TRAFIKVERKET

Road Data Overview

Version 2.0

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List of revisions

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Contents

1 Introduction

1.1 What is road data?

Road data is the name given to data used to describe a road network and the fundamental characteristics, referred to as features, linked to the network. There are also other data related to different traffic networks such as railway data and road traffic data. Within road data, there are various types of product groups, for example NVDB, the National Road Database, which is the name the Swedish Transport Administration (Trafikverket) uses to market certain data on Sweden's motor vehicle and bicycle routes. There is a substantial need for quality road data that covers the entire country. This data has a wide sphere of application both within the Swedish Transport Administration's own operations and in other activities within the road sector.

Data is modelled and stored according to a specific model and technology. This enables the road network and its features to be represented in a database to be provided and widely spread. NVDB data is available to commercial operators as well as public sector organisations.

1.2 Background

The NVDB was commissioned by the Swedish government and ought to be regarded as the general public's fundamental database, which means the database contains a limited amount of basic information about Sweden's roads. The data in the NVDB is stored according to a Swedish standard which makes it possible to combine the information in the NVDB with other road information. In addition, a certain portion of the country's bicycle routes are stored in the database. NVDB is the result of a cooperation between the Swedish Transport Administration, the Swedish Association of Local Authorities and Regions (Transportstyrelsen), the forestry industry, the Swedish Transport Agency and the Swedish Land Survey (Lantmäteriet). These bodies are NVDB's partners, and they are also the source of the majority of the data that is in NVDB.

The Swedish Transport Administration supplies the road data, kept up to date by NVDB's partners, to clients who have a need for road data. For those clients who require it, the Swedish Transport Administration is prepared to supplement the data with other road data that the Administration gathers for its own needs. NVDB can therefore be regarded more as a collective term or brand name than as a database for fundamental road data that has been collected by NVDB's partners and provided via the Swedish Transport Administration.

1.3 Document overview

This document is a general introduction to a series of data product specifications for road data, and has been translated into English. Here, an overview is presented of NVDB, its content, how requirements are specified and how the quality is reported in NVDB.

Dataproduktspecifikation – Det svenska vägnätet (Data product specification on Swedish Road Network*)* specifies requirements governing how the motor vehicle, bicycle and pedestrian network is to be represented in the database.

All data product specifications for the different feature types describe the requirements for how data is to be represented in the database.

For further information on the road network connection are referred to the document entitled "*Information Model Transport Network - Road and Railway*".

The above documents are published in current versions at NVDB's website (www.nvdb.se).

1.4 The purpose of NVDB

The purpose of NVDB is to gather, update, store, and supply basic road data on all Swedish roads, bicycle and pedestrian routes. The need for a nationwide database of this type is substantial, and it has a wide range of use.

The data shall be subject to a quality declaration and be available for the individual needs of the partners, but also for other clients. NVDB is thus available for both commercial and public sector players.

Combining the data with other road network related data is enabled by the fact that data in NVDB is stored in accordance with a Swedish standard. Similarly, effective channels for data exchange between different organisations are made possible. NVDB basically contains two parts: on one hand the road network, which describes how the roads are aligned and interconnected through the landscape, and on the other feature types that are related to the road and describe the road's characteristics and objects as well as the rules and regulations that apply to it. The feature type could, for example, be information on the width of the road, speed limit, the name of the road, etc.

At times, it may be necessary to regard information about a road with different levels of detail for different purposes or applications:

- The road level, where a road, irrespective of the number of physical lanes, is represented by one reference line (a motorway is represented with only one reference line).
- The carriageway level, where a road with physically separated lanes is represented by one reference line for each lane
- The lane level, where each lane can have its own reference line and even features. At this level intersections can be represented.

NVDB is constructed at the carriageway level. This level is for the majority of the road network the same as the road level, with the exception of roads with separate lanes and lanes where several types of networks have to share the same carriageway (e.g. streets with bicycle lanes).

1.5 Data maintenance

The updating of road data is performed in cooperation with the source of the information, i.e. with NVDB's partners. NVDB is a collaboration project between the data suppliers, who are also partners who own and administer data jointly. This guarantees a well defined quality.

1.6 Clients usage of road data

Sample areas of use

- Navigation for e.g. rescue services, taxi services or tourists that need to find their way.
- Transport planning for all types of transportation by road, but also for the planning of transportation that involves several different modes of transport (intermodal transportation).
- Planning of public transport.
- Planning and follow-up of how traffic safety can be developed.
- Planning and follow up of operation and maintenance for streets and roads.
- School bus journeys, mobility services and home care planning.
- Equipment for Intelligent Speed Adaptation (ISA).

1.7 Terms, definitions and abbreviations

For the description of terms, definitions and abbreviations, reference is made to *Vägdata - termer, begrepp och förkortningar (*Road Data – Terms, Definitions and Abbreviations*)*.

2 Scope

The product covers the Swedish road network, including the bicycle and pedestrian network and feature types linked to the road network. The road network and feature types are described in separate data product specifications.

2.1 Road networks that are included in NVDB

The NVDB is a complete road database for Sweden. That means all roads, streets, squares, ferry routes, and other routes or places used by motorized vehicles and bicycles are included. It is even possible to enter pedestrian paths for those that so choose. It is also possible to insert roads inside parking facilities, housing and industrial areas, where car traffic is not usually found but where it is fully possible to drive for special reasons.

Trails or routes that are arranged to carry snow scooters, or horse-riding trails are not included in NVDB. Neither are tractor routes or temporary routes such as winter roads on ice. When looked at from a general transport point of view, there are differents demands concerning how well road properties are to be described depending on the importance of the road.

2.2 Feature types in Road data

Road characteristics and objects are referred to as **features.** A **feature type** is a description of a group of features that are of a certain type with similar characteristics and how they are linked to the road network, i.e. a model for describing a certain type of feature along the road network.

A feature is an individual occurrence of a certain object or property with a fixed set of attributes that are linked to the road network. A feature is of a certain type, a so-called feature type.

Details of the characteristics of the feature types are described with one or more attribute types.

Certain attribute types define how the presence of a feature is to be linked to the road network.

An example of a feature of the type “Road width” on a certain stretch of road in which the attribute “Width” specifies that the road width is 9 m.

In the table below, it can be seen which feature types are included in NVDB. A more detailed description is to be found in each data product specification (DPS) where the feature types with their attributes are defined. Specific collection regulations for each respective feature type are specified in *Regler för insamling och leverans av vägdata* (Regulations for the collection and supply of road data*)*.

Feature types	Description
Number of lanes	Specifies the number of lanes on the road network.
ATM camera locker	Refers to the lockers that contain cameras for Automatic Traffic Monitoring.

