National road databases in the Nordic countries and their development possibilities

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- A national road database contains road and traffic data covering the whole country

- The most important Nordic national road databases are Digiroad in Finland, Nationell vägdatabas in Sweden, Nasjonal vegdatabank in Norway and VIS in Denmark

- A road database consists of both geometry and features

- The Nordic road databases differ remarkably, since they have been planned for different purposes

- Traffic telematics need road data from different countries, and a Nordic road standard might be needed in the future

The Finnish road and street database Digiroad

•Digiroad is in use since Autumn 2004

•Digiroad is made for traffic telematic needs, and is a part of a wide project. It is based on the standard GDF

•The register contains a total of 430 000 km roads, railroads, ferries and pedestrian or bicycle routes

•Digiroad's double geometry consists of *traffic elements* and *reference chains*. The most important features are *element attributes* and *segments,* related to the chains. The features are quite sharp, and they are all related to traffic telematics

•The information is supplied by the National Land Survey, the Finnish Road Administration, the municipalities and some others. All the Finnish municipalities are obliged to support data about their own roads in Digiroad

•Digiroad has also information from the Åland Islands, although the Finnish Road Administration doesn't own any roads there

The Swedish road and street database Nationell vägdatabas (NVDB)

•The Swedish NVDB is in use since 2001

•The register contains about 500 000 km roads and ferries for standard vehicles

•The roads are registered as *geometrical* and *topological* objects that are related to each other. The geometrical objects are called *reference lines*, and the topological *nodes* and *reference links*

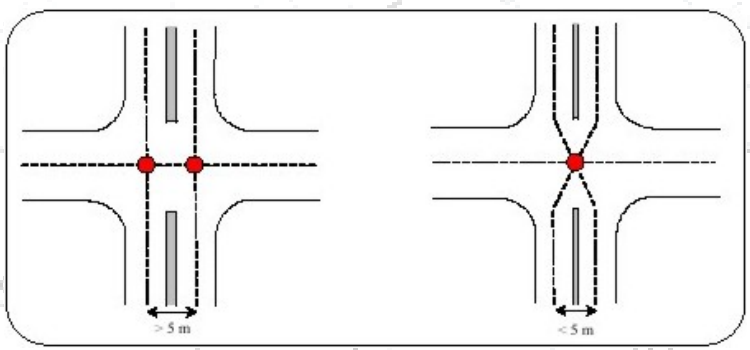
•NVDB contains about 100 different road and traffic features. They are stored on the topological objects. There are many ways to store data, although they don't differ very much

•All NVDB information is public. Still, it's not possible for anybody to use it. The price and the data formats make it impossible

The Swedish road and street database Nationell vägdatabas (NVDB)

•NVDB is a good prototype for further development in the Nordic countries, since it is so strictly defined:

- •The road network is divided into *quality classes* according to the importance of the roads. The classes have different *quality requirements*
- •The quality rules for the geometry, topology and the features use *quality parameters* that follow an ISO-standard
- •NVDB has also generalisation rules for the road geometry



The Norwegian road information system Nasjonal vegdatabank (NVDB)

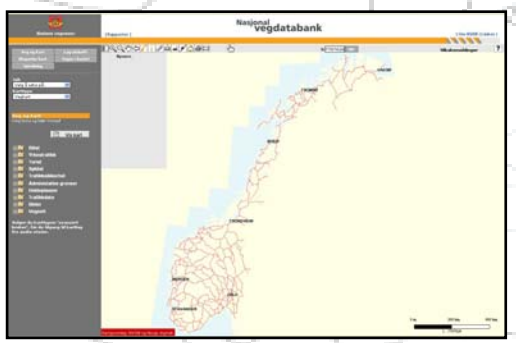
•NVDB is in use since Spring 2005

•The Norwegian NVDB contains about 206 000 km roads, ferries and pedestrian or bicycle routes

•The basic data model is the same as in the Swedish NVDB. A difference is the fact that the Norwegian is based on an ISO-standard

•There are hundreds of road and traffic features in NVDB. NVDB will replace many other information systems

•NVDB is a road information system, which contains applications. There are also free web map services. Different users have access to different data

