ROad **S**afety **ATT**ributes exchange infrastructure in **E**urope

Deliverable D1.1

State of the Art

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Abstract:
The document, State of the Art describes the current road authorities and infrastructure operators' situation with respect to how safety relevant data is stored, exchanged and updated.

Keyword list: Safety attributes, ADAS, digital maps, data exchange, database, public/private cooperation

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Abbreviations

A-

ActMAP	Actualize Map
ADAS	Advanced Driver Assistance Systems
API	Application Programming Interface
ASCII	American Standard Code for Information Interchange
ASF	Autoroutes du sud de la France Motorways of the south of France
ASFA	French Motorway Companies Association
ASFINAG	Autobahn und Schnellstraßen Finanzierungs-Aktiengesellschaft. Highway and road construction financing company owned by the Republic of Austria.
ATMB	Autoroutes et Tunnel du Mont Blanc Motorways and tunnel Of Mont Blanc

B-

BALI	BAse de données des LImites de vitesses Speed limit Database
BAST	Bundesanstalt fuer Strassenwesen Federal Highway Research Institute), Germany
BMVIT	Bundesministerium für Verkehr, Innovation und Technik (Federal Ministry for Transport, Innovation and Technology), Austria

C-

CEN	European Commission for Standardisation
CGPC	Advisory Board of the Ministry of Transport, France.
CSV	Comma-separated values

D-

DATEX	Data Exchange
DB	Database
DBMS	Database Management System
DEUFRAKO	DEUtsch-FRAnzösische KOoperation
DG INFSO	General Directorate for Information Society and Media
DG TREN	General Directorate for Energy and Transport
DOI	Digital Identifier Object

DSCR	Direction de la Sécurité et de la Circulation Routières

F-

FP7	Seventh Research Framework Programme
FTP	File Transfer Protocol

G-

GDF	Geographic Data File
GIS	Geographic Information System
GML	Geographic Markup Language
GPS	Global Positioning System
GPX	Or GPS exchange format

I-

IDF	International DOI (Digital Identifier Object) System
ICT	Information and Communication Technologies
INSPIRE	Infrastructure for Spatial Information In the European Community initiative, www.ec-gis.org/inspire/
INTREST	Intermodal referencing system for transport related data
ISO	International Organisation for standardisation
ITS	Intelligent Transport Systems and Services

L-

LAVIA	Limiteur s'Adaptant à la VItessse Autorisée Intelligent Speed Adaptation
LROP	West Paris Regional Laboratory Laboratoire Régional de l'Ouest Parisien, France

N-

NPRA	Norwegian Public Road Authorities, www.vegvesen.no
NVDB	Swedish national road database
NRA	National Road Authority, Ireland

O-

OBB	Bavarian Department of Highways and Bridges
OGC	Open Geospatial Consortium, www.opengeospatial.org/

P-

PA	Public Authority
PTV	Planung Transport Verkehr, www.ptv.de/

R-

RADEF	Road Administration Data Exchange Format
RDBMS	Relational Database Management System
RDT	Swedish traffic regulations

S-

SETRA	Road and Motorway Technical Studies Department, France
SIF	Standard Interchange Format
SINTEF	Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (NTH), www.sintef.no
SOAP	Simple Object Access Protocol
SOLVI	Swedish IVSS Intelligent Vehicle Safety Systems programme
SQL	Structured Query Language
SRA	Swedish Road Administration
STREP	Small or medium-scale focused research project

T-

TC	Technical Committee
TNE	Transport Network Engine
TPEG	Transport Protocol Experts Group

U-

UML	Unified Modelling Language

V-

VMS	Variable Message Sign

W-

WP	Work Package
WFS	Web Feature Service
WMS	Web Map Service
WSDL	Web Services Description Language

X-

XLS	Microsoft Excel worksheet sheet
XML	Extensible Markup Language

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1. Introduction

1.1. ROSATTE Contractual References

ROSATTE is a STREP submitted for the call FP7-ICT-2007-1. It stands *for ROad SAfety ATTributes exchange infrastructure in Europe*.

The Grant Agreement number is 213467 and project duration is 30 months, effective from 01 January 2008 until June 2010. It is a contract with the European Commission, DG INFSO.

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1.2. Project Objectives

The ROSATTE project intends to develop the enabling infrastructure and supporting tools that will ensure European access to road safety attributes including incremental updates. This infrastructure will facilitate administrative internal functions as well as supply of data to third parties e.g. for safety relevant services.

The **overall objectives** of the project are to:

1. Facilitate access to, exchange and maintain European-wide core road safety spatial data from national/regional/local sources by standard procedures
2. Enable multi-level aggregation and update of European-wide safety map data
3. Assess the technical and organisational feasibility of this infrastructure

1.3. Purpose of Document

The objective of WP1 is to identify, prioritise and agree on the requirements of data providers and data users. The resulting prioritised functional, technical, quality and organisational requirements will be the basis for the technical work done in the succeeding work packages.

Task 1.1 - State of the Art

- Describe the current road authorities and infrastructure operators' situation with respect to how safety relevant data is stored, exchanged and updated. Give an overview of technologies, environment, organisation workflow and data quality aspects involved. Evaluate existing PA test-beds with multi-user data access and

maintenance. Identify international and de facto standards and best practice use of standards (e.g. ISO 191xx, CEN TC 287, GDF, EuroRoadS, etc).

The result of the task 1.1 will be reported in this deliverable:

D1.1 – State of the art

This document is addressed to public road authorities and commercial map providers.

Task 1.2 - Identify functional, technical, quality and organisational requirements

- Define actors involved and the data flow between them. Establish detailed user needs, described in use cases, for the maintenance of safety related data attributes. (WP6)
- Identify functional and technical requirements for the registration tools (WP2), the infrastructure (WP3) and the receipt tools (WP4). This to assist road authorities in their data maintenance activities and to enable them to deliver data to third parties. (WP5)
- Evaluation of quality requirements from data users' side.
- Identify organisational requirements by road authorities and data exchange centrals. This includes non-functional requirements found at different levels of quality assurance related to process, organization and end-user demands i.e map providers. (WP6, 6.1)

Task 1.3 - Overall Architecture

Define an overall architecture to be used by the three main blocks developed in (WP2, WP3 & WP4).

1.4. Structure of Document

The 'State of the Art' section contains a review of all the relevant European activities or projects and a description of the commonly used standards followed by a summary of the survey and results. It gives in this way a detailed overview of the different levels of development concerning road safety attributes in road databases of the countries that participated in the survey.
Chapters 3 and 4 contain the list of the contacted road administrations and countries' contributions.

1.5. Description of the issue

The ROSATTE project aims at establishing an efficient and quality ensured data supply chain from public authorities to commercial map providers with regards to safety-related road content. Accurate and up-to-date safety related road network attributes, such as speed limits, traffic signs and traffic regulation messages, are particularly important for efficient road operation and administration, and for safe driving along the European road network. This project will develop an appropriate infrastructure and support tools to ensure the interoperability between European digital road databases. [1]

A large majority of European member states has no national database. Some countries, such as Sweden, Norway, and Finland, have already established national road databases in close cooperation with data owners at national, regional and local levels. A few public authorities have started public roads database projects to facilitate their own data management and to provide easy data access for private and commercial purposes. And some private road operators such as French motorways operators have already established their own databases too. The main challenge will be to ensure safe and suitable access to digital road databases owned and maintained by thousands of road authorities in a standardised way. Mechanisms are also needed to enhance the data quality in terms of accuracy, correctness and up-to-datedness, and to enable multi-level (local/national/European) data aggregation. [1]

1.6. Analysis of the demand

Major road data users such as road authorities, map providers and users have a substantial need for high quality digital road databases including safety attributes in terms of accuracy and up-to-datedness. To create such databases with harmonised data exchange infrastructure, these authorities will implement appropriate procedures and tools at different levels (national, regional, local) with respect to their organisational and legal framework. One of the consequences may be the conception of national digital road databases by the European member states. [1]

The safety attributes in digital databases are delivered to map providers who return back to road authorities maps integrating these data. Safety related data must be conformant with the situation on the road. Road authorities will be responsible for the timeliness delivery (within an agreed time period after the change of the attribute on the road), and for the correctness and positional accuracy of the data. Data integrators, i.e. the providers of in-vehicle digital map databases, on their side will be responsible for correct interpretation of the received data, and correct inclusion in their digital map databases.

There is also an increasing demand for in-vehicle safety applications such as ADAS (Advanced Driver Assistance System) that can contribute to safer, smarter and cleaner road transport. This project will focus on a limited number of attributes with the highest priority market demand characterised by a high change frequency such as speed limits and traffic signs related to road safety. The ADAS applications corresponding to these attributes are for the speed limit, in-vehicle speed limit information with a warning system and an enhanced navigation system with awareness of potential risks signposted by traffic signs for the driver. [1]

Safety Attributes	Example of ADAS application	Change frequency
Speed limit	Speed alert	Very high (7-9% /year)
Traffic signs	Enhanced navigation (e.g. truck)	High
Lane information (number, width, divider, connectivity)	Lane keeping assistance, Lane departure warning, Curve warning	Medium

Safety Attributes	Example of ADAS application	Change frequency
Traffic lights	Intersection assistance	Medium
Crossings (pedestrian, tram)	Enhanced navigation Vulnerable road-users protection	Medium
Toll barriers, motorway junctions, tunnel access	Obstacles / change of lighting / speed limit / inter-vehicle distance management	Very low (new road or reshaping)
Gradient (slope)	Curve warning Fuel consumption assistance (car and truck)	Very low (new road or reshaping)
Transverse gradient (banking)	Roll-over warning system (truck) Curve warning	Low (new road or reshaping)

Table 1 – Safety attributes for in-vehicle ADAS applications [1]

1.7. Success indicators

The main objective is the development of an infrastructure with the appropriate integrated tools and the success of the ROSATTE project is therefore dependent on the degree and quality of the developed components of the infrastructure, on the components' ability to fulfil the requirements of the involved actors and the facility to adopt the infrastructure and tools by organisations. [1]

The project will start by establishing a baseline with respect to the exchange requirements of qualitative and quantitative factors without a working infrastructure in place. Then, the integration time of selected high priority safety attributes by a map provider will be evaluated from their time of modification by the road owners. At the end of the project the baseline will be compared to the results of the test cases in order to document the effectiveness of the solution. [1]

Four major milestones are defined in the project [1]:

- Milestone 1 – Requirements and overall architecture defined and agreed (Month 8)
- Milestone 2 – Infrastructure and tools developed (Month 20)
- Milestone 3 – Testing conducted and demonstrations developed (Month 26)
- Milestone 4 – Organisational recommendations and project finished (Month 30)

Most of the technical work will be done between Milestone 1 and Milestone 3. The project follows a waterfall process model. However, it is clear that the results of the tests may lead to the need for modifications to the infrastructure and tools. If this is the case a revised version of specifications will be produced. After a successful test period the infrastructure and tools will become a part of the operational systems of the various partners. [1]

2. State of the Art

2.1. European activities and projects

Several European activities have come to the conclusion that (1) digital road databases and digital maps can contribute substantially to improving road safety and mobility, and (2) deployment of map-based safety applications for driver support requires as a top priority the creation and delivery of consistent, pan-European and up-to-date road data. [1]

- **eSafety Forum Digital Map Working Group** [1]

The eSafety Forum is a joint platform involving all road traffic safety stakeholders. As part of the eSafety Forum initiatives, the Digital Map Working Group has as purpose to coordinate activities concerning road traffic safety related elements of digital map databases, and to bring together relevant stakeholders such as digital map providers, the automotive industry, public authorities, user organisations, safety authorities, road operators, universities and research institutes. It published its Final Report in November 2005. The main recommendation to develop a closer cooperation between public and road authorities and map providers for the provision and maintenance of road safety attributes is composed of three phases:

  - *Phase 1 – "COOPERATION":* Supply of safety attributes in the form that they are currently available at public authorities.
  - *Phase 2 – "QUALITY ASSURANCE"*: Standardisation of information provision and output quality testing.
  - *Phase 3 – "OPTIMISATION"*: Standardisation of transfer format and transfer media and optimisation of the transfer process.

- **MAPS&ADAS** (Part of PReVENT Integrated Project, FP6 DG INFSO) [1]
  The MAPS&ADAS project is addressing the issue of the provision of safety-related attributes. Based on driver assistance application requirements, MAPS&ADAS has identified a priority list of road attributes that has been reviewed and consolidated by the MAPS&ADAS Public Authorities Consultation Platform (see Table 1).

  Public authorities are considered as the preferred source for such information, but current practices and procedures for registration of status of, and changes in road geometry and road attributes differ widely across Europe.

  Results from data sourcing and certification & business model activities clearly indicate the need for a close cooperation between public authorities and map providers for safety attributes that require frequent updates (e.g. speed limits, traffic signs) by means of an adapted exchange infrastructure in order to ensure the data quality and the commercial feasibility. [1]

  A Pan European data inventory was presented in 2005 based on information collected by Tele Atlas and NAVTEQ. The results show a very heterogenic availability of speed limit information across Europe. There are significant differences in data registration, collection, updating as well as in data model, format and coverage.

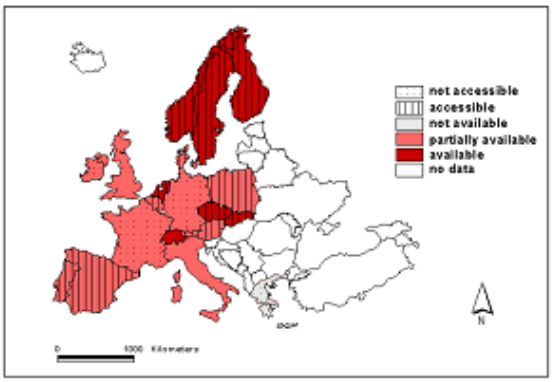


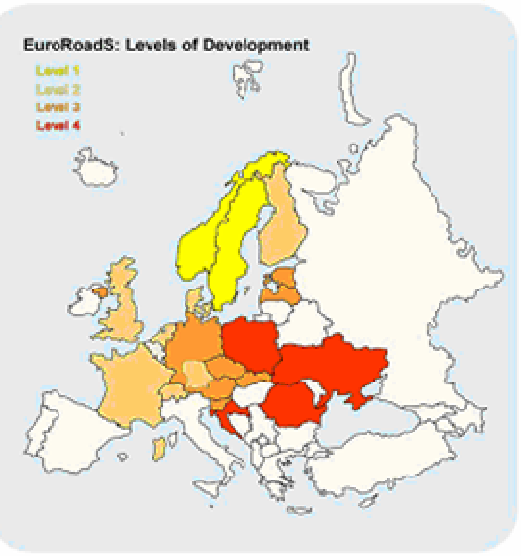
Figure 1: Availability and accessibility of speed limit information [2]

- SpeedAlert (DG TREN feasibility study) [1]
  A speed limit information and warning system is considered by the eSafety Initiative and also by a majority of Member States as one of the promising applications for contributing to road traffic safety and mobility. One of the recommendations of the SpeedAlert project addresses the crucial need to ensure procurement of European-wide and up-to-date speed limit information:
  "Assess technical and economical feasibility of speed limit data collection and maintenance throughout Europe taking into consideration national/local differences (existing infrastructure, organisation, actors, decision-making process, legal aspects)."

  The project has developed a useful speed limits classification in two categories, general and specific speed limits:

General (implicit) speed limits	**National speed legislation. Not necessarily signposted**
G.1 – Static fixed - Infrastructure	Speed limits depending on road category (motorway, other road, built up area…).
G.2 – Static variable - Environment/weather	Speed limits that are subject to prevailing environmental or weather conditions. E.g. Rain and snow speed limits in France, and dependent on visibility in Germany. Day and night dependent speed limits would also fall under this category.
G.3 – Static fixed - Vehicle	Vehicle (and equipment) dependent speed limits. E.g., trucks, buses, and use of studded winter-tyres.
G.4 – Static fixed - Driver	Driver dependent speed limits. E.g. young drivers

Specific (explicit) speed limits	Local regulation. Signposted
S.1 – Fixed speed limit, signposted **- Static fixed**	Permanently signposted by means of static road signs. Typical applications are specific speed limits for tunnels, dangerous curves, bridges, and built-up areas.
S.2 – Variable speed limit, fixed signposted **- Static variable**	Speed limits, fixed signposted indicating a variable speed limit. A typical application is a specific speed limit regulation during school hours. Outside the school hours, the default speed limit for the area will apply. The enacted regulation behind a variable speed limit (S2 and S3) is in each case not limited in duration and consequently states no date or time when it expires.
S.3 – Variable speed limit, variable message sign **- Dynamic**	Speed limits, posted on variable message (road) signs (VMS), which may be of a permanent or mobile nature. A typical application is speed limits displayed by VMS over motorways to control traffic flow in the case of, for example, bad weather conditions or risk for traffic congestion. Depending in this case on the traffic or weather conditions the displayed speed limits will be variable. The enacted regulation behind a variable speed limit (S2 and S3) is in each case not limited in duration and consequently states no date when it expires.
S.4 – Temporary speed limit, fixed signposted	Speed limits, fixed signposted indicating a speed limit restricted to a defined time period. These speed limits can vary depending on the regulation. The enacted regulation behind a temporary speed limit (S4 and S5) is in each case limited in duration and consequently states the date and time when it expires. A typical application is speed limit restrictions during a roadwork, which is predefined to a specific period. Another typical case is during police traffic control or accidents when police or other authorised actor decides to post a specific speed limit until accident area is cleared or traffic control completed.
S.5 – Temporary speed limit, **Variable Message Sign (VMS).**	Speed limits, posted on variable message (road) signs (VMS), in case of a temporary situation. A typical application is during road works. As in S.4, the speed limit regulation is temporary, but in this case it is displayed on a VMS to enable different speed limits during and outside working hours. These speed limits can be of stationary or movable nature. The latter enables the signposting through use of VMS sign to "follow" when the roadwork moves along the road. The enacted regulation behind a temporary speed limit (S4 and S5) is in each case limited in duration and consequently states the date or time when it expires.
S.6 – Recommended maximum Speed – static fixed	These maximum speed recommendations are not enacted regulations but are speed recommendations designed to minimise traffic congestion and enhance traffic safety.



	Local regulation. Signposted
	Announcing the approach to a speed limit, usually by a fixed signpost with additional text indicating the distance to the actual speed limit.

ategories and definitions

RAKO project) [1]
roject is a French-German research project in the framework of the gramme. It focuses on analysis of societal benefits of safety-related erms of improvement of road traffic safety) and the feasibility and n of such data in in-vehicle map databases.

s are or have been dealing with aspects of geographical information and are relevant to the ROSATTE initiative in terms of state of the art:

- **EU-sponsored INSPIRE (Infrastructure for Spatial Information In the European Community initiative)** [1]
  The INSPIRE directive published in the Official Journal on 25th April 2007 provides a legal framework for the establishment and operation of a geographical information infrastructure in Europe. Its purpose is twofold: first, to make top-quality geographical data available at all levels across the European Union, in order to better implement community policies; and, second, to give the public access to the information. The target application areas include transportation.

- EuroRoadS (eContent project, DG INFSO) [1]
  EuroRoadS has laid the ground for a pan-European standardised, seamless, updated, and quality assured digital road data infrastructure by defining a specification framework for the exchange of road data. The project will consider EuroRoadS results in its implementation in order to deliver quality assured digital road data relating to road safety to map providers in a standardised and seamless way. The quality framework developed in EuroRoadS is a key input for quality assurance in ROSATTE.

Figure 2: Level of development of a national road database (2005) [5]

- **ActMAP Incremental map update** (DG INFSO) [1]
  ActMAP has developed, tested and validated standardised mechanisms to update existing map database content and enable dynamic attachment of information to the digital in-vehicle map. These mechanisms represent an important milestone for the ubiquitous availability of future location-based information and the quality of the map databases for future in-vehicle applications. However, it is unlikely that future mechanisms for providing incremental updates to the in-vehicle map database will use the format specified by ActMAP.

- **FeedMAP** (DG INFSO) [1]
  In addition to the surveys, mapmakers rely on road authorities and user feedback to detect the latest changes in the road network. The FeedMAP project will study the commercial and technical feasibility of map deviation feedback. In order to improve the flow of user map feedback, the FeedMAP concept uses all vehicles equipped with a digital map for deviation detection, i.e. to check if the maps are indeed accurate and complete. The project is developing a framework that will detect map anomalies when cars happen to come across a faulty map attribute and that will quickly update the maps of all other vehicles using a standardised mechanism for delivering incremental map updates as developed in the ActMAP project.

- **AGORA project and follow up** [1]
  The AGORA project (2000-2002) developed a method for map-based location referencing, i.e. without pre-coding and the use of location tables. In a follow-up activity, which was later adopted by the German Mobile Info project, this method was further developed to what is called the AGORA-C method. AGORA-C is currently in the process of becoming an ISO standard.

2.2. Relevant standards

In a few countries common standards are currently used for road database management, while in others, the development of their implementation is actually at different stages.
In 2005, the study realised for the EuroRoadS project showed that the majority of the European countries participating in the project, believes that it is important to establish a European harmonised infrastructure. The table below shows the expectation in use of common standards for 2010 and the significant progress expected in the utilisation of ISO standard in combination with GML [5].