ATM camera route	Refers to those segments of road that have Automatic Traffic Monitoring with high-speed cameras. The segment in question begins at the first sign and ends where the first sign is positioned in the opposite direction.
Limited gross weight	A traffic regulation on limited gross weight communicated by means of a directive or other ruling
Limited vehicle width	Traffic regulation on limited vehicle width communicated by means of a directive or other ruling
Limited vehicle length	Traffic regulation on limited vehicle length communicated by means of a directive or other ruling
Limited axle/bogie pressure	Traffic regulation on traffic with a certain axle pressure and/or bogie pressure and/or triple axle pressure communicated by means of a directive or other ruling
Anti-glare screen	Screening exists for light emitted by the headlights of oncoming vehicles.
Bridge and tunnel	Structures that allow traffic to cross over and under watercourses, valleys, roads, buildings, railways and bicycle routes or through rock or earth.
Manhole	Refers to the presence of manholes within the road area.
Bearing capacity	Permitted bearing capacity on national and municipal roads and streets.
Illumination	Specifies whether or not there is lighting along a bicycle route/track.
Bicycle road type	Description of the bicycle road structure
Biycle route	An integrated series of roads/tracks intended or suitable for bicycle traffic
Roundabout	Traffic regulation on roundabouts communicated by means of a directive.
Regulation	Information on regulations at intersections
Recommended road for bicycle traffic	Roads for motor vehicles that are recommended for use by bicycle traffic.
Separation	Refers to type of separation between bicycle and motor vehicle network.
Traffic safety improvement measures	Shows the presence of measures that increase road safety at crossing points.
Municipal operation and maintenance grant	A road or part of a road for which a grant for operation and maintenance is allocated by a local authority.
Operational area	A geographical area that is used in connection with the procurement of operation and maintenance services.
Operatng turning point	Refers to a place that is arranged if necessary in order for road maintenance and rescue vehicles to be able to turn without needing to drive to the nearest interchange point or roundabout.

Speed breaker	Refers to a permanent physical measure that affects the speed chosen by motor vehicle traffic at a certain point or on a certain stretch of road.
Accessibility for certain types of vehicle combinations	The alignment of a road classified on the basis of a system drawn up by the forestry industry in Sweden.
Functional road class	A classification based on how important a road is for the connectivity of the total road network.
Ferry route	A road connection over a watercourse with a vessel (road ferry). May be public (without charge) or private.
Prohibited direction of travel	Information on the forbidden direction of travel on a stretch of road communicated by means of a directive or as a result of the physical road design.
Prohibited turn	Information on forbidden turns at a road intersections.
Traffic prohibited	A traffic regulation that prohibits traffic.
Traffic prohibited – private road	A traffic regulation sign on a private road that prohibits traffic that is not communicated by means of a directive.
Feature lineage	A description of the process by which data for a feature has been created and handled.
Street name	The official address-forming name of a street.
Pedestrian, bicycle and moped passage	Refers to an established crossing for pedestrians and/or bicycles/mopeds across roads with a functional road class of 1-5.
Passage	Describes a crossing by means of a bridge or a tunnel structure.
Pedestrian street	Traffic regulation on a pedestrian street.
Pedestrian zone	Traffic regulation on a pedestrian speed area.
Speed limit	Traffic regulation on the highest speed at which a vehicle may be driven according to a ruling
Main road network for transportation of goods	A road allocated for use by heavy long-distance goods/freight transport trucks. Together, the roads constitute the main road network for heavy long-distance transportation (HVN) in Sweden.
Bus stop	A joint, virtual place for a set of bus stops.
Bus stop location	A marked, identified place along the road network that has been created for passengers embarking on or disembarking from public transport vehicles.
Limited axle/tandem load – private road	A traffic regulation marked on a sign on a private road limiting traffic with a certain axle pressure, bogie pressure and triple axle pressure that has not been communicated by means of a local traffic ruling.
Limited gross weight – private road	A traffic regulation marked on a sign on a private road limiting traffic with a certain gross weight that has not been communicated by means of a local traffic ruling.

Limited vehicle width – private road	A traffic regulation marked on a sign on a private road limiting maximum permissible vehicle width that has not been communicated by means of a local traffic ruling.
Limited vehicle length – private road	A traffic regulation marked on a sign on a private road limiting maximum permissible vehicle length that has not been communicated by means of a local traffic ruling.
Height restriction less than 4.5 metres	A height obstruction in the form of an artificial obstacle or other type of structure that entails a restriction in vertical clearance up to 4.5 m.
Restrictions for transport of hazardous materials good	Traffic regulation on restrictions of the transport of hazardous goods.
Railway crossing	Refers to railway level crossings (a track for regular scheduled traffic owned by the State) between the national track network and the road network in NVDB.
Calibration segment	Refers to a marked, measured and guaranteed control segmentn for the calibration of measuring instruments. Intended for length measurements.
Marker post	Refers to the occurrence of safety or guide posts within the road area.
Disaster passage	Refers to an opening in the central crash barrier that separates the direction of traffic travel, and is intended for rescue service vehicles. Disaster crossings may also be used for conveying traffic over the other direction of travel and for the dual direction of traffic on one half of a motorway or an expressway.
Structure	Describes the structure for each crossing by means of a bridge or tunnel structure.
Intersection	Refers to a place where two or more roads connect to each other. The roads should be national or municipal. All the nodes in an intersection should be held together in one feature regardless of the road authority responsibility for intersecting roads.
Quality requirement class	The subdivision of the road network to allow differentiated quality requirements on different parts of the road network
Traffic flow direction	Information on the permitted direction of travel on the stretch of road in question as a result of physical road design or based on generalisation of the road network.
Environmental zone	Traffic regulation on environmental zones.
Central reserve	Refers to markings that separate carriageways with traffic flowing in the opposite direction.
Motorway without a central reserve	Traffic regulation of a motorway without a central reserve.
Motorway	Traffic regulation of a motorway.

Road network with national interest for communications	Refers to the road network where an area of national interest for communications could be encountered when connecting a new road or upgrading an old one.
Overtaking prohibited	Refers to a segment of road for which overtaking is prohibited that is marked with the sign "Overtaking prohibited" up to the sign "End of overtaking prohibited"
Route diversion	Refers to a road that is intended for the temporary rerouting of traffic. These roads may be on national, municipal or private road network.
Commuter and service road	A designated road network for commuting to and from work, service transportation and public transport around major built-up areas. Important national and regional corridors that are designated on the basis of traffic volume, commuting pattern and travel by public transport, with the aim of guaranteeing reliable transportation around major urban areas.
Prioritized road for public transport	A road that is prioritised for public transport that can be used for persons with some sort of physical impairment.
Lay-by	A lay-by is a space beyond the limits of the carriageway, often in the form of a longitudinal broadening, but also as a separate loop, that is intended for temporary parking.
Rest area	A roadside facility for the needs of road users to rest, eat, visit the restrooms, recreation or similar purposes.
Reference line lineage	A description of the process that created and managed data about the reference line.
Regional service area network	Refers to a road network that consists of regionally designated important corridors which, together with the national trunk road network, comprises a national rest area road network.
Recommended road for hazardous goods	Specifies whether or not a road is recommended by the county administrative board for the transport of hazardous goods.
SE-TERN-Road Network	A designated road network and identified links for TERN operations within the EU.
Side passage	Describes a corridor running next to or alongside a structure.
Road safety classification	Refers to roads that are classified with respect to safety in connection with road works.
Road surface	A road's surface.
Snowposts	Refers to roads that are marked with snow rods or sticks.
Trunk road network	A collection of main roads that are classified as the trunk road network in Sweden.
Climbing lane	Refers to stretches of road that have been given an increased road width on steep gradients in order to facilitate accessibility.