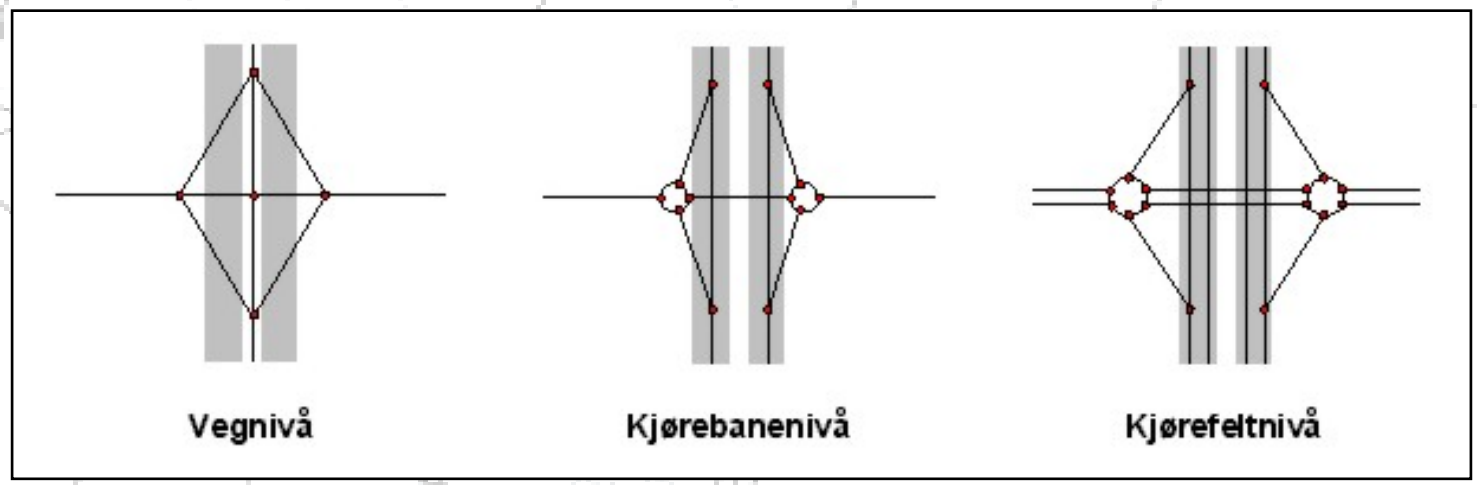


The Norwegian road information system Nasjonal vegdatabank (NVDB)

•An important extension, that the Swedish NVDB doesn't have, is the *topological levels*

•NVDB has, in addition to *road* geometry, also *carriageway* and *lane* geometry. A carriageway or a lane belongs to one road, which is the base level

•A feature can be given to any on the three levels. Possible limitations are specified for each feature



The Danish road information system VIS (Vejsektorens Informations System)

•The first VIS version dates from the 1970's

•VIS contains only 12 000 km roads for standard vehicles, owned by the state or the provinces (amts). Municipal and private roads are not included in VIS

•The VIS system contains many applications, but no free map service

•There is a total of about 600 road and traffic features in VIS

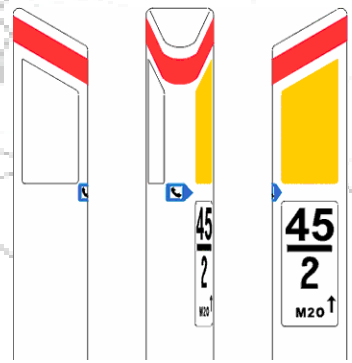
•From 2007 there are no longer provinces in Denmark. The provincial roads will be taken over by the state and the municipalities. As a consequence, all the municipal roads will be added to VIS

The Danish road information system VIS (Vejsektorens Informations System)

•There are two main reference systems in VIS: the *segment model* and the *administrative system*

•The segment model is the internal way to store data technically. A *segment* is a known road or part of a road

•The users, though, use the administrative system, where the information is positioned with kilometer poles



•The road geometry is stored in a system called *DGP*

•A third reference system with simple nodes and links will be made in the future

Standardization contents

•Standardization is a natural following step after having developed a national concept

•A possible Nordic road data standard needs at least:
- •a data model
- •features

•Other quite essential issues are:
- •a Nordic coordinate system
- •a strict road definition
- •requirements for generalization and quality

•EUREF89 is an accurate coordinate system, already used in the Norwegian and Danish road databases, and can be used also by Finland and Sweden

•The Swedish NVDB contains detailed rules for data generalization and quality, which can be seen as a prototype for all the countries in the future

Data model definitions

•The broad concept ’data model’ deals with making *discrete objects* of the road network, and *feature management*

•A data model contains rules for *geometry*, *topology*, *features* and the *time*

•The universal solution for a data model is to use *nodes* and *links* for building an abstract road network. The road *geometry* is then handled as link features. Other features are also given to the links, and sometimes to the nodes

•This universal solution isn’t used in the Nordic countries at present, but will be used in Denmark quite soon, as a supplement VIS data model

•The Swedish and Norwegian NVDB databases use long topological objects, so-called *reference links.* Long objects might sometimes be handy but must be split if data in other formats are used

•The data model in the Finnish Digiroad is very different from the solutions recommended here

Road definitions

•A road database can model either *roads*, *carriageways* or *lanes*.

•At least for solving driving routes, the best solution is to model carriageways, since these are the real routes that a vehicle follows. Two carriageways of the same road can be far from each other, and it's usually not possible to move from one to another

•Lane geometries don't give very much more information. Lanes can hence be managed as features

•Carriageway geometry is used in Finland, Sweden and Norway, although the road level is the base level in Norway

•In Denmark VIS uses road geometries, but has separate geometries for motorways and roundabouts. The lack of the rest of the carriageways is, after all, not a serious problem

Feature standardization

•The European road network project *EuroRoadS* specifies five mandatory road features:

- •Geometry
- •Unique identifier (ID)
- •Functional road class
- •Form of way/node/ferry
- •Road link/road node/ferry link level

•Specifying *ID:s* can be generated when combining road data, not necessarily eariler

•*Functional road class* is the primary criterion for choosing a driving route, when both big and small roads are available. This is the most important feature that is not data but information or knowledge

•The Finnish Digiroad and the Swedish NVDB have road classes for all roads. The Norwegian NVDB and the Danish VIS have unfortunately no such classes

Feature standardization

•The attribute *Form of way/node/ferry* specifies the technical road type. Typical classes are motorway, freeway, dual carriageway, single carriageway, bicycle route, pedestrian zone and ferry. This information can be found in all the four databases

•The attribute *Road link/Road node/Ferry link level* is related to the standard *GDF*. This attribute is not necessary, if a carriageway data model is consistently used

•*Road authority* could also be defined as a mandatory feature. Road authority data exist in all the four countries

Feature standardization

•A correct driving route additionally needs data about at least *direction of traffic flow* and *turn restrictions*. A *manoeuvre* is a type of turn restriction that can be defined as a data format of its own

•The Finnish, Swedish and Norwegian systems contain turn restrictions. The Swedish and Norwegian definitions are similar

•Using *address data* is a more convenient method for solving routes than using direct coordinates. Also *road numbers* are essential for specifying roads

•All the four Nordic databases contain addresses and road numbers