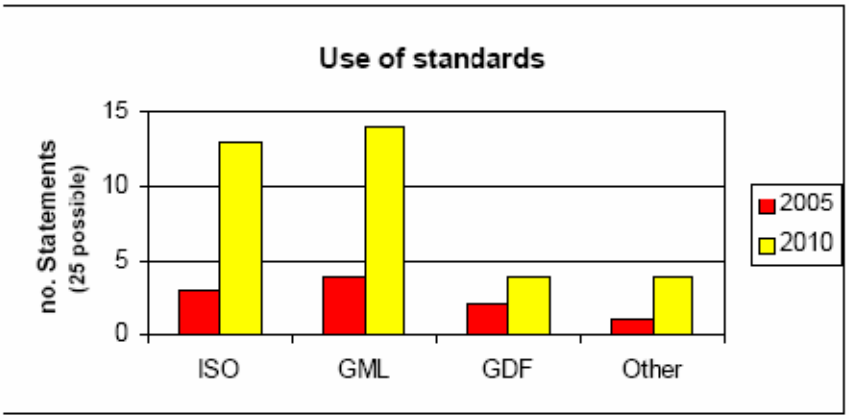


Table 3: Use of standards [5]

The EuroRoadS-project terminated on 31 August 2006. EuroRoadS has defined common specifications for the quality assured provision and exchange of road data, carried out demonstrations and proposed implementation and exploitation activities.

For data exchange it is primarily the deliverables D6.* that are of interest. The EuroRoadS GML-schema is primarily based on TC211/ISO 19100-series of standards (the international standard for geographical information) and defined in D6.11. The aim is to facilitate data exchange between EuroRoadS and GDF, RADEF as well as other formats.
[6]

D6.3 Road Network Information Model	The conceptual model. Defined according to ISO 19109 – Rules for application schema using UML. Defines classes for the road network, linear referencing systems and mechanisms for attaching attributes and features/events to the entities in the road network
D6.5 Core European Road Data	Defines rules for generalization and also specific classes for attributes and features/events.
D6.8 Metadata Catalogue	Defines a profile of ISO 19115 – Metadata
D6.10 Road Network Exchange Model	Defines the data exchange model (based on D6.3/D6.5/D6.8). Exchange specific classes are defined and conceptual classes from D6.3/D6.5/D6.8 are adjusted for data exchange purposes.

D6.11 Road Network Exchange Format	Defines a comprehensive GML-schema (XML) based on D6.10.

The final draft version 2.0 of all framework documents is available at www.euroroads.org.

The standard ISO/DIS 17572-3 "Location referencing for geographic databases – Part 3: Dynamic location references (dynamic profile)" is under development by Technical Committee 204 Intelligent Transport Systems. This standard (also known as AGORA-C) describes dynamic Location Referencing Methods for encoding and decoding of location references in digital map databases.

2.3. Summary of the Survey

This report presents results from an enquiry distributed to road authorities and agencies inside and outside Europe. A form was sent with ten sections to fill in with specific required information concerning the current road authorities and infrastructure operators' situation with respect to how safety related data is stored, exchanged and updated. The results are presented below by taking into account the main objectives of this project in order to provide an effective work support to the other tasks in this WP.

2.3.1. Methodology

A document containing Norway's contribution as an example was furnished to support the road authorities in this work. NPRA, the Norwegian Public Road Authority manages already a centralised national road database containing safety attributes and could give in this way one example of information and answers expected in task 1.1, State of the Art.

The document of the survey to fill-in consists of ten different paragraphs that have been completed by each country:

- Road network
- Organisational aspects
- Safety attributes – Status

  A number of safety attributes have been previously identified by investigating PA's data and map providers' needs:
  - Speed limits
  - Traffic signs
  - Lane information (number, width, divider, connectivity)
  - Traffic lights
  - Crossings (pedestrian, tram)
  - Toll barriers, motorway junctions, tunnel access
  - Gradient (slope)
  - Transverse gradient (banking)

- Regulation
- Databases – Status
- Applications – Status
- Data exchange

- Data integration
- Standards used
- National projects

The 42 countries contacted through different organisational levels are:
Albania, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Montenegro, The Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, the US, the UK and Ukraine.

2.3.2. Objectives

The ROSATTE project aims at ensuring an efficient and high quality safety related data chain from public authorities to commercial map providers. For efficient road administration and for safe driving along the European road network, accessibility, quality, roads coverage and update frequency of safety related data appear to be of great significance and are specially investigated in this survey. To develop an appropriate infrastructure and support tools to guarantee the interoperability between European digital road databases, it is necessary to examine databases (status and applications), in particular data format exchange and standards used by road authorities. Map providers are confronted with the difficult work of compiling and distributing all road safety attributes on a European scale.

This task gives an overview about the level of development of road databases both within and outside Europe, by collecting information from as many countries as possible.

This survey has dealt with the difficulty of different organisational levels and multiple road administrations for most of the countries where the road data are not centralised. The required information was available at national, regional and local levels with varied quality and completeness. It was necessary to contact public administrations, such as ministries of transport, state owned agencies, or even private companies, in order to cover all road networks. However cities and municipalities were out of the survey for the obvious reason that it requires an enormous amount of work (Example: In France, there are over 36,000 municipalities).

To realise this survey, a list of relevant contacts in each country has been compiled by using different sources such as previous European projects, working groups, personal contacts and even searches on the Internet.

The absence of any agreement between ERTICO/ROSATTE and non-members of the project made the completion of the document voluntary.

2.3.3. Results

The answers from all countries were compiled to give an overview of the general situation concerning road databases and handling of safety attributes in Europe and beyond. However these results must be taken with care as it was difficult to obtain an efficient and exhaustive contribution of sufficient quality at a national level from all countries.

The results represent a picture of safety related data processing at this time of the survey as most of the countries are in the process of improving their data management situation by centralising their road data and by participating in projects and activities.

2.3.3.1. Contributions

The 30 road authorities of 23 countries that have completed the document are:

- AUSTRIA
  - Tyrol and lower Austria Administration office
- BELGIUM
  - Flanders authority, Flanders Traffic Centre
  - Ministry of Equipment and transportation of the Walloon Region
- BULGARIA
  - Ministry of transport
- CYPRUS
  - Ministry of Communications and Works, Public Works Department Transport Planning Section
- CZECH REPUBLIC
  - Ministry of Transport
- DENMARK
  - Danish Road Directorate
- ESTONIA
  - Estonian Road Administration
- FINLAND
  - Finnish Road Administration
- FRANCE
  - SETRA, Technical Department for Transport, Roads and Bridges
  - LROP, West Paris Region Public Works Research Laboratory
  - ASFA, Association of French motorway companies
- GERMANY
  - BAST the Federal Highway Research Institute
  - The Bavarian Ministry of the Interior
  - The Ministry of Building and Transport - Mecklenburg-Vorpommern
  - The Ministry of Building and Transport - North Rhine-Westphalia
- HUNGARIA
  - Hungarian Public Roads Co,
- ICELAND
  - Icelandic Road Administration
- IRELAND
  - The National Road Authority
- ITALY
  - The National Road Agency
- JAPAN
  - Digital Map Road Association
- LITHUANIA
  - Lithuanian road administration under The Ministry of transport and communications
- Luxembourg
  - Administration des ponts et chaussées
- NORWAY

  - NPRA, Norwegian Public Road Authorities
- Portugal
  - Institute for Road Infrastructures
- SLOVAKIA
  - Slovak Road Administration
- SLOVENIA
  - Ministry of Transport, Slovenian Roads Agency
- SWEDEN
  - SRA, Swedish Road Administration
- UNITED KINGDOM, NORTHERN IRELAND
  - Northern Ireland Government, Road Safety Policy & Development
  - WALES, Transport Wales
  - SCOTLAND, Transport Scotland

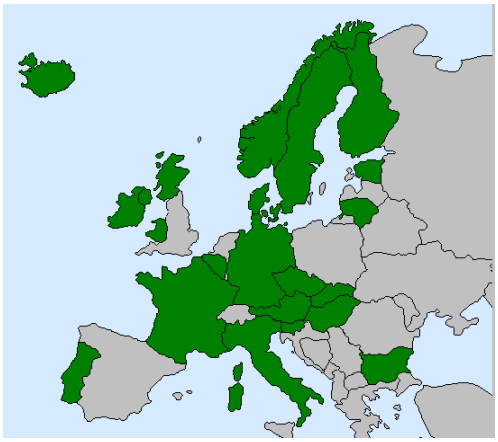


Figure 3: Countries participating in the survey

2.3.3.2. Road network

Most of the road authorities describe the road types in the same way (the detailed nomenclatures were not furnished). Differences are only on the number of categories; for example regional and county roads can be differentiated. Special ways such as slip roads, ring ways, dual or junction carriageways were sometimes distinguished and added to the road types' specification.
In general, the road types could be represented in the following classification:

- Motorways, expressways
- European, National, state roads
- Regional, county, provincial, district, prefectural roads
- Communal roads, municipal and urban roads, streets
- Private roads
- Agricultural and forestry roads
- Bicycle paths

2.3.3.3. Organisational aspects

In most countries with a large road network, the public authorities are on three levels

- Governmental, federal, national

- Regional, provincial, county, district
- Municipal, communal, cities

Forestry roads may also be managed by independent departments of public road authorities. In countries with a relative small road network, the road authorities operate only on two levels (national and municipal).

Traffic regulation is by this way dispersed and governed by different authorities, highways agencies for highways, public road administrations for national or state roads, regional and county administrations for regional or county roads and municipalities for municipal roads. In general, little cooperation is seen between authorities. One consequence is the fact that no common storage exists for safety attributes and no official national body has the responsibility for digital handling of safety related data.

2.3.3.4. Road databases

Two of the contacted road administrations (in Bulgaria and in the UK (Wales)) have not yet developed a GIS database. The Bulgarian Ministry of Transport has planned to start to determine the location of the road signs and road marking sections with the aim of establishing an initial database.

The development of road databases is still in progress in most countries. The documents sent by the road administrations show enormous disparities between them.

The different stages of development brought to light by this survey are:
- national database covering all public roads
- national database covering motorways/highways and national public roads excluding municipality/communal/provincial/regional/urban roads
- database covering only motorways
- official or unofficial municipal road databases
- private road databases managed by mapping agencies (not in the survey)

Only five road administrations of the 23 countries participating in the survey manage their own centralised road database (Estonia, Finland, Luxembourg, Norway and Sweden). It means that the coverage of the whole road network is realised with the help of the municipalities that update regularly their local road data in the database.

Several countries have the aim to build such a centralised database in the future but the difficulty is proportional to the road network and the number of localities.

However in many countries, administrations or agencies own a database that contains specific road data such as motorways and national roads and cover the whole territory for only these categories of roads. Mapping agencies have a tendency to build databases containing all types of roads on their own.

2.3.3.4.1. Database Management System, DBMS

To control data infrastructure, management, storage and exchange, road administrations manage their spatial data using a Database Management System, DBMS. All of the systems already implemented for managing the attributes of geographic data are Relational

Database Management Systems, such as Oracle, Microsoft Access, Microsoft SQL server, dBase, Informix and Sybase (figure 4). Next to these commercial systems, PostGreSQL an open-source RDBMS, is used in one country.

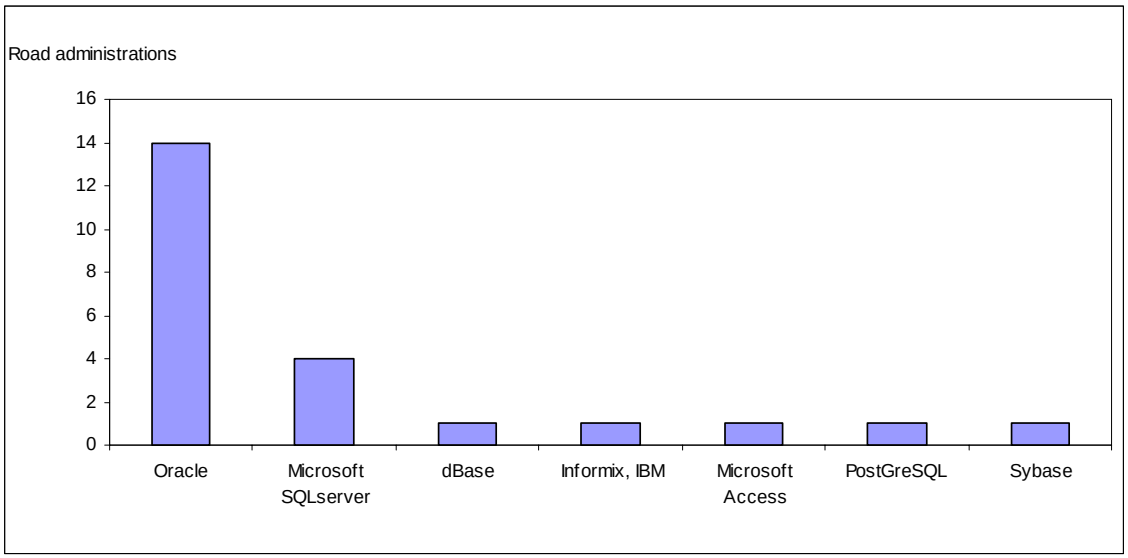


Figure 4: Database Management Systems

Other own local systems exist, such as the system used by the Digital Road Map Association in Japan.

It is important to note that common DBM systems between organisations for data storage do not imply the interoperability of the systems. However GIS software products have developed their system's interoperability by ensuring the possibility of data migration from one platform to another and by being conformable to standards (ISO, OGC).

2.3.3.4.2. GIS Software

The most currently used GIS software products to handle geographic data management are the ESRI products, i.e. the Arc family software, often in combination with an ORACLE DBMS (figure 5). GIS software products by ESRI, MapInfo by Mapinfo, Geomedia by Intergraph, Oracle Spatial by Oracle, Visum by PTV and Smallworld by Smallword are proprietary whereas PostGIS by Refractions Research is an open source software.

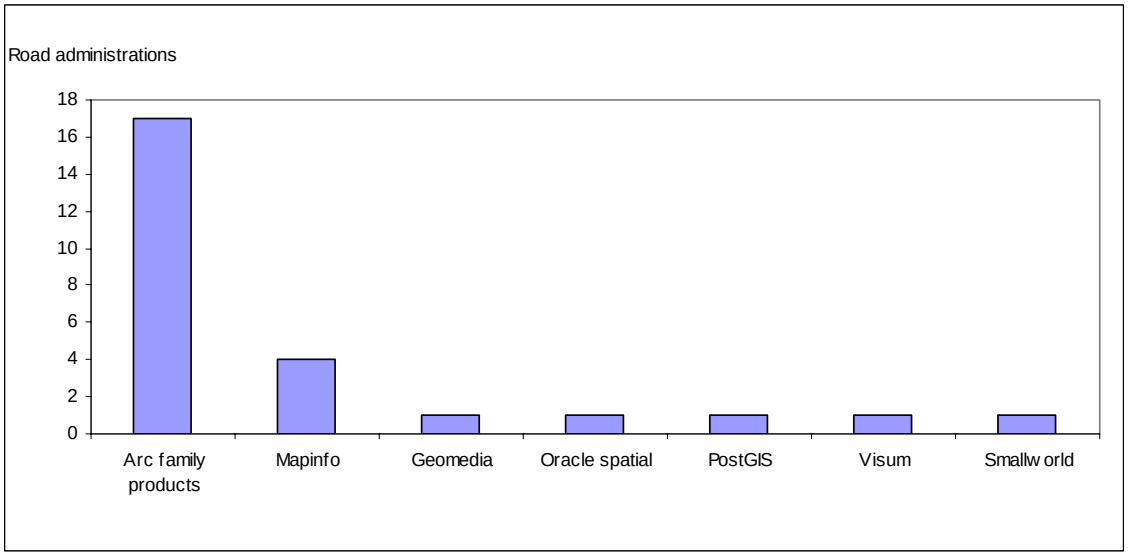


Figure 5: GIS Software products

These current software products have Windows- and Web-applications for access. With the viewing of data over the Internet, common data format and transfer standards are obviously required.

2.3.3.4.3. Data formats

Depending on the GIS software used, only certain data formats are supported. If a data set is delivered in a format not supported by the GIS software, it requires a transformation of the set into an appropriate format which makes the operation more complex and prone to errors.

The rising need to interchange data among public authorities internally and externally generates the necessity to adhere to common and standardized exchange formats. On the other hand, efficient data exchange can be accomplished by using the software's own data format, if the receiving side is using the same product. Figure 6 shows a summary of data exchange formats used by the different countries.

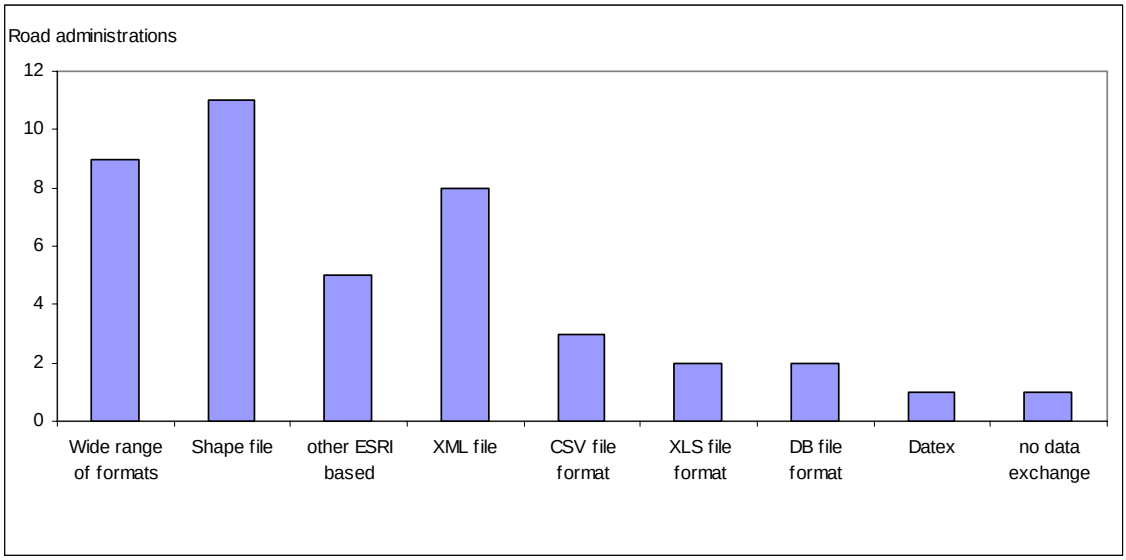


Figure 6: Popular data exchange formats

2.3.3.4.4. Standards

Most widely used road network information systems are designed according to different standards and interoperability protocols. Figure 7 shows the current standards used for managing databases by the road administrations contacted for this survey:

- ISO, ISO combined with GML, Geographic Markup language
- GDF, Geographic Data File
- WMS, Web Map service, OGC, Open Geospatial Consortium
- WFS, Web Feature Service, OGC
- INSPIRE principles
- EuroRoadS

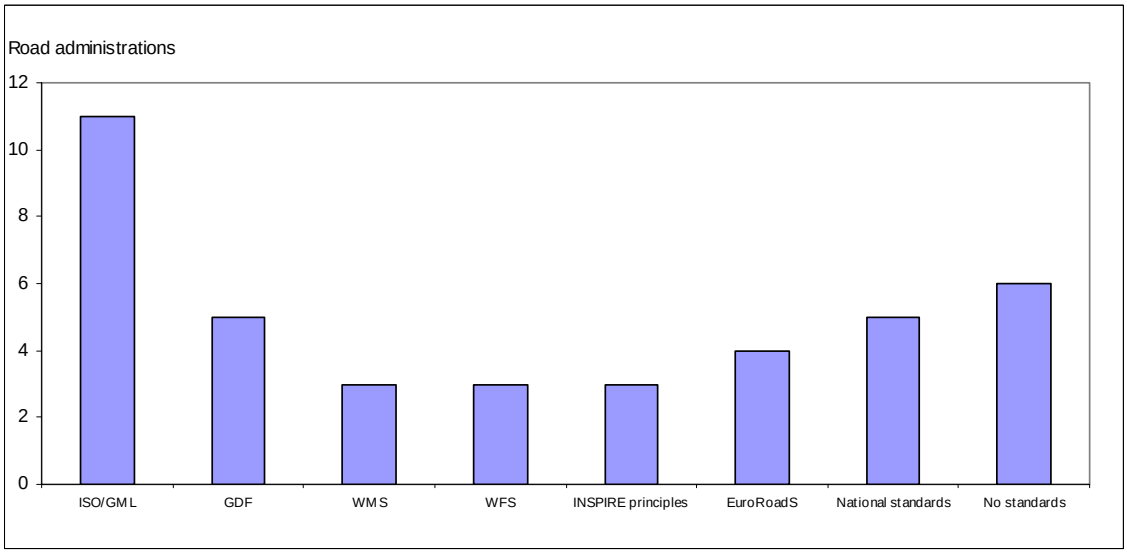


Figure 7: Standards

The histogram reveals that a significant change and progression have occurred the last years in using international standards. Access by Internet to centralised servers is also progressing quickly and facilitated by standards, such as WMS, Web Map Service and WFS, Web Features Service, provided by the Open Geospatial Consortium.