Urban road	A limited road network with designated roads in the metropolitan regions of Stockholm, Gothenburg and Malmö that carry large traffic volumes. The road network has common characteristics with respect to special requirements for operation and maintenance, especially in connection with accessibility.
Turn possibility	The possibility to turn for different types of vehicle combinations at an intersection as a consequence of its design.
Accessibility	The accesability of the road for different types of vehicle at different times of the year.
Licensed cable passage	Refers to a point where a permit-issued utility line/cable crosses a state road.
Licensed cable segment	Refers to a permit-issued utility line/cable route that runs alongside a State road. It may run on the left/right-hand side or in the middle of the road.
STA- cable passage	Refers to a point where a utility line/cable route that is owned by the Swedish Transport Administration runs alongside a State road.
STA- cable segment	Refers to a utility line/cable route that runs alongside a State road that is owned by the Swedish Transport Administration. It may run on the left/right-hand side or in the middle of the road.
Urban area	A traffic regulation on urban areas communicated by means of a directive.
Underpass	Describes the crossing beneath a bridge or tunnel structure (beneath an overpass).
Wildlife fence	Refers to a high wire-netting fence intended to make it difficult for wild animals to access the road.
Winter2003	Used for the subdivision of winter maintenance standards into operation procurement from 2003 onwards in accordance with the regulations VINTER 2003.
Winter bearing capacity	Allowed increase of bearing capacity on State and municipal roads and streets over the winter period 16 November – 31 March.
Road weather information systems	Refers to Road weather information system (VVIS) poles running alongside roads.
VV road surface	Road surface on state roads.
Road width	The mean width of the carriageway for the specified stretch of road. In the case of a surfaced road, the width is the distance between the edges of the pavement or kerb. For other roads it refers to the load-bearing width, or in other words that part of the carriageway that fulfils the specified bearing.
Road block	The occurrence of permanent physical obstacles for the purpose of preventing unauthorised vehicle access.
Road manager	The body responsible for road maintenance.

Road category	The Swedish Transport Authority's subdivision for the importance of the State road network for the national demand for transportation.
Road number	The road number of public roads that are included in the national and county road network.
New road construction	Specifies on one hand the year in which a new construction was performed on the road or the stretch of road was built, and on the other the year that reinforcement work was carried out on a certain stretch of road.
Guard rail	A permanently installed guard rail for the purpose of alleviating the damage caused to vehicles that drive off the road and to their drivers and passengers.
Guard rail terminal	How the crash barriers lining the road start and finnish.
Guard rail reflector	Guard rail reflectors mounted on guard rails for the purpose of guiding vehicle drivers.
Road traffic network	Describes primarily the way in which the network component is intended to be used
Road type	Refers to the road type designation according to the General director's decision dated 2001-06-20 Dnr 16783 for current types of road at Vägverket (the Swedish Road Administration and formerly equivalent to the Transport Administration) with a certain amount of adaptation to data already existing in VDB (former road data base).
Turnaround possibility	The presence of a loop, a hard standing or a turning bay that makes it possible t50 turn the vehicle.
Overpass	Describes the crossing over/on a bridge or tunnel structure that is burdened with traffic loads in the form of motor vehicle, bicycle or pedestrian traffic.
Passage in central barrier	Refers to a place that is arranged on roads with a central reserve so that traffic can be driven from one carriageway to the other when one of the carriageways is temporarily closed.
Other road name	The non-address-forming identification of a road

2.3 Business-specific feature types

Since NVDB is to be regarded as one of society's basic databases containing data about Sweden's roads, it may be used as a base and supplemented with more specific information. The number of different feature types and other road data is therefore relatively limited. Those wishing to use NVDB's road network as the base for a database with company-specific data can do so, for instance a road database with information for tourists. The basic starting point is in this case NVDB's road network and feature types and this is complemented by feature types such as attractions, scenic routes, nature reserves, museums, eating-places, etc. This data is not included in NVDB and cannot be regarded as part of the product.

At the Swedish Transport Administration, there are several different feature types that are only supported for the Administration's own activities and for the road network for which the Administration is responsible.

2.3.1 Integration of NVDB data in existing system

There may be cases when companies may want to use NVDB's road network and associated features in separate company-specific, or commercial, systems. It could be used in applications for the control and planning of transportation, systems for analysis of accident data, systems for directing or checking traffic, etc. Since NVDB's road network model is based on a standard[1] it is fully possible to adapt already existing systems or to construct new systems so that they can handle NVDB data.

In a system like this, it is possible to update the road network data with changes from NVDB. This way, it is possible to have a constantly up-to-date road network to connect the operational features to (or as up-to-date as is necessary).

For all such systems, they must be able to maintain a connection between company-specific features and NVDB's road network, i.e. the systems must handle identities for nodes and links from NVDB so that it is possible for a company's own features to be connected to them. When updating the road network (new supply from NVDB) the system must be able to process the changes that have occurred. If a road has changed, the system must be able to identify when that happens so the company can decide what changes are needed for its' own specific features connected to that road.

When exchanging data between different databases based on the same standard as NVDB, it is always important to collaborate so that both parties are in agreement on definitions and requirements on data.

[1] SS 637004 Road and Railway Networks

3 Descriptions of features and their connection to the road network

3.1 Data product structure (model)

A data product (feature type) is described by a location on the road network, called an extent, and one or more attribute types. For some features only the extent on the road network is given as there is no need for attributes to describe the features. All feature types are linked to the road network in order to make it possible to regard them in a uniform way in relation to each other and to the road network.

The location of a feature on the road network – its extent – is created by applying the location of the feature to one or more valid reference link identities. There are five different types of extents that describe the location of a feature: segment, point, node, turn, road, and road extent with host. Most feature types have segment extents.

The description of a feature type is made with one or more types of attributes by means of valid data types and value quantities. All features have a unique ID and a validity in time. The validity of a feature on the road network is described by a time version given to the feature.

The feature type definitions and structures are described in a data catalogue.

3.2 Attributes describe features

Features are composed of two parts: a description of the feature and the location on the road network. In addition there is also an attribute that specifies the features time version, i.e. when it is valid on the road network. The feature type is described by its attributes. Each attribute belongs to an attribute type. The attribute type belongs to a certain data type that can have certain predetermined values. The description of each occurrence of a feature, including its location and time version, is given with one or more attributes. The location is specified by giving the feature an extent which also has attributes.

An example of a type of feature is “Road width” that is located on a certain stretch of road, an extent, where the attribute “Width” specifies that the road has a width of 9.0 and the unit is metres.

For most feature types, there may be **mandatory attributes** (apart from the extent and time version attributes). If so, it is mandatory to specify a value for the attribute. If the attribute is mandatory it entails that it is not possible to register a feature with only its extension; a description of the feature must also be registered. It would not, for example, be of any interest to register the extent of the feature type “Street name” without specifying the actual name itself. Therefore, the attribute “Name” is compulsory for the feature type “Street name”.

Not all attributes, however, are mandatory. For the feature type “Road authority”, for instance, it might be of interest to know that there is an extent of road authority even though no value has been registered for the other attributes: “Road authority name”, “Corporate identity number”, and “Form of administration”. Therefore, the latter attributes are not mandatory.

For certain feature types, however, it could be of interest to know only their extent. For the feature type “Possibility to turn”, it could be of interest to know only the extent, even though the attributes “Possibility to turn class”, or “Type of possibility to turn” are not given.

The basic form for an attribute is that it has a value list and from this only one single value should be chosen for the registration of a feature. There are, however, other types of attributes:

Concurrent attribute – A concurrent attribute has a value list from which several values can be chosen, and they shall apply for the same period of time on a certain predetermined part of the road network, i.e. what is registered is a mark-up of zero, one or more values.

