2: The data source referred to by Source Description Identifier must belong to the same Dataset as the Name in question.

11.5.6 Time Domain

The data structures described in this section provide the means to express a time period of any complexity. See Appendix A1.15 for more details.

11.5.6.1 Time domain list

	= [TIME DOMAIN]*	11.5.6.2

11.5.6.2 Time domain

[

Time Domain Identifier	:UNSIGNED LONG	11.1.4.38
Source Description Identifier	:ELEMENT(SOURCE LIST)	11.3.5.1
Time Domain Description	:COMPOSITE TIME DOMAIN	11.5.6.3
	| BASIC TIME DOMAIN	11.5.6.4

]

Constraints

C1: The Time Domain Identifier is an identifier of a Time Domain which must be unique within a particular Section.

C2: The data source referred to by Source Description Identifier must belong to the same Dataset as the Time Domain in question.

11.5.6.3 Composite time domain

[

Time Domain Description	:COMPOSITE TIME DOMAIN|	11.5.6.3
	BASIC TIME DOMAIN	11.5.6.4
Set Operator	: [+ | * | -]	
Time Domain Description	:COMPOSITE TIME DOMAIN|	11.5.6.3
	BASIC TIME DOMAIN	11.5.6.4

]

The Set Operator symbols have the following meaning:

A+B:the union of A and B

A*B:the intersection of A and B

A-B:the difference of A and B

11.5.6.4 Basic time domain

[

Starting Date	:STARTING DATE	11.5.6.5
Duration	:DURATION	11.5.6.6

]

11.5.6.5 Starting date

[

Year	:SIGNED LONG | NULL	11.1.4.36
Month in Year	:MONTH IN YEAR CODE | NULL	11.1.4.22
Week in Year	:WEEK CODE | NULL	11.1.4.41
Day in Month	:DAY IN MONTHCODE | NULL	11.1.4.39
Forwards or Backwards	:BOOLEAN | NULL	11.1.4.3
Week in Month	:WEEK IN MONTH CODE | NULL	11.1.4.42
Day in Week	:DAY IN WEEK CODE | NULL	11.1.4.10
Hour in Day	:HOUR IN DAY CODE | NULL	11.1.4.18
Minute in Hour	:SET 0-59 | NULL	11.1.4.32
Second in Minute	:SET 0-59 | NULL	11.1.4.32

]

11.5.6.6 Time duration

[

Number of Years	:UNSIGNED SHORT | NULL	11.1.4.39
Number of Months	:UNSIGNED SHORT | NULL	11.1.4.39
Number of Weeks	:UNSIGNED SHORT | NULL	11.1.4.39
Number of Days	:UNSIGNED SHORT | NULL	11.1.4.39
Number of Hours	:UNSIGNED SHORT | NULL	11.1.4.39
Number of Minutes	:UNSIGNED SHORT | NULL	11.1.4.39
Number of Seconds	:UNSIGNED SHORT | NULL	11.1.4.39

]

11.5.7 Attribute

11.5.7.1 Attribute set list

	=[ATTRIBUTE SET]*	11.5.7.2

11.5.7.2 Attribute set

[

Attribute Set Identifier	: UNSIGNED LONG	11.1.4.38
From Curvimetric Position	: UNSIGNED SHORT	11.1.4.39
To Curvimetric Position	: UNSIGNED SHORT	11.1.4.39
Validity Direction	: +- | NULL	11.1.4.43
Attributes	: ATTRIBUTE LIST	11.5.7.3

]

Constraints

C1: The Attribute Set Identifier is an identifier of a particular Attribute Set which is unique within a particular Section.

11.5.7.3 Attribute list

	= [ATTRIBUTE]*	11.5.7.4

11.5.7.4 Attribute

	= COMPOSITE ATTRIBUTE	11.5.7.5
	| SIMPLE ATTRIBUTE	11.5.7.6

11.5.7.5 Composite attribute

[

Sub-attributes	:ATTRIBUTE LIST	11.5.7.3

]

11.5.7.6 Simple attribute

[

Attribute Type Code	:ATTRIBUTE TYPE CODE	11.1.4.1
Description Identifier	:ELEMENT(SOURCE LIST)	11.3.5.1
Attribute Value	:ATTRIBUTE VALUE CODE|	11.1.4.2
	ELEMENT(NAME LIST)	11.5.5.1
	ELEMENT(TIME DOMAIN LIST)	11.5.6.1

]

Constraints

C1: The data source referred to by Description Identifier must belong to the same Dataset as the Attribute in question.

C2: The Name or Time Domain referred to by Attribute Value must belong to the same Layer as the Attribute in question.

11.5.8 Point Feature

11.5.8.1 Point feature list

= [POINT FEATURE]* 11.5.6.2

11.5.8.2 POINT FEATURE

[

Point Feature Identifier	:UNSIGNED LONG	11.1.4.38
Feature Class Code	:FEATURE CLASS CODE	11.1.4.12
Node Identifier	:ELEMENT(NODE LIST)	11.5.2.1
Attribute Set Identifier(s)	:RANGE(ATTRIBUTE SET LIST)	11.5.7.1

]

Constraints

C1: The Point Feature Identifier is an identifier of a Point Feature which must be unique within a particular Section.

C2: The Node referred to by Node Identifier must belong to the same Layer as the Point Feature in question.

C3: The Attribute Set(s) referred to by Attribute Set Identifier must belong to the same Layer as the Point Feature in question.

11.5.9 Line Features

11.5.9.1 Line feature list

= [LINE FEATURE]* 11.5.9.2

11.5.9.2 Line feature

[

Line Feature Identifier	:UNSIGNED LONG	11.1.4.38
Feature Class Code	:FEATURE CLASS CODE	11.1.4.12
Split Indicator	:BOOLEAN	11.1.4.3
Edge References	:EDGE REFERENCE LIST	11.5.9.3
Attribute Set Identifier(s)	:RANGE(ATTRIBUTE SET LIST)	11.5.7.1
From Point Identifier	:ELEMENT(POINT FEATURE LIST)	11.5.8.1
To Point Identifier	:ELEMENT(POINT FEATURE LIST)	11.5.8.1

]

Constraints

C1: The Line Feature Identifier is an identifier of a Line Feature which must unique within a particular Section.

C2: The Attribute Set(s) referred to by Attribute Set Identifier must belong to the same Layer as the Line Feature in question.

C3: The Points referred to by From Point Identifier and To Point Identifier must belong to the same Layer as the Line Feature in question.

11.5.9.3 Edge reference list

= [EDGE REFERENCE]* 11.5.9.4

11.5.9.4 Edge reference

[

Edge Identifier	:ELEMENT(EDGE LIST)	11.5.3.1
Line Direction	:BOOLEAN	11.1.4.3

]

Constraints

C1: The Edge referred to by Edge Identifier must belong to the same Layer as the Line Feature that refers to that Edge.

11.5.10 Area Features

11.5.10.1 Area feature list

	= [AREA FEATURE]*	11.5.10.2

11.5.10.2 Area Feature

[

Area Feature Identifier	:UNSIGNED LONG	11.1.4.38
Feature Class Code	:FEATURE CLASS CODE	11.1.4.12
Split Indicator	:BOOLEAN	11.1.4.3
Face Identifier(s)	:RANGE(FACE LIST)	11.5.4.1
Attribute Set Identifier(s)	:RANGE(ATTRIBUTE SET LIST)	11.5.7.1

]

Constraints

C1: The Area Feature Identifier is an identifier of an Area feature that must be unique within a particular Section.

C2: The Face(s) referred to by Face Identifier must belong to the same Layer as the Area Feature in question.

C3: The Attribute Set(s) referred to by Attribute Set Identifier must belong to the same Layer as the Area Feature in question.

11.5.11 Complex Features

11.5.11.1 Complex feature list

	= [COMPLEX FEATURE]*	11.5.11.2

11.5.11.2 Complex feature

[

Complex Feature Identifier	:UNSIGNED LONG	11.1.4.38
Feature Class Code	:FEATURE CLASS CODE	11.1.4.12
Split Indicator	:BOOLEAN	11.1.4.3
Composing Features	:COMPOSING FEATURE LIST	11.5.11.4
Attribute Set Identifier(s)	:RANGE(ATTRIBUTE SET LIST)	11.5.7.1
From Complex Feature	:ELEMENT(COMPLEX FEATURE LIST)	11.5.11.1
To Complex Feature	:ELEMENT(COMPLEX FEATURE LIST)	11.5.11.1

]

Constraints

C1: The Complex Feature Identifier is an identifier of a Complex feature which must be unique within a particular Section.

C2: The Attribute Set(s) referred to by Attribute Set Identifier must belong to the same Layer as the Complex Feature in question.

C3: The Complex Features referred to by From Complex Feature and To Complex Feature must belong to the same Layer as the Complex Feature in question.

11.5.11.3 Composing feature list

	= [COMPOSING FEATURE]*	11.5.11.4

11.5.11.4 Composing feature

[

Feature Category	:FEATURE CATEGORY CODE	11.1.4.31
	:SET 1-4	11.1.4.31
Feature Identifier	:ELEMENT(POINT FEATURE LIST)|	11.5.8.1
	ELEMENT(LINE FEATURE LIST)|	11.5.9.1
	ELEMENT(AREA FEATURE LIST)|	11.5.10.1
	ELEMENT(COMPLEX FEATURE LIST	11.5.11.1

]

Constraints

C1: The Features referred to by Feature Identifier must belong to the same Layer as the Complex Feature in question.

11.6 Conversion

The data structures described in this section are meant to enable cross reference between features that belong to different Sections. If a feature A is outside a particular

Section X, but nevertheless it has a relationship with a feature B inside Section X, feature A may be converted to Section X, i.e. it receives a Feature Identifier which fits in the set of identifiers already assigned.

11.6.1 Conversion list

	=[CONVERSION]*	11.6.2

11.6.2 Conversion

[

Dataset Identifier	:ELEMENT(ALBUM)	11.2.1
Section Identifier	:ELEMENT(SECTION LIST)	11.4.1.1
Feature Category	:SET 1-4	11.1.4.31
Feature Identifier	:ELEMENT(POINT FEATURE LIST)|	11.5.8.1
	ELEMENT(LINE FEATURE LIST) |	11.5.9.1
	ELEMENT(AREA FEATURE LIST) |	11.5.10.1
	ELEMENT(COMPLEX FEATURE LIST)	11.5.11.1
Feature Category	:SET 1-4	11.1.4.31
Internal Identifier	:UNSIGNED LONG	11.1.4.38

]

Constraints

C1: The Dataset referred to by Dataset Identifier must belong to the same Album as the Feature in question

C2: The Section referred to by Section Identifier must belong to the Dataset referred to by the preceding Dataset Identifier.

C3: The Feature referred to by Feature Identifier must belong to the Section referred to by the preceding Section Identifier

11.7 Semantic relationship

The data structures defined in this section are meant to represent relationships between features, and attributes.

11.7.1 Relationship list

	=[SEMANTIC RELATIONSHIP]*	11.7.2

11.7.2 Semantic relationship

[

Relationship Identifier	:UNSIGNED LONG	11.1.4.38
Relationship Code	:RELATIONSHIP CODE	11.1.4.28
Source Description Identifier	:ELEMENT(SOURCE LIST)	11.3.5.1
Relationship Partners	:PARTNER LIST	11.7.3
Attribute Set Identifier(s)	:RANGE(ATTRIBUTE SET LIST)	11.5.7.1

]

Constraints

C1: The Relationship Identifier is an identifier of a Relationship instance which must be unique within a particular Section.

C2: The source document referred to by Source Description Identifier must belong to the same Dataset as the Relationship in question.

C3: The Attribute Set(s) referred to by Attribute Set Identifier must belong to the same Section as the Relationship in question.

11.7.3 Partner list

	= [PARTNER]*	11.7.4

11.7.4 Partner

Feature Category	:SET 1-4	11.1.4.31
Feature Identifier	:ELEMENT(POINT FEATURE LIST)|	11.5.8.1
	ELEMENT(LINE FEATURE LIST)|	11.5.9.1
	ELEMENT(AREA FEATURE LIST)|	11.5.10.1
	ELEMENT(COMPLEX FEATURE LIST)	11.5.11.1

]

Constraints

C1: The Feature referred to by Feature Identifier must belong to the same Section as the Relationship in question.