Quite a large number of domestic standards are developed nationally and it was not investigated by this survey how much they fit the international requirements. Six road administrations confirm that they do not use any standards. However five of them manage their road database thanks to an ESRI product, that could be conformed to standards cited above.

2.3.3.5. Safety attributes

2.3.3.5.1. Coverage of the road network

Figure 8 shows a heterogeneous availability of safety attributes across Europe and beyond.

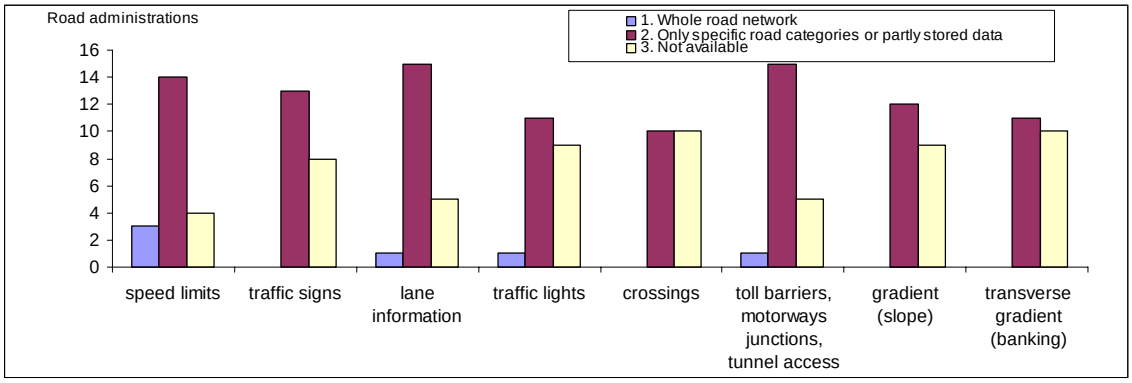


Figure 8: Coverage of the road network

Due to the different degrees of database development, safety related data in digital databases do not cover the complete road network in most countries. This implies that information cannot be available digitally, is not complete or split between different organisations.

Only administrations with a national centralised database can provide some of the safety related data such as speed limits, lane information or traffic lights for their entire road network in a digital way. This survey shows also that most developed bases do not contain all the priority attributes identified in 2.3.1. For example, only three of the five national databases contain speed limits for all roads. Speed limits, lane information, toll barriers, motorway junctions and tunnel access data are the most present in road databases. And only 64% of the selected attributes are available in databases that contain safety attributes.

For the countries where several authorities are concerned, it was not possible in this survey to evaluate in a concrete way how much the road network is covered by safety attributes in databases, as information from municipalities was not easily accessible.

2.3.3.5.2. Location accuracy of safety attributes

The analysis of existing quality in the national databases did intentionally not go into the details of the quality parameters defined in Deliverable D1.2, Requirements and overall architecture of the ROSATTE project.

Concerning location accuracy of safety attributes, figure 9 shows a relatively homogeneous picture. The self assessment of accuracy is described as quite acceptable or even pretty good by road administrations. Some given answers were not precise enough, as it was difficult for some contacted persons to judge the data accuracy without a serious internal investigation concerning all the different attributes. The location accuracy of a safety data is strongly dependent on its data type and on the road categories concerned.

It is also interesting to notice that attributes are not always associated with traffic signs and regulations and information about lanes can only concern their number and width.

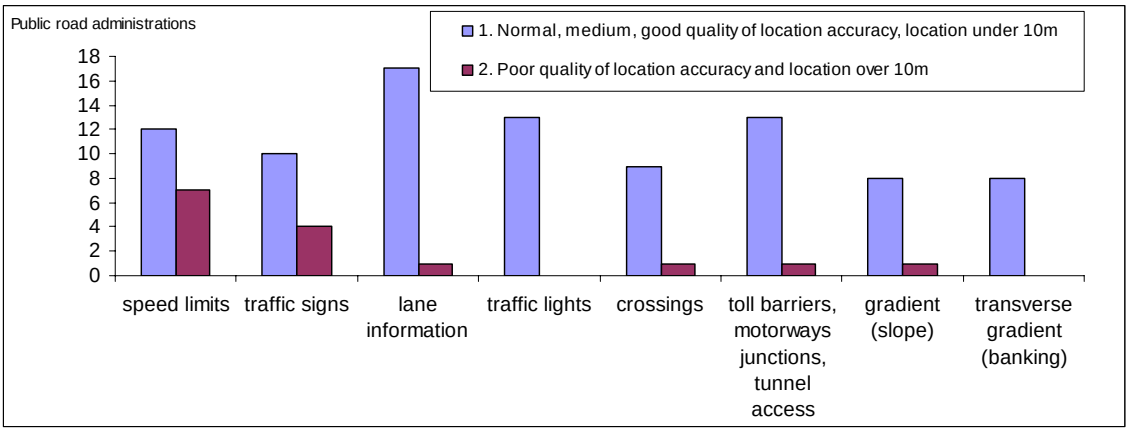


Figure 9: Location accuracy of safety attributes

2.3.3.5.3. Update frequency of safety attributes

Figure 10 shows a strong heterogeneity of updating of safety related data in road databases. It can be done periodically (quarterly, yearly) or continuously, right after attributes are changed on the roads. When no periodic time is fixed for updates, it is quite difficult to know when the update will occur in the database as it follows a reporting process. In the best of cases, some data updates happen just after the changes on the road.

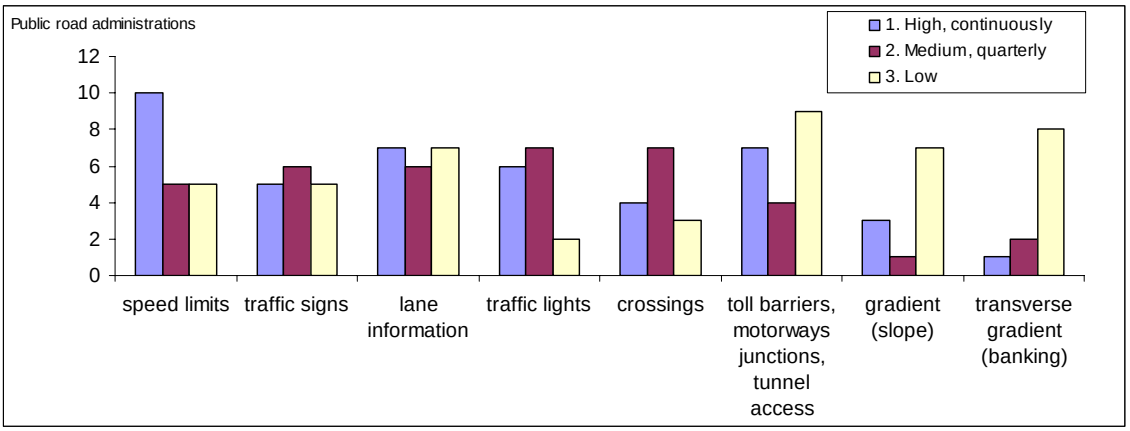


Figure 10: Update frequency of safety attributes

It can be noticed that data updates are executed by different organisations according to the road categories. It implies that different levels of updating can exist in a common database as a function of the road type.

2.4. Conclusion

The survey has shown clearly the heterogeneous stages in road database development and in safety attributes storage. Few road authorities own a well developed road database with safety attributes integrated in the database. Most others have just started to create a database or to store safety attributes. As a consequence, differences occur between countries in the number of safety attributes available in databases. Great variations are also revealed by this survey concerning the percent of roads covered by safety attributes in databases and the degrees of safety data quality in general.

Harmonisation and improvement in road database infrastructure and supply of safety attributes in road databases are the challenges facing the European road authorities. These Public Authorities make ongoing efforts to develop their road database

- by including new lower road categories
- by inventorying new attributes
- by ensuring better quality of data
- by developing new data formats or standards and
- by following specifications for road data exchange and database infrastructure (EuroRoadS project and INSPIRE concept).

3. Road Administrations

Countries	Organisations/ Contacts
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GERMANY **BAST**	Bundesanstalt für Straßenwesen (Federal Highway Research Institute) Bruederstr. 53 * D - 51427 Bergisch Gladbach Tel.: +49 2204 43518 * Fax: +49 2204 43683 Internet: www.bast.de Mr. Ulrich Loehe M.Sc. E-Mail: Loehe@bast.de
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SLOVENIA	Ministry of Transport Slovenian Roads Agency Tržaška cesta 19 1000 Ljubljana Slovenia Tel: 01 478 80 02 e- mail: gp.drsc@gov.si Samo Koprivec Samo.Koprivec@gov.si
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4. Contributions

4.1. AUSTRIA

4.1.1. LOWER AUSTRIA

4.1.1.1. Road network

Road Network	Refer to BMVIT, *Bundesministerium für Verkehr, Innovation und Technik,* the Federal Ministry for Transport, Innovation and Technology
Motorways	Refer to ASFINAG, *Autobahn und Schnellstraßen Finanzierungs-Aktiengesellschaft,* Highway and road construction financing company owned by the Republic of Austria
Highways, main and national roads	Refer to ASFINAG, Highway and road construction financing company owned by the Republic of Austria
Regional, secondary roads	3.000 km
Provincial roads	see Regional
County roads	10.600 km
Communal roads	Refer to BMVIT, the Federal Ministry for Transport, Innovation and Technology or Community
Private roads	Refer to BMVIT(?), the Federal Ministry for Transport, Innovation and Technology

4.1.1.2. Organisational aspects

Road Network Competency	Organisational Level	Governmental Level
Motorways ad Highways	ASFINAG, Highway and road construction financing company owned by the Republic of Austria.	BMVIT, Federal Ministry for Transport, Innovation and Technology

Road Network Competency	Organisational Level	Governmental Level
Regional, Provincial and County Roads	Lower Austria state government	District Administration
Communal Roads	Community	District Administration
Private Roads	The Real Owner	Different authorities depending of the type of road

All the 9 federal authorities are free in choosing or setting up their own solutions to store and maintain geographical information. They implement GIS and already use it to maintain, plan and follow up road constructions. [3]

4.1.1.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update Frequency
Speed limit	Arranged analogically through the district administrations	Widespread on every level	Not available, only per ordinance
Traffic signs	Arranged analogically through the district administrations	Widespread on every level	Not available, only per ordinance
Lane information (number, width, divider, connectivity)	Part of the road database of lower Austria	In an own sphere of influence(Regional roads B and L)	Updated when changed
Traffic lights	Digitally prepared in an administration database	In an own sphere of influence(Regional roads B and L)	Updated when changed
Crossings (pedestrian, tram)	Part of the road database of lower Austria	In an own sphere of influence(Regional roads B and L)	Updated when changed
Toll barriers, motorway junctions, tunnel access	Part of the "Bridge database" of lower Austria	In an own sphere of influence(Regional roads B and L)	Updated when changed

Safety Attributes	Quality	Coverage	Update Frequency
Gradient (slope)	Part of the road database of lower Austria	If >6%, in an own sphere of influence(Regional roads B and L)	Updated when changed
Transverse gradient (banking)	Partially from Airborne Laserscan overflights project (DEM)	Ca. 1/3 of the country area	Partially after structural changes

4.1.1.4. Regulation

District administrations of the states by technical agreements.

4.1.1.5. Databases – Status

- **NÖGIS, road database for the federal state of Niederösterreich (Lower Austria)** [3]

The road data is stored in a GIS database and updated at least annually. A commercial map from TeleAtlas is used as reference to maintain and store public authorities road and attributes. Road attributes and information of the state can be provided in digital format (shape-file, for instance) under the state's restrictions and conditions.

4.1.1.6. Applications – Status

Beside special Applications, the following GIS Platforms are mainly used:

- ESRI – ArcGIS Desktop, ArcSDE, ArcIMS
- SQL Server and also Oracle Spatial
- Intergraph GeoMedia

- **Geoland.at, digital portal** [3]

The digital portal Geoland.at offers free access to important Geographical data of all 9 federal states by using an Internet Browser (without any Plug-in). Both the specific data pool and the functionality of the maps are steadily enhanced. The Geographical data was set up in line with INSPIRE principles and the portal with the international standards (OGC, Open Geospatial Consortium).
Geoland.at offers a GPS transformation service. Data can be transformed from WGS84 into all Coordinate systems used in Austria. The service is based on the open SOURCE library "proj4", all computations take place with genuine date transition. Data can be uploaded in different input formats (ASCII, CSV, and GPX). A visual control with WMS is possible.
http://www.Geoland.at/

4.1.1.7. Data exchange

Data infrastructure: Data is provided over geographical databases such as Oracle Spatial and Spatial Access Layer such as ArcSDE.

ESRI Shapefile is widely used as data exchange Format. In case of simple attribute data, dBase or Excel is used.

4.1.1.8. Data integration

See above.

4.1.1.9. Standards used

For data storing, data exchange and data integration, ISO standards are in use. Also for data models and API's ISO standards are used as far as possible.
ISO 19115 – Metadata Standard
OGC Web Mapping Service
OGC Web Feature Service
OGC Catalogue Service

4.1.1.10. National projects

ITS Vienna Region – http://www.its-viennaregion.at

4.1.2. TYROL

4.1.2.1. Road network

- Motorways, National or State Roads, county Roads => aoor.
- Communal Roads and Private Roads
- Agricultural and Forest Roads

4.1.2.2. Organisational aspects

1. Freeways: ASFINAG – *Autobahn und Schnellstraßen Finanzierungs-AG,*
Highway and road construction financing company owned by the Republic of Austria.
2. National or State Roads, county Roads: Federal Government of Tyrol,
Department of Constructions.
3. Communal Roads, Private Roads: Local Authorities of the 279 Towns and villages in Tyrol.
4. Forest Roads and agricultural Roads: Department of Agriculture, Department of Forest, - Federal Government of Tyrol.

4.1.2.3. Safety attributes - Status

There are no data for safety attributes

4.1.2.4. Regulation

We have no information about this subject.

4.1.2.5. Databases – Status

GIS-Line-Data: There is existing a GIS-Layer of all roads (that to be traveled by motor vehicles). min 1,5 m width.
ARC-GIS-Route Layer:
Owner: Fed. Gov. of Tyrol, tiris (Organisation of GIS).

Data-Base for main Roads
Owner Fed. Gov. of Tyrol, Department of Construction
Data-Base for Forest Roads:
Owner: Fed. Gov. of Tyrol, Department of Forestry

4.1.2.6. Applications – Status

GIS-Line Data for Roads => ARCGIS, ARCVIEW, ARCIMS (ESRI)
Data-Base for main Roads => ACCESS
Data-Base for Forest Roads => ACCESS

4.1.2.7. Data exchange

Data exchange by Data-Catalogue and Data-Price list
Exchange Format: ESRI-Shape Files

4.1.2.8. Data integration

GIS-Data: ARC-SDE
Attribute Data: ARC-SDE, ORACLE

4.1.2.9. Standards used

There are no attribute data for official Road-Standards.

4.1.2.10. National projects

1.) Fed. Gov. of Tyrol: Project for Integration of all Road GIS-Layers, exploring GIS-Datamodel, Common Attributes and Databases for Roads
2.) Austria: Intiative for Implementation and use of a common Software to Integrate road graph data, participation of all 9 Federal Governments of Austria.

4.2. BELGIUM

4.2.1. Flanders

4.2.1.1. Road network

Road Network	Flanders
Motorways	832 km
Slip roads	520 km
Ring ways with motorway statute	143 km
Other ring ways	202 km
Other regional roads	4.750 km
Provincial roads	628 km
Other roads (cities and municipalities)	54.000 km

4.2.1.2. Organisational aspects

After the independency in 1830, Belgium was a united state where all the decision power was vested with a national parliament and a national government. Four state reforms (1970, 1980, 1988-1989 and 1993) have reformed Belgium into what it is now: is a federal state composed out of communities and regions. Belgium consists out of 3 communities (the Flemish Community, the French community and the German speaking community), 3 regions (the Flemish region, the Brussels Capital region and the Walloon region), 10 provinces and 589 municipalities.

As a consequence, Belgium has a complex structure with 3 organisational levels: the highest level consists out of the federal government, the communities and the regions; the middle level consists out of the provinces and finally the lowest level with the municipalities.

The decision power is now not longer in the hands of the federal parliament and the federal government. The country is governed by the different authorities that autonomously decide on affairs for which they have been appointed.

The legislation on the Belgian road network is an authority of the federal government. However, the competence of the construction, the maintenance and management of the roads is assigned to the 3 regional governments (the Flemish region, the Brussels Capital region and the Walloon region), the provinces and the cities and municipalities. The regions are responsible for the motorways, highways and main roads, and the regional and

(most of the) secondary roads. The provincial roads are partially secondary roads, and partially local roads. The rest of the road network is for the cities and municipalities.
In Flanders, it is planned in the coming years to divide all the provincial roads among AWV (secondary roads) and the cities and municipalities (local roads).

In the Flemish part of Belgium, the upper level in the data collection process is the Ministry of Flemish Community with an Agency for Roads and Traffic that stores information about highways regional roads, and even some secondary roads.
The AWV (Agentschap Wegen en Verkeer – Agency for Roads and Traffic) is an agency of the policy domain of Mobility and Public works (MOW). AWV is responsible for the road database of Flanders. This road database contains information such as speed limits, safety constructions, number of lanes, pavement, etc, but only concerning the roads maintained by AWV! In March 2007, AWV started with the inventory of all the traffic signs along their roads. This will be complete at the end of 2009. At the same time the department of Mobility and Public Works will start with the inventory of the traffic signs for the rest of the Flemish roads.
The Flanders Traffic Centre (Verkeerscentrum Vlaanderen), a unit within the policy domain and department of Mobility and Public works, is in charge of the traffic monitoring and management on the highways regional roads, and even some secondary roads. The Unit Traffic Centre is operating the Regional Traffic Control & Information Centre (TCC-TIC). A subunit is dealing with data capturing and validation, and traffic modelling, while another subunit is in charge of policy preparation in the field of traffic management scenarios and telematics services.
http://www.wegen.vlaanderen.be/

The following information is available at the AWV [3]:
- geographic representation (centre line, slope)
- lane related data (number of lanes, lane width, divider type (legal, physical), single/dual carriage, lane connectivity)
- pavements (road surface type, surface quality status)
- intersection data (priority regulation)
- physical infrastructure (bridge/tunnel, guard rails)
- technical infrastructure (traffic lights, traffic signs, direction signs (sign posts), variable message signs)
- crossings with other modes (pedestrian, bicycle, tramway)
- legal restrictions (legal speed limits, parking/stop restrictions, drive/turn restrictions, weight, width and height restrictions)

4.2.1.3. Safety attributes - Status

The table below is completed with data about the safety attributes along the roads under the jurisdiction of the Flemish Government. For the municipal roads in Flanders, no sufficient accurate data is available at this time. The process of making an inventory of the traffic signs along the municipal roads is planned to start in the second half of 2008.

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Very good	Flanders, motorways, highways and main roads, regional and secondary roads 95%	daily
Traffic signs	Very good	Flanders, motorways, highways and main roads, regional and secondary roads (2009)	daily
Lane information (number, width, divider, connectivity)	Normal	Flanders motorways, highways and main roads, regional and secondary roads not yet up-to-date (expected by the end of 2008)	
Traffic lights	Very good	Flanders, motorways, highways and main roads, regional and secondary roads (2009)	

[7]

4.2.1.4. Regulation

At the time of writing, the traffic regulation is an authority of the federal government. Discussions are however taking place to regionalise some aspects of the traffic regulations like e.g. traffic safety.

4.2.1.5. Database - Status

- **Road database of Flemish region** [3]

AWV has a central road database called ADA (Algemene Databank AWV). ADA is in fact a web based GIS-application with a viewer and 2 editors (1 for road attributes, 1 for roadwork's). The goal of ADA is to distribute all relevant (geo)datasets for the daily activities of all her employees. These datasets are speed limits, traffic accidents, traffic counts, safety constructions, traffic signs, etc.

4.2.1.6. Applications - Status

- **ADA**

ADA is operational, using ESRI software components (ArcSDE, ArcIMS), Informix, and JAVA for the editors. In 2008 ADA2 will be operational, using Oracle and ArcGISServer (1 application for viewing and editing).

4.2.1.7. Data exchange

The Flemish regional traffic sign database produces standardized products and reports on a wide range of formats:

- Geo-database (ESRI-based)

4.2.1.8. Data integration

Not applicable.

4.2.1.9. Standards used

The applications will be ESRI bases (see above).

4.2.1.10. National projects

- **Traffic sign database of Flemish region**

This traffic sign database is not yet operational. There is also a different approach between AWV-roads, and the other roads in Flanders. The **AWV roads** are the motorways, highways, main roads and regional roads (about 6500 km) in Flanders. The Agency for Roads and Traffic of the Flemish Government (AWV) is responsible for the development of the central traffic sign database, and the integration of the actualisation in the workflows of the AWV districts.
This central database will be updated by AWV personnel in the districts, and uses existing tools such as SIMaD, SignInvent and ArcGIS. This database will be complete at the end of 2009.

For AWV, a contractor is making an inventory of all the traffic signs, except for temporary signs. This inventory contains the following attributes:

- position: X, Y coordinate (accuracy of 1 meter), road number, distance (in meters) to the nearest hectometre post, left/right of the road, orientation (relative to north) and in case of a side-street that is not a AWV road (so without road number and hectometre post), the street name and distance to the border of the AWV-road is also stored.

