

1.1.1 SpatialG0

1.1.1.1 Identification

Name : SpatialG0
Identifier : ViaNova.Dbdd.ConceptualSchema.SpatialG0

1.1.1.2 Description

[1] This schema describes the SpatialG0 schema of the CEN prENV 12160 (final draft November 1996) as far as applicable for the spatial and topological specifications of road networks.

[2] However, :

- where clauses in 'comment' form are not included and
- the reference to the 'direct_position' entity in the schema 'direct_position_schema' is replaced by an direct_position entity with a [WGS84] location reference.

[3] In case of any differences between this text and the CEN prENV 12160 and unless explicitly stated otherwise, the text of the CEN prENV 12160 prevails.

Note1: This schema also contains the entities 'face' and 'ring'. If this entities where not required, this schema should become equal to the CEN prENV 12160 schema SpatialG4.

Note2: The entity direct position should still be replace by a reference (or use) of to (or of) another schema.

1.1.1.3 Conceptual schema

```
<< to be corrected :  
  ENTITY boundary;  
    is_composed_of : LIST [1:?] OF UNIQUE curve; -- add UNIQUE  
>>
```

```
SCHEMA SPATIALG0;  
  
  TYPE Schema_id = STRING;  
  END_TYPE;  
  
  TYPE Interpolation_method = ENUMERATION OF  
    (SHORTEST_WAY,  
     CIRCULAR_ARC,  
     B_SPLINE,  
     CLOTHOID);  
  END_TYPE;  
  
  TYPE direction = REAL;  
  WHERE  
    (SELF > - PI) AND (SELF <= PI);  
  END_TYPE;  
  
  TYPE Microdegrees = INTEGER;  
  END_TYPE;  
  
  TYPE Decimetre = INTEGER;  
  END_TYPE;  
  
  (*  
  <direct_position>  
  Wgs'84 Geodetic coordinates  
  *)  
  ENTITY direct_position;  
    latitude : Microdegrees;  
    longitude : Microdegrees;  
    height : OPTIONAL Decimetre;  
  WHERE  
    MinMaxLatitude : {-900000000 <= latitude <= 900000000 } ;  
    MinMaxLongitude : {- 1800000000 <= longitude <= 1800000000};  
  END_ENTITY;  
  
  ENTITY spatial_view;  
    conforming_to : Schema_id;  
  INVERSE
```

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        has_geometric_parts : SET OF geometric_primitive FOR is_part_of;
        has_topological_parts : SET OF topological_primitive FOR is_part_of;
    WHERE
        DR1 : (* A spatial view shall be composed of at least one primitive of any
type*)
        SIZEOF(has_geometric_parts) + SIZEOF(has_topological_parts) > 0 ;
    END_ENTITY;

ENTITY geometric_primitive
    ABSTRACT SUPERTYPE OF (ONEOF(point, curve, surface));
    is_part_of : SET [1:?] OF spatial_view;
    INVERSE
        is_description_of : SET OF topological_primitive FOR is_described_by;
    END_ENTITY;

ENTITY point
    SUBTYPE OF(geometric_primitive);
    has_position : direct_position;
    END_ENTITY;

ENTITY curve
    SUBTYPE OF(geometric_primitive);
    has_position : LIST [2:?] OF direct_position;
    interpolation : Interpolation_method;
    tangent_direction_at_first_end : OPTIONAL direction;
    tangent_direction_at_last_end : OPTIONAL direction;
    INVERSE
        is_a_component_of : SET OF boundary FOR is_composed_of;
    END_ENTITY;

ENTITY boundary;
    is_composed_of : LIST [1:?] OF curve;
    INVERSE
        is_outer_boundary : SET OF surface FOR has_outer_boundary;
        is_inner_boundary : SET OF surface FOR has_inner_boundary;
    END_ENTITY;

ENTITY surface
    SUBTYPE OF(geometric_primitive);
    has_outer_boundary : boundary;
    has_inner_boundary : SET OF boundary;
    END_ENTITY;

ENTITY topological_primitive
    ABSTRACT SUPERTYPE OF (ONEOF(node, face, edge));
    is_described_by : OPTIONAL SET [1:?] OF geometric_primitive;
    is_part_of : SET [1:?] OF spatial_view;
    END_ENTITY;

ENTITY node
    ABSTRACT SUPERTYPE OF (ONEOF(isolated_node, connected_node))
    SUBTYPE OF(topological_primitive);
    END_ENTITY;

ENTITY isolated_node
    SUBTYPE OF(node);
    is_within : SET OF face;
    END_ENTITY;

ENTITY face
    SUBTYPE OF(topological_primitive);
    has_outer_ring : OPTIONAL ring;
    has_inner_ring : OPTIONAL SET [1:?] OF ring;
    INVERSE
        contains : SET OF isolated_node FOR is_within;
        is_on_the_left_of : SET OF edge FOR has_on_its_left;
        is_on_the_right_of : SET OF edge FOR has_on_its_right;
    WHERE
        DR1 : (* A face shall be bounded by at least one edge *)
        SIZEOF(is_on_the_left_of) + SIZEOF(is_on_the_right_of) > 0 ;
    END_ENTITY;