11.8 Album and Volume

When transferring one or more Datasets using physical storage media such as magnetic tapes or floppy disks, it may happen that the information does not fit on one media unit and must be split over several units.

Each such storage unit is called a Volume. A collection of Volumes belonging together is called an Album which corresponds to the Album considered as a set of Datasets.

By splitting Datasets over more than one Volume, some linkages will be destroyed. To enable the re-establishment of these linkages, some additional data structures must be added to the individual Volumes of an Album. These additional data structures are specified in this section. See also the Global Data Catalogue for more details.

The relations between Album, Datasets and Sections, and Album and Volume are illustrated in the NIAM diagram of Figure 11.5.

11.8.1 Structure of an Album

An Album consist of one or more Volumes

11.8.2 Album

= [VOLUME]* 11.8.4

Constraints

C1: An Album must contain at least one Volume

C2: Each Volume must belong to exactly one Album

11.8.3 Structure of a Volume

Each Volume starts with a Volume Header, followed by the Volume Data, a Volume end and a Volume Terminator.

A Volume contains the information of zero or more entire Datasets and zero, one or two partial Datasets.

11.8.4 Volume

[

Volume Header	:VOLUME HEADER	11.8.4.1
Volume Data	:VOLUME DATA	11.8.4.2
Volume Terminator	:VOLUME TERMINATOR	11.8.4.3

]

Constraints

C1: Each Volume must have exactly one Volume Header

C2: Each Volume must have exactly one Volume Terminator

11.8.4.1 Volume header

[

Data Supplier Name	:FREE TEXT	11.1.5.5
Standard Name	:FREE TEXT	11.1.5.5
Version Number	:FREE TEXT	11.1.5.5
Creation Date	:DATE	11.1.5.3
Volume Size	:UNSIGNED LONG	11.1.4.38
Album Identifier	:UNSIGNED LONG	11.1.4.38
Number of Volumes	:UNSIGNED SHORT	11.1.4.39
Volume Identifier	:UNSIGNED SHORT	11.1.4.39
Character Set	:SHORT STRING	11.1.4.4
Date of Copyright	:DATE	11.1.5.3
Associated Dataset(s)	:DATASET LIST	11.8.4.1.1
Copyright Owner	:FREE TEXT	11.1.5.5

]

Constraints

C1: An Album Identifier is an identifier of an Album and must be unique within the set of Albums supplied by a certain supplier.

C2: An Volume Identifier is an identifier of a Volume and must be unique within a particular Album.

11.8.4.1.1 Dataset list

= [DATASET IN VOLUME]* 11.8.4.1.2

11.8.4.1.2 Dataset in volume

[

Supplier Dataset ID	:UNSIGNED LONG	11.1.4.38
Volume Identifier	:ELEMENT(ALBUM)	11.8.4

]

C1: A Supplier Dataset Identification Number is an identifier of a Dataset and must be unique within the set of all Datasets supplied by a certain supplier.

C2: The Volume referred to by Volume Identifier must belong to the same Album as the Dataset in question.

11.8.4.2 Volume data

[

Dataset Global Data	: DATASET GLOBAL DATA | NULL	11.3
Sections	:SECTION LIST | NULL	11.4.1.1

]

11.8.4.3 Volume Terminator

[

Volume Termination Comments	: FREE TEXT	11.1.5.5
Volume Continuation Mark	: BOOLEAN	11.1.4.3

]

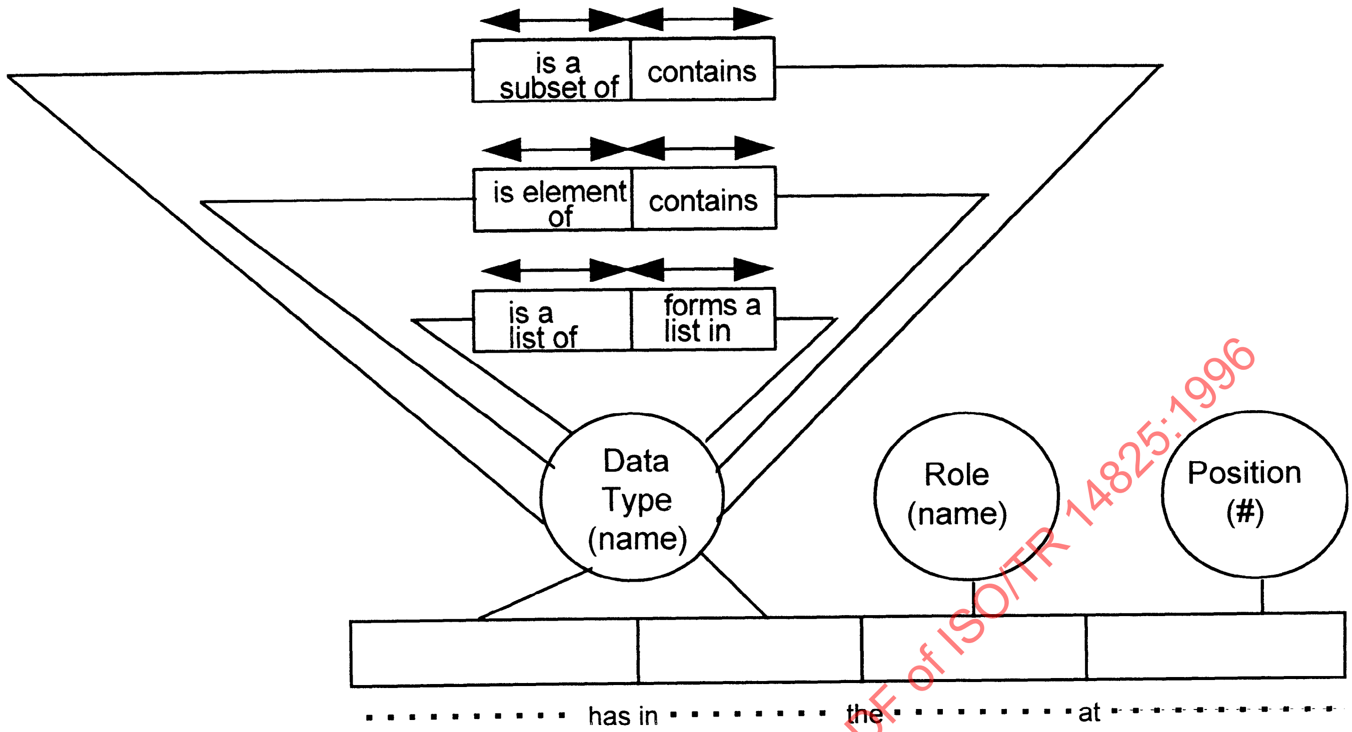


Figure 11.1 Composition of Data Types

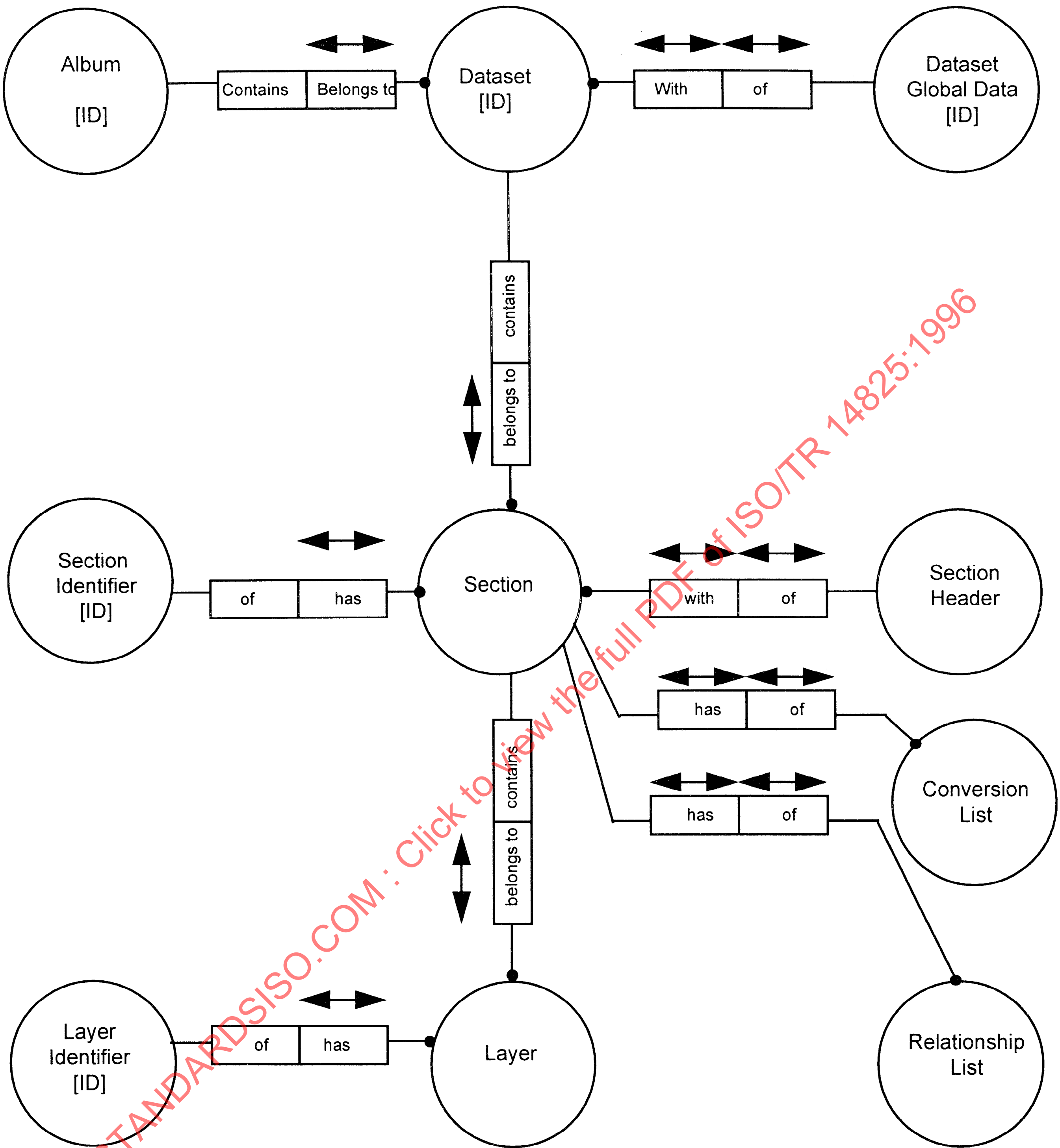


Figure 11.2 Datamodel showing the relations between Album, Dataset, Section and Layer