Example: A feature of the type traffic prohibited has the concurrent attribute "Vehicle" and for which, on the specified segment of road, from a certain point in time until further notice, the prohibition applies for trucks, buses and tractors.

Complex attribute – A complex attribute consists in itself of two or more sub-attributes. In order to cement a description into a logical unit, it has been decided to group the sub–attributes together to create a complex attribute.

One example of this is the attribute "Time interval", which in itself contains a number of attributes, such as starting day, finishing day, type of day, time of day, etc.

It is possible for an attribute to be both complex and concurrent.

3.3 Temporal validity of features

All features have a unique ID and temporal validity. The validity of the feature on the road network is described by the validity of the feature's connection to the road on the road network and the temporal validity of the road network.

A feature can have one or more time versions, although they do not apply simultaneously.

A feature's time version is a certain period during which the attribute values and extents are valid for the feature.

3.3.1 From-date and to-date

All features have a time version that indicates their validity on the road network. The time versions have a from-date and a to-date. These two dates describe the period of validity of the individual feature concerned, i.e. when the feature begins to apply or be valid until it ceases to apply or be valid. Or – expressed in another way – when it is born and dies.

All features have at least a From-date.

3.3.1.1 Definition of a From-date

Mandatory attribute:	**From-date**
Definition:	The date on which the feature starts to be valid.
Value quantity:	**<date>**
Example	1998-03-15

3.3.1.2 Definition of a To-date

Attribute:	**To-date**
Definition:	The date on which the feature ceases to be valid.
Value quantity:	**<date>**
Example	1998-03-15

When a feature is registered for the first time, it is often valid until further notice, i.e. there is no defined date on which it ceases to apply or be valid. The "To-date" is in these cases always 9999-12-31, a date that is to be regarded as "until further notice".

3.3.2 Historical background

In NVDB, the road network history is stored. All reference links, nodes and features with attributes and extents are saved even though they may have been terminated, been replaced by new ones, or have in some other way ceased to apply. Therefore, the time at which the object ceased to apply must be registered.

3.4 Different types of extents

A feature's location is specified by its extent. There are different types of extents by which the feature types are linked to the road network.

In NVDB, there are various types of extents which are described below. For each feature type, its' extents and types of extents must be determined. Most feature types have segment extents.

For a detailed description of the different types of extents, please refer to the document titled "*Information Model Transport Network - Road and Railway*".

Type of extent	**Explanation**
Segment extent	The extent is linked to one or more segments on one or more reference links, see example in *Figure 1*
Node extent	The extent is linked to one or more nodes (used, for example, for the feature types Possibility to turn, Speed calmer and GCM crossing) see example in *Figure 2.*
Point extent	The extent is linked to one or more points on one or more reference links (used, for example, for the feature type Height obstruction up to 4.5 m, Road obstruction, Traffic calmer, GCM crossing and Possibility to turn) see example in *Figure 3*
Turn extent	The extent is linked to a node and describes a possible turn from one link to another link via a node (used only for the feature types Forbidden turn and Possibility to turn) see example in *Figure 4*
Road extent	This is a variation of segment extent in which link role can be specified.
Road extent with host	This is a variation of segment extent in which the link role and host road/guest road can be specified. This kind of extent is used for the feature types Street name and Road number

3.4.1 Segment extent

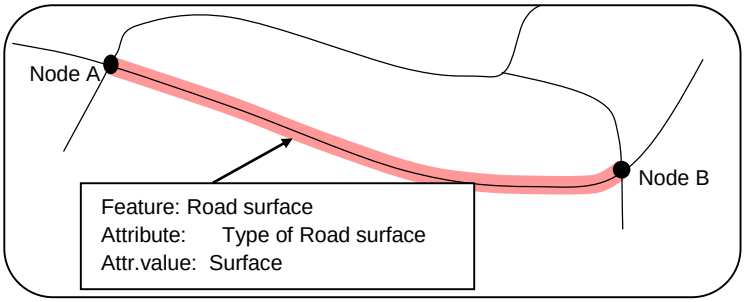

Figure 1
In order to describe that the road between Node A and Node B is surfaced, use is made of the feature type Road surface. For the feature type attribute "Type of road surface", the attribute value "surfaced" is used. The location of the feature is specified by means of a segment extent that is linked to the stretch of road between Nodes A and B.

3.4.2 Node extent

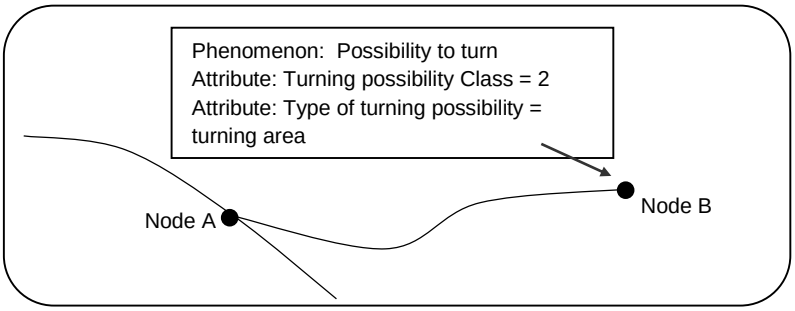

Figure 2.
In order to show that there is a turning area at the end of the road, and to describe the turning area, use is made of the feature type Possibility to turn. The extent of the feature is linked to the node at the end of the road (Node B). The feature is described with attributes: Turning possibility Class 2 (trucks with shortened trailers or shorter vehicles can turn). The type of turning possibility is "turning area".

3.4.3 Point extent

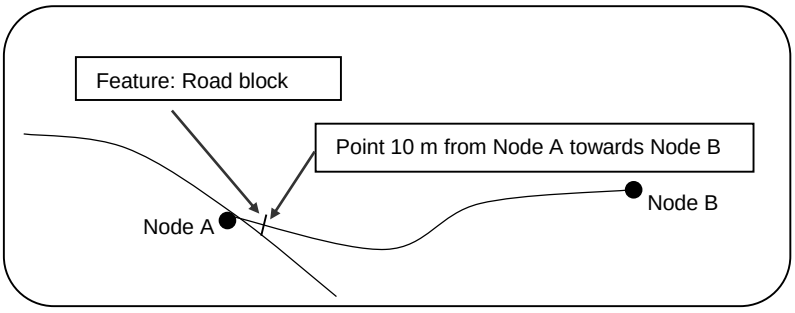

Figure 3
In order to show that there is a road barrier boom on the link between Node A and Node B, use is made of the feature type "Road block". The location of the feature is specified with a point extent that specifies the distance to the road block from Node A to Node B. Alternatively, the location could have been given with the aid of coordinates.

3.4.4 Turn extent

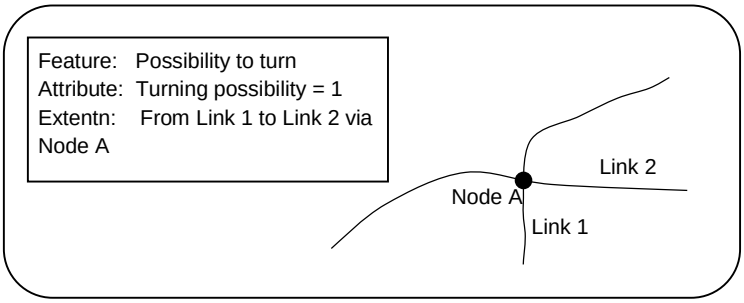

Figure 4
In order to describe which types of vehicles can turn from Link 1 to Link 2, use is made of the feature type "Possibility to turn". For the feature's attribute "Turning possibility", the attribute value "1" is given (truck with trailer and shorter vehicles can turn). The location of the feature is specified with the aid of a turning extent that points out the From-link and the To-link, and the nodes where these links meet.