ENTITY ring;
    is_composed_of : LIST [1:?] OF edge;
    INVERSE
        is_the_outer_ring_of : SET [0:1] OF face FOR has_outer_ring;
        is_inner_ring_within : SET [0:1] OF face FOR has_inner_ring;
    WHERE
        DR1 : (* A ring shall be either an outer ring or an inner ring of at least
one face *)
        SIZEOF(is_the_outer_ring_of) + SIZEOF(is_inner_ring_within) >= 1;

```

```

END_ENTITY;

ENTITY edge
  SUBTYPE OF(topological_primitive);
  starts_at      : terminating_node;
  ends_at        : terminating_node;
  has_on_its_left : OPTIONAL SET [1:?] OF face;
  has_on_its_right : OPTIONAL SET [1:?] OF face;
  next_right     : OPTIONAL edge;
  next_left      : OPTIONAL edge;
  previous_right  : OPTIONAL edge;
  previous_left   : OPTIONAL edge;
  INVERSE
    supports      : SET OF intermediate_node FOR is_coincident_with;
    is_a_component_of : SET OF ring FOR is_composed_of;
END_ENTITY;

ENTITY terminating_node
  SUBTYPE OF(connected_node);
  INVERSE
    is_start_node_of : SET OF edge FOR starts_at;
    is_end_node_of   : SET OF edge FOR ends_at;
  WHERE
    DR1 : (* A terminating_node shall terminate at least one edge*)
          SIZEOF(is_start_node_of) + SIZEOF(is_end_node_of) > 0;
END_ENTITY;

ENTITY connected_node
  ABSTRACT SUPERTYPE
  SUBTYPE OF(node);
END_ENTITY;

ENTITY intermediate_node
  SUBTYPE OF(connected_node);
  is_coincident_with : SET [1:?] OF edge;
END_ENTITY;

END_SCHEMA;

```

Schema Fout! Onbekende schakeloptie-instructie. SpatialGO

1.1.1.4 Entity descriptions

The various entities together with some auxiliary definitions are described below.

All definitions are, unless stated otherwise, conform CEN [prENV12160].

Boundary

Closed 1-dimensional non-intersecting, either implicitly or explicitly, element.

Connected node

Node related to one or more edges.

Curve

Bounded continuous 1-dimensional geometric primitive.

Direct position

WGS'84 based geodetic position with optional height parameter. The latitude and longitude are measured in microdegrees, the height in decimetres. (different form [prENV12160]).

Edge

1-dimensional topological primitive being an oriented connection between two terminating nodes, which may be the same.

Explicit intersection

Two primitives explicitly intersects one each other when the two respective lists of coordinates have one or more repeated values between them. One primitive intersects explicitly itself when in its list of coordinates there are one or more repeated values.

Face

2-dimensional topological primitive.

Geometric primitive

Description, partial or total, of the spatial aspects of an object by means of coordinates and mathematical functions.

Geometry

Metric spatial aspects of Geographic Information.

Implicit intersection

Two primitives implicitly intersect one each other when their respective interpolation methods applied to its respective lists of coordinates pass two or more times for exactly the same spatial position. One primitive intersects implicitly itself when its interpolation method is applied to its list of coordinates and passes two or more times through exactly the same spatial position.

Intermediate node

Connected node coincident with an edge without terminating it.

Isolated node

Node not related to any edge.

Node

0-dimensional topological primitive.

Point

0-dimensional geometric primitive.

Ring

Ordered set of connected edges forming a 1-dimensional closed not intersecting, either implicitly or explicitly, element.

Spatial view

Collection of geometric primitives and/or topological primitives conforming to a pre-defined spatial schema.

Surface

Bounded continuous 2-dimensional geometric primitive.

Terminating node

Connected node terminating an edge.

Topological primitive

Description, partial or total, of the topological aspects of an object.

Topology

Non-metric discrete spatial aspects of Geographic Information.

1.1.1.5**Type descriptions**

The various types together with some auxiliary definitions are described below.

Interpolation method

Defines the different allowed interpolation methods [prENV12160]

Direction

An angle defining the direction of a straight curve.

Angles are counted from the first axes and counter clockwise. [prENV12160]

Decimetre

One tenth of a metre.

Note: As 40.000 km = 40 million metres = 400 million decimetres < 2.000 million, any distance on earth can be represented by a four bytes integer if measured in decimetres. At the same time the decimetre is more than accurate for all known traffic applications.

MicroDegrees

One millions of a degree.

Note: As 360 million is less then 2.000 million, any value between -360 and 360 degrees can be represented by a four byte integer if measured in microdegrees.

Schema_id

The string which uniquely identifies a schema. [prENV12160]

1.1.1.6 Integrity constraints

See [prENV12160].

1.1.1.7 Other security aspects

There are no additional security requirements

1.1.1.8 Performance aspects

There are no additional performance requirements

1.1.1.9 Implementation aspects

There are no additional implementation requirements.

1.1.1.10 Abbreviations

CEN	Comité Européen de Normalisation (European Committee for Standardization)
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prENV	European Prestandard
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WGS	World Geodetic System
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1.1.1.11 References

See section 2 for a complete reference description.

[prENV12160]	Geographic Information - Data Description - Spatial schema November 1996
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[WGS84]	MIL-STD-2401 US Department of Defence World Geodetic System (WGS) 11 January 1994
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