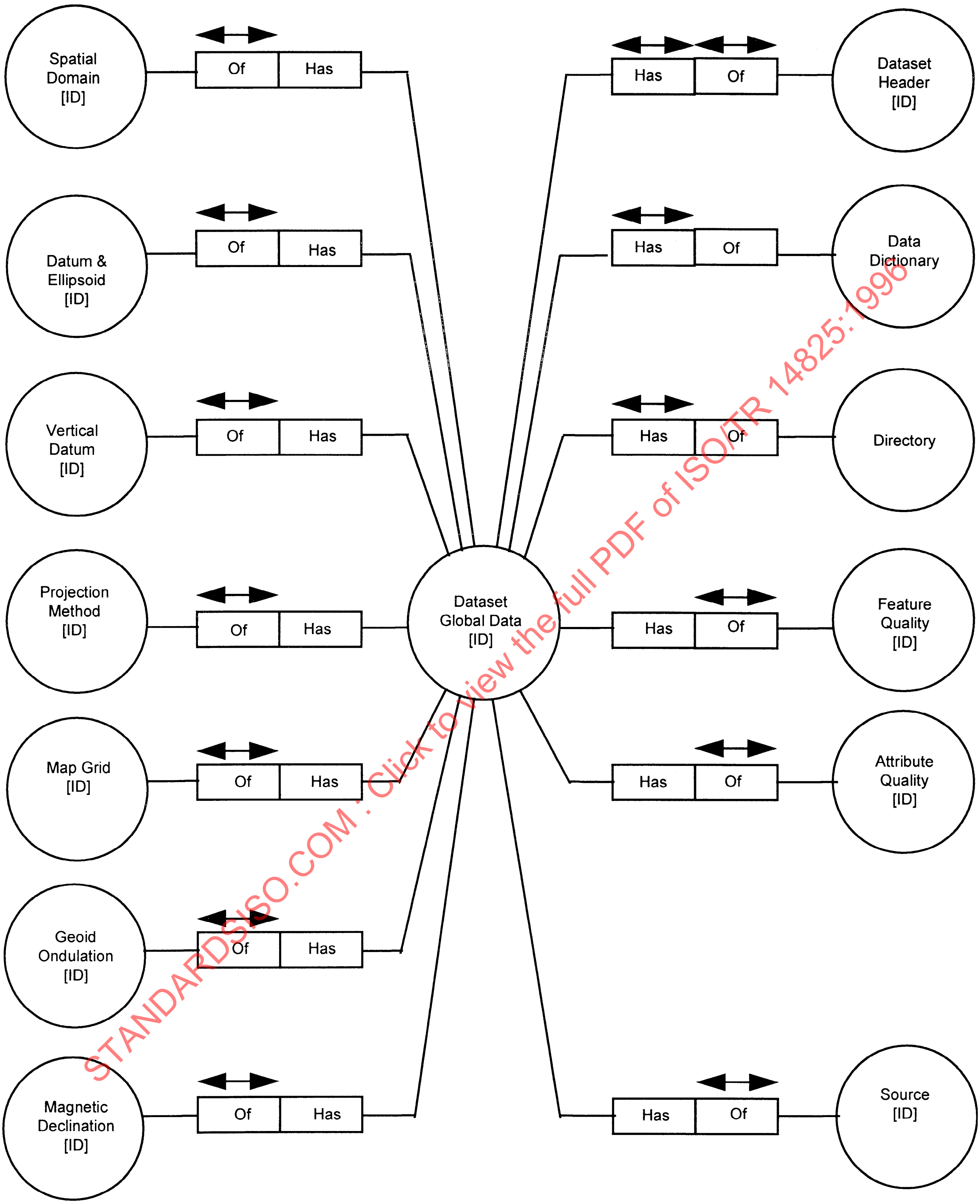


Figure 11.3 Overview of the structure of Dataset Global Data

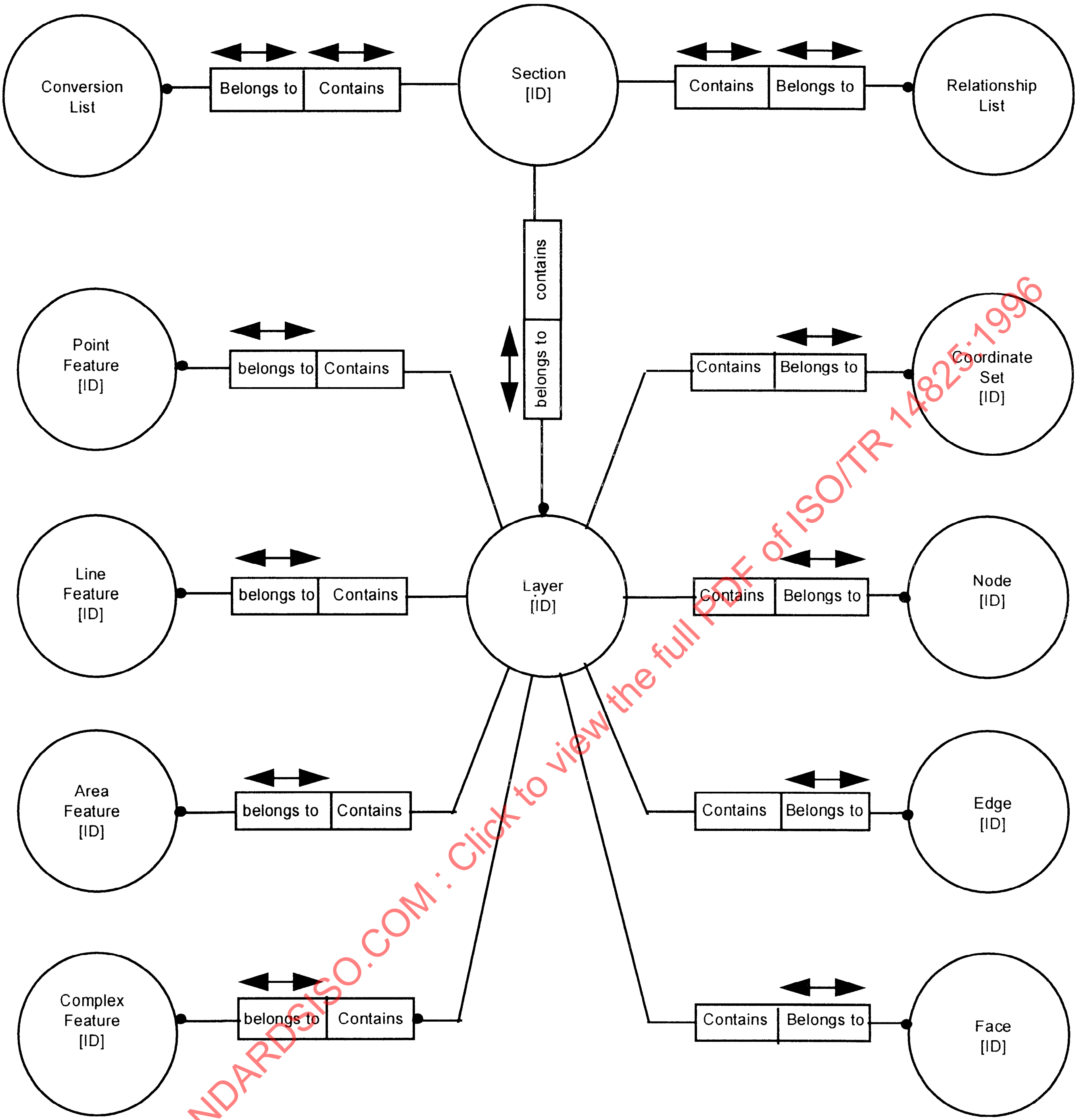


Figure 11.4 Relations between Section, Layers and Primitives

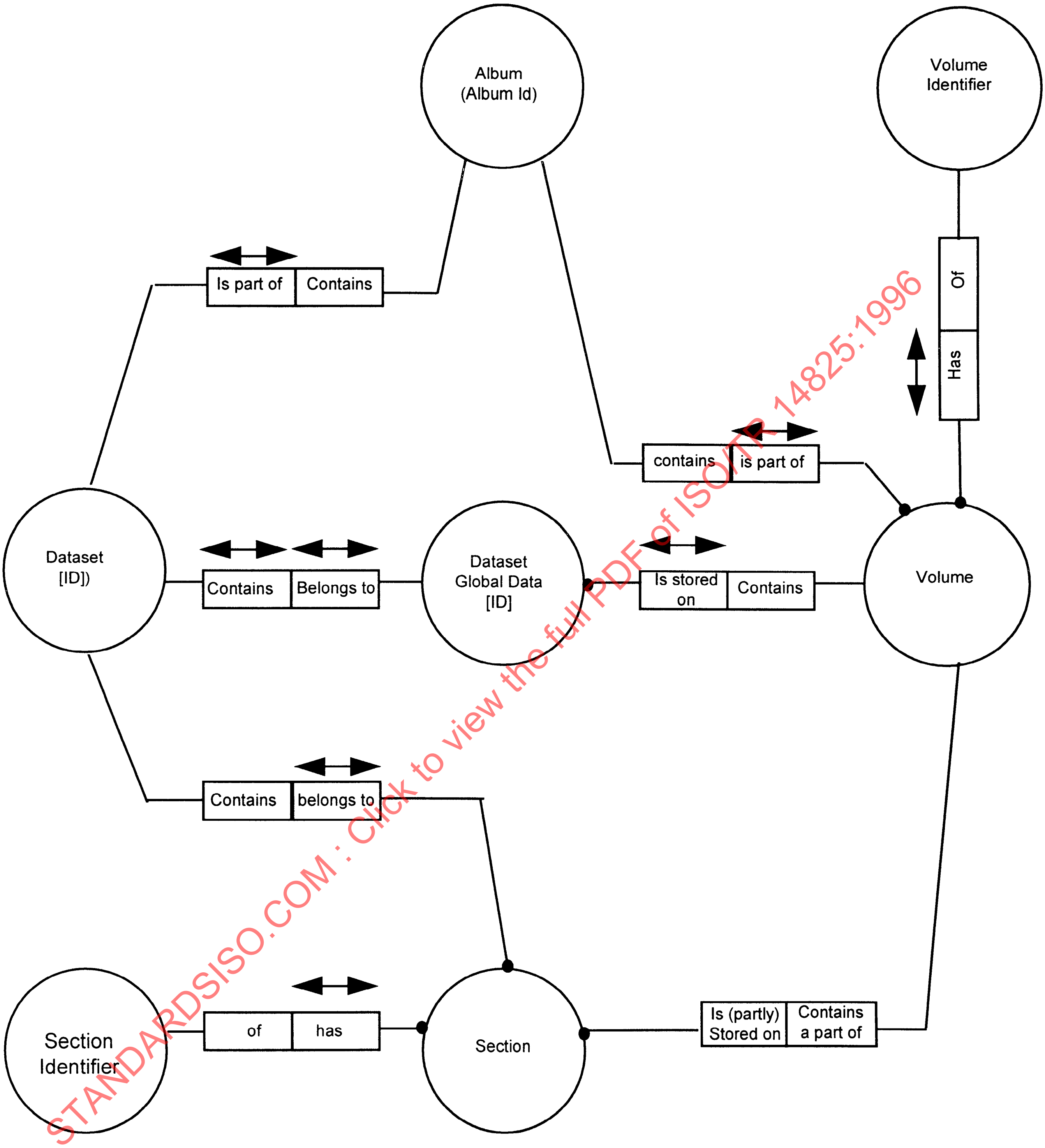


Figure 11.5 The relation between the logical data structures and Volumes

12. MEDIA RECORD SPECIFICATIONS

12.1 General Specifications

12.1.1 Introduction

This section explains some basic concepts.

12.1.2 Logical Record

A group of sequential data fields which belong together and which can be considered as a logical unit. A logical record has no fixed length. It may contain one or more media records. The start and end of a logical record is governed by the record type code and the Continuation Mark.

12.1.3 Media Record

The name of a group of sequential data fields which belong together. A media record in a GDF has a length of 81 or 82 characters, depending on whether one or two control characters are used to terminate the record.
Each media record starts with a record type code and ends with a Carriage Return character (CR), a Line Feed (LF) or a combination of these two control characters, as agreed by the data supplier and the customer.
(The ISO 8859-9 code of <CR> and <LF> characters is 0/13 and 0/10, respectively).

12.1.4 Continuation Record

A media record that is used for the representation of that part of a particular logical record which exceeds 80 characters. A continuation record has two Zero characters in the field which is used for the record type code.

12.1.5 Null Record

Media records which can be used to fill a block. The first two positions of this record (reserved for the record type code) shall contain two Space characters (code 2/0).

12.1.6 Fields of Variable Length, Fixed Length

Most of the data fields will have a pre-specified fixed length. Only text fields may have a variable length.
A fixed length field should not be split. When a particular field does not fit in media record X, this field has to be moved to the next media record (which is then, by definition, a Continuation Record, see 12.1.4).

12.1.7 Repeating Fields

A repeating field is a field that may have more than one successive instance in a particular record.
The number of occurrences of a repeating field in the record is variable.
Each repeating field is preceded by a Field Counter that specifies how many times the subsequent field repeats within the logical record in issue.
In the specification of the format of the individual record types (chapters 12.3 12.6), a repeating field is indicated by means of a vertical line (|) proceeding the field name.

12.1.8 Repeating Field Groups

A sequence of two or more fields which may repeat together with the other fields belonging to that group.
A repeating group is also preceded by a Field Counter. This counter belongs to the group as a whole. It specifies how many times the repeating group repeats within the logical record in issue.
In the specification of the format of the record (Chapters 12.3 - 12.6), the presence of a repeating field group is indicated by means of indentation and by preceding vertical lines (|).

12.1.9 Packing

Any character positions unused between the last complete field and position 80 have to be packed with Space characters (code 2/0). The Continuation Mark and the agreed control character(s) are then written.

12.1.10 Justification

Numeric values (fields of data type I or N) are right justified. Alphanumeric values (fields of data type A, G and AN) are left justified. In fields of type I or N, unused leading characters will be Space characters.

12.1.11 Order of Records

Figure 12.1 shows that every volume has to start with a Volume Header Record. Each volume ends with a Volume Termination Record.