4 Regulations for distributions

4.1 The direction of extents

Direction is given when it is necessary to specify that the feature should express the direction in relation to the direction of the reference link in which an object is moving or is directed.

4.1.1 Direction for road-stretch and road extents

A featuren can be valid for traffic in only one direction of traffic. This applies, for example, to the feature type “Forbidden direction of travel”. The forbidden direction of travel is specified by the extent of the feature being given a certain direction – the direction for which the feature is valid, or in other words in this case the forbidden direction of travel.

A feature may also have different attribute values depending on the direction of the traffic. This applies, for example, to speed restrictions. When the speed limit is changed from 90 to 70 and then down to 50, it is not doneso at exactly the same segment of road as the corresponding upward change in speed limit is made in the opposite direction of travel. The extents for the feature type “Speed limit” must therefore have a given direction.

The directions for extents are always stored in the database in relation to the direction of the link (“same”, “opposite” or "same and opposite”).

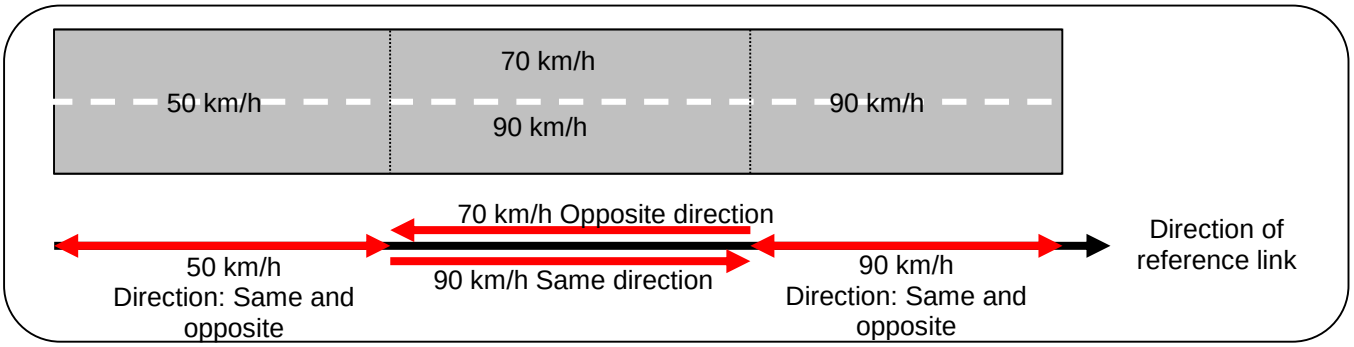

Figure 5 On the road segment, there are different speed limits depending on the direction of travel. For those features that have been registered it is specified with regard to the extent whether it is in the same direction, in the opposite direction or same and opposite. The direction is specified in relation to the direction of the reference link.

4.1.2 Direction for turn extents

Turn distributions may be divided into directions. At the intersection shown in Figure 4, one distribution may apply for the turn link1-nodA-link2 and another distribution for the turn link2-nodA-link1.

4.2 Road extent with host

Road extent with host is a special type of road-segment extent in which there are a number of attributes coupled to the actual extent. Apart from **direction,** a specification shall also be given of the **order number** for each segment of road within the feature, **link role** that specifies the role of the link on the road or street and **host road/guest road** which indicates one of the features as being superordinate to the others when there are several features on the same segment of road at the same time. This type of extent is used for the feature types “Street name” and “Road number”.

4.2.1 Link role

In conjunction with the registration of feature types “Road number” and “Street name”, link role must also be specified. Link role describes the role of a road segment as a part of a road extent. A road with a certain road number may sometimes divide into two parallel or several diverging links (for example separate carriageways on esplanades and motorways or connecting roads at intersections). There should always be a link role for each road segment. The reason for this, among other things, is that it must be possible to calculate the length of a road with separate carriageways without double-counting the so-called "sibling links” and to exclude the branches (the ramps).

Separate extents must be created for the different parts of the road where the link roles differ. Furthermore, each extent must cover an entire link and must have a certain sequence.

4.2.1.1 Definition

Compulsory attribute:	**Link role**
Definition:	The role of a link on a certain road where the road has one and the same Road number or Street name
Value quantity	**normal** – a link where both directions of travel exist on the same carriageway and where the road is not of the branch type **sibling forward** – a link that is part of a road where traffic in respective directions of travel is carried on separate carriageways and where the direction of travel on the carriageway is in the same direction as the road **sibling backward** – a link that is part of a road where traffic in respective directions of travel is carried on separate carriageways and where the direction of travel on the carriageway is in the opposite direction of the road **branch –** a road, the purpose of which is to convey traffic between the main roads at an interchange, intersection or roundabout, and which is not part of the through-road’s link sequence. It could also be a shorter, parallel stretch of road running alongside the main road that is shown with a separate link, for example a rest area or a bus-stop.

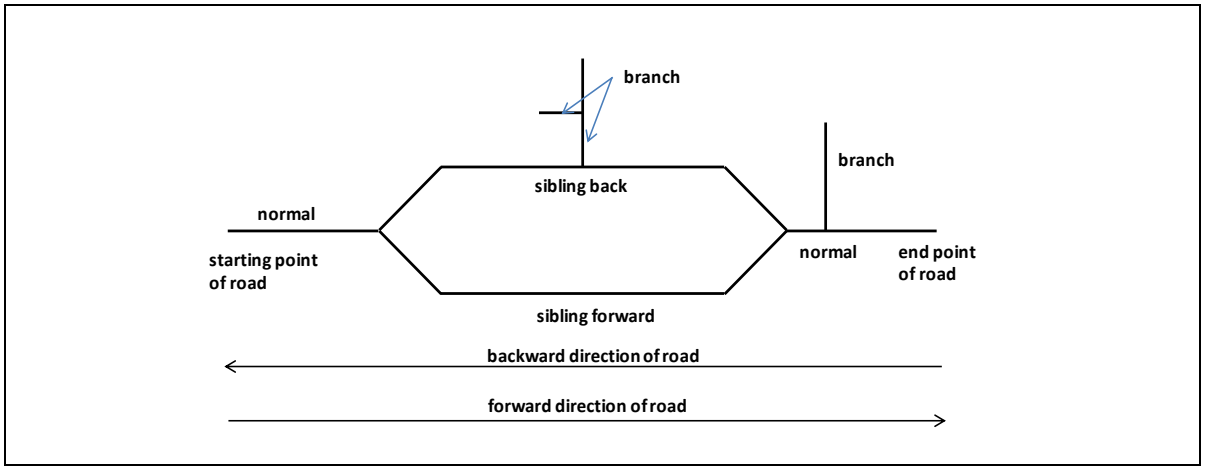

Figure 6 Sample use of link role.

4.2.1.2 Sibling link forward, sibling link backwards

Sibling links are used when a road has different carriageways, which are represented by two separate reference lines. This applies, for example, in the case of motorways, and for certain streets in built-up areas. The carriageways are separated by the specification of the link role. A series of links that that constitute separate carriageways on the same road will be sibling links to each other. For each link that becomes a "sibling link forward" there are one or more links that are "sibling links back".