- Type of fitting (pole, traffic light, against a wall, internal illuminated, etc.)
- Height (measured from surface level until every sign)
- Type of sign
- Production type of sing(s) and pole(s)
- Code
- Type of film
- Production date
- Producer
- Type of pole (round, rectangle, IPE-profile, SB250)
- Basic dimensions of the sign(s) and the pole(s) (diameter, width, length)
- Colour of pole
- Length of pole above surface level
- Picture of the traffic sign if containing text elements.
- Date of survey

- **Traffic sign database of Flemish municipalities**

On the other hand the Department of Mobility and Public Works will re-use the knowledge and experience of AWV concerning the central traffic sign database, for the development of their own central database for all the **other roads** (most of it local and secondary roads maintained by the provinces or the municipalities and cities) in Flanders (about 54000 km).
For the other roads, only following attributes will be listed for every traffic sign:

- X, Y coordinate
- street name
- municipality or city
- date of survey
- type of sign
- code of the sign.

Each city or municipality is free to add extra attributes to the basic inventory, but at this moment they are not obligated

The inventory of traffic signs for the other roads will be completed at the end of 2010.

These two databases will be using the same tools for updating, as well as the same traffic sign 'libraries'.

Following key requirements are posed in the specifications [7]:
SimAD database has to be used for the library
ArcGIS has to be used for the visualisation

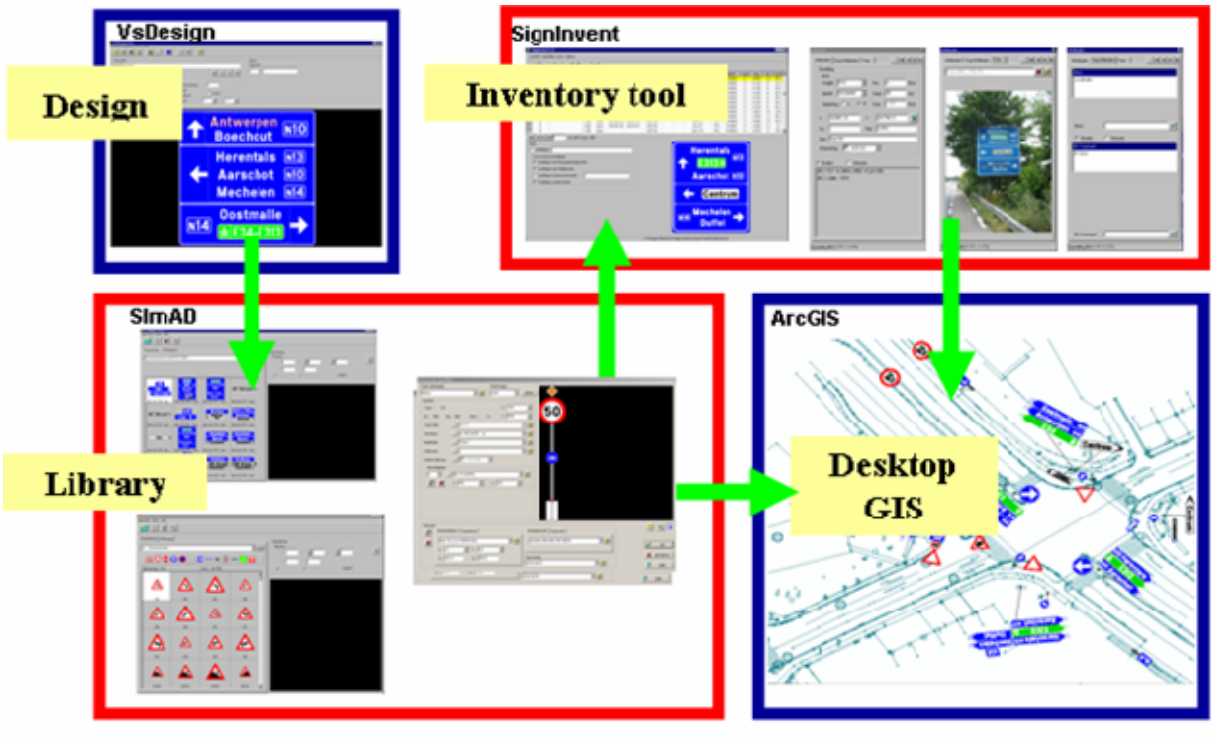
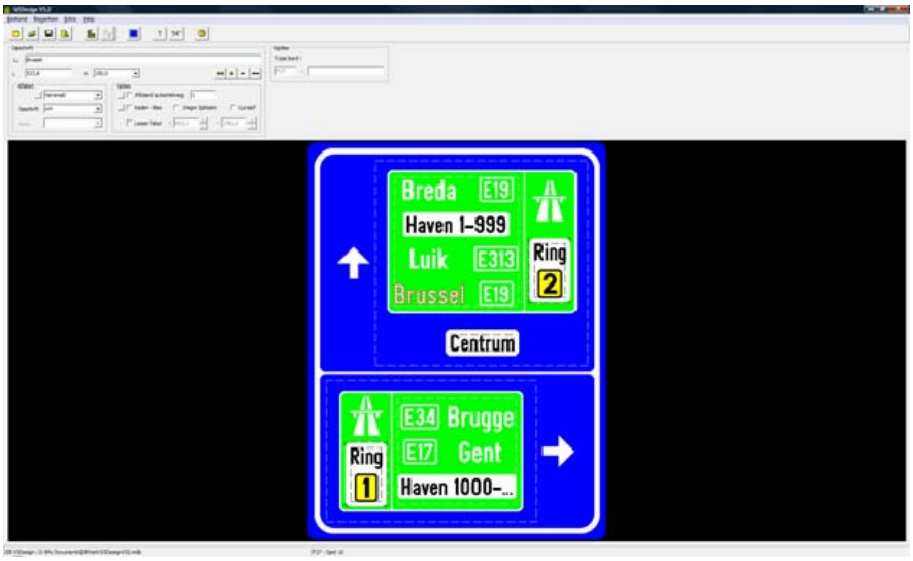


Figure 11: Storage/Road database [7]

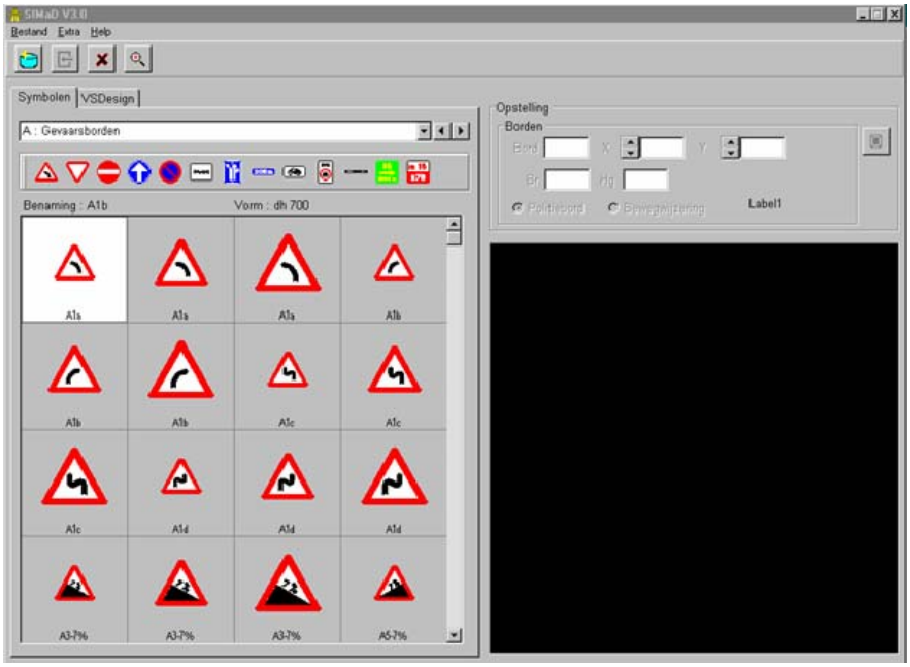
1. VsDesign

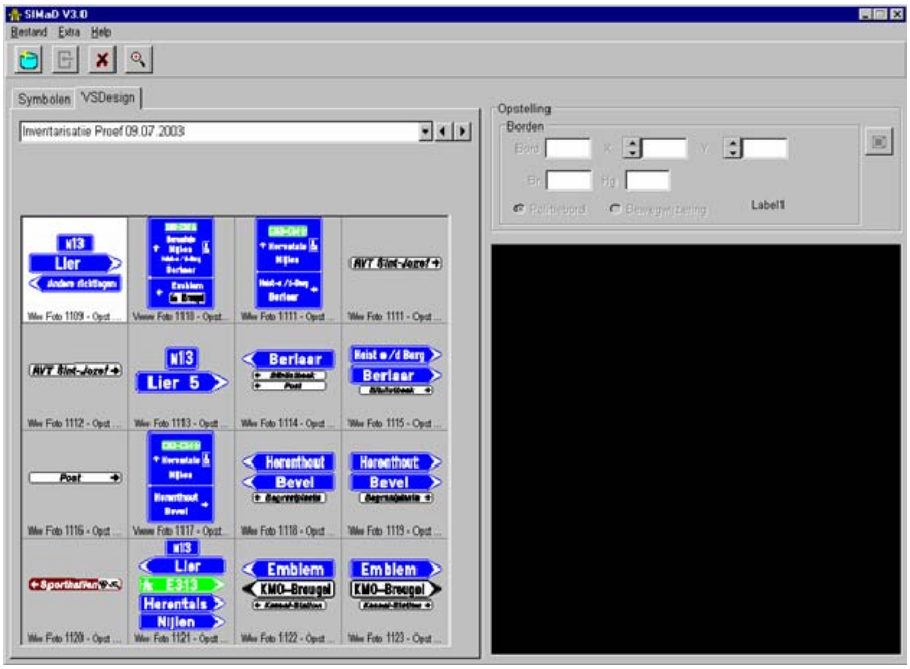
VsDesign is being used for designing traffic signs that are not yet available in the existing standard traffic sign libraries. This drawing is a vector.

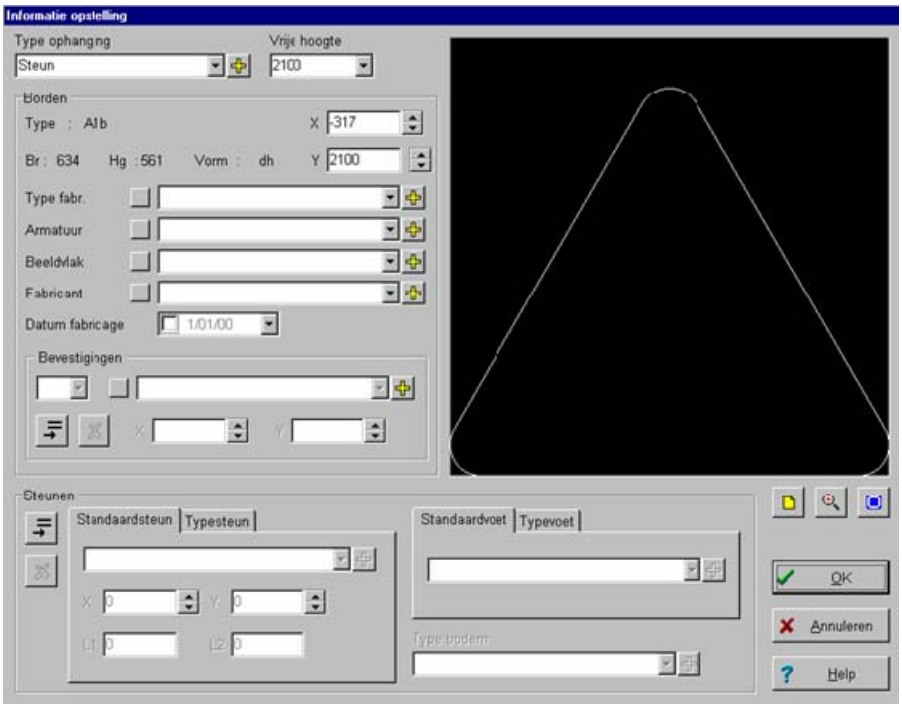


2. SIMaD

SIMaD users put together traffic signs using the traffic sign libraries of VsDesign or the standard traffic sign library.
Attributes such as basic dimensions, type, shape, text, year of production, producer, information about poles and fittings, can be added to each traffic sign.
SIMaD is an extension that is compatible with SignInvent and ArcGIS.

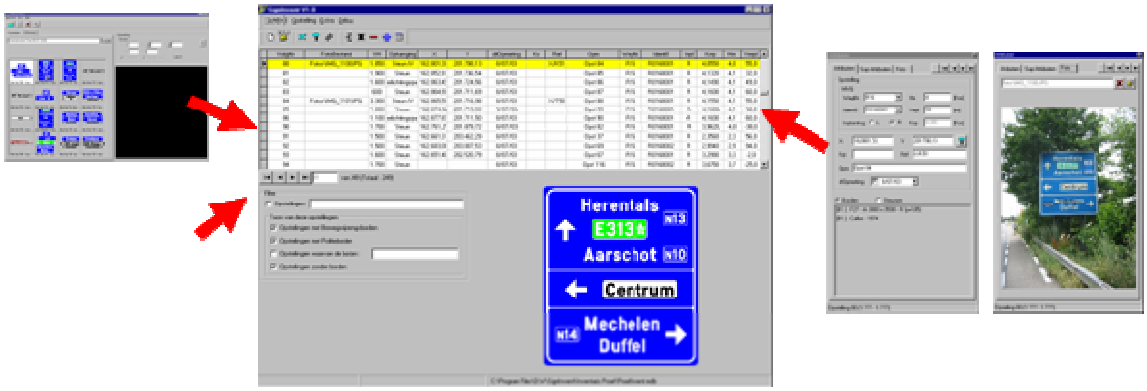






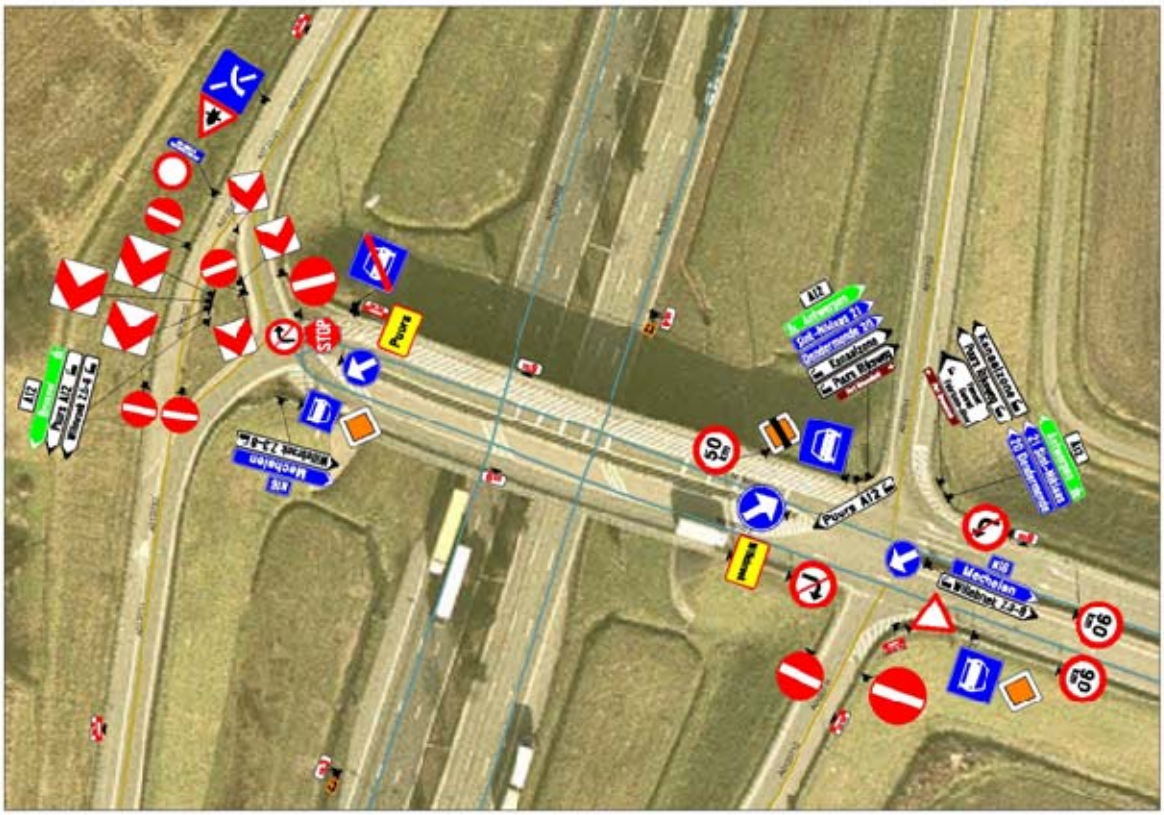
3. SignInvent

This application is developed for updating the inventory of traffic signs. The inventory is stored in an Access database. SignInvent users can make reports of the inventory, build queries, etc. At this moment SignInvent can only adjust the data-part of a SIMaD dataset. The graphical part has to be changed using ArcGIS. When a user adjusts the data-part using SignInvent, then the graphical part has to be updated using ArcGIS.



4. ArcGIS

ArcGIS is used for the updating and representing of the inventory of traffic signs. The SIMaD extension of ArcGIS is necessary. So it is possible to update and change the traffic sign database in ArcGIS. The traffic signs can be visualised on a map. Therefore, the drawing of a traffic sign is converted to polygons in shapefile, or in a file geodatabase.
The combination of an MsAccess database with a shapefile or filegeodatabse is called a SIMaD dataset.



Currently, the Desktop GIS application is being enriched with a Web GIS application.

4.2.2. Wallonia

4.2.2.1. Road network

Road Network	Wallonia
Motorways	869 km
Other regional roads	6401 km
Provincial roads	714 km
Other roads (cities and municipalities)	71732 km

4.2.2.2. Organisational aspects

The Walloon part is divided in two categories, regional and local roads. The regional roads are under the authority of the M.E.T. (Ministry of Equipment and Transport). The General direction of Motorways and Roads has several divisions such as the Road data division and three territorial divisions (Division of centre, west and east road network).
The Road Data division DGAR is divided in four specialised cells. It assures the technical assistance for data acquisition and exploitation of the territorial divisions, conceives and manages the applications related to road data (BDR - ALPHA), to road mapping (BDR - CARTO), to road conception (CAO/DAO) and to road maintenance (SOGER).
It manages also road data (standardisation and data exchanges) at regional, national and international levels.
http://met.wallonie.be/opencms/opencms/fr/

In the Walloon part, the following road information is available [3]:

- geographic representation (shape (shape points))
- lane related data (number of lanes, lane width, single/dual carriage, lane divider, divider type (legal, physical), banking (transverse gradient, super elevation))
- pavements (road surface type, surface quality status)
- intersection data (priority regulation)
- physical infrastructure (bridge/tunnel, guard rails)
- technical infrastructure (traffic signs, direction signs (sign posts), traffic lights, variable message signs)
- legal restrictions (legal speed limits, weight, width and height restrictions)
- crossings with other modes (pedestrian, bicycle)

4.2.2.3. Safety attributes - status

Safety Attributes	Database	Data quality	Coverage	Update frequency
Speed limits	road database BDR	satisfactory	regional roads	continuously
Traffic signs	not any centralized data			
lane information number, width, divider, connectivity	road database BDR	good	regional roads	continuously
Traffic lights	BDR	rather good	regional roads	continuously
Pedestrians crossings	Road database BDR	good	regional roads	continuously
Crossings (cycles, trams)	not any database			
toll barriers, motorway junctions, tunnel access	Road database BDR	good	regional roads	continuously
Gradient (slope)	not any database			
transverse gradient	not any database			

4.3. BULGARIA

After examination, we carried out, we fond out, that, unfortunately, in Bulgaria, at the moment there is no such data base with regards to road safety attributes.

4.3.1. Road network

Road Network – National Roads	19 425
Motorways	418

Highways, main and national roads	Approximately 2975
Regional, secondary roads	16032
Communal roads – Municipality Roads	21432
Private roads	No information for the length

4.3.2. Organisational aspects

Regarding the classification of the road network, Bulgaria has two different levels of public authorities:

- National level, represented by National Road Infrastructure Fund
- Municipal level: Represented by ca 264 local administrations

4.3.3. Safety attributes - Status

Safety Attributes	Quality	Coverage
Speed limit	Location: associated to regulations and signs	National and municipality roads
Traffic signs	Location 2 to 10 m	National and municipality roads
Lane information (number, width, divider, connectivity)	Lane OK Divider OK	National and municipality roads
Traffic lights	Only in sections, passing through the cities	National and municipality roads
Gradient (slope)		National and municipality roads

4.3.4. Regulation

Regulations for speed limits and traffic signs are made by either:

- National Road Infrastructure Fund
- The municipal Administration

In addition, placing of the signs, have to be agreed and approved by Traffic Police authorities.

4.3.5. Databases - Status

No

4.3.6. Applications - Status

No

4.3.7. Data exchange

No

4.3.8. Data integration

No

4.3.9. National projects

Ministry of Transport, having in mind importance of road safety, have planned to start a study to determine the location of the road signs and road marking sections and their accuracy, aimed at establishing an initial data base, for purposes of forming the National policy in conducting of the management of the safety of the road infrastructure.
This became imperativeness, after had examined the proposed EU directive for road safety. Our target is to conduct this study by the end of the year.