The Volume Header Record is followed immediately by the Dataset Header Record which is the first of a group of records which are called dataset records (because they contain general information that applies to the whole dataset). The group occurs only once in a dataset. If a dataset is distributed over more than one volume, these records appear only in the first volume.

The occurrence of a Dataset Header Record indicates the beginning of a dataset. The dataset ends with the next Dataset Header Record or with a Volume Termination Record with a Volume Termination Mark = 0 (last volume in an album).

The order of the dataset records, apart from the Dataset Header Record, is not essential. However, it is recommended to arrange them in a standardized order, e.g. in the order as proposed in Figure 12.1.

The dataset records are immediately followed by a Section Header Record. Its first appearance means the beginning of the first section. The section logically ends at the occurrence of another Section Header Record with a different Section ID or with the presence of a Volume Termination Record having a Volume Termination Mark = 0 (last volume of an album).

If a section logically continues on the next volume, the corresponding Section Header Record has to be repeated.

The Section Header Record is followed by a Layer Header Record. This record indicates the beginning of a new layer. A layer ends at the occurrence of another Layer Header Record.

The last layer of a section ends at the occurrence of a Conversion Record, a Semantic Relationship Record, a Section Header Record, a Volume Termination Record or a Dataset Header Record.

A Layer Header Record is followed by the so-called "data records". The order of the records within this group is not essential, but it is strongly recommended to arrange them in some standardized and logical way, e.g. as proposed in figure 12.1: first all Coordinate Records, next all Node Records, next all Edge Records, etc.

The data records belonging to the last layer in a section are followed by zero or more Semantic Relationship Records possibly accompanied with one or more Comment Records. These Records do not belong to one particular layer because they may contain information that refers to features that belong to different layers.

An asterix (*) indicates that a record may have more than one successive instance within one group. "Rc" means "Record".

Volume Level	Dataset Level	Section Level	Layer Level
Volume Header Rc			
Comment Rc*			
	[		
	Dataset Header Rc		
	Field Definition Rc*		
	Record Definition Rc*		
	Attribute Definition Rc*		
	Feature Definition Rc*		
	Directory Rc*		
	Spatial Domain Rc*		
	Feature Quality Rc*		
	Attribute Quality Rc*		
	Source Rc*		
	Default Attribute Rc*		
	Datum & Ellipsoid. Rc*		
	Vertical Datum Rc*		
	Projection Rc*		
	National Grid Rc*		
	Geoid Undulation Rc*		
	Earth Magn. Field Rc*		
	Comment Rc*		
		[	
		Section Header Rc	
			[
			Layer Header Rc
			Coordinates Rc*
			New Node Rc*
			Edge Rc*
			Face Rc*
			Point Feature Rc*
			Line Feature Rc*
			Area Feature Rc*
			Complex Feature Rc*
			Name Rc*
			Segm. Attribute Rc*
			Time Domain Rc*
			Conversion Rc*
			Comment Rc*
			]
		Relationship Rc*	
		Name Rc*	
		Segm.Attribute Rc*	
		Time Domain Rc*	
		Comment Rc*	
		]*	
	]*		
Volume Term. Rc.			

Figure 12.1. Order of records

12.1.12 Order of subrecords

Some records are subdivided into a number of subrecords. This concerns the Dataset Header Record, the Source Record, and the Section Header Record.
The subrecord instances have to occur in a particular order within the record they belong to. This is specified in the following.

12.1.12.1 Dataset Header Record

[
Dataset Identification Subrecord
[
Dataset Main Title Subrecord
Dataset Subtitle Subrecord
]*
Dataset Producer Subrecord*
Dataset Extensiveness & Currency Subrecord
Dataset Contents Subrecord*
Dataset Quality Subrecord
]

12.1.12.2 Source Record

[
Description Info Subrecord
ISBN Subrecord
Author Name Subrecord
Scale and Title Subrecord*
Volume Name Subrecord*
Edition and Impression Subrecord
Publisher Subrecord*
Distribution Subrecord*
Host Document Subrecord
]

12.1.12.3 Section Header Record

[
Section Identification Subrecord
Section Quality Subrecord
Quality Reference Subrecord
Datasource Reference Subrecord
Datum & Magnetism Subrecord
Orthometric Reference Subrecord
Section Border Subrecord
XY Control Point Subrecord*
Z Control Point Subrecord*
]

12.1.13 Links between data records

The relations between the entities of the Conceptual Data Model (see chapter 4) have been implemented in the form of pointers between the data records. Each record type has therefore been provided with a field where a unique identifier for a record occurrence can be stored. Each record type has furthermore one or more fields in which a reference pointer to another record can be stored.

Figure 12.2 shows in a nutshell how the records are interlinked: by following the arrows, one can see which record refers to which other record.

Figure 12.3 shows the pointer fields and their role in the records. An open dot indicates a field where the identifier is assigned. A full black dot indicates a field that is used to refer to another record.

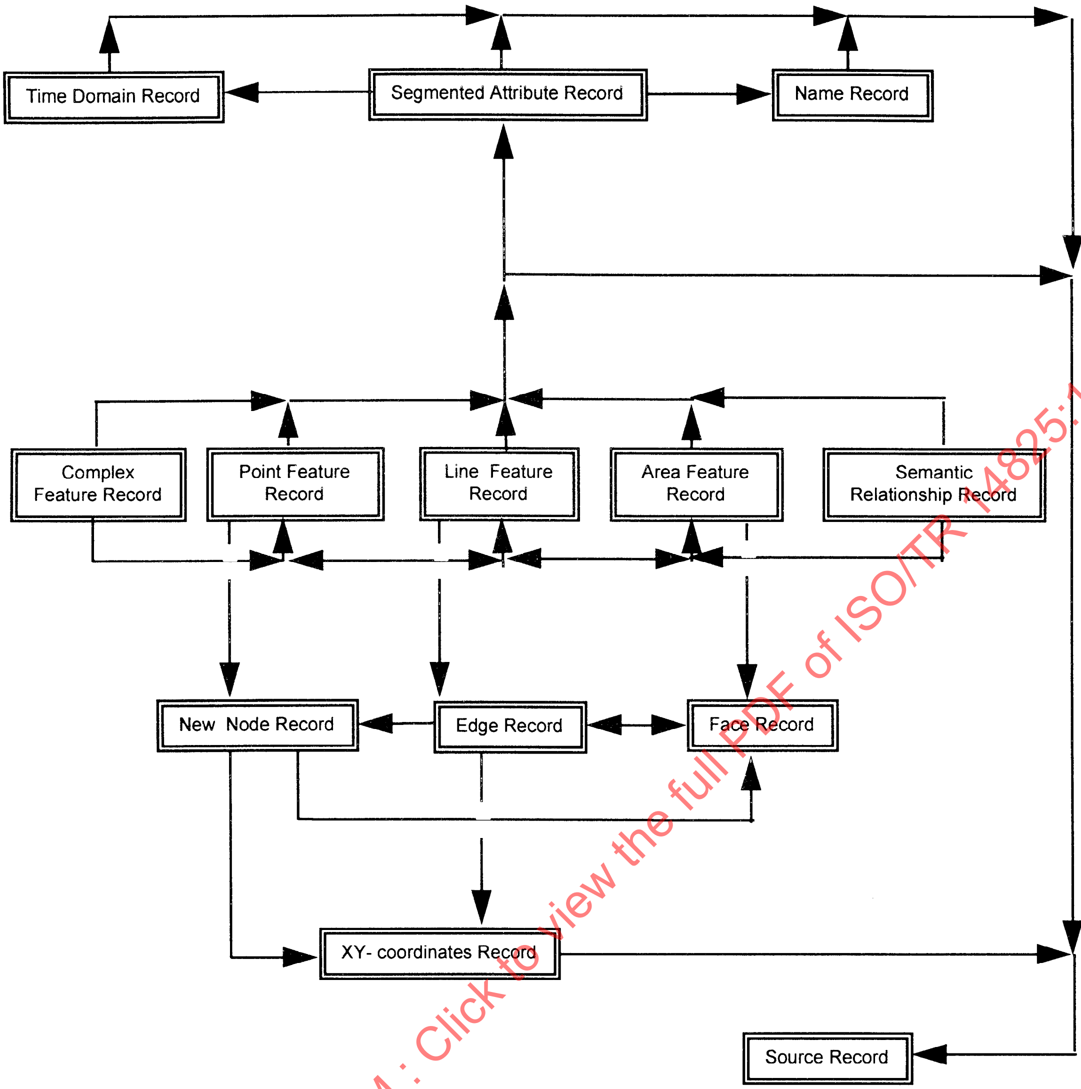


Figure 12.2 Relations between Data Records

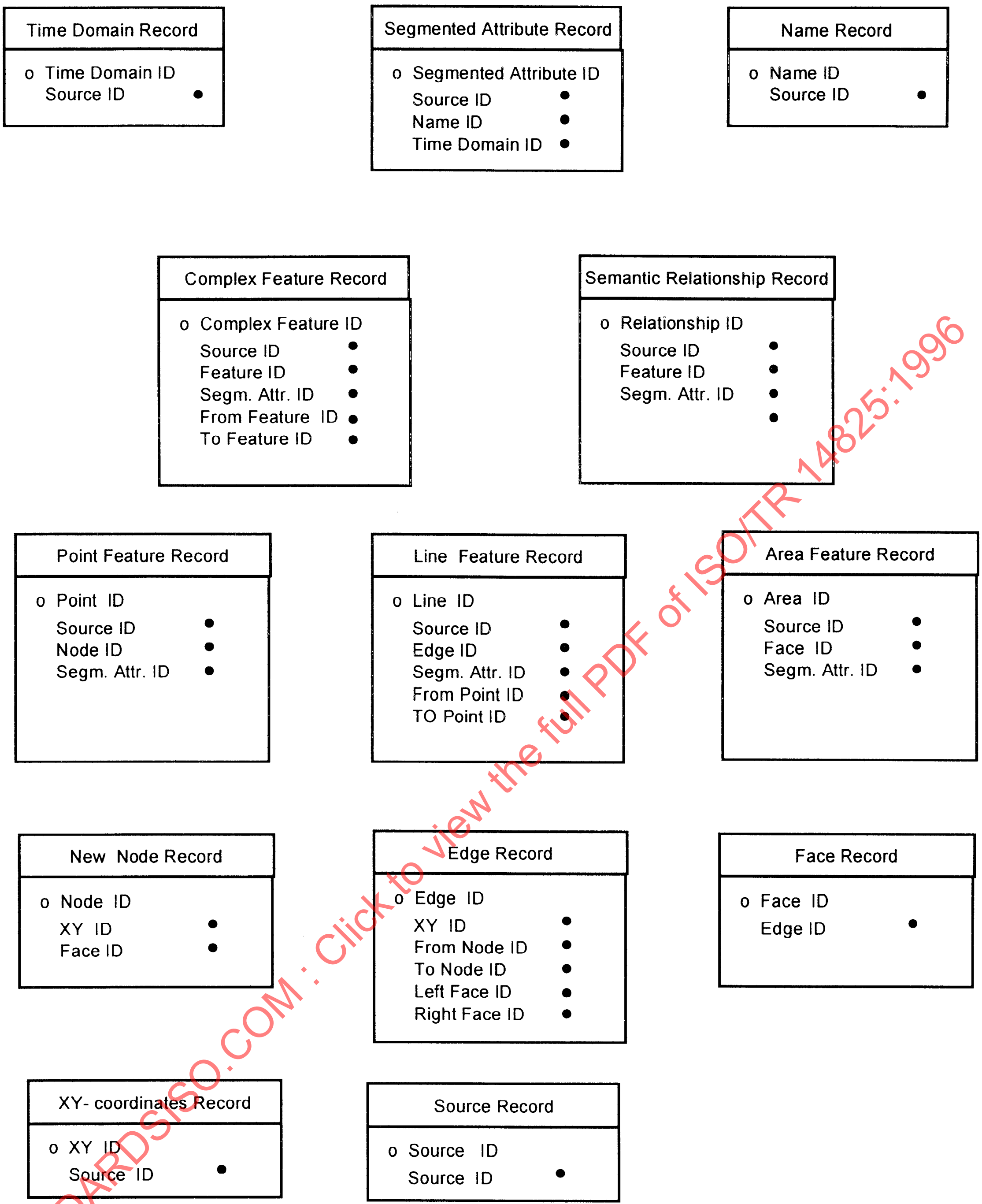


Figure 12.3 Pointer fields and their role in the records

12.2 Field Specifications

12.2.1 Field Name

The Field Name is an identifier of a field which is unique within the field definitions of GDF.