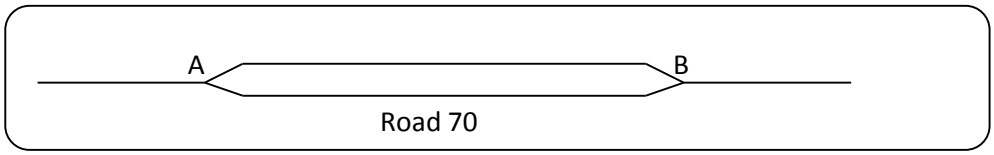

Figure 7
On the two roads between A and B there are two segments of Road Number 70. For these segments it must be specified that they are sibling links to each other.

By specifying link role, it is possible to calculate the length of a road with a certain road number or street name without having to double-count the segments where the road has separate carriageways. The carriageway in itself may carry traffic travelling in both directions.

4.2.1.2.1 Branch

Connection roads have the same road number and sometimes the same street name as one of the roads to which they are connected. If that is the case, and the connection road is not included as part of the through-road's link sequence, it is called a "branch" road.

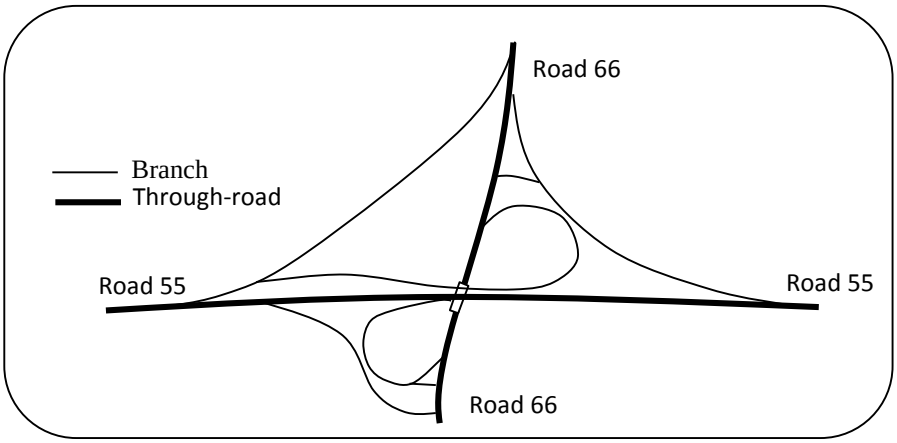

Figure 8 All roads at the interchange whose purpose it is to convey traffic between through-roads are of the "branch" type. According to the Swedish Transport Administration's regulations for road numbering, all branches will have road number 55. A branch that runs between two main roads will always have the same road number as the one among the main roads that has the lowest road number.

4.2.2 Sequence number

The series of links within a feature with road distribution should have a certain sequence and extent because each sequence number must cover an entire link.

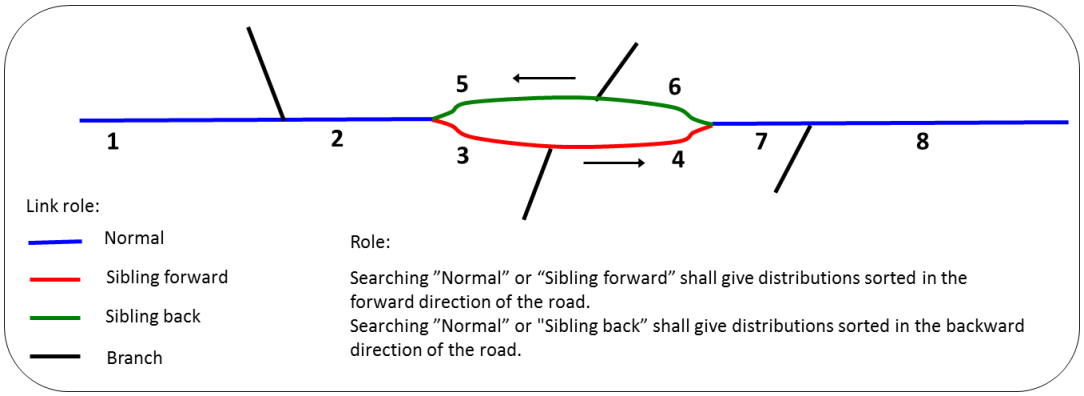

Figure 9 The example shows distribution sequence and link role.

4.2.3 Host road/guest road

When the features types "Street name" and "Road number" are registered, the host road and eventually the guest road features must be registered.

For "Road number", the following applies: guest road is registered when two or more road numbers are on the same physical segment of road since a road number extent must not be broken. Certain stretches of road are therefore connected together into several road numbers, and the roads are said to have a common segment. One of the roads, normally the one with the lowest road number, is called the host road and there is always a segment of road that is connected to the host road number. The others are referred to as guest roads. A host road can have a number of guest roads that may have different directions compared to the host road.

The same principle applies in the case of street name. However, there is no rule specifying which name is to be the host road and which is the guest.

Example:

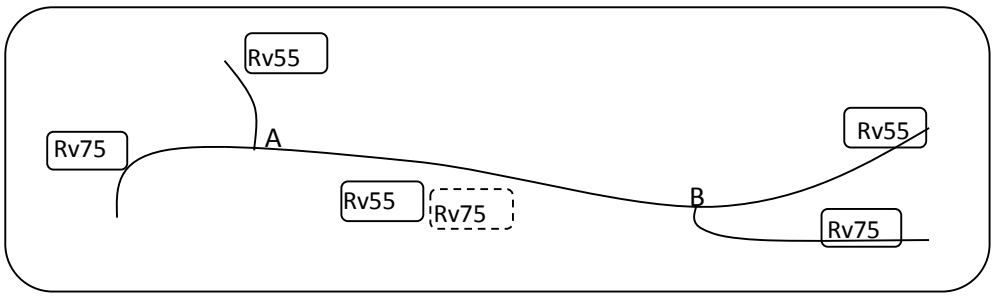

Figure 10
On the segment of road from A to B, main road 55 is the host road to main road 75. Similarly, main road 75 is the guest road to main road 55 on the same segment.

4.2.3.1 Definition

Compulsory attribute:	**Host road/Guest road**
Definition:	The relative order for Road number or Street name when several numbers or names exist on the same segment of road

Value quantity:

Host road – road number/street name that has been decided to be host road

Guest road - road number/street name that is not the host road

4.2.4 Example showing extents of the type road extent with host

1. Intersecting main roads at an interchange

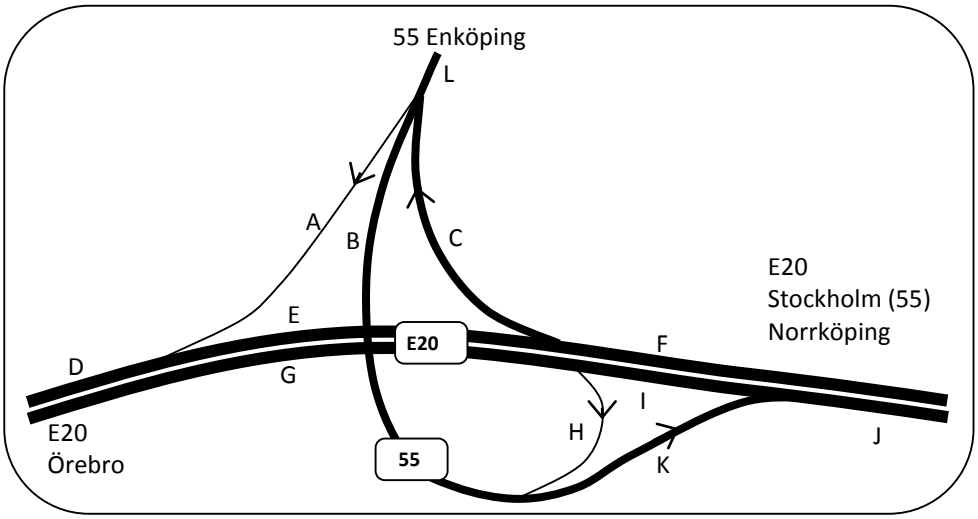

Figure 11

The figure shows the interchange at St Eskils Källa in Strängnäs where main road 55 meets European highway 20. The link roles for the constituent links are as follows:

- *Links F and C are sibling links in the forward direction, while B, K and J are sibling links in the backward direction for main road 55*
- *Links G, I and J are sibling links in the forward direction, while F, E and D are sibling links in the backward direction for European highway 20*
- *Links A and H are branches. They are registered as road number 20 but are not included in the link sequence of the through-road*
- *Link L is a normal link since it carries traffic in both directions of travel on the same carriageway and is not a branch*

2. Branch in a three-way intersection

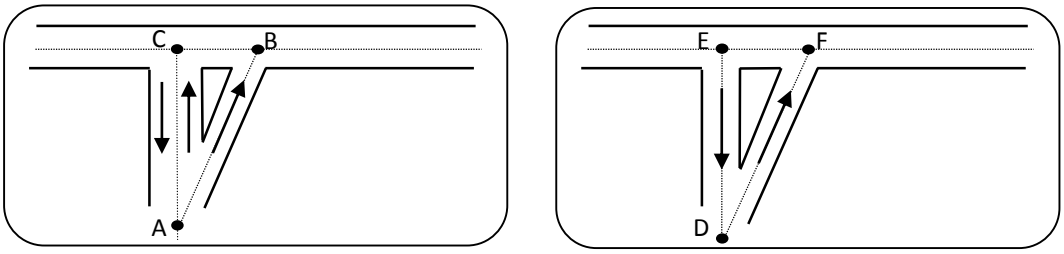

Figure 12

Link AB is to be regarded as a branch to link AC since AC has dual-direction traffic. On the other hand, link DF is not a branch because DE carries single-direction traffic

3. Branch at a rest area

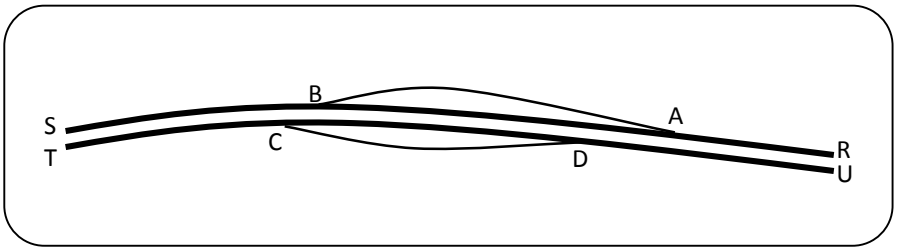

Figure 13
The figure shows a segment of a motorway with rest areas. All segments of roads in the figure constitute parts of one road with the same road number. Links A B and C D, which constitute rest areas, are branches. The segment of road R S is a sibling link backward and T U is a sibling link forward.

4. Link roles for Street name

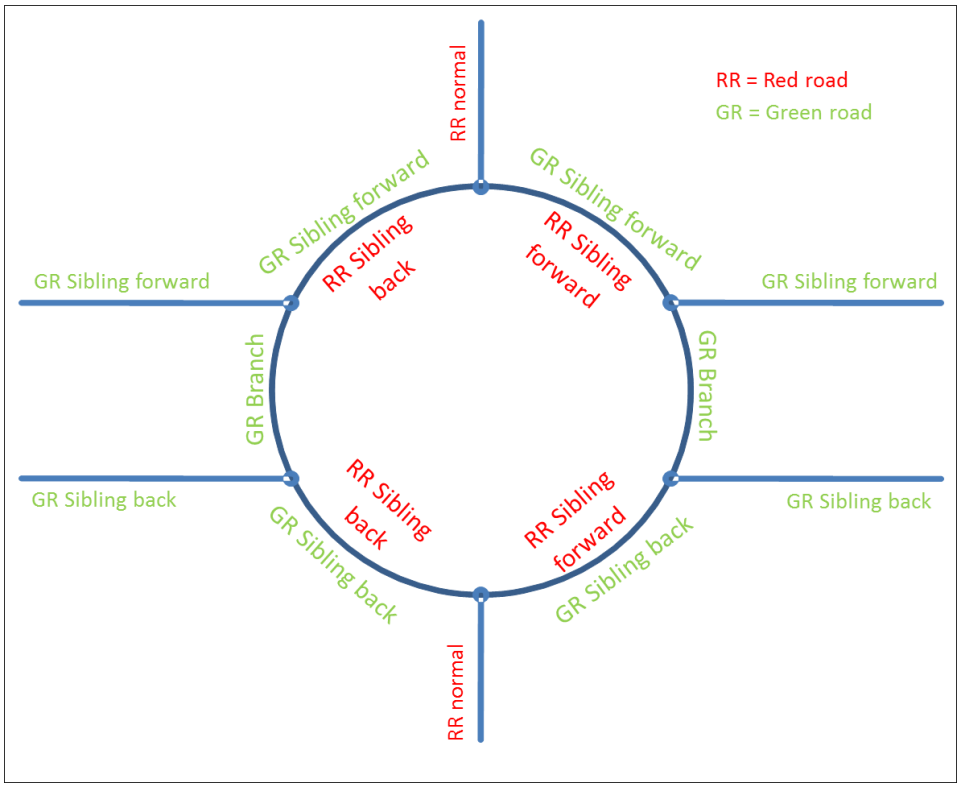

Figure 14
The figure shows link roles for the feature Red road and Green road where they cross each other at a roundabout.

4.3 Side positions for extents

Extents can be subdivided according to side, i.e. features may, for example, have their position or validity on only one side of the road. The side positions that can be specified are “Right”, “Left”, “Right and left”, “Middle” and “Crossing”. The side position is always relative to the direction of the reference link.

Side location is specified for objects that are in a certain place in relation to the direction of the reference link.

The feature types “Pedestrian street” and “Pedestrian speed area” have extents with side locations since these regulations can apply to a certain side of a segment of road.

4.4 All extents for features of the same type

The term concurrent extents means a feature type, for example “Other road name”, can actually exist more than once on the same road segment at the same time. A road may have several names and a roundabout several street names.

On those occasions when concurrent extents are not allowed, features of the same type may not overlap each other and be valid at the same time.

If the extent for a certain feature type is divided up in terms of direction and/or divided in terms of side, concurrent extents apply per direction and side.

In the case of node and point distribution, concurrent extents gives that two extents for features of the same type have identical locations.

4.5 Only one distribution type per feature

Certain feature types may have either a point distribution or a node distribution, for example “Possibility to turn” may occur at a point along the road or at a node at the end of the road or at an intersection with another road. For a feature, however, it is forbidden to mix different types of extent. Either the feature has an extent of the point type or it an extent of the node type.