If you want to obtain information from the source you can contact:

- National Road Infrastructure Fund

3, Macedonia Blvd.
1606, Sofia
Bulgaria
Tel: +359229173226;
Fax: +'35929515422

- Central Road and Bridges Laboratory

http://www.crbl-bg.net

4.4. CYPRUS

4.4.1. Road network

Road Network	11994 km
Motorways	257 km
Highways, main and national roads	As above for highways and as below for main roads
Regional, secondary roads (and main roads)	2141 km
Provincial roads (Forestry Department Roads)	3162 km
County roads (Districts)	2702 km

Communal roads (Municipal)	3732 km
Private roads	no comprehensive data collected

4.4.2. Organisational aspects

Every authority in Cyprus (Public Works Department, Municipality, District, Local Council or the Forestry Department) is responsible for the maintenance and improvement of the roads under its jurisdiction.

Cyprus has 6 Districts and 33 Municipalities.

4.4.3. Safety attributes - Status

The PWD`s Highway Management System (HMS) includes a Geographical Information System (GIS) database with urban centre (city) maps of 1:7500 scale and 1:50000 for all other roads. The accuracy is estimated to be about 10-50m. In regards to the HMS the following attributes exist:

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Not associated to the location of signs	Mostly Public Works Department and District Roads	Very low
Traffic signs	Not yet	-	Very low
Lane information (number, width, divider, connectivity)	Lane –OK Width- OK (Not up to date)	Mostly Public Works Department and District Roads	Low
Traffic lights	OK (most city traffic lights are included)	Urban only	Medium
Crossings (pedestrian, tram)	No information	-	-
Toll barriers, motorway junctions, tunnel access	Only motorway junctions	Motorways only	Medium
Gradient (slope)	No info	-	-
Transverse gradient (banking)	No info	-	-

4.4.4. Regulation

Regulations for traffic signs, speed limits, traffic lights are controlled by the Public Works Department or the relevant Municipality, District and when needed (such as the speed limit regulations) by the Police. See details for database below.

4.4.5. Databases - Status

The Public Works Department (PWD) developed the Highway Management System (HMS) which is a GIS based system and includes all roads under PWD jurisdiction which includes all motorways, main and national roads and also district roads. The HMS also includes street furniture, road safety and traffic data and is regularly updated through a maintenance contract with the system suppliers.

4.4.6. Applications - Status

Cyprus use ESRI ArcMap for the Highway Management System.

4.4.7. Data exchange

No data exchange exists as of April 2008

4.4.8. Data integration

No integrations in external of customer systems.

4.4.9. Standards used

No standards used as of today

4.4.10. National projects

Regular update and upgrade of the Highway Management System and the introduction of Intelligent Transport Systems (ITS) in Cyprus. The ongoing project for ITS will include a database for traffic and other data which will be used for traffic management and monitoring.

4.5. CZECH REPUBLIC

This contribution has arrived the 1st of September. It was included in the document; however we did not take it into account in the tables because of time constraint.

4.5.1. Road network

Road Network	55 585 km (without local roads)
Motorways	633 km
Motorways, main and national roads	1st class roads 6 174 km
Regional, secondary roads	2nd class roads 14 660 km
Provincial roads	
County roads	3rd class roads 34 118 km
Communal roads	local roads 72 927 km
Private roads	not registered

Classification of road network in qaccordance with national methodology:

Road Transport Infrastructure (Km)

	2000	2002	2003	2004	2005	2006
Total road and motorways network	*55 410*	*55 422*	*55 447*	*55 500*	*55 510*	*55 585*
of which **european road network, type E**	2 596	2 599	2 599	2 601	2 601	2 599
Motorways in operation	501	518	518	546	564	633
Expressways[1)]	299	305	320	336	322	331
Other roads	54 909	54 904	54 929	54 953	54 945	54 952
of which **I. class roads**	6 031	6 102	6 121	6 156	6 154	6 174
II. class roads	14 688	14 668	14 667	14 669	14 668	14 660
III. class roads	34 190	34 134	34 141	34 128	34 124	34 118
Local roads	72 300	72 300	72 927	72 927	72 927	72 927

1) Length of expressways is included in the length of I. class roads

Source : ŘSD, ČSÚ

The Czech Republic has 627 km of motorways and 54,958 km of roads in operation, out of that 6,156 km of class I roads (out of that 336 km of expressways), 14,669 km of class II roads and 34,128 km of class IIII roads. Motorways and major roads carry the biggest portion of traffic volumes and connect the most important administrative, economic and resort centers. This includes a network of international roads (including motorways) marked with the letter E, according to the AGR (European Agreement on Main International Traffic Arteries), in the length of 2,644 km. With the density of 0.70 km of roads and motorways per 1 km^2, the Czech Republic ranks among the leading European countries.

4.5.2. Organisational aspects

Regarding the classification of the road network, the Czech Republic has three different levels of competency for road network management:

- National level, represented by the Road and Motorway Directorate of the Czech Republic
- Regional level, represented by 13 different regional administrations (Road Administration and Maintenance Units)
- Municipal level, represented by local administrations

The Road and Motorway Directorate is responsible for property administration, maintenance and repairs, construction and modernization of motorways and 1st class roads (include expressways). The regional administrations are responsible for property administration, maintenance, repairs and investment activities of 2nd class roads and 3rd class roads. Local administrations are responsible for property administration, maintenance, repairs and investment activities of local roads.

4.5.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit		motorways, 1st, 2nd and 3rd class roads	twice per year
Traffic signs		motorways, 1st, 2nd and 3rd class roads	twice per year
Lane information (number, width, divider, connectivity)		motorways, 1st, 2nd and 3rd class roads	twice per year
Traffic lights		motorways, 1st, 2nd and 3rd class roads	twice per year
Crossings (pedestrian, tram)		motorways, 1st, 2nd and 3rd class roads	twice per year
Toll barriers, motorway junctions, tunnel access		motorways, 1st, 2nd and 3rd class roads	twice per year
Gradient (slope)		motorways, 1st, 2nd and 3rd class roads	twice per year
Transverse gradient (banking)		motorways, 1st, 2nd and 3rd class roads	twice per year

In practice, the best description is for motorways and 1st class roads. For 2nd and 3rd class roads, the description may not be complete in the National Road Data Bank. The data updating deadline is by 1 January and 1 July every year. The accuracy of description is generally in units of meters (or better).

For the local roads, there is only partial independent description in some large cities.

4.5.4. Regulation

The organization levels for the safety attributes regulation are in relation with general different levels of public authorities:

- National level, represented by the Road and Motorway Directorate of the Czech Republic
- Regional level, represented by 13 different regional administrations
- Municipal level, represented by local administrations

4.5.5. Databases - Status

Only one institution is responsible for road operations and services - ŘSD (Road and Motorway Directorate of the Czech Republic). ŘSD is state owned organization established by the Ministry of Transport and Communication.

Responsibility of ITS implementation belongs to ŘSD. Implementation of ITS provides a significant contribution to the improvement of the traffic situation on motorways, as it is possible now to have complete and updated information for drivers.

ŘSD is responsible for the national project JSDI (Unified System Interface for Information). The main goal of JSDI is to design a complete, aquisition, evaluation and traffic information provisioning with many different subjects involvement. Preferred information from the public sector (Police CZ, Fire service CZ, First aid service, Road operators, Regional police, Czech Hydro-Meteorologícal Institut, server administrators etc.) Data dissemination from data JSDI dictionary is guaranteed by a State authorities portal (PVS).

All data are collecting and evaluating in NDIC (National Traffic Monitoring Centre) in city of Ostrava. The NDIC have two parts: Road Data Bank Unit and National monitoring centre.
The NDIC ensures working of its information system that includes data processing, regular data updating, output data processing, data supplying to users, exchange, ending and selling data, system development and innovation.

The Road and Motorway Directorate owns and maintains the National Road Data Bank (with the seat in Ostrava) which contains data on the whole national public road network - motorways, 1st, 2nd and 3rd class roads (but not local roads).

Some big cities (Praha, Brno etc.) have their own municipal road databases, but these databases are decentralized and without common standard. Big part of the local roads has even no own registration.

The main road data stored in the National Road Data Bank:

- **node location system**: nodes, road segments, complicated crossroads and road alignments
- **resistant parameters**: passportization description (width layout, lanes number, pavement of carriageway, speed limits, safety arrangement, road equipment, protect walls, lines of trees), detailed crossroads description, road objects (bridges, tunnels, level crossings etc.), road bed and layers, environmental data, route tracing (directional, horizontal, transversal), Motorways specification (motorway rest stops, rest houses, car-campings, fuels stations, car services)

- **variable parameters**: bearing capacity, roughness, longitudinal and transversal asperities, carriageway failures, macrotextures
- **construction activity register**: finished road constructions, road or objects touched by finished constructions, finished reparation or continual maintenance actions
- **traffic engineering**: traffic countings, traffic intensities and volumes

Closing date for annual updating: 1 January and 1 July.

4.5.6. Applications – Status

The software of the National Road Data Bank is based on GIS products of ESRI company.

The product **ArcInfo** runs on the workstation as a complete geographic system with all necessary instruments for administration, analysis, modelling and data publication, especially for data management and thematic maps creation.

The product **ArcView** runs as a desktop on the PC platform; it enables before all to make sophisticated geographic analyses.

The superstructure object **ArcGIS 3D Analyst** provides instruments for creation, projection and analysis of 3D data.

The development product **MapObjects** is intended for the creation of user GIS applications.

For the work with geographic databases, a basic user application software in programming environment Delphi was created, with components MapObjects utilization, which runs on PC under MS Windows as the operating system.

The NDIC (National Traffic Monitoring Centre) is ready to use Windows aswell as Linux operational system and Web-applications for access are available (Apache web server). The system is carefully designed and developed to accommodate all kinds of technologies ad basic user needs.

NDIC features a core data store (CDS) that contains authorized, digital, and geographically located traffic information encoded using the standardized Alert-C protocol in .xml format. The data is ready to be distributed among public office institutions, crisis groups, road users and so on. The system provides cross-the-border exchange of traffic information within EU countries.

Due to tight cooperation among individual RDIC (regional traffic information centers), NDIC contains updated data from the entire area of the Czech Republic for further distribution to drivers.
Also, NDIC communicates with other JSDI applications (winter road announcements, central registry of blocked roads etc.)

Traffic information can be also provided via RSS channel or uploaded into maps in PDA devices.
As the first country from the former eastern European block, the Czech Republic started dissemination of actual traffic information by RDS-TMC technology.

4.5.7. Data exchange

All maps are created in GIS ESRI environment - two-dimensional by means of ArcInfo and ArcView, three-dimensional by means of ArcGIS 3D Analyst, with the possibility of export into JPG, TIF, BMP, RTL formats.

The NDIC produces standardized products and reports on wide range of formats:

- ISO IS 14825 – GDF 4.0 - Global Network map product. Digital geographical localization.
- ALERT-C (ISO 14819-3:2004)
- TPEG is preparing
- TC204 – (ISO,CEN) Intelligent Transport Systems
- CEN TC278 – DSRC – Multilane free flow electronic toll collection
- Other – report and exchange formats based on linear reference systems coordinates.

4.5.8. Data integration

Data is integration within NDIC. All data is stored according to standardizations in .xml format.
JSDI is collecting traffic data from Electronic toll collection for traffic management purposes.

Data are for free for companies which they want to disseminate traffic information for public which directly affecting transport safety and traffic throughput on roads.

Emergency services are provided country-wide and are accessible through the national telephone numbers as well as the international 112 emergency telephone number, which was introduced in 2005. The co-ordination of emergency services uses an integrated rescue system. There are measures in preparation to introduce the e-call system.

Accident data collection is done by the Police Force (causes, circumstances and consequences).

4.5.9. Standards used

For data storing, data exchange and data integration, ISO standards are in use.

4.5.10. National projects

There are some national projects in progress.

ŘSD is responsible for the national project JSDI (Unified System Interface for Information). The main goal of JSDI is to design a complete, aquisition, evaluation and traffic information provisioning with many different subjects involvement. Preferred information from the public sector (Police CZ, Fire service CZ, First aid service, Road operators, Regional police, Czech Hydro-Meteorologícal Institut, server administrators etc.). The NDIC transfers information from JSDI to traffic information and then distributes it to users (drivers, road districts) via various channels. One of the important channels is the RDS-TMC, which makes it possible for the drivers to receive the traffic information online - i.e. directly in a car.

NDIC cooperates on RDS-TMC with Czech Radio. System for the RDS –TMS service was finished during realization of the Euro-regional project CONNECT. System is based on the technical solution of GEWI TIC Server and GEWI TIC RDS-TMC Server. This solution enables to distribute traffic information to different regions with different content. The RDS-TMC operator is Road and Motorway Directorate of the Czech Republic. RDS-TMC testing will be finished at the end of 2008.

Under construction is 31 km of Active traffic management system in Motorway D1. On the rest of D1 (220km) will be installed ITS information system. This project is under supervision of RSD.
The NDIC in Ostrava is brand new and has been developed to collect traffic data from all over the Czech Republic and to accommodate new ITS systems which are under development. It has been developed to satisfy more user needs.

The Road and Motorway Directorate runs statistics on the location of accidents on the road and motorway network. A research project on the introduction of GPS for police road accident collection is being carried out.

Many of the projects are within the Ministry of Transport's research programme.

4.6. DENMARK

4.6.1. Road network

Road Network	72 411 km
Motorways	1062 km
Highways, main and national roads	state's road network administered by the National Road Authority: 3 788 km (including motorways) roads administered by S&B Hold: 41 km
Regional, secondary roads	Not available – the network is being reclassified
Provincial roads	Not available – the network is being reclassified
County roads	Not available – the network is being reclassified
Communal roads	administered by the Danish counties 68 582 km (includes the three network types above, due to changes in the local and regional administrations)
Private roads	Not available

http://www.vejsektoren.dk/wimpdoc.asp?page=document&objno=164194

4.6.2. Organisational aspects

Three levels of public authorities, national, regional and municipalities are responsible for the Danish road network. The National Road Authority is responsible for the national and regional roads. There are 5 regions and 98 municipalities which can decide on their own how they want to store the road data. Some private companies collect data at the three different levels.

4.6.3. Safety attributes - Status

Comment: Quality rating is 'good, medium, bad' and related to the needs of DRD. Concerning 'Coverage' and 'Update frequency' the answers are what is stated in regulations - the situation in the field might be different. All answers refer to the national network and may or may not be valid for the municipal network.

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Good	100%	When changed
Traffic signs	Good	100%	When changed
Lane information (number, width, divider, connectivity)	Good	100%	When changed
Traffic lights	Good	100%	When changed
Crossings (pedestrian, tram)	Not available	Not available	Not available
Toll barriers, motorway junctions, tunnel access	Good	100%	When changed
Gradient (slope)	Not available	Not available	Not available
Transverse gradient (banking)	Not available		

'Not available' means in this connection: The data elements do not exist as global elements in the databases, but information might exist in specific cases or cold be derived from other data sources hold by DRD.

4.6.4. Regulation

Concerning the traffic accident data hold in the database three organisations have a primary role: The Police, The Road Directorate and the municipalities. Data are collected

by the police, data are checked and disseminated by the Road Directorate and data are located to the network by DRD and the municipalities. All data are stored in one central database hold and maintained by DRD and the database is part of VIS/vejman.dk.
The three bodies together with other interested organisations have set up a traffic safety statistic advisory board that proposes and decides changes in the regulation of the safety attributes.

4.6.5. Databases – Status

- **Road databases** [3]

All national spatial information is stored in a VIS (Vejsektorens Informationssystem) or vejman.dk. Data are entered at the following stages: planning, construction, review, maintenance and upgrade/extension. Regional roads are now administered by the municipalities and data are either hold in VIS/vejman.dk or in Rosy.

Road information stored is:

- geographic representation (centre line, shape (shape points,)

lane related data (number of lanes, lane width, single/dual carriage, lane divider, divider type (legal, physical), banking, lane connectivity)

- pavements (road surface type, surface quality status)
- intersection data (priority regulation)
- physical infrastructure (bridge/tunnel, guard rails)
- technical infrastructure (traffic signs, direction signs (sign posts), traffic lights, variable message signs)
- legal restrictions (legal speed limits, parking/stop restrictions, drive/turn restrictions, width, height and weight restrictions)
- crossings with other modes (pedestrian, bicycle, tram)

Currently maps are archived in digital map databases by each municipality. All municipalities use GIS.

4.6.6. Applications – Status

- **Digital portal, Vejman.dk (2007)**

The National Road Authority develops a new common road management system, vejman.dk, where all Danish roads might be stored in. The state and the municipalities have in this way an internet based system with all data together from VEJMAN and VIS. The data conversion process from different systems (Vejman, RoSy, Regneark, GIS) by the municipalities is not yet finished.
http://www.vejman.dk/default.asp
In 2009 about 60 municipalities will have their data in vejman.dk where as the rest (about 38) will use Rosy. Concerning data about traffic accidents all data are stores in VIS/vejman.dk.
The DRD uses Oracle DBMS as database management system and on top of this we have developed all input and output modules which are required. This includes an in house developed GIS-module targeted at presenting road information on digital maps. Data can be transferred to commercial GIS-products in order to produce other presentations at the users own choice. DRD uses MapInfo frequently.

4.6.7. Data exchange

Data exchange takes place regularly and with different bodies. Data format is agreed individually with the receiving organisation. VIS/vejman.dk is able to deliver data using a webservice.

4.6.8. Data integration

All data in VIS/vejman.dk including accident data are integrated to each other by the road reference system.

4.6.9. Standards used

No international standards are used concerning road data (applications, exchange, integration). This does not mean that it is not possible but until now no needs have been seen.
Concerning spatial coordinates we use EUREF89.

4.6.10. National projects

Development of a road portal and further development of vejman.dk as mentioned above. This year we try to establish data from the hospitals together with data from the police.

- **INFATI Project**

INFATI is the first Intelligent Speed Adaptation development project in Denmark. The project is carried out by Aalborg University in collaboration with two local companies. Aalborg University has previous experience with, and knowledge of, traffic information. The project is managed by the university's Transport Research Group with support from the Laboratory for Geoinformatics.
With the aid of satellites, the technology in INFATI can determine the position of the car and inform the driver of the local speed limit.
http://www.infati.dk/uk/index.htm

4.7. ESTONIA

4.7.1. Road network

Road Network	57 565 km
National roads	16 465 km
Main roads	1601 km
Including: Dual carriageways	99 km (I class roads - 4 lane roads with separated directions)
Basic roads	2391 km

Secondary roads	12 425 km
Ramps and connecting roads	48 km
Local and private roads	38 078 km
Urban roads and streets	3022 km

4.7.2. Organisational aspects

Regarding the classification of the road network, Estonia has two different levels of public authorities:

- National level, represented by The Estonian Road Administration
- Municipal level: Represented by ca 230 local administrations.

Estonian Road Administration (ERA) is a government agency, which operates within the administrative area of the Ministry of Economic Affairs and Communications.
The area of activity of the ERA includes fulfilling the management and national supervision function within the scope of the duties prescribed by law, and applying enforcement powers of the state in the area of road management and traffic safety on the grounds and in the extent established by legislation.

Estonian Road Administration administrates the following state agencies:
The Road Administration of Northern Region;

Offices under the administration of the Road Administration:
Kagu Road Office;
Pärnu Road Office;
Saarte Road Office;
Tartu Road Office;
Viru Road Office

4.7.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Location: 10 to 20 m Attributes: not always associated to traffic signs	National roads	Medium
Traffic signs	Location 10 to 20 m Quality is low.	National roads	Low
Lane information (number, width, divider, connectivity)	No		

Safety Attributes	Quality	Coverage	Update frequency
Traffic lights	No		
Crossings (pedestrian, tram)	No		
Toll barriers, motorway junctions, tunnel access	No		
Gradient (slope)	No		
Transverse gradient (banking)	No		

4.7.4. Regulation

Regulations for speed limits and traffic signs are made by either:

- The Estonian Roads Administration
- Municipalities

4.7.5. Databases - Status

According to the amendments made to the Roads Act, a National Road Databank has been established on the basis of the Register of National Roads, providing information on both the national roads and other public roads. The national road register was established and its statutes endorsed with Regulation No 199 of the Government of the Republic of July 28, 2005.
The National Road Databank is a web-based database, administered and processed under the authorization of the Estonian Road Administration.
The National Road Data Bank runs on a Sybase platform, using Windows- and Web-applications for access.
Many municipalities have their own unofficial road databases.

4.7.6. Applications - Status

The system support shelf application in map server and also output to the ESRI supported file.
The map system is developed by Estonian Land Board.

4.7.7. Data exchange

The National Road Databank produces standardized products and reports on wide range of formats.

4.7.8. Data integration

No integrations in external or customer systems.

4.7.9. Standards used

We don't use any standards.