12.2.2 Record Control Fields

The following subsections describe fields which are used for record control.

12.2.2.1 Record Type Code

This is a two-character field which occurs at the beginning of each logical and media record. It is used to indicate the record type of a particular record, and contains a numeric code.
The following codes have been fixed:

Code	Mnemonic Name	Record Full Name
All-purpose media records		
<SS>	[NULLREC]	Null Record
00	[CONTREC]	Continuation Record
	<SS> means two successive Space characters	
Global records		
01	[VOLHDREC]	Volume Header Record
02	[DSHDREC]	Dataset Header Record
03	[FIELDEFREC]	Field Definition Record
04	[RECDEFREC]	Record Definition Record
05	[ATDEFREC]	Attribute Definition Record
06	[DIREC]	Directory Record
07	[FEATDEFREC]	Feature Definition Record
08	[SPADOREC]	Spatial Domain Record
12	[FEAQUALREC]	Feature Quality Record
13	[ATQUALREC]	Attribute Quality Record
14	[SRCEREC]	Source Record
15	[DATTVALREC]	Default Attribute Value Record
16	[SECHREC]	Section Header Record
17	[LAYHREC]	Layer Header Record
61	[DATELREC]	Datum & Ellipsoid Record
62	[VERDATREC]	Vertical Datum Record
63	[PROJECREC]	Projection Record
64	[NATGRIDREC]	National Grid Record
65	[GEOIDREC]	Geoid Undulation Record
66	[MAGNETREC]	Earth Magnetic Field Record
90	[COMMENTREC]	Comment Record
99	[VOLTERMREC]	Volume Termination Record
Data records		
23	[XYZREC]	Coordinates Record
24	[NEDGEREC]	Edge Record
25	[KNOTREC]	New Node Record
29	[FACEREC]	Face Record
41	[NAMEREC]	Name Record
44	[DSATREC]	Segmented Attribute Record
45	[TIMEREC]	Time Domain Record
46	[CONVERTREC]	Conversion Record
50	[RELATREC]	Relationship Record
51	[POFEREC]	Point Feature Record
52	[LINFREC]	Line Feature Record
53	[ARFEREC]	Area Feature Record
54	[COMPFEREC]	Complex Feature Record

12.2.2.2 Record Subtype Code

A record type can be subdivided into a hundred different subtypes by means of a subtype code. This field has a length of 2 positions and can be filled with numbers ranging from 00 to 99.
The following record subtypes have been defined. This concerns subdivisions of the Dataset Header Record, Source Record and the Section Header Record.

Rec. Code	Subt. Code	Mnemonic Name	Full Record Name
Dataset Header Record			
02	01	[DSHDREC.01]	Dataset Identification Subrecord
02	02	[DSHDREC.02]	Dataset Main Title Subrecord
02	03	[DSHDREC.03]	Dataset Subtitle Subrecord
02	04	[DSHDREC.04]	Dataset Producer Subrecord
02	05	[DSHDREC.05]	Dataset Extensiveness & Currency Subrecord
02	06	[DSHDREC.06]	Dataset Contents Subrecord
02	07	[DSHDREC.07]	Dataset Quality Subrecord
Source Record			
14	01	[SRCEREC.01]	Description Info Subrecord
14	02	[SRCEREC.02]	ISBN & Survey Subrecord
14	03	[SRCEREC.03]	Author Name Subrecord
14	04	[SRCEREC.04]	Scale and Title Subrecord
14	05	[SRCEREC.05]	Volume Name Subrecord
14	06	[SRCEREC.06]	Edition & Impression Subrecord
14	07	[SRCEREC.07]	Publisher Subrecord
14	08	[SRCEREC.08]	Distribution Subrecord
14	09	[SRCEREC.09]	Host Document Subrecord
Section Header Record			
16	01	[SECHREC.01]	Section Identification Subrecord
16	02	[SECHREC.02]	Section Quality Subrecord
16	03	[SECHREC.03]	Quality Reference Subrecord
16	04	[SECHREC.04]	Datasource Reference Subrecord
16	05	[SECHREC.05]	Datum & Magnetism Subrecord
16	06	[SECHREC.06]	Orthometric Reference Subrecord
16	07	[SECHREC.07]	Section Border Subrecord
16	08	[SECHREC.08]	XY Control Point Subrecord
16	09	[SECHREC.09]	Z Control Point Subrecord

12.2.2.3 Continuation Mark

The Continuation Mark is a one-character field which occurs at the end of each media record (at the 80th position). It occurs in all record types except the Volume Termination Record. Its function is to indicate the end of media and/or logical records.

The Continuation Mark can have two values: 0 or 1.
A value = 0 means that the logical record ends together with the media record.
A value = 1 means that the logical record continues in the subsequent Continuation Record.

12.2.2.4 Field Counter

In many record types data fields or field groups occur which may repeat within the overall structure of the logical record. This means that within a particular instance of a logical record, there may be 0, 1 or more occurrences of that field. This number may vary from one logical record instance to the other.

When there are more than 1 of these repeating field types in a record, or when the repeating field is followed by other (non repeating) fields, it will be necessary to specify the number of occurrences in advance, because otherwise the fields cannot be interpreted in a correct manner.

The number of repetitions is indicated by means of a Field Counter. This is a small field that immediately preceeds a repeating field or field group. The mnemonic names of these fields all have the generic form: {NUM_ * }, where * has to be substituted by a letter string.

The following Field Counters have been defined:

Mnemonic Field Name	Description
NUM_FIELD	Number of fields
NUM_PARTS	Number of parts
NUM_DASET	Number of datasets
NUM_CNTRY	Number of countries
NUM_LAN	Number of languages
NUM_LEV	Number of adjacent orthometric levels
NUM_DOC	Number of related documents
NUM_THEM	Number of themes
NUM_COORD	Number of coordinates
NUM_EDGE	Number of Edges
NUM_KNOT	Number of Nodes
NUM_FACE	Number of Faces
NUM_ATT	Number of Segmented Attribute Records or Number of attributes in a Segmented Attribute Record

12.2.3 Common fields

This section describes fields which occur in many different record types.

12.2.3.1 Language Code

Some free text fields may be preceded by a field named Language Code. This field contains the MARC language code of the language which is used in the text field that follows.

The MARC language code is an internationally used 3-letter code. A complete list of language codes can be obtained from the Bibliographic Systems Office of the Library of Congress, Washington D.C., USA. A comprehensive list for European languages can be found in Appendix A1.7.

12.2.3.2 ISO-3166 Country Code

This field shall contain the Alpha-3 country code as specified in document 3166 of the International Standard Organisation (ISO 3166).
A comprehensive list of the codes of European countries can be found in Appendix A1.6

12.2.3.3 Theme Code

This field is 2 characters long and contains numerical characters, so that as many as 100 different themes can be defined.
The theme code values can be found in Appendix A1.1.

12.2.3.4 Feature Code

A field that can be found in all feature records. This field shall contain a 4-digit code of the feature class to which the feature in issue belongs.
The feature code values can be found in the Appendix A1.1.

12.2.3.5 Identifiers

Many record types have fields where an ID-number of a particular entity is declared or that refer to the ID-number of an entity declared in another record. These ID-numbers have to be unique within a given context (Section, Dataset, Supplier) and for a particular entity type (Feature Category, Edge Name, Source Description, Feature Quality Description, etc.). This means that no two entity instances of the same type within the same context may have the same ID-number.

The fields for ID-numbers have a length of 10 characters in many cases. The maximum value that may be stored in an ID-field is 2E32-1.

As a rule the ID-number fields have mnemonic field names which have the generic form: {*_ID}, where * may be substituted by a string of letters.

The following ID-fields have been defined:

Mnemonic Name	Full Field Name
Global records	
ALBUM_ID	Album Identifier
VOL_ID	Volume Identifier
DASET_ SECT_ID	Section Identification Number
DESC_ID	Source Description Identifier
PAR_ID	Parent Description Identifier
HOST_ID	Host Description Identifier
FQREC_ID	Feature Quality Record Identifier
AQREC_ID	Attribute Quality Record Identifier
DATEL_ID	Datum Description Identifier
VERDAT_ID	Vertical Datum Description Identifier
PROJEC_ID	Projection Description Identifier
NATGRID_ID	Grid Description Identifier
GEOID_ID	Geoid Description Identifier
MAGN_ID	Declination Description Identifier
GEOREC_ID	Geodetical Parameter Record Identifier
Data records	
NAME_ID	Name Record Identifier
SATT_ID	Segmented Attribute Record Identifier
XY_ID	XY-coordinate Record Identifier
KNOT_ID	Node Identifier
FKNOT_ID	From Node Identifier
TKNOT_ID	To Node Identifier
EDGE_ID	Edge Identifier
FACE_ID	Face Identifier
LFACE_ID	Left Face Identifier
RFACE_ID	Right Face Identifier
POINT_ID	Point Feature Identifier
LIFE_ID	Line Feature Identifier
AREA_ID	Area Feature Identifier
COMF_ID	Complex Feature Identifier
FEAT_ID	Feature Identifier
EXT_ID	Foreign Section Feature Identifier
INT_ID	Internal Section Feature Identifier
REL_ID	Relationship Identifier
TIME_ID	Time Domain Record Identifier

12.2.4 Fields in Global Records

Detailed descriptions of the fields that occur in the Global Records can be found in the Global Data Catalogue. The field names used in the column "Description" of the record syntax definitions (section 12.3) match the section names in this catalogue and can be found by means of the index.

12.2.5 Fields in Data Records

12.2.5.1 Geometry Type Code

This field is reserved for future application. In the present version it shall be left empty (containing Space characters).

12.2.5.2 Quality Code

This field describes the positional accuracy of the points listed in a XY-coordinates Record. The value shall be calculated as follows:
Let Qd be the default accuracy value as specified in the Layer or Section Header. Let Qr be the actual accuracy.Then the value of Quality Code will be: 10LOG(Qr/Qd)
All the values have to be rounded off to the most nearest integer and be preceded by a plus (+) or minus (-) sign.
The value of 0 (if Qr = Qd) may be represented without a sign.

12.2.5.3 X-coordinate

This field contains the value of the X-coordinate of a point.
The coordinate value shall refer to the (national) grid as mentioned in the Section Header, taking into account the offset value as specified in the same header.
The coordinate value shall be expressed in the length unit of the (national) grid as mentioned in the Section Header, taking into account the multiplication factor as specified in the same header.

12.2.5.4 Y-coordinate

This field contains the value of the corresponding Y-coordinate of the point in question. See "X-coordinate" for further specifications.

12.2.5.5 Z-coordinate

This field contains the value of the corresponding Z-coordinate of the point in question. The Z-value shall be expressed in the length unit and relative to the vertical datum as mentioned in the Section Header, taking into account the multiplication factor as specified in the same header.

12.2.5.6 Status

This field contains an indicator which specifies whether the Node or Edge is located exactly at the Section Border (and thus corresponds with a Node in the adjacent Section) or whether it is located inside the Section.
The fact that a node is located on a section border is either caused because it simply is located there (already before the sectioning) or because it was introduced in order to terminate the edges continuing in the other section. When two neighbouring sections are merged again into one, a pair of nodes of the first type will have to be combined into one and a pair of nodes of the second type will have to be deleted completely. An edge can only be located on a section border because it is there. It will never have been defined because of the sectioning. Therefore, when merging two adjacent sections, a pair of edges identified as border edges always will have to be combined into one edge.
When two Sections are merged into one new one, appropriate Nodes will be deleted or combined into one. In order to distinguish the different types of Nodes, they can be flagged with a Status indicator.

Status can have the values 1- 5:

1 means that a Node or Edge is situated at the section border for sectioning purposes only.
2 means that the Node or Edge is "normal", i.e. not situated at the Section Border.
3 means that the Node or Edge is situated at the Section Border which is also the Dataset Border
4 means that the Node is at the end of a so called "stubble", i.e. a Line at the interior of a Section or Dataset that has been truncated and only represents a part of a feature because further information was not available or required.
5 means that the Node or Edge is situated at the Section Border for other reasons than sectioning.