4.6 Ferry crossing

A ferry crossing is not a physical road. It is a connection between two roads in which the ferry itself is the connection in the road network. Only a few feature types are registered for ferry services. In the data product specifications for each feature type, it is specified whether it should be registered on ferry routes or not.

4.7 Generalisation

Since the road network in NVDB is a generalisation (i.e. the real road network is not always depicted in its entirety) there are cases in which features cannot be registered. It could, for example, be traffic regulations for an intersection where the real connections are generalised away in the database.

5 Feature linage

The lineage of feature data and geometry data is described by a feature type. The purpose of describing the history behind data origin is primarily to make it traceable, i.e. to mark it so that in connection with data management it will be possible to identify the source. In addition to traceability, the origin history also gives a brief description of the process in which the data was created.

The feature types “Feature lineage” and “Reference line origin” describe the lineage with one or several process stages (see also the data product specification for the feature types). The process stages that should be specified are those that are most quality-critical. In other words, when you have carried out a certain process that is of decisive importance to the quality of the data.

5.1 Lineage

The lineage shall be specified for data in the NVDB regardless of how they were collected. That applies for both the road network and all feature types[2] and their attributes.

5.1.1 Lineage of the road network

A historical account of the road network lineage is described in NVDB with the feature type “Reference line lineage” with the attributes:

- “Responsible organisation”
- “Process step reference line” (with the sub-attributes: “Method reference line”, “Altitude”, “Scale-factors”, “Dimensions”, “End date”, “Average error”, “Comments process step”)

For a more detailed description, see the data product specification – Reference line lineage.

5.1.2 Lineage for features

The lineage should be registered for all features, i.e. how the information for the features have been captured as well as eventually prepared. This is done by connecting all features to a lineage feature.

The feature lineage is linked to each feature and describes its lineage. One and the same feature lineage can be connected several different features, i.e. several features can have the same lineage. Lineage is described partly for the features attributes and partly for its extents.

Lineage for the features is described with feature lineage and is linked with a number of attributes to all features (several extra attributes). The extra attributes are:

- “Responsible organisation”
- “Process step attribute” (with the sub-attributes: “Method attribute”, “End date”, “Comments process step”)
- “Process step extension” (with the sub-attributes: “Method distribution”, “End date”, “Comments process step”)

For a more detailed description, see the data product specification – Feature lineage.

[2] Nevertheless, no lineage is provided for those feature types used to describe the road network’s lineage

6 Requirement specifications and quality reporting

According to the government commission, NVDB shall have a guaranteed and well-defined quality. In order to cope with this, requirements are imposed on the data that is supplied to NVDB and which is provided from NVDB. With the introduction of data product specifications, the Swedish Transport Administration's road data operations will apply the international standards for geographic information.

6.1 Quality model

The quality model that is used for road data within NVDB is the one that is set by the standard Geographic information[3]. For more information see "*Dataproduktspecifikation – introduktion och läshänvisning*" (Data product specification – introduction and reading guide) or directly in the standard. The quality model is the model which in the standards is used to specify requirements and follow up, calculate and report quality.

For each data product, a data product specification shall be provided that specifies requirements in accordance with this model.

6.2 Quality requirement classes

The road network is divided into four quality requirement classes that make it possible to specify what requirements apply where. The quality requirement classes are defined by the feature type "Functional road class", which specifies how important a road is for the total road network's connectivity. See description in 1.7 Terms, definitions and abbreviations .

A road network that lacks a functional road class, such as a bicycle network, belongs to Quality Requirement Class 3.

6.3 Quality assurance measures for the validation of input data and the management of internal processing

Direct quality management is conducted by the quality management being performed automatically in the system during updating. Documentation of the checks that are made in order to validate input data is to be found in "*Handbok för avvikelsehantering vid dataleverans till GVT/NVDB*" (Manual for deviation management in connection with data supply to GVT/NVDB) that can be accessed at www.nvdb.se .

6.4 Requirements on data products

For each data product, requirements are made on data quality properties, and a value with an approval level that can be assesed is specified.

The table shows data quality parameters for the product and conformance quality levels for the different quality classes, i.e. acceptable conformance level/tolerance should also be specified. The table follows the model below.

Requirement per data quality parameter	**Acceptable conformance quality levels per quality requirement class**			
	Q1	**Q2**	**Q3**	**Q4**
<Data quality parameter x > *<Description of requirement>*	n%	n%	n%	n%

[3] Data quality SS-ISO 19 157

.....	n%	n%	n%	n%

6.4.1 Measurement values and definitions for data quality parameters

Measurement values and definitions correspond with SS -ISO 19 157. The data quality parameters are:

Data quality parameter	Definition	Type of value
Completeness in features - omission	Number of metres missing in the data quantity in relation to the total length. *Comments: For features with a complete segment extent, the total length is the total length of the road network's total length for the data set. For other extents, the total length is the length which, according to the data product specification, shall be included in the data set.*	Error rate
Completeness in mandatory attributes - omission	Number of metres lacking in the data quantity in relation to the total number of metres that should be there according to the data product specification.	Error rate
Completeness in attribute - omission	Number of metres lacking in the data quantity in relation to the total length that should be there according to the data product specification.	Error rate
Completeness in phenomenon – comission	Number of surplus metres in relation to the total number of metres that should be there according to the data product specification.	Error rate
Logical consistency - conceptual consistency	Number of metres with a breach of the conceptual regulations in relation to the total number of metres in the data set (according to the measurement value this means the total number of objects, but in order to acquire a better metric, one metre of road is equated with one object).	Error rate
Logical consistency- domain consistency	Number of metres that do not concur with their value domain in relation to the total number of metres in data set (according to the measurement value this means the total number of objects, but in order to acquire a better metric, one metre of road is equated with one object).	Error rate
Logical consistency - format consistency	Number of metres that have been stored in conflict with the format in relation to the total number of metres in the data set (adapted so that one metre is regarded as one object).	Error rate
Logical consistency - topological consistency	*Comment: Not applied.*	

Thematic accuracy of attribute classification	Number of metres of erroneously classified attribute value in relation to the total number of metres in the data quantity.	Error rate
Location accuracy – absolute accuracy	*Comment: Not applied.*	
Location accuracy – external accuracy	Half the length of the interval that is defined by an upper and a lower limit in which the true value with 95% probability lies within the interval	Measure in metres
Temporal quality	*Comment: Not applied.*	
Actuality (up-to-dateness) when updating features	**1:** Number that do not fulfil the requirement in relation to the total number in the data set	Error rate
Comment: We have chosen to apply two measurement values; one that shows number and one that shows number of metres	**2:** Number of metres that do not corespond with the value domain in relation to the total number in the data set (according to the measurement value this refers to the number of objects, but in order to acquire a better metric one metre of road is equated with one object)	Error rate
Actuality when updating road network	**1:** Number that do not fulfil the requirement in relation to the total number in the data set	Error rate
Comment: We have chosen to apply two measurement values; one that shows number and one that shows number of metres	**2:** Number of metres that do not correspond with the value domain in relation to the total number in the data set (according to the measurement value this refers to the number of objects, but in order to acquire a better metric, one metre of road is equated with one object)	Error rate

6.5 Responsibility for data quality

The responsibility of the data suppliers for the quality of the information delivered can be seen in agreements and data supply contracts. Certain quality information can also be found in the data product specifications.

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