4.8. FINLAND

4.8.1. Road network

Road Network	**447.396 km**
Public Roads	78.500 km
- Motorways	- 258 km
- Highways, main and national roads	- 13.264 km
- Regional, secondary roads	- 13.519 km
- Provincial & county roads	- 51.407 km
Communal roads (streets)	38.948 km
Private roads	330.000 km

4.8.2. Organisational aspects

The Finnish Road Administration (Finnra) is responsible for storing and managing road geometry and attribute data. Road data is stored in a centralized digital national database called Digiroad by different national and regional authorities. Municipalities have the obligation to report update changes on their streets and the Land Survey any road geometry changes.
In addition to Digiroad, Finnra has a more comprehensive RoadDataBank (RDB) covering state owned public roads (78500 km).

4.8.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Location 5 to 10 m. Common speed limit 80 km/h is not marked with signs.	All roads	Very high on public roads, high on streets, medium on private roads
Traffic signs	Poor	Only some regions in separate databases	5 – 7 years
Lane information (number, width, divider, connectivity)	Width of carriageways, number of lanes	All Roads	Very high on public roads, high on streets, medium on private roads
Traffic lights	OK	All roads	Very High
Crossings (pedestrian, tram)	Not exact, poor geometry	Pedestrian roads only in RDB	High
Toll barriers, motorway junctions, tunnel access	Yes		High
Gradient (slope)	Rough (m/km)	RDB, only Main roads	After construction
Transverse gradient (banking)	NO	Separately available on Public paved roads	3 – 10 years

4.8.4. Regulation

Regulations for speed limits and traffic signs are made by either:

- The Finnish National Road Administration
- The municipal Administration

4.8.5. Databases - Status

1. **Digiroad, National Road database** [3]

The Digiroad database contains comprehensive data on the geometry and physical features of roads and streets of the whole country. The data is updated through different methods: paper maps, digital data, via a WEB interface and from plans at the planning and construction stage. The Finnish data is also included in the OECD's database, IRTAD, International Road Traffic and Accident Database.
The following road information is available in Digiroad:

- geographic representation (centre line, shape and slope)

- lane related data (number of lanes, single/dual carriage, divider type)
- pavements (road surface type)
- intersection data
- physical infrastructure (bridge/tunnel)
- technical infrastructure (direction signs, traffic lights)
- legal restrictions (legal speed limits, drive/turn restrictions, weight, width and height restrictions)
- crossings with other modes (pedestrian (with variable quality), bicycle, tram (not if separated from road geometry))
- other (railway crossings, road official name and road number)

Attribute data is stored using linear referencing but can also be retrieves as geographic coordinates.

4.8.6. Applications - Status

Digiroad runs on an Oracle platform applying Esri's software, using Windows- and Web-applications for access.

4.8.7. Data exchange

Different export formats are available: Shapefile, specific Shapefile adapted for MapInfo and XML format. Data delivery is based on export batch files. All data deliveries are governed by signed contracts. The database delivers updates every 3 months.

4.8.8. Data integration

No integrations in external or customer systems.

4.8.9. Standards used

GDF-standard was used as the basis for the data model, data storing and data exchange.

4.8.10. National projects

None

4.9. FRANCE

4.9.1. Road network

The road network contains 3 levels operated by the state, the 100 counties and the 36 600 communities, often grouped together in "intermunicipal cooperation entities" in charge of their road network

Road Network	**1 200 000 km around**
Motorways	11 000 km (includes 8 200 km operated by 14 companies under state contract)
Highways, main and national roads	9 000 km ("national roads")
County roads	384 000 km
Communal roads	604 000 km (local roads and urban streets)

4.9.2. Organisational aspects

The road administration in France is clearly separated between the national and the local administrations.

National Public authorities:
The non-conceded national road network is directly managed by 11 dedicated departments (DIR) depending on the ministry in charge of transport (MEEDDAT). Among their dues they have to follow the network definition and collect data about it. They also have to propose modifications to the local regulations (e.g. speed limit modification) to the local representative of the State (*préfet* or prefect)

Private companies:

- **ASFA** (French Association of Highways and Tolls Companies)
  ASFA covers a total of 8200Km of road network operated and maintained by 14 different private companies. Each of the 14 private companies under the ASFA association uses their own database and their own way to keep them. Their reference is PK (kilometric point) or PR (road point). The only complete database is a toll database maintained by ASFA.

- **GIE Autoroutes-Trafic**
  GIE Autoroutes-Trafic consolidates traffic information from the same 14 companies, broadcasted on the motorways, via radios and TMC codes.

Regional public authorities:
Case of counties ("*départements*"): the road network managed by the counties is operated by technical department depending on the General Council of the county (Conseil Général). A general rule states each county is free to organise itself. Therefore there is no common framework for this organisation. These technical services propose modifications to the local regulations (outside built-up areas) to the Chair of the General Council (Président du Conseil Général) (see below).

Case of communities ("*communes*"): the road network managed by the cities and the communities is operated either by services directly depending on these communities or by services belonging to an "intermunicipal cooperation entity". In some limited cases this entity may directly manage the local network.

Please notice that beside the public local road network a "private" local network exists for the agricultural needs ("rural ways"). It is owned and managed by the rural communities and is considered as not open to public traffic.

4.9.3. Safety attributes - Status

No common storage for safety attributes. The following table applies to the toll motorway network. For the other road networks, there is no common framework for collecting and storing road data including safety attributes.

Safety Attributes	Quality	Coverage	Change frequency
Speed limit	50 – 100 m	All toll motorways (except exchangers)	high
Traffic signs	50 – 100 m (speed signs)	All toll motorways (except exchangers)	high
Lane information (number, width, divider, connectivity)	OK	all	low
Traffic lights	Not relevant		
Crossings (pedestrian, tram)	Not relevant		
Toll barriers, motorway junctions, tunnel access	10 m	all	low
Gradient (slope)	OK	~ all	low
Transverse gradient (banking)	OK	~ all	low

4.9.4. Regulation

Regulation competences [9]:

-Local authorities (Mayors) in built-up areas (with some exceptions)
-Road authorities outside built-up areas (countryside)
-Specificities of the major roads (consultation & the prefect's decision)

Rules / Roads	In built-up area			outside built-up area
	Area with 30 km/h	SL < 50km/h	Increase SL to 70km/h	
National Road network[1]	Prefect	Mayor	Prefect	Prefect
Classified County Roads with high traffic	Prefect	Mayor	Prefect	PCG
County Roads	Mayor	Mayor	Mayor	PCG
Communal Roads	Mayor	Mayor	Mayor	Mayor

PCG : President of the county (Conseil Général)

Each motorway company can propose regulations for particular sections on its network; the decision is then made by the police authority, who releases a legal form corresponding to the new regulation.

4.9.5. Databases - Status

NATIONAL DATABASES

A common database of the total French road network does not exist.

- **SICRE**

SICRE is a national road network information system. The system contains the nomenclature of the national road network (road names, management accounts, marks…), the descriptive data of the road network state and use (traffic, accidents…). These data are stored with the localisation system by reference points (PR).
Information is furnished by local technical departments (DIR) for the national road network not operated by private companies and by the DGR (Directorate-General of the Roads). The data updating is executed every year from data coming from the different local databases (VISAGE) managed by the DIRs and accessible by all the public services of the related ministry.

- **CONCERTO** is another database managing accident data for all the roads (not only for national road network).

There are some other dedicated national databases about railway crossing or landmarks. Last the local departments in charge of abnormal transports (DDE) generally own a

[1] Includes the motorway network operated by the private companies

database containing the specific restrictions for these transports (height, width, weight …).

PRIVATE DATABASES

Autoroutes-Trafic manages an internet platform to collect and store data from all French motorway companies (Webtr@fic database). This database includes speed limits (only for the free-flow sections), incidents, works, traffic status and travel times.
It is updated on a regular basis (about 10 times a year) for speed limits and in real time for traffic and incident data (broadcast to Autoroutes-Trafic by FTP transfer).

Each company owns other internal databases, containing static attributes like road geometry or road equipment, for an internal use only. Each company owns also an internal database for events (incidents, works and breakdowns) that is updated in real time.

REGIONAL DATABASES
As mentioned above there is no common database for regional or local road network. However, most of counties have road assets management tools. Some of them may capture data regarding speed limits and other safety attributes. They generally belongs an accident database.

COUNTY "YVELINES"

- **VISAGE**, road database

The accident spot locations on county roads are integrated in the VISAGE database to propose new road infrastructure to enhance road safety.

4.9.6. Applications – Status

National road network:
The SICRE database is hosted at SETRA on an ORACLE platform (with UNIX). It also includes a GIS based on ESRI (ARCINFO) software. The information is available to the different ministry's entities through Intranet (SIRNET) with capabilities of displaying maps on a browser.

Regional and local network: no information

ASFA

- Postgres/Postgis database
- Macromedia Flash
- Windows 2003 Servers

4.9.7. Data exchange

National road network
For data stored in the SICRE database, the newly adopted format is proprietary (FEOR). It is based on XML and should quickly be implemented in future software.

Regional and local road network
No information available

Motorways companies
Formats for data exchange between motorway companies and Autoroutes-Trafic:

- DATEX for traffic events (works, incidents…)
- XML for level of service and travel time
- MS Excel files for permanent speed limits data
- XML for temporary speed limits data

Formats for data exchange between Autoroutes-Trafic and clients (BToB):

- Permanent speed limits: ESRI Shapefile format, CSV files
- Temporary speed limits: XML

Data exchange protocol: FTP
Motorway operators push data on Autoroutes-Trafic servers.
Service providers and map providers pull data from Autoroutes-Trafic FTP server.

4.9.8. Data integration

National road network
The location system adopted for locating data on the national road network is based on reference point (PR or post). Having replaced the old system of kilometre posts, it uses fixed markers where the distance between two consequent ones is measured.
The matching between PRs and geographic database uses specific coupling data "RIU" (geocoding of PRs).
The RIU also includes data about ALERT-C locations.

Regional road network
The counties generally have kept the location referencing system from the State (PR), sometimes with adaptations. Some of them also use RIUs for map coupling but they are not always updated regularly. The major road network is also covered with ALERT-C locations.

Local road network
Generally there is no referencing system (PR or other) outside built-up areas. Information is only located through crossroads.
In built-up areas the most frequently used system is based on postal addresses. One can also mention in some cities another system based streetlights numbering.

Motorway companies
Motorway operators use Road, PR and Direction location method. Autoroutes-Trafic translates the collected data to two other location methods:

- Geographic location
- TMC location (Alert-C)

These data are stored into a geographic database (PostGres/PostGis).

4.9.9. Standards used

For data storing, data exchange and data integration, ISO standards are in use. For data models and API's, ISO standards are used as far as possible.

The BALI system is being developed according to the rules defined by the French ministry of transport (ACAI, Khefren ...) and the conclusions of European projects supported by ISO standards (TC211 19100-family as well as TC204 17572).

4.9.10. National projects

The BALI project

The Advisory Board of the Ministry of Transport ("CGPC") proposed in a report [8] the following statement: "Show how the Speed limit database operates in a pilot district (in French: *département*) (…) i*n order to validate* planned *technical process* options (collecting, processing and broadcasting data via the Internet) as well as *administrative and legal provisions*, (…). The experiment would involve organising and implementing the proposed operational device, on the scale of a district and during a sufficiently long observation period."

This is the BALI project, from the French acronym for "*BAse de données des LImites de vitesses*" (speed limit database), which started at the end of 2005 and should run until the end of 2008.

The BALI project has a dual aim:

- Analyse the technical and operational conditions and methods for building a national database (initialisation and update) of speed limits and assess investment and future management economic costs;
- Implement a demonstration / prefiguration operation on the scale of one (or several) pilot district(s) (computer development will be required), foreshadowing the management of a future national database, enabling to validate costs and partner interest (service editors, order issuers, map makers etc.). This demonstration will be led accordingly to the Europe-defined recommendations for this topic

Legal aspects, such as penal responsibility or the legal impact of data certification are not part of the project. On the other hand, the intellectual property rights of information providers, notably mapping, supplying information from a national database to third parties must be assessed.

Such a national database is indeed acknowledged to improve the reliability, and thus pertinence of in-vehicle devices providing motorists with speed limit data. We can therefore rightfully expect a positive impact on road safety.

Also, it could enable bodies in charge of setting police regulations to improve the management of speed limit choices and locations throughout networks under their responsibility.

Participants

The Directorate for Road Safety and Traffic Management (*DSCR - Direction de la Sécurité et de la Circulation Routières)* is in charge of the project's client function for the French ministry of transport

Technical Centre for Highways & Motorways (SETRA) has been entrusted with conducting and monitoring the project.

The region-level office for infrastructure in Île-de-France (West Paris Regional Laboratory - *LROP*) ensures the whole project design, due to its LAVIA project experience. Design and technical development have been outcontracted to the private sector.

Experiment area

The chosen initial experiment area is the Yvelines district. Indeed, the LAVIA project experiment area was mainly located in this district. Data is available, following the project, but the area must be widened to the whole district for more significant cover. At the end of the experiment, the latter may be extended to another district, which did not enjoy this precedence.

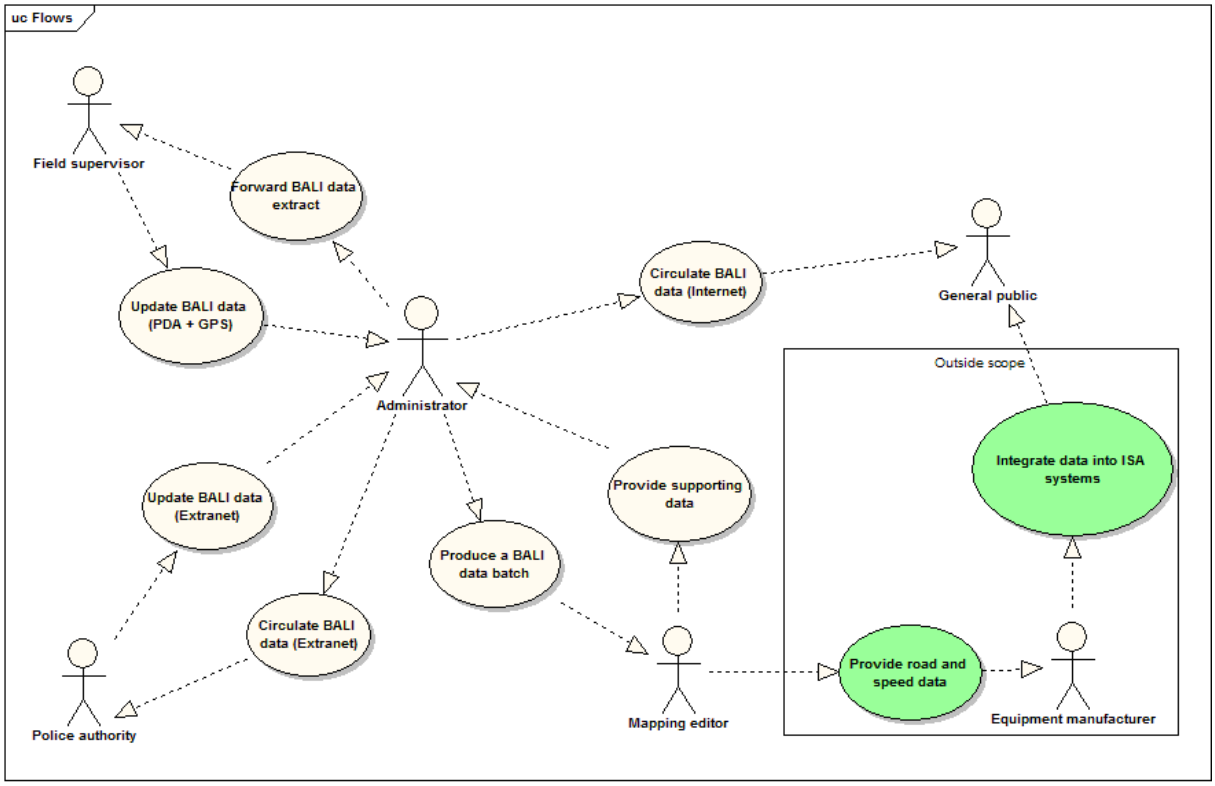


Figure 12: BALI test site setup

Project platform: The BALI project runs on 3 servers:

- an Oracle platform using UNIX,
- ArcGIS server (ESRI) platform using Windows 2003
- Web-applications for access and consultation (Tomcat and Apache).

The adopted format for data exchange and distribution [8]:

-BALI export using EuroRoads format and embedding ISO 17572-3 locations (XML)
-Public use: data displayed on Internet
-Professional use: to potentially develop service of information to the driver

ASFA Projects (French Motorway Operators)

ASFA have begun to work since 2006 on a new project about on board information on speed limits. The goal is to alert the driver through the navigation system about the current speed limit (according to where he is and when). French motorway companies are currently setting up a process to collect all speed limits on their network.

These speed limits must be divided in two categories:

Static speed limits (130, 110, 90 km/h) induced by particular road geometry.

-Data collection from the motorway companies
-Display and check of the data (internet)
-Data publishing to map providers
Autoroute-Trafic merges the data and creates a national database. The Public has access to the speed limits information on a map via the Internet (www.autoroutes.fr). The data should also be transmitted to vehicles via map providers CD-ROMs and DVDs.

Dynamic speed limits
-Real time data collection linked to special events such as road works at first (traffic regulation, weather, pollution plan …).
-Experimental broadcast towards vehicles (emulating Traffic Message Channel)
Concept experimented by two companies ASF and ATMB. Autoroutes-Trafic collects centrally temporary speed limit changes from companies and converts them into a format that can be used by external partners (converting the PK into geographic coordinates, for example).

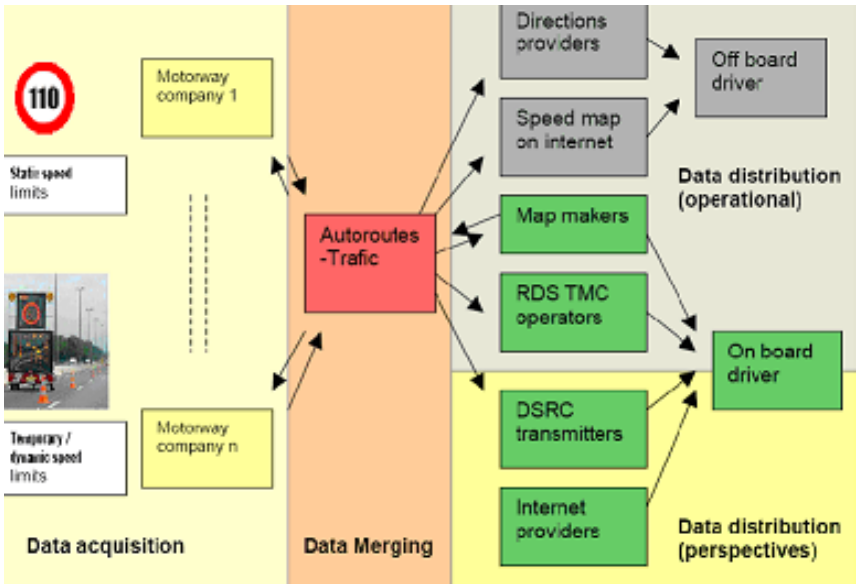


Figure 13: Global information flow diagram [10]

4.10. GERMANY

4.10.1. BAST, Federal Highway Research Institute

4.10.1.1. Road network

In Germany five road types can be distinguished: motorways, federal roads, country roads, district roads and not classified municipal roads.
The following table gives an overview about the length of each road type. Following the Federal Statistical Office of Germany there have been 231.400 km classified roads in

Germany in 2007[2]. There are no nation wide statistics about not classified municipal roads in Germany, the last nation wide estimation was published in 1997 with 395.400 km of not classified roads.[3]

Road Network	626.700 km
Motorways	12.550 km
Federal roads	40.700 km
Country roads	86.600 km
District roads	91.550 km
Not classified municipal roads	395.400 km

4.10.1.2. Organisational aspects

According to national road traffic regulations in Germany the fields of responsibility of each road traffic authority are regulated by laws of the 16 federal states. The structure and organisation can be different in each federal state.
Road traffic authorities can be categorised by

- the national government, represented by the Federal Ministry of Transport, Building and Housing
- the supreme authority, represented by the ministry of the 16 federal states
- the lower authority, represented by the administrations of 439 rural districts
- the municipal authority, represented by the administrations of about 13.000 municipals.

At the top level, the Federal Ministry for Traffic, Construction and Civil engineering is in charge of the motorways and federal roads. They maintain a database called AIS (Motorway Information System). The charge of the actual administration of the roads in charge of the federal ministry is given to the States together with a certain amount of funding to do so.

Each state has its State Authority integrated into a State Ministry. In most states, they are supported by a State Department of Road Technique. They are responsible for all classified Federal and State roads, except the county roads. For the administration of these roads the ministries have subordinate local authorities and sometimes special authorities for the highways. [3]

4.10.1.3. Regulation

[2] Bundesministerium für Verkehr, Bau und Stadtentwicklung: Längenstatistik der Straßen des überörtlichen Verkehrs. August 2007 www.bmvbs.de
[3] Der Elsner 2004. Handbuch für Straßen- und Verkehrswesen. 2003 www.elsner.de

Germany has 16 federal states. In each state a road administration is responsible for the construction of the road infrastructure. The administration for the traffic legislation (Verkehrsbehörde) decides which traffic signs and road markings have to be installed. Usually special plans with the traffic signs and road markings are the basis for the decision (produced by the road administration or by engineering companies)
There are different levels of decentralisation in the states. Usually there are three levels:

- -state ministry
- -regional governments ("Regierungspräsidien")
- -district authorities ("Kreisverwaltung") and authorities of large cities.

The federal government is responsible for the motorways and federal roads (Remark: The federal government gave the responsibility for administration of motorways and federal roads to the federal states).
The states are responsible for the state roads, the district authorities for the rural roads and the cities for the city roads and every other roads inside their city limits.

4.10.2. BAVARIA

4.10.2.1. Road network

	Bavaria
Road Network without private roads	136 873 km
Motorways Bundesautobahnen	2 376 km (20% of German network)
Highways, main and national roads federal roads (Bundes-straßen) Number prefix B	6 759 km federal roads (16% of German network)
Regional, secondary roads Country or state roads (Landes- (Staats-) straßen) Number prefix L, S or St	13 946 km state roads (16% of German network)
Number prefix K	18 792 km county/district roads (21% of German network)
Communal roads (Gemeinde-straßen)	95 000 km communal roads (24% of German network)

There is no current data about the length of private roads.

The general speed limit is in built-up areas 50 km/h, in outside built-up areas 100 km/h and the recommended speed limit is 130 km/h on motorways.

4.10.2.2. Organisational aspects

Several authorities of the maintenance, infrastructure and financial departments are involved in the road data process. The cooperation between levels and bodies is still very limited.

The OBB (Bavarian Department of Highways and Bridges in the State Ministry for the Interior) currently looks after an extensive network of freeways, federal highways and some of the rural district roads with numerous bridges and tunnels. [3]

Some States have Administrative Districts ("Bezirke") with their own District Traffic Department in charge of county roads in several counties. This level is missing in some states. At the county level, a Traffic Department is competent for county roads. Some large cities have their own City Traffic Department which is responsible for all city roads.

The lowest level is the municipality level. [3]

Class/Player	Federal ministry	State Ministry with subordinate authorities	district authorities	county authorities	municipalities
Federal highway	x[1]	x[2]			
Federal road	x[1]	x[2]		x[4]	x[5]
State road		x		x[4]	x[5]
County road			x[3]	x	x[5]
Community or municipal roads					x

[1] given to the States
[2] taken from the Federal Ministry, executed by subordinate authorities (local offices for most federal roads, the highways agencies for highways and some federal roads)
[3] only in some States
[4] in cooperation with the local authorities of the Federal Ministry
[5] some larger municipalities take over complete responsibility for their area

4.10.2.3. Safety attributes - Status

For geometry and safety attributes there is no official responsibility for digital handling of road safety attributes. There is also no common storage for safety attributes [11]. The coverage of the speed limit attribute, which is stored as a linear attribute on the road and as a POI for the road sign, is all highways in Bavaria, the EuroRoadS test bed Ansbach County in the West of Bavaria and the City of Munich, Capital of the State of Bavaria.

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Location 10-100m	Highways, subordinate road network in test areas (e.g. City of Munich)	High (1% a year)
Traffic signs	-	-	-
Lane information (number, width, divider, connectivity)	lane number	all roads	low
Traffic lights	-	-	-
Crossings (pedestrian, tram)	-	-	-
Toll barriers, motorway junctions, tunnel access	-	-	-
Gradient (slope)	In external database	Highways, federal and state roads	Very low
Transverse gradient (banking)	In external database	Highways, federal and state roads	Very low

4.10.2.4. Regulation

For traffic regulations [11] there is a complex situation in Bavaria with the State Ministry, highways agencies, construction authorities and municipalities. Due to many special agreements and exceptions to the basic organization of responsibilities there are many different options, how traffic ruling can be organized. In addition to the regulation responsibility there is still a need for hearings, consultation and installation.
In Bavaria there are overall more than 2000 municipalities, 70 districts, 25 district-free independent cities and subordinate to the State Ministry two highways agencies and 20 road construction authorities.

As an example for responsibilities the situation in the test bed of the EuroRoadS project is shown here.

The responsible players in the test area Ansbach are:

- Parts of the State Ministry: Highway agencies Northern and Southern Bavaria (HA) with subordinate highway surveillance centers of the highway agencies (HSC) and Road construction authority in Ansbach (RC) with 4 subordinate surveillance centers of the road construction authority (SC)
- District authority of Ansbach (DA)
- City of Ansbach (CA)
- Police department of Ansbach (PO)
- other communities (OTH)

In the area of the EuroRoadS test bed Ansbach the responsibility is as follows:

Class	Ruling	Installation	Hearing
Federal Highway	HA	HSC	PO
Federal Road	RC or CA (depending on location)	SC	RC, PO
State Road	RC or CA (depending on location)	SC	RC, PO
County Road	DA	DA	RC, PO
Community Road	CA	CA	PO, OTH

Table 1: Responsibilities for traffic ruling in the Ansbach area

Figure 14: Municipalities in the district of Ansbach

In other cases the responsibilities can be different. In the City of Munich the Munich municipality is responsible for ruling and installation on all roads. On all the highways in Bavaria the Highways Agency Southern Bavaria is responsible for ruling and installation alone. In both cases only the police is heard.

In terms of storage of the rulings, there is no general requirement by law or rule and also no common software or archive. The rulings are mostly handled by simple forms that are stored as PDF or filed as paper. For this forms, there are few software tools in use, most authorities use MS Word templates.

A request for a new regulation is coming from a community, privateers, companies, other public authorities or the police. The organisational workflow of traffic regulation within the organisation responsible for the ruling can be described as follows:

- check for completeness and correctness of the request
- check of the location by using maps, orthophotos or expert knowledge
- hearing of external partners: hearing and in some cases joint meeting at the place, where the order shall become operative ("Verkehrsschau")
- decision on the order, if positive →
  - predefinition of the traffic regulation
  - predefinition of traffic regulation on a map or orthophoto
  - documentation of draft traffic regulation for the hearing procedure
  - hearing of other parties concerned by the order (if necessary), e.g. companies or public bodies owning facilities next to the concerned road
  - elaboration of the final official traffic ruling paper

  - forwarding of the paper together with a visualisation of the order to the installing partner (road construction authority, road surveillance centre)
  - physical installation of the sign: the place of installation can differ slightly from the place ordered due to the specific situation at the face (bridges or trees might handicap visibility of the sign or the ground at the spot might not be suitable for installing a sign etc.)
  - notification of installation by the installing partner (via E-Mail) including justification of deviations from the order. The notification is not transferred completly in time, but at the next possible occasion the installing person will notify about all signs installed in the last day/days/week
- if negative → information of concerned parties
- filing of the paper copies by all authorities concerned with the order

4.10.2.5. Databases – Status

There are two different databases in place for Bavaria: INTREST and BaySIS. As BaySIS only covers the classified road network, INTREST is the focus of the information in the following chapters. Nevertheless a short description of the BaySIS database is included in this chapter.

- Road maintenance database BAYSIS [3]

BAYSIS is a separate road database for road maintenance purposes with a focus on the 'classified' network only. The German OKSTRA standard is used as information and data model
The road information at the state level can/might be:

- geographic representation (slope, longitudinal gradient)
- lane related data (number of lanes, single/dual carriage)
- pavements
- intersection data
- physical infrastructure (bridge, tunnel)
- technical infrastructure (stored by the infrastructure department, traffic signs, direction signs (sign post), traffic lights, variable message signs)
- legal restrictions (weight and height restrictions)
- crossings with other modes (pedestrian)

Following spatial information can/might be:

- road name, km (mile), start of road offset (construction, operation)
- In urban areas, other spatial references are used (counties, blocks, road name/house-numbers, postal codes, city-names)

At the local level (municipalities), there is no coverage in this database. At the regional level, only analogical data are collected chronologically and it is impossible to give spatial information.

- INTREST

Within the "Initiative Mobility 21" the Government of Bavaria has tendered the operation of its traffic information service to a private consortium called VIB, Traffic Information Agency Bavaria, which operates in a public-private-partnership construct.
The aim of the VIB is first of all to set up traffic information services regarding traffic load, messages and routing functionalities for the citizens, but also to offer services for the public authorities.

As an underlying component the georeferencing system INTREST ('intermodal referencing system for transport related data') has been developed. It relies on an enhanced commercial map as road database.
This system offers a central database for decentralised access and maintenance of transport related (static) data by Bavarian authorities. [1]

INTREST System [11]

- Database
  - Intermodal network
  - Feature catalogue defines all object/attributes, definition of speed limits used from EuroRoadS specification
    - Minimal object information for identification and referencing
    - Application specific data on the object not included
  - Based on enhanced commercial map
    - 'Full coverage'
    - regular updates and maintenance of basic road network and information
- Client/server architecture
  - Multi-user client/server architecture
  - Access for decentralised data maintenance
  - Open for specialised editing tools (e.g. road regulations)

Data exchange [11]

- The exchange format is 'IDF' (.csv), also converters into Shape, MapInfo, EuroRoadS and FeedMAP MDR interfaces have been/are being used
- It is filled with basic content from the commercial mapmaker (NAVTEQ)
- Additional content is being added e.g.
  - public transport network
  - touristic content (backgrounds, foot and cycling paths, POI)
  - road data (mileage system, lane etc.)
  - Pilot: speed limits for the Bavarian highways, for 1 district within EuroRoadS and for the City of Munich within FeedMAP
- There is no permanent data supply organized by local authorities → system and organisation to be pioneered by task in ROSATTE

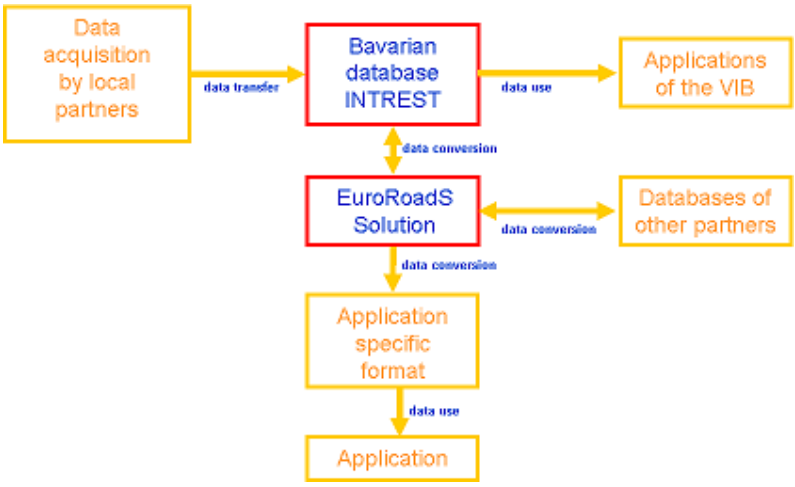


Figure 15: OBB as a part of EuroRoadS [11]

Pilot Editor Software [11]

- Data entry
  - at the office
  - in the field
- Network can be edited (insert/change/delete objects/attributes): addition of new roads, changes in road attribution etc.
- two different speed limit concepts can be edited
  - Sign-posts
    - Point objects
    - Reference to administrative order
    - Simple data model adjustable to specific needs of administration
    - Useful for mobile capture
  - Speed limits in the network
    - Line object
    - Elaborate, standardised data model (EuroRoads conform)
    - Potential use for applications (speedalert...)
- Network editor is VISUM (from PTV) and Diva Geo (from mdv)

PA storage/road database [11]

- INTREST database contains limited number of regulations already (Pilot)
- INTREST system/database can serve as central repository for safety attributes/objects (core information), but needs to be complemented by adapted decentralised SW tools which support PA workflow.
  - Core information
    - Unique ID
    - Location
    - Regulation type, attributes
    - Order number
  - Complementary information (outside central DB)
    - Regulation details, (order number, dates etc.)
    - Maintenance information of signpost etc…

4.10.2.6. Applications – Status

Several applications and tools are in use in the moment as road network editing tool, data repository and client applications as well as for road network and network attribute maintenance.

Network editing software

There are two commercial products in use for network editing, object referencing and attribute maintenance purposes: VISUM (from PTV AG) and Diva Geo (from mdv GmbH).

VISUM is an off-the-shelf product with a large, world-wide user base and an ongoing development (updates are issued within regular product update cycles as well as via service packs). DIVA Geo is also an off-the-shelf product.

INTREST Client

The INTREST server as central data repository offers a web service interface for data interchange and administrative purposes. A client application is therefore needed to extract and update data via SOAP communication to the server.
The INTREST client is used by INTREST partners and operators for maintenance of the INTREST network.

INTREST Server
The INTREST server acts as the central Bavarian repository for road network data. It was developed and is operated by PTV AG. The public traffic data is maintained in a fully compliant derivate of the INTREST server specialized on this content developed and maintained by mdv GmbH.
The INTREST server consists of two parts: a database which holds a representation of the INTREST data model for data storage and management and an application server, which provides the interface to the clients and the business logic of the functionalities offered by INTREST through direct interaction with the database.

Miscellaneous Tools
Furthermore there are several tools in use by PTV and mdv as operators of the INTREST server for data integration, data manipulation, data conversion and more. These tools are proprietary to the companies and are used in all manual, semi-automatic as well as fully automatic data maintenance tasks. These tasks include the update of the network, the generation of derivate nets of various levels of detail, bulk data integration routines, the generation of special (non-INTREST standard) data formats and so on. The tools are kept up to date according to the INTREST data model development to accommodate changes of the data format.
Also MapInfo GIS is used as tool for viewing and analysis mainly.

The applications and tools in place in Bavaria are of vital use in terms of ROSATTE objectives, yet there is still a lack of functionality concerning several aspects of ROSATTE. This necessitates the development of either new applications or the adaptation of current software. The scope of the development work needed is still to be analyzed according to the requirements formulated in ROSATTE.

4.10.2.7. Data exchange

There are several aspects of the data exchange used by the INTREST system at the Bavarian test site:

Physical file format
The INTREST data format (IDF) is used to exchange data to and from the server as well as between partners inside the VIB consortium and data end users. Because of size considerations, XML was not chosen as an exchange format, instead IDF files are human readable ASCII text representations (CSV variant) of the data according to the INTREST data model with additional metadata.

Client-server communication
According to the application components described above, communication between the INTREST data repository and the user is handled via SOAP web services offered by the INTREST server and triggered by each data request, change request, information request or other request from a client.

4.10.2.8. Data integration

Data integration into the INTREST database is only possible if all of the following conditions are met:

- A prior data request was sent to the server with request for maintenance authorization in a specified region and for specified data object type groups

- The user has the authorization to perform the changes
- The data sent back to the server is only edited according to the authorizations set
- The data set for integration is in itself a complete stand-alone network, consistent concerning primary keys and foreign key references

The activities preceding the integration are as follows:
A data request is made by the client. If the user is authorized to access the selected objects in the selected region, the server prepares an extract of the INTREST database in the interchange format. If the user requests an extract for maintenance, locks are set on the server to ensure data integrity. Furthermore, ID contingents are set for each user to allow unambiguous data integration for different editors.
The user is able to edit the data with certified editor software within the boundaries and object authorizations set by the server according to the request. After finalizing the edits, the data is sent to the server via the client in IDF format. There, the edits will be checked for consistency and integrated into the INTREST database.
The integration itself is performed by exchanging tiles of the network (the whole network is tiled into well defined "lock areas"). The data extract is compiled according to the boundaries set by the requested lock areas. At integration time, the content of the lock areas is cut and replaced by the content of the checked in edited data. During this process, many checks for data integrity and consistency are performed to assure the quality of INTREST data contents.

4.10.2.9. Standards used

As no existing standard fit all of the requirements for the INTREST use-case, the new data exchange format for INTREST (IDF) was developed. It is an open standard (documentation available for any interested party). A standard used within the INTREST system is SOAP/WSDL. SOAP is used as communication protocol between INTREST clients and server and the offered web services are defined using WSDL.

4.10.2.10. National projects

- INTREST system [1]

Within the INTREST and the EuroRoadS project the basis for acquisition and integration of road safety attributes into the Bavarian system architecture has been developed. This basis shall be brought into an operational status within ROSATTE.

4.10.3. MECKLENBURG-VORPOMMERN

4.10.3.1. Road network

Mecklenburg-Vorpommern divides its road network into
-Motorways
-Highways
-Regional
-County roads
-Communal roads

Road Network (Straßennetz gesamt)	27470 km
Motorways (Bundesautobahnen)	540 km
Highways (Bundesstraßen)	2040 km
Regional (Landesstraßen)	3250 km
Provincial roads	
County roads (Kreisstraßen)	4140 km
Communal roads (Gemeindestraßen)	17500 km
Private roads	

4.10.3.2. Organisational aspects

The motorways and highways are administered through the road construction administration in Mecklenburg-Vorpommern (M-V) on behalf of the Federal Republic of Germany. The regional roads are administrated through the road construction administration M-V.
The county roads are administered through 12 districts + 6 cities.
The communal roads are administrated through 850 municipalities.

4.10.3.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Not available		
Traffic signs	Not available		
Lane information (number, width, divider, connectivity)	Well registered	Highways and regional roads	medium
Traffic lights	Not available		
Crossings (pedestrian, tram)	Well registered	Highways and regional roads	medium

Safety Attributes	Quality	Coverage	Update frequency
Toll barriers, motorway junctions, tunnel access	Registered	Highways and regional roads	medium
Gradient (slope)	Not available		
Transverse gradient (banking)	Not available		

4.10.3.4. Regulation

For ordinances regarding speed limitations and traffic signs, the districts and municipalities are responsible.

4.10.3.5. Databases – Status

The road construction administration M-V operates a road database using ASB (nationally standardized direction of data capture). The road database covers roads which lie in the jurisdiction of the administration. The product TTSIB version 4.14 is used by the firm NOVASIB. The districts in M-V use the product TTSIB likewise predominantly in the administration of their streets, however in other versions. Statements about the road database on a municipal level could not be made.

4.10.3.6. Applications – Status

The present TTSIB consists of a monolithic software solution which scarcely supports standards. Oracle is used as a database platform. Geo references are included in the program MapInfo.

4.10.3.7. Data exchange

The TTSIB uses a DBase-based data format for the data exchange.

4.10.3.8. Data integration

Integration with foreign systems is not included. The data in the TTSIB are arranged differently and geo referenced.

4.10.3.9. Standards used

The TTSIB is in conformity with ASB.

4.10.3.10. National projects

Data in the TTSIB are exported to BISSTR (nationally standardized road database), and are brought from there to national projects (Mautierung, VEMAX, accident analyses …).

4.10.4. NORTH RHINE-WESTPHALIA

4.10.4.1. Road network

Status: 1.1.2006

For Germany see “Statistisches Bundesamt Deutschland” http://www.destatis.de

Road Network	
Motorways	2172 km (Autobahnen)
Highways, main and national roads	5051 km (Bundesstraßen)
Regional, secondary roads	12671 km (Landesstraßen)
Provincial roads	-
County roads	9796 km (Kreisstraßen)
Communal roads	108512 km (Gemeindestraßen)
Private roads	n.a.

4.10.4.2. Organisational aspects

In North Rhine-Westphalia the Ministry of Building and Transport (Ministerium für Bauen und Verkehr des Landes Nordrhein-Westfalen – short MBV, see www.mbv.nrw.de) – as the highest governmental road and traffic administrative agency - is responsible for mobility and safety on the high density road infrastructure of the German state North Rhine-Westphalia with its nearly 30 000 kilometres of roads for non-local traffic ("Autobahnen, Bundesstraßen, Landesstraßen, Kreisstraßen", i.e. state and federal highways, state and county roads). The ministry has the functional and financial public control over the regional road and traffic administrative authorities responsible for the legal, operational and maintenance tasks.

The states traffic authorities are situated at five district governments (“Bezirksregierungen”), responsible e.g. for legal ordering tasks.

On the operative level roads construction and maintenance for the federal highways and states roads in North Rhine-Westphalia is organised as a State Government Enterprise (Landesbetrieb Straßenbau NRW – short labelled “Straßen.NRW”, see www.strassen.nrw.de), tasked with planning, construction and maintenance of motorways as well as Federal and State highways. Current total length of the State's Enterprise

responsible road network is approximately 20 000 kilometres. At field level, planning, construction and operation are carried out by 11 satellite offices and 84 motorway or highway maintenance units.

Following the "Straßen- und Wegegesetz NRW" (Law for roads and ways) Straßen.nrw is responsible for the road registry ("Straßenverzeichnis") on states and county level containing e.g. legal responsibilities ("Baulast"), road classification and numbers. A special Surveying / Road Information Systems Task Centre at Straßen.nrw is responsible for the states road infrastructure documentation including road data acquisition, distribution and lifecycle management of core road information products supporting all states road administration business processes.

Counties and major towns ("kreisfreie Städte") are responsible for their county roads. Municipalities with population over 80.000 are responsible for cross-town linking road segments ("Ortsdurchfahrten"). Municipalities ("Gemeinden") are responsible for their communal roads.

4.10.4.3. Safety attributes - Status

There is no official responsibility for digital handling of road safety geometry and attributes and no common storage for safety attributes

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	m	motorways	tbd. [4]
Traffic signs	n.a.	n.a.	n.a.
Lane information (number, width, divider, connectivity)	n.a.	state and federal highways, state roads, some county roads	
Traffic lights	n.a.	n.a.	n.a.
Crossings (pedestrian, tram)	Depends on object type and road group	state and federal highways, state roads, some county roads	Depends on object type and road group
Toll barriers, motorway junctions, tunnel access	Depends on object type and road group.	State and federal highways, state roads, some county roads	Depends on object type and road group
Gradient (slope)	n.a.	n.a.	n.a.
Transverse gradient (banking)	n.a.	n.a.	n.a.

[4] NWSIB-Online-based application for the district governments ("Bezirksregierungen") under development.

4.10.4.4. Regulation

The states traffic authorities, situated at five district governments (“Bezirksregierungen”), are responsible e.g. for traffic regulation on the state highways. For counties and cities the communal traffic authorities are responsible.

4.10.4.5. Databases – Status.

On states level: Road information system called NWSIB (see www.nwsib.de).
Different systems on county and communal level.
On national level: BISStra (Bundesinformationssystem Straße)

4.10.4.6. Applications – Status

NWSIB is based on Smallworld GIS and ORACLE. OGC conform web viewer (NWSIB Online, see www.nwsib-online.nrw.de).
Applications on communal level: n.a.

4.10.4.7. Data exchange

NWSIB: OKSTRA ® CTE, OKSTRA® XML (national road data standard), GDF, CentroMap (GDF + ALERT C), GIS Data Formats

4.10.4.8. Data integration

A sustainable product management for customer-driven, well-defined and standard based digital road GDF-maps (“CentroMap”) as reference maps for the states Traffic Maintenance and Traffic Information Centre (TIC NRW) is implemented.
NWSIB-based Road Information lifecycle management (considering e.g. ISO 191xx standards) under development.

4.10.4.9. Standards used

National: OKSTRA ® (including e.g. ISO 19136/GML), development of national standard for communal road data in progress (“OKSTRA Kommunal”, see www.kim-strasse.de)
International: ISO/DIS 14825:2004 (GDF), OGC WMS, WFS, ISO 191xx
Overview on concerned international standards: see e.g. eMotion-project, Deliverable No.: D 5 ”eMOTION System – Analysis of Technical Standards”
(http://srvweb01.softeco.it/emotion/)

4.10.4.10. National projects

National Project: ”Base Road Net for Heavy Weight Regulation Online System”

4.11. HUNGARY

4.11.1. Road network

Hungary divides its road network following way:

- National road network: Motorways, main-roads, secondary roads
- municipal roads
- private roads: there is no official register of private roads

Road Network	**31178 km + 161920 km**
Motorways	858 km main carriageways + 305 km junction carriageway = 1163 km
National main-roads	6 756 km
National secondary roads	23 261 km
Communal, municipal roads	161 920 km
Private roads	n. a.

4.11.2. Organisational aspects

Regarding the classification of the road network, Hungary has two different levels of public road operators.

Policy:

- Government, Ministry of Economy and Transport, Department for Network Infrastructure. Back up organisation: Co-ordination Centre for Transport Development

National level:

- Motorway operators: There are 3 motorway companies. State Motorway Company (ÁAK), the other two is PPP concession company AKA, M6 Duna Intertoll
- The national public roads are operated by Hungarian Public Roads Co. (Magyar Közút Kht.)

Municipality level:

- There is 3175 local government.

4.11.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Location: 10 to 50 m Attributes: not always associated to regulations and signs	National roads	Medium
Traffic signs	Location 2 to 10 m Attributes: missing association to regulation	National roads	Medium
Lane information (number, width, divider, connectivity)	Lane OK Divider OK	National roads	Medium
Traffic lights	OK	National roads	Medium
Crossings (pedestrian, tram)	Complete	National roads	Medium
Toll barriers, motorway junctions, tunnel access	Fairly good	Most national roads	Low (new road or reshaping)
Gradient (slope)	Derived from geometry, medium	Most national roads	Low (new road or reshaping)
Transverse gradient (banking)	Measured, medium	Most national roads	Low (new road or reshaping)

4.11.4. Regulation

Regulations for speed limits and traffic signs are made by either:

- The public roads operator companies
- The municipal administrations.

The documentation and registers of traffic safety data and road signs are at the road operator companies. The regulation made by road operators in accordance with Police and National Transport Authority

4.11.5. Databases – Status

The Hungarian Public Roads Co. owns and maintains the National Road Data Bank. This system is design to hold information of all national public roads in Hungary and their attributes. The bank is accessible at the Ministry, the Co-ordination Centre for Transport Development, the national and county centres of the Hungarian Public Roads Co.. It contents all fields of static (not real-time) data only on the National Road Network.

Any of municipalities have their own road database. Most of these databases support on only one field of operation, like pavement management, accident analysis or traffic counts. Seen from the national point of view these will be incomplete and poorly standardized.

4.11.6. Applications – Status

The National Road Data Bank runs on Borland and ESRI platform, using Windows- and Web-applications for access. The application is designed and developed for the road operators in accordance the Hungarian standards. The program system was designed by skilled road-operators and specialists and has gone through strict controlling during realization. The system is carefully designed and developed to accommodate all kinds of technologies and basic user needs.
The Hungarian Public Roads Co. is reliable for the statistical and budget data-register of the municipal roads.

4.11.7. Data exchange

- ArcGIS - standard format
- UT – Hungarian Road Regulations (Magyar útügyi előírások)
- Other – report and exchange formats based on linear reference systems coordinates

4.11.8. Data integration

No integrations in external or customer systems. All data is stored according to a standardized feature catalogue.

4.11.9. Standards used

Harmonization to the international standards (e.g. Inspire, EuroRoads) has been going on.

4.11.10. National projects

Developments are going on the central data registering on the sectors of transport. The Co-ordination Centre for Transport Development has been building up a central

GIS that register data of different traffic sectors in accordance international standards.

Connecting to this project there is going on the reorganization of the central road databank and the digital road register of the motorways.

4.12. ICELAND

4.12.1. Road network

Road Network	
Motorways	Around zero.
Highways, main and national roads	4200 km
Regional, secondary roads	6600 km
County roads	2200 km

4.12.2. Organisational aspects

Regarding the classification of the road network, Iceland has two different levels of public authorities:

- National level, represented by The Icelandic Road Administration
- Municipal level: Represented by 79 local administrations.

4.12.3. Safety attributes - Status

The Icelandic Road Administration collects digital data on the location of traffic signs, also on the width of road. This information is updated once a year. However digital data layers (f.ex. data on speed limits) for use in navigation systems do not exist at the moment.

4.12.4. Regulation

The Icelandic Road Administration, the Ministry of Communications and the Road Traffic Directorate write regulation on traffic signs.
The Director General of the Icelandic Road Administration decides the speed limits for national roads outside urban areas. The chief of police decides the speed limits for other roads based on proposals from municipal administrations.

4.12.5. Databases - Status

The Icelandic Road Administration owns its own databank. The first version was introduced in 1984. In 1996, it was decided to buy a database solution from the Danish Road Administration. Only a few datasets were imported into this database and updated regularly. This applies for example to data on the length of road sections and to data on traffic counts. Data for many fields of operation were collected and maintained in separate databases. This applies for example to information on pavements, bridges and accidents. Last year, 2007, it was decided to develop a new system. The database is not accessible from outside the Icelandic Road Administration.

Some municipalities have their own databases. It is possible that Heidar Hallgrimsson, e-mail: heidar.hallgrimsson@reykjavik.is, can give information on the database of the city of Reykjavik.

4.12.6. Applications - Status

The road data bank of the Icelandic Road Administration runs on an Oracle platform. The data in the system are available through ESRI.

4.12.7. Data exchange

The road data bank of the Icelandic Road Administration reports on wide range of formats:

- TNE-Transport Network Engine (ESRI-based)
- Geo-database (ESRI-based)

4.12.8. Standards used

For data storing and data exchange ISO standards are in use.

4.13. IRELAND

4.13.1. Road network

Road Network	5,426 Km
Motorways	270km
Highways, main and national roads	National Primary roads: 2,747 km (includes motorway)
Regional, secondary roads	National Secondary roads: 2679 km
County roads	Estimated 90,000 - 100,000km

[3]

4.13.2. Organisational aspects

The Irish national road system is the responsibility of the National Roads Authority (NRA). The non-national roads are managed by the numerous Local Authorities across the country.

The National Road Authority, NRA is responsible for the road database of National Roads Only.
http://www.nra.ie/

Local authorities are responsible for the local road building and the maintenance, including the protection of public rights of way and speed limits. No co-ordinated databases exist for the non-national roads.

Road safety in Ireland is the responsibility of the RSA (Road Safety Authority), which was formed in September 2006. The RSA works in cooperation with many stakeholders working in the area of road safety, including the Gardai, education sector, health sector, local authorities, National Roads Authority, the media and of course the general public. The NRA remains responsible for engineering aspects of road safety.

4.13.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	10m to 50m in terms of positional accuracy, missing data from selected areas, overall a good coverage	National Routes	Very high
Traffic signs	Good	National Routes	Quarterly
Lane information (number, width, divider, connectivity)	Lane info OK Width data OK in parts	National Routes	Annually where new schemes have been built
Traffic lights			
Crossings (pedestrian, tram)			
Toll barriers, motorway junctions, tunnel access	Good, not too many to consider	All for national routes (1 toll on regional road)	Low
Gradient (slope)			
Transverse gradient (banking)			

4.13.4. Regulation

Changes to speed limits on National Roads require NRA approval

4.13.5. Databases – Status

The National Roads database currently in operation in the NRA originated with a study of the road network in the mid 1990's, The database contains information on many aspects of the national road network: however some of which would need to be verified as it may not have been updated since the original study. In 2005 the Roads Database was migrated to ESRIs ArcGIS platform to support the Authority's increasing use of GIS.

Much work has been done on speed limit data contained in the database however there are pockets throughout the country where gaps may exist. There is no restriction concerning the publication of speed limit data but work would have to be undertaken prior to release to ensure positional accuracy

A National database has been developed which stores information on all aspects of the road network. The National Road Authority, NRA, holds an asset database of signs on the national road network, including directions and information signs as well as legal restrictions and speed limits. This covered, in 2005, 20% of the network. The Authority holds also a photographic archive of the national network.

The road data includes GPS locations, but it was not linked to a link-node road network in 2005. They were not used for commercial purposes in 2005, although there is no restriction concerning the publication of speed limits data.

Sign databases contain up to 40 data points relating to each sign (eg, age, material, posts, foundations, photo, type, condition, mount height). The databases are prepared in excel format by the contractor but can be read into any geo referenced database. Sign databases are updated quarterly.

4.13.6. Applications – Status

The NRA uses the ESRI ArcMap product to perform GIS operations on the accident data on national roads.

Most of the local authorities use the MapInfo MapRoad GIS developed by the Local Government Computer Services Board (LGCSB) with OS 1:50 000 raster background maps to overlay the road data collision in their administrative area. [3]

4.13.7. Data exchange

Can exchange data in most GIS formats

4.13.8. Standards used

No standards currently being applied

4.13.9. National projects

No current projects.

4.14. ITALY

4.14.1. Road network

(directly managed by Anas S.p.A.)

Road Network	20.781,121 Km
Motorways	904.606 Km
National roads	18.850,523 Km

N.B.: the above lengths are referred to those roads directly managed by Anas and doesn't correspond to the whole Italian road network.

4.14.2. Organisational aspects

The responsibility of the road network is split into a large number of authorities.
The National Road Agency, ANAS, is the highest authority at the government level under the aegis of the Ministry of Infrastructures and Transportation. ANAS is in charge of the management of all trunk roads, motorways and ordinary highways. The other classified roads are managed by regions, provinces and municipalities. [3]
http://www.trasporti.gov.it/page/NuovoSito/site.php

4.14.3. Safety attributes - Status

Following data concern road network managed by Anas. Anas is completing data import on its Information System from a survey made on 2006. In the future data are going to be updated with daily frequency (a part from Gradient (slope) and Transverse gradient (banking).

Safety Attributes	Quality	Coverage	Update frequency
Speed limit (signs)	Location: 2 m	All roads	Last update 2006
Traffic signs	Location: 2 m	All roads	Last update 2006
Lane information (number, carriage width)	Location: 2 m	All roads	Last update 2006

Safety Attributes	Quality	Coverage	Update frequency
Traffic lights	Location: 2 m	All roads	Last update 2006
Crossings (pedestrian)	Location: 2 m	All roads	Last update 2006
Gradient (slope)	Location: 2 m	All roads	Last update 2006
Transverse gradient (banking)	Location: 2 m	All roads	Last update 2006

4.14.4. Regulation

- Regulations for speed limits and traffic signs are made by every Managing Authorities for their road network

4.14.5. Databases - Status

- **Road database [3]**

A central archive for road geometry or for technical infrastructure does not exist. Road data is kept at the operational office level, mostly on paper or blue print.
The available information is:

- geographic representation (full road project)
- lane related data (number of lanes, lane width, lane divider, single/dual carriage, divider type (legal, physical), banking (transverse gradient, super elevation), lane connectivity)
- pavements (road surface type, surface quality status)
- intersection data (priority regulation)
- physical infrastructure (bridge/tunnel, guard rails)
- technical infrastructure (traffic signs, direction signs (sign post), traffic lights, variable message signs)
- legal restrictions (legal speed limits, parking/stop restrictions, drive/turn restrictions, weight, width and height restrictions)
- crossings with other modes (pedestrian, bicycle and tram)

For these data, attributes are referenced partially with geographic coordinates where road cadastre exits.
Two different spatial reference systems are used depending upon the type of the road

- road name, km, start of road offset (construction, operation)
- road name and house numbers

In provinces, a GIS is more widely used to store and maintain road data. In 2005, the coverage from the province of Venezia was of 40% of the province road network. Some provinces had no digital data in 2005.
There is no formal procedure to obtain road data, but the non centralised system makes the data availability difficult.

4.14.6. Applications - Status

The ANAS Road Data information system runs on an Oracle platform, using Windows, and Desktop or Web applications for access. Part of the system is based on off-the-shelf applications (such as ESRI for the GIS) and part was expressly developed for ANAS.

4.14.7. Data exchange

The National Road Data Bank produces standardized products and reports on wide range of formats:

- SHP – Shapefile (ESRI-based)
- Geo-database (ESRI-based)
- GDF - Geographic Data Files (CEN TC 278)
- Other – report and exchange formats based on linear reference systems coordinates

4.14.8. Standards used

- GDF - Geographic Data Files (CEN TC 278)
- ISO-OGC
- WMS-ISO
- WFS-ISO

4.15. JAPAN

4.15.1. Road network

Most roads in Japan are under the control of the Road Law.
They are classified into expressways, national highways, prefectural roads, and municipal roads.
The rest are the public roads like forestry roads, harbour roads and so on which are under the control of laws other than the Road Law, as well as private roads owned by private enterprises or persons.

Road Network	**1,197,548 km**
Expressways	7,932 km
National Highways	54,347 km
Prefectural Roads	129,294 km
Municipal Roads	1,005,975 km
Other Roads	unknown (Note2)

	(Based on the survey in the year 2006)

Note1 The entire country of Japan is divided into forty-seven (47) prefectures, and those prefectures are subdivided into some eighteen hundred (1800) municipalities.
Note2 There are no reliable statistics. Rough estimates are 100,000 km ~300,000 km depending on the definition of the road.

4.15.2. Organisational aspects

There are several types of road authorities corresponding to the level of roads.

- Expressways
  Japan Expressway Holding and Debt Repayment Agency
  and related Expressway Companies (6)
  Expressway Public Corporations (3)
- National highways
  Regional bureaus of Ministry of Land, Infrastructure, Transport and Tourism, and etc. (10)
  Prefecture Governments (47) and Large Scale Municipalities (17)
- Prefectural roads
  Prefecture Governments (47) and Large Scale Municipalities (17)
- Municipal roads
  Municipalities (about 1800)
- Other roads
  Public offices such as forestry offices, harbour authorities and etc., and private enterprises and persons

4.15.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Attributes of road intervals	Expressways, national highways, prefectural roads and some part of municipal roads	Once per five years
Traffic signs	None		
Lane information (number, width, divider, connectivity)	Ok	Expressways, national highways, prefectural roads and some part of municipal roads	Once per five years
Traffic lights	None		

Safety Attributes	Quality	Coverage	Update frequency
Crossings (pedestrian, tram)	Railway Ok	National highways, prefectural roads and municipal roads	At construction or reshaping
	Pedestrian None Tram None		
Toll barriers, motorway junctions, tunnel access	Ok	Expressways, national highways and prefectural roads	At construction or reshaping
Gradient (slope)	Under Preparation	Expressways, national highways and prefectural roads	
Transverse gradient (banking)	None		

Note 1: This table shows the status of the DRM Database maintained by the DRM Association. (see 2.2.5)
Note 2: There might exist databases made for specific subjects and for specific districts managed by relevant organizations. But no nation wide consistent databases other than the DRM Database are open to the public.

4.15.4. Regulation

The regulations related to safety attributes are issued both by the respective road authorities and by the police of respective prefectures.

The traffic regulations such as restrictions caused by the maintenance work, to be caused by the bad weather conditions and so on are issued by the road authorities. Among them the type and the location of the restrictions related to the bad weather conditions are contained in the DRM Database (see 2.2.5).

Some traffic regulations like speed limit issued by the police are contained in the DRM Database as well. And detailed data on the traffic regulations by the police are compiled in another database called the KKD Database maintained by another public association,

Note The location reference along the roads in the KKD Database is based on the DRM Database.

4.15.5. Databases – Status

Although there are many databases of road information managed by many organizations for their respective purposes, the most important database from ROSATTE viewpoint is the National Digital Road Map Database (DRM Database) maintained by the Japan Digital Road Map Association (DRM Association).

This association was established in 1988 mainly for the purpose of creation of the national database of the road network which did not exist at that time and the database update as well under the cooperation of the Road Bureau of the then Ministry of Construction (which has been reformed into the present Ministry of Land, Infrastructure, Transport and Tourism) and the private sector including car enterprises, car device makers and map providers, who were all interested in car navigation.

The DRM Database is a database of the road network of main roads at least 3.0 m in width in Japan. The Database has been updated with the data source like detailed plans supplied by the respective public road authorities for the basic roads of expressways, national highways, and prefectural roads. As for other roads the Database has been updated basically based on the new 1:25000 or 1:10000 topographic maps issued by the national mapping agency.

The main data items are the identification code of intersections and other reference points, location of centre lines, name of roads, facilities like bridge, tunnel, and other attributes.

As for major roads, the information of the road scheduled to be open in coming two years are stored in advance. The information is to be renewed accordingly.

The updated Database is released four times a year. The release at the end of every fiscal year is a more thorough update than the other releases.

4.15.6. Applications – Status

The DRM Database is updated by the DRM Association. The updated Database is provided to the users either in the form of files in the CR-ROM, or in the form of download files through the net from the DRM Association data server.

The database system in the DRM Association works on a specific GIS engine developed for the purpose of efficient data manipulation for the DRM Database.

The users of the DRM Database are provided the basic tool software package as well as the viewer software which shows road network maps on the display screen
and pops up all the attributes in the Database.

Many systems related to roads in Japan, not only car navigation systems used by many drivers but also the systems of the road authorities and the police, are using the DRM Database as their base frame data.

For example there is a system called the “VICS” (Note) which provides real time information on traffic accident, traffic jam, road maintenance work, vacancy of parking lots and so on to drivers through car navigation systems on board. Most information is provided by the road authorities and the police who have their own information collection and provision systems, and the DRM Database is supporting those systems. Each car navigation device can realize the VICS information because it uses map data which also uses the DRM Database as the base on the other hand.

Note Vehicle Information and Communication System

4.15.7. Data exchange

There are two types of data format for the DRM Database.

One is a 256bytes fixed record length format called the "National Digital Road Map Database Format" which has been used from the initial release of the Database since 1988. The other is a recently established format called the "DRM Standard Format 21" which is more versatile, more flexible for expansion and more conformable to the ISO Standards.

The DRM Database has been provided in both formats since 2005, while some data items added recently are not able to be contained in the former format.

Both formats are open to the public.

4.15.8. Data integration

Many systems related to roads in Japan utilize and take the DRM Database into their own database as an integral component.

Examples are the VICS system for traffic condition information service (see 2.2.6), the road facility management system dealing bridges, tunnels, pavements and so on, the KKD Database of detailed traffic regulation issued by the police (see 2.2.4), and etc.

4.15.9. Standards used

The DRM Standard Format 21 is conformable to the format XGDF which has been under development by ISO/TC204/WG3.

4.15.10. National projects

Based on e-Japan Strategy II, the New IT Reformation Strategy was decided in January 2006 by the IT Strategic Headquarters in the government. The strategy, which aims to drive forward the structural reformation of information technology, includes a key IT policy of implementing systems for assisting safe driving by infrastructure-vehicle cooperation in order to make the highways of Japan among the safest in the world, and to reduce the number of traffic accident fatalities to less than 5,000 by the end of 2012.

Nationwide development of the systems are planned to begin in fiscal 2010 starting at accident-prone sites, and the deployment of on-board units compatible with the systems will be promoted.

Ministry of Land, Infrastructure, Transport and Tourism (MLIT), as one of leading ministries in the government for the promotion of ITS, has made the "Innovation Plan in the field of Land, Infrastructure, Transport and Tourism" in 2007, in which is listed up the establishment of advanced car navigation systems with full use of advanced location and mapping technology. This has been followed by the brand-new MLIT Basic Technology Development Plan announced in 2008 which includes the research, implementation and promotion of the safe drive assist system with help