12.2.5.7 Edge Orientation

This field indicates the direction of an Edge relative to the boundary of the Face that it bounds.

A value = 0 means that the Edge is clockwise oriented. A value =1 means that the Edge is counterclockwise oriented.

The direction of an Edge is determined by its start and end Nodes. In the case of circular edges (i.e. with identical start and end node) two possibilities exists to define the direction :

1. the edge can be split into two edges (Non circular)
2. The order of the vertices of the edge

12.2.5.8 From Curvimetric Position

This field indicates the Curvimetric Position along a feature from which a particular attribute (or set of attributes) is valid.
The position shall be given in meters.
It shall be measured from a clearly and sharply defined zero point.

12.2.5.9 To Curvimetric Position

This field indicates the Curvimetric Position along a feature to which a particular attribute (or set of attributes) is valid.
The position shall be given in meters.
It shall be measured from a clearly and sharply defined zero point.

12.2.5.10 NUM_ATT

Usually, a feature shall have more than one attribute value attached to it. Several ways exist to specify these. The feature records contain the fields NUM_ATT and SATT_ID through which NUM_ATT attribute records can be referred. These attribute records themselves contain the fields NUM_ATT, ATT_TYPE and ATT_VALUE, which can be used to specify NUM_ATT attribute values. With one exception, no requirements exists which way should be adopted in which situation. The two possibilities even can be combined in one GDF. The exception refers to the specifications of Composite Attribute values and (Composite) Attribute - Restrictive Sub-attribute value combinations. These only can be specified if they are stored completely in one attribute record, which than should not contain any specifications of other attribute values.

12.2.5.11 Attribute Type Code

This field contains the code of the attribute type in issue. This code governs the type, range and interpretation of the subsequent Attribute Value field.
The Attribute Type Code consists of 2 letters. These can be found in the Attribute Catalogue.

12.2.5.12 Attribute Value

This field contains an attribute value of the object in question, within the range of the attribute type. The data type of this field is always 'G'. The domain of a particular attribute type can be found in chapter 6. Codes for corresponding values can be found in appendix A1.5.

12.2.5.13 Feature Category Code

This field indicates the Category to which a feature belongs.
1 = Point Feature
2 = Line Feature
3 = Area Feature
4 = Complex Feature

12.2.5.14 Relation Code

This field contains a 4-digit code for the type of Relationship represented in a particular Semantic Relationship Record.
A list of codes can be found in the Relationship Catalogue.

12.2.5.15 Time Domain Description

Time domains are represented by a particular record type, the Time Domain Record, which has it's own particular syntax (See appendix A1.15).
Each attribute that refers to a Time Domain (e.g. Opening Period, Validity Period) contains in the Attribute Value field a pointer to a Time Domain Record.

12.2.5.16 Split Indicator

When a Dataset is split into Sections, features may be split across Sections. In such a case a feature will be represented by two or more Lines (or Areas or Complexes), one in each Section and each only representing a part of the feature.
When the Split Indicator has a value = 0, this means that the Line, Area or complex represents the entire feature. When it has a value = 1, this means that the Line, Area or Complex only represents a part of the feature and that the other parts are to be found in the adjacent Section(s). In the case of a complex feature it is also possible that the complete feature is defined in both sections completely. This is indicated by the value 2. Value 2 refers to Complex Features only. It indicates that a definition of the feature is repeated in another section.

12.2.5.17 Line Direction

Indicator whether a Line has the same direction or the opposite direction as the underlying Edge.
0 = in direction of Edge
1 = in opposite direction

12.3 Additional Constraints

12.3.1 Order of Edges in line features and Faces

Within a line feature, edges shall be listed in consecutive order. Edges describing the boundary of a face shall be (consecutively) ordered in clockwise orientation (i.e. the face is situated on the right side of the boundary line). Consequently enclaves shall be described counterclockwise.

12.3.2 Order of Co-ordinate triplets in Coordinates Records

The coordinate triplets stored in this record together form a List. This means that the order in which they are stored is significant, i.e. representing the direction of the corresponding level-0 object.

In case of the geometrical description of an Edges, the co-ordinate list shall be ordered in such a way that within the Edge definition the first vertex is preceeded by the start node and the last vertex succeeded by the end node.

12.3.3 Order of Features in Relationship Records

The order of Features in a semantical relationship is important for the semantical meaning of the relationship. For the relationship types defined in GDF, See Appendix A1.6 for the order of features involved.

12.4 Global Records

12.4.1 Volume Header Record [VOLHDREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (01)
SUP_NAME	20	G	<S>			Data Supplier Name Name of the producer or deliverer of this volume
STAN_NAME	10	G	Obl			Standard Name to which this[1] volume conforms
VERSION	4	G	Obl			Version Number of the standard to which this volume conforms[2]
CREA_DATE	6	N	<S>			Creation Date of this volume
VOL_SIZE	10	N	<S>			Volume Size in bytes
ALBUM_ID	10	N	Obl			A unique Album Identifier
TOT_VOL	4	N	<S>			Number of Volumes in the album
VOL_ID	4	N	Obl			A unique Volume Identifier
CHAR_SET	10	G	Obl			Character Set used in this volume
CORI_DATE	6	N	<S>			Date of Copyright
NUM_DASET	2	N	Obl			Field counter
|DASET_ID	8	N	Obl			Dataset Identifier of a dataset which is associated wit this volume
| VOL_ID	4	N	Obl			Foreign Volume Identifier of the volume which contains the Dataset Header and the global data
CORI_OWNER	*	G	<S>			Copyright Owner Name of the legal Person having the copyrights of this volume

Note: The exact meaning of the data types (N, A, G, etc.) can be found in the Global Data Catalogue

[1] The name of the standard is “GDF”
[2] The version number is “3.0”

12.4.2 Dataset Header Record [DSHDREC]

12.4.2.1 Dataset Identification Subrecord [DSHDREC.01]

Field name	Size	Type	No data Min.	Max.	Description
REC_DESCR	2	N	Obl		Record Type Code (02)
REC_CODE	2	N	Obl		Record Subtype Code (01)
IDSI-NR	13	G	<S>		International Dataset Identification Number
DASET_ID	10	N	Obl		Supplier Dataset Identification Number, which is unique within the system of the producer (supplier) of this dataset.
ED_DATE	8	N	Obl		Edition Date and hour of this particular version of the dataset which constitutes also a unique version number of the present version
NUM_LAN	2	N	Obl		Field counter indicating how many times the next field repeats
| LAN_CODE	3	A	<S>		Dataset Language The MARC language code of a language used in this dataset
NUM_CNTRY	2	N	Obl		Field counter indicating how many times the next field repeats
| CNT_CODE	3	A	<S>		Country Involved

The ISO-3166 Alpha-3 code of a country involved in the production of this dataset

12.4.2.2 Dataset Main Title Subrecord [DSHDREC.02]

Field name	Size	Type	No data Min. Max.	Description
REC_DESCR	2	N	Obl	Record Type Code (02)
REC_CODE	2	N	Obl	Record Subtype Code (02)
LAN_CODE	3	A	<S>	Dataset Title Language The MARC-language code of specified in the next field
DASET_NAME	*	G	<S>	Dataset Main Title

12.4.2.3 Dataset Subtitle Subrecord [DSHDREC.03]

Field name	Size	Type	No data Min.	Max.	Description
REC_DESCR	2	N	Obl		Record Type Code (02)
REC_CODE	2	N	Obl		Record Subtype Code (03)
SEC_NAME	*	G	<S>		Dataset Subtitle in the same language as in Dataset Main Title

12.4.2.4 Dataset Producer Subrecord [DSHDREC.04]

Field name	Size	Type	No data Min.	Max.	Description
REC_DESCR	2	N	Obl		Record Type Code (02)
REC_CODE	2	N	Obl		Record Subtype Code (04)
CNT_CODE	3	A	<S>		Production Country The ISO-3166 alpha-3 country code of the country to which Production Place belongs
PROD_PLACE	25	G	<S>		Production Place
LAN_CODE	3	A	<S>		Producer Name Language The MARC language code of the language used in Producer Name
PROD_NAME	*	G	<S>		Producer Name

12.4.2.5 Dataset Extensiveness & Currency Subrecord [DSHDREC.05]

Field name	Size	Type	No data Min.	Max.	Description
REC_DESCR	2	N	Obl		Record Type Code (02)
REC_CODE	2	N	Obl		Record Subtype Code (05)
CREA_YEAR	4	N	<S>		Creation Year of this dataset
GEO_AREA	*	G	<S>		Dataset Geographical coverage An area name that is representative for the dataset

12.4.2.6 Dataset Contents Subrecord[DSHDREC.06]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (02)
REC_CODE	2	N	Obl			Record Subtype Code (06)
THEM_CODE	2	N	<S>			Feature Theme Code
THEM_NAME	*	G	<S>			Feature Theme Name The name of a feature theme which is present in this dataset

12.4.2.7 Dataset Quality Subrecord [DSHDREC.07]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (02)
REC_CODE	2	N	Obl			Record Subtype Code (07)
XY_RES	3	N	<S>			Dataset XY Resolution Worst case value in any part of the dataset, expressed in m
XY_ACC	3	N	<S>			Dataset XY Accuracy Worst case value in any part of the dataset, expressed in m
Z_ACC	2	N	<S>			Dataset Z Accuracy Worst case value in any part of the dataset, expressed in m
REL_ACC	2	N	<S>			Dataset Relative Accuracy Worst case relative accuracy in any quantitative attribute, in any part of the dataset, expressed %
SURV_DATE	6	N	<S>			Dataset Mean Survey Date Date of the survey of the dataset as a whole
MAX_AGE	6	N	<S>			Dataset Maximum Age Worst case survey date of any data item in the entire dataset
FEAT_COMP	2	N	<S>			Dataset Feature Completeness Worst case value in any part of the dataset, expressed in %
ATT_COMP	2	N	<S>			Dataset Attribute Completeness Worst case value in any part of the dataset,expressed in %
ATT_COR	2	N	<S>			Dataset Correctness Worst case value in any attribute in any part of the dataset, expressed in %

12.4.3 Field Definition Record [FIELDEFREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (03)
FLD_NAME	10	G	Obl			Field Name The name of the field which is specified in this record
FIELD_SIZE	2	N	Obl			Field Size Length of the field which is specified
DATA_TYPE	2	A	<S>			Data Type The subset of characters that the field may contain G = printable characters A = alphabetic characters N = digits I = digits and + or
-						AN = alphabetic and numeric
DATA_UNIT	3	A	<S>			Data Unit Code of the SI-unit or other standard unit or form in which the data values are expressed
UNIT_EXP	2	I	<S>			Unit Exponent 10LOG of the multiplication factor with which the data values have to be multiplied to obtain the unit as specified in Data Unit
NO_DATA	6	G	Obl			No Data Value if no data is being sent Obl = Obligatory <S> = Space characters
MIN_VAL	12	G	<S>			Minimum Value Allowed
MAX_VAL	12	G	<S>			Maximum Value Allowed
DATA_USE	2	G	<S>			Field Class Indication to which Field Class the field belongs 1 = Entity Identifier 2 = Foreign Identifier 3 = Field Counter 4 = Other
FIELD_DESC	*	G	<S>			Field Description Short explanation of the field which is specified

12.4.4 Record Definition Record [RECDEFREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (04)
REC_TYPE	2	N	Obl	01	99	Record Type Code Code of the record type which is specified
REC_CODE	2	N	<S>			Record Subtype Code A possible subtype code of the record type which is specified.
REC_NAME	10	G	<S>			Record Name Name of the record type which is specified in this record
NUM_FIELD	2	N	Obl			Field counter, indicating howmany times the next field repeats
|FLD_NAME	8	G	Obl			Field Name A list of field names, for the record type in issue, in order[3]
COMMENT	*	G	<S>			Short indication of the content of the record type in issue

[3] The names of fields that may repeat or fields that participate in a field group that possibly repeats, are defined by enclosing their names between parenthesis, i.e. "(" and ")" . For this reason, field names shall not start with '(' and end with ')'. Also, names of repeating fields shall not exceed 8 characters.

12.4.5 Attribute Definition Record [ATDEFREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (05)
ATT_TYPE	2	A	Obl			Attribute Type Code The code of the attribute type which is specified in this record
FIELD_SIZE	2	N	Obl			Attribute Value Field Size The length of the field which is specified
DATA_TYPE	2	A	<S>			Data Type The type of characters that this field may contain G = printable characters A = alphabetic characters N = digits I = digits and + or - AN = alphanumeric characters
DATA_UNIT	3	A	<S>			Data Unit Code of the SI-unit or other standard unit or form in which the data values are expressed
UNIT_EXP	2	I	<S>			Unit Exponent 10LOG of the factor with which the data values have to be multiplied to obtain the unit as specified in Data Unit
NO_DATA	6	G	Obl			No Data. Value if no data is being sent Obl = Obligatory <S> = Space characters
MIN_VAL	12	G	<S>			Minimum Value Allowed
MAX_VAL	12	G	<S>			Maximum Value Allowed
ATT_DESC	*	G	<S>			Attribute Description Textual description of the attribute type which is specified

12.4.6 Feature Definition Record [FEATDEFREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (07)
FEAT_CODE	4	N	<S>	1000	9999	Feature Class Code Four-digit code of the feature class
FEAT_NAME	20	A	<S>			Feature Class Name English name for the feature class
LAN_CODE	3	A	<S>			Language Code MARC language code of the language used in Feature Class Alias
FEAT_SYN	20	A	<S>			Feature Class Alias A name of the feature class in a language other than English

12.4.7 Directory Record [DIREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (06)
VOL_ID	4	N	Obl			Volume Identifier The identification number of the volume that contains the section specified in Section Identification Number
SECT_ID	4	N	Obl			Section Identification Number The identification number of the section containing the layer which is specified in the next field
LAY_ID	2	N	<S>			Layer Identifier Identification number of the layer that contains the records specified in the next fields
REC_TYPE	2	N	Obl	01	99	Record Type Code Code of the record type of which the amount is specified in Record Quantity
REC_QTY	8	N	<S>			Record Quantity Number of occurrences of the logical record type mentioned in Record Type Code

12.4.8 Spatial Domain Record [SPADOREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (08)
SECT_ID	4	N	Obl			Section Identification Number The ID-number of the section of which the spatial domain is specified in this record
MAX_LAT	7	I	<S>	-90000	+90000	Maximum Latitude Maximum latitude value of the section,in millidegrees
MIN_LAT	7	I	<S>	-90000	+90000	Minimum Latitude Minimum latitude value in the section,in millidegrees
MAX_LONG	7	I	<S>	-180000	+180000	Maximum Longitude Maximum longitude value of the section in millidegrees
MIN_LONG	7	I	<S>	-180000	+180000	Minimum Longitude Minimum longitude value of the section in millidegrees
GEO_AREA	*	G	<S>			Area Name A characteristic topographical name of the section

12.4.9 Source Record [SRCEREC]

12.4.9.1 Description Info Subrecord [SRCEREC.01]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (14)
REC_CODE	2	N	Obl			Record Subtype Code (01)
DESCR_LEV	1	N	<S>	1	4	Description Level
COMPL_LEV	1	N	<S>	1	3	Level of Completeness Always = 1 in the current version of the standard
DESC_ID	5	N	Obl			Source Description Identifier An identification number of this Cartographic Source Description which is unique within the set of all Source Material Description
PAR_ID	5	N	<S>			Parent Description Identifier The identification number of the "parent" of the source description in issue

12.4.9.2 ISBN & Survey Subrecord [SRCEREC.02]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (14)
REC_CODE	2	N	Obl			Record Subtype Code (02)
ISBN	13	G	<S>			International Standard Book Number of the document in issue
ISSN	10	G	<S>			International Standard Serial Number of the document
NUM_LAN	2	N	Obl			Number of languages used in the document
|LAN_CODE	3	A	<S>			Document Language MARC language code of a language used in the document
NUM_CNTRY	2	N	Obl			Number of countries involved in the production of the document in issue
|CNT_CODE	3	A	<S>			Country Involve The ISO-3166 Alpha-3 code of a country involved in the production of the document
SURV_YEAR	4	N	<S>			Year of Survey of the situation as represented in the document
SURV_DATE	6	N	<S>			Date of Survey Month and (if relevant) day and hour of survey of the situation as represented in the document

12.4.9.3 Author Name Subrecord [SRCEREC.03]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (14)
REC_CODE	2	N	Obl			Record Subtype Code (03)
AUTHOR	*	G	Obl			Author Name Name(s) of the author(s) of the document according to ISO/DIS 690 specifications

12.4.9.4 Scale and Title Subrecord [SRCEREC.04]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (09)
REC_CODE	2	N	Obl			Record Subtype Code (03)
MAP_SCALE	7	N	Obl			Map Scale (cartographic documents only) The value with which all distances in the map have to multiplied to obtain real world distances
LAN_CODE	3	A	<S>			Document Title Language MARC-language code of the title as specified in the next field
DOC_TITLE	*	A	Obl			Document Title Text Title of the document in issue

12.4.9.5 Volume Name Subrecord [SRCEREC.05]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (14)
REC_CODE	2	N	Obl			Record Subtype Code (05)
LAN_CODE	3	A	<S>			Volume Name Language MARC-language code of the text as specified in the next field
VOL_NAME	*	G	<S>			Volume Name Short name and/or number of a volume or map sheet

12.4.9.6 Edition & Impression Subrecord [SRCEREC.06]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (14)
REC_CODE	2	N	Obl			Record Subtype Code (06)
EDIT_NR	20	G	<S>			Edition Number of the document
IMP_NR	20	G	<S>			Impression Number of the document in issue

12.4.9.7 Publisher Subrecord [SRCEREC.07]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (14)
REC_CODE	2	N	Obl			Record Subtype Code (07)
PUB_YEAR	4	N	<S>			Year of Publication
CNT_CODE	3	A	<S>			Country of Publication ISO-3166 Alpha-3 code of the country to which the place belongs that is specified in Place of Publication
PUB_PLACE	20	G	<S>			Place of Publication
PUB_NAME	*	G	<S>			Name of Publisher

12.4.9.8 Distribution Subrecord [SRCEREC.08]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (14)
REC_CODE	2	N	Obl			Record Subtype Code (08)
DIST_YEAR	4	N	<S>			Year of Distribution
CNT_CODE	3	A	<S>			Country of Distribution ISO-3166 Alpha-3 code of the country to which the place belongs that is specified in Place of Distribution
DIST_PLACE	20	G	<S>			Place of Distribution
DIST_NAME	*	G	<S>			Name of Distributor

12.4.9.9 Host Document Subrecord [SRCEREC.09]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (14)
REC_CODE	2	N	Obl			Record Subtype Code (09)
HOST_ID	5	N	Obl			Host Description Identifier Identification number of a host document
REL_KIND	2	N	<S>	11	15	Kind of Relationship Code for the kind of relation with the host document
FST_PAGE	5	N	<S>			From Page
LST_PAGE	5	N	<S>			To Page
COMMENT	*	G	<S>			General Comment

12.4.10 Default Attribute Record [DATTVALREC]

Field name	Size	Type	No data Min.	Max.	Description
REC_DESCR	2	N	Obl		Record Type Code (15)
ATT_TYPE	2	A	Obl		Attribute Type Code
DATT_VAL	10	G	Obl		Default Attribute Value

Although the SPACE character <S> is a legal value in the DATT_VAL field, it doesnot mean that there is no information available for this meta-data field. It means that in the attribute data of the given type, "not-collected / unknown" must be considered as the default case.

12.4.11 Geodetical Parameter Records

12.4.11.1 Datum & Ellipsoid Record [DATELREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (61)
DATEL_ID	5	N	Obl			Datum Description Identifier Identification number of this datum description which is unique within the set of all Datum & Elliposoid Records in the dataset
TRANS_X	5	I	<S>			X-Origin X-coordinate of the origin of the datum, expressed in deci-meters,relative to the origin of WGS-'84
TRANS_Y	5	I	<S>			Y-Origin Y-coordinate of the origin of the datum, expressed in decimeters, relative to the origin of WGS-'84
TRANS_Z	5	I	<S>			Z-Origin Z-coordinate of the origin of the datum, expressed in decimeters, relative to the origin of WGS-'84
ROT_Z	5	I	<S>	0	+40000000	Z-Rotation Rotation around the Z-axis, expressed in gon -5 (hundredths of a milligon)
SCALE_FAC	5	I	<S>			Scale Factor Scale factor Mo, expressed in the form of (1 - Mo) * 10E9
DAT_NAME	47	G	<S>			Datum Name A short name of the geodetic datum in issue
SEM_MAJOR	8	N	<S>			Semi Major Axis The length of the semi-major axis of the reference ellipsoid expressed in meters
SEM_MINOR	8	N	<S>			Semi Minor Axis The length of the semi-minor axis of the reference ellipsoid expressed in meters
EL_CODE	4	A	0			Ellipsoid Code Alpha-4 code of the reference ellipsoid

12.4.11.2 Vertical Datum Record [VERDATREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (62)
VERDAT_ID	5	N	Obl			Vertical Datum Description Identifier An identification number of the record that is unique within the set of all Vertical Datum Records in the dataset
CNT_CODE	3	A	<S>			Relevant Country ISO-3166 country code of the country in which the orthometric reference system, as mentioned in the next Height Level Name is used
LEV_NAME	15	G	<S>			Height Level Name Short name of the orthometric reference system in issue
NUM_LEV	2	N	Obl			Field counter, indicating the number of adjacent orthometric reference systems
CNT_CODE	3	A	<S>			Used in Country ISO-3166 Alpha-3 country code of the country in which the adjacent system, as specified in the next Height Level Name, is used
LEV_NAME	15	G	<S>			Height Level Name Short name of an adjacent orthometric reference system
TRANS_H	5	I	<S>			Height Difference The orthometric height of the origin of the adjacent system, relative to system in issue, expressed in centimeters

12.4.11.3 Projection Record [PROJECREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (63)
PROJEC_ID	5	N	Obl			Projection Description Identifier An identification number of this record that is unique within the set of all Projection Records in the dataset
PROJ_CODE	4	A	Obl			Projection Type Code
NUM_PAR	2	N	Obl			Field counter, indicating how many times the next field group repeats
|PAR_LAT	10	I	<S>	-90000000	+90000000	Parameter Latitude Latitude of a projection parameter, expressed in microdegrees
| PAR_LONG	10	I	<S>	-180000000	+180000000	Parameter Longitude Longitude of a projection parameter, expressed in microdegrees
SCALE_FAC	5	I	<S>			Point Scale Factor Point scale factor Mo, expressed in the form of (1-Mo) * 10 E7

12.4.11.4 National Grid Record [NATGRIDREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (64)
NATGRID_ID	5	N	Obl			Grid Description Identifier An identification number of this record that is unique within the set of all National Grid Records in the dataset
GRID_ORT	1	N	Obl			Grid Axes Orientation Indicates whether the orientation of the national grid is normal cartesian (= 0) or reverse cartesian (= 1)
HELP_LAT	10	I	<S>	-90000000	+90000000	Help Grid Latitude Latitude of the origin of the help grid, expressed in microdegrees
HELP_LONG	10	I	<S>	-180000000	+180000000	Help Grid Longitude Longitude of the origin of the help grid, expressed in micro-degrees
X_ORIG	10	I	<S>			X Origin X-coordinate of the origin of the national grid, relative to the origin of the help grid and expressed in decimeters
Y_ORIG	10	I	<S>			Y Origin Y-coordinate of the origin of the national grid, relative to the origin of the help grid, expressed in decimeters
ROT_GRID	10	I	<S>	0	+400000000	Grid Rotation Clockwise counted angle between the positive Y-axis of the national grid and the positive Y-axis of the help grid, expres sed in gon 10E-6

12.4.11.5 Geoid Undulation Record [GEOIDREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (65)
GEOID_ID	5	N	Obl			Geoid Description Identifier An identification number of the record that is unique within the set of all Geoid Undulation Records in the dataset
REF_LAT	10	I	<S>	-90000000	+90000000	Reference Point Latitude Latitude of the point at which the geoid ondulation is speci- fied, expressed in microdegrees
REF_LONG	10	I	<S>	-180000000	+180000000	Reference Point Longitude Longitude of the point at which the geoid ondulation is speci- fied, expressed in microdegrees
GEOID_OND	5	I	<S>			Ellipsoidal Height Height of the national ortho- metric reference level (geoid) above the reference ellipsoid, expressed in decimeters

12.4.11.6 Earth Magnetic Field Record [MAGNETREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (66)
MAGN_ID	5	N	Obl			Declination Description identifier An identification number of this record that is unique within the set of all Earth Magnetic Field Records in the dataset
REF_LAT	10	I	<S>	-90000000	+90000000	Reference Point Latitude Latitude of the point at which the magnetic declination is specified, expressed in microdegrees
REF_LONG	10	I	<S>	-180000000	+180000000	Reference Point Longitude Longitude of the point at which the magnetic declination is specified, expressed in microdegrees
DEC_DATE	6	N	<S>			Validity Date Date of the declination value specified in Magnetic Variation
DEC_VALUE	5	I	<S>	0	+4000	Magnetic Variation Value of the clockwise counted angle between the direction of the Geographic North and the direction of the Magnetic North, expressed in decigon
DEV_ANNUAL	5	I	<S>	0	+4000	Annual Change Value of the clockwise counted angle of the annual deviation of the magnetic declination, expressed in decigon
HMAG_INT	5	I	<S>	0		Horizontal Magnetic Field Intensity in nano Tesla
VMAG_INT	5	I	<S>	0		Vertical Magnetic Field Intensity in nano Tesla

12.4.12 Feature Quality Record [FEAQUALREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (12)
FQREC_ID	5	N	Obl			Feature Quality Description Identifier Identification number that is unique for a particular [FEAQUALREC] record
FEAT_CODE	4	N	Obl			Feature Class Code The code of the feature class whose quality is specified in the present record
FEAT_COMP	2	N	<S>			Feature Completeness The completeness value of the feature class in issue, expressed as a percentage

12.4.13 Attribute Quality Record [ATQUALREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (13)
AQREC_ID	5	N	Obl			Attribute Quality Description Identifier Identification number that is unique for a particular [ATQUALREC] record
FEAT_CODE	4	N	Obl			Feature Class Code Feature code of the feature class whose attribute quality is specified
ATT_TYPE	2	A	Obl			Attribute Type Code Code of the attribute type whose quality is specified
ATT_VAL	10	G	<S>			Attribute Value Code A possible subset of attribute values which quality is specified
SURV_DATE	6	N	<S>			Survey Date Date of survey of the attribute type/values in question
AGING_RATE	2	N	<S>			Aging Rate of the attribute type/values in question, expressed as a percentage
ATT_RES	5	N	<S>			Attribute Resolution
ABS_ACC	5	N	<S>			Absolute Attribute Accuracy
REL_ACC	2	N	<S>			Relative Attribute Accuracy
ATT_COMP	2	N	<S>			Attribute Completeness Completeness rate of an attribute, expressed as a percentage
ATT_COR	2	N	<S>			Error Rate of an attribute, expressed as a percentage

12.4.14 Section Header Record [SECHREC]

12.4.14.1 Section Identification Subrecord [SECHREC.01]

Field name	Size	Type	No data Min.	Max.	Description
REC_DESCR	2	N	Obl		Record Type Code (16)
REC_CODE	2	N	Obl		Record Subtype Code (01)
SECT_ID	10	N	Obl		Section Identification Number An identification number of the section in issue, which is unique within the dataset
GEO_AREA	*	G	<S>		Section Geographic Coverage A characteristic topographical name of the section

12.4.14.2 Section Quality Subrecord [SECHREC.02]

Field name	Size	Type	No data Min.	Max.	Description
REC_DESCR	2	N	Obl		Record Type Code (16)
REC_CODE	2	N	Obl		Record Subtype Code (02)
XY_RES	3	N	<S>		Section XY Resolution
XY_ACC	3	N	<S>		Section XY Accuracy Worst case XY-accuracy in any part of the section, expressed in meters
Z_ACC	2	N	<S>		Section Z Accuracy Worst case Z-accuracy in any part of the section, expressed in meters
REL_ACC	2	N	<S>		Section Relative Accuracy
SURV_DATE	6	N	<S>		Section Mean Survey Date Date of the survey of the section as a whole
MAX_AGE	6	N	<S>		Section Maximum Age Worst case survey date of any data item in the entire section
FEAT_COMP	2	N	<S>		Section Feature Completeness Worst case value in any part of the section, expressed as a percentage
ATT_COMP	2	N	<S>		Section Attribute Completeness Worst case value in any part of the section, expressed as a percentage
ATT_COR	2	N	<S>		Section Correctness Worse case error rate in any attribute in any part of the section, expressed as a percentage

12.4.14.3 Quality Reference Subrecord [SECHREC.03]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N		Obl		Record Type Code (16)
REC_CODE	2	N		Obl		Record Subtype Code (03)
NUM_FIELD	2	N		Obl		Field counter which specifies how many times the next field repeats
FQREC_ID	5	N		<S>		Feature Quality Description Identifier Identification number of a [FEAQUALREC]record which is relevant for a feature class in the present section
NUM_FIELD	2	N		Obl		Field counter which specifies how many times the next field repeats
AQREC_ID	5	N		<S>		Attribute Quality Description Identifier Identification number of an [ATTQUALREC] record which is relevant for an attribute type in the present section

12.4.14.4 Datasource Reference Subrecord [SECHREC.04]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N		Obl		Record Type Code (16)
REC_CODE	2	N		Obl		Record Subtype Code (04)
NUM_DOC	2	N		Obl		Field counter which specifies how many times the next field repeats
DESC_ID	5	N		<S>		Source Description Identifier Identification number of a [SRCEREC] record which is related to this section

12.4.14.5 Datum & Magnetism Subrecord [SECHREC.05]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (16)
REC_CODE	2	N	Obl			Record Subtype Code (05)
DATEL_ID	5	N	Obl			Datum Description Identifier The identification number of the Datum & Elliposoid Record which contains information about the geodetical datum and reference ellipsoid which is relevant for the section in issue
COORD_TYPE	1	N	Obl	0	1	Horizontal Reference Type Indicates whether the coordinate values in the present section are given in the form of geographi-cal latitude and longitude (= 0) or as X- and Y-values within a rectangular cartesian coordinate system (= 1)
PROJEC_ID	5	N	<S>			Projection Description Identifier Identification number of the Projection Record that contains the information about the pro-jection
NATGRID_ID	5	N	<S>			Grid Description Identifier Identification number of the National Grid Record that contains information about the national grid
NUM_FIELD	2	N	Obl			Field counter which specifies how many times the next field repeats
|MAGN_ID	5	N	<S>			Declination Description Identifier Identification number of a Earth Magnetic Field Record that con-tains information about the magnetic declination

12.4.14.6 Orthometric Reference Subrecord [SECHREC.06]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (16)
REC_CODE	2	N	Obl			Record Subtype Code (06)
H_TYPE	1	N	Obl	0	1	Height Reference Type Indicates whether the height values in the present section are given in the form of ellipsoidal heights (= 0), or as orthometric heights (= 1)
VERDAT_ID	5	N	<S>			Vertical Datum Description Identifier Identification number of the Vertical Datum Record that contains information about the orthometric height reference system, which is relevant for the section in issue
NUM_FIELD	2	N	Obl			Field counter which specifies how many times the next field repeats
GEOID_ID	5	N	<S>			Geoid Description Identifier Identification number of a Geoid Undulation Record that contains information about the geoid height at a particular point

12.4.14.7 Section Border Subrecord [SECHREC.07]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (16)
REC_CODE	2	N	Obl			Record Subtype Code (07)
XY_CONFAC	2	I	0			XY Multiplication Factor 10 LOG of the multiplication factor for the X- and Y-values in the present section
Z_CONFAC	2	I	0	-9	+9	Z Multiplication Factor 10 LOG of the multiplication factor for the Z-values in this section
X_OFFSET	10	I	0			X Offset An additive constant for all the Xcoordinates in this section
Y_OFFSET	10	I	0			Y Offset An additive constant for all the Ycoordinates in this section
Z_OFFSET	10	I	0			Z Offset An additive constant for all the Zcoordinates in this section
X_MAX	10	I	<S>			Maximum X The maximum logical X-value which may occur in this section
Y_MAX	10	I	<S>			Maximum Y The maximum logical Y-value which may occur
X_MIN	10	I	<S>			Minimum X The minimum X-value which may occur
Y_MIN	10	I	<S>			Minimum Y The minimum logical Y-value which may occur

12.4.14.8 XY Control Point Subrecord [SECHREC.08]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (16)
REC_CODE	2	N	Obl			Record Subtype Code (08)
POINT_NAME	20	G	<S>			Point Name A unique external identification number or name of the control point
X_DIG	12	I	<S>			X Digitized The digitized X-coordinate of the control point, expressed in centimeters
Y_DIG	12	I	<S>			Y Digitized The digitized Y-coordinate of the control point, expressed in centimeters
X_SURV	12	I	<S>			X Surveyed The surveyed X-coordinate of the control point, expressed in centimeters
Y_SURV	12	I	<S>			Y Surveyed The surveyed Y-coordinate of the bench mark, expressed in centimeters

12.4.14.9 Z Control Point Subrecord [SECHREC.09]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (16)
REC_CODE	2	N	Obl			Record Subtype Code (09)
POINT_NAME	20	G	<S>			Point Name A unique external identification number or name of the control point
X_COORD	10	I	<S>			X Reference X-coordinate of the control point expressed in the same unit as in the data records
Y_COORD	10	I	<S>			Y Reference Y-coordinate of the control point, expressed in the same unit as in the data records
Z_DIG	10	I	<S>			Z Digitized Digitized Z-coordinate of the control point, expressed in centimeters
Z_SURV	10	I	<S>			Z Surveyed Surveyed Z-coordinate of the control point, expressed in centimeters

12.4.15 Layer Header Record [LAYHREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (17)
LAY_ID	2	N	Obl			Layer Identifier Unique identification number for this layer (within the section to which it belongs)
XY_RES	3	N	<S>			Layer XY Resolution
XY_ACC	3	N	<S>			Layer XY Accuracy Worst case XY-accuracy in any part of the layer, expressed in meters
Z_ACC	2	N	<S>			Layer Z Accuracy
REL_ACC	2	N	<S>			Layer Relative Accuracy
SURV_DATE	6	N	<S>			Layer Mean Survey Date Survey date of the layer as a whole
MAX_AGE	6	N	<S>			Layer Maximum Age
FEAT_COMP	2	N	<S>			Layer Feature Completeness Worst case feature completeness value in any part of the layer, expressed as a percentage
ATT_COMP	2	N	<S>			Layer Attribute Completeness Worst case attribute completeness value in any part of the layer, expressed as a percentage
ATT_COR	2	N	<S>			Layer Correctness Worst case error rate in any attribute in any part of the layer, expressed as a percentage
NUM_THEM	2	N	Obl			Field counter, indicating how many times the next field repeats
|THEM_COD	2	N	<S>			Feature Theme Code Code of a theme that occurs in this layer

12.4.16 Comment Record [COMMENTREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (90)
FREE_TEXT	*	G	<S>			General Comment

12.4.17 Volume Termination Record [VOLTERMREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (99)
FREE_TEXT	76	G	<S>			Volume Termination Comments
CONT_VOL	1	N	Obl	0	1	Volume Continuation Mark = 0 if the present volume is the last volume in the dataset =1 if another volume follows

12.5 Data Records

12.5.1 Coordinates Record [XYZREC]

Field name	Size	Type	No data	Min.	Max.	Description
REC_DESCR	2	N	Obl			Record Type Code (23)
XYZ_ID	10	N	<S>	1	2E32	Geometry Identifier ID-number of the [XYZREC] record which is unique within the section
G_TYPE	1	N	<S>			Geometry Type Code
Q_PLAN	2	I	<S>			Quality Code
DESC_ID	5	N	<S>			Source Description Identifier ID-number of the source document where the information of this record has been derived
NUM_COORD	5	N	Obl			Field counter which specifies how many times the next repeating field group repeats
| X_COORD	10	I	<S>	-2E31	2E31	X-coordinate
| Y_COORD	10	I	<S>	-2E31	2E31	Y-coordinate
| Z_COORD	10	I	<S>	-2E31	2E31	Z-coordinate

Note 1: The exact meaning of the data types (N, A, I, etc.) is explained in the Global Data Catalogue.
Note 2: "Obl" in the field specifications of the data records only means that the field value is required to enable the correct interpretation of the syntax of an individual record. Other fields may be mandatory to enable the interpretation of higher order data structures, but this is not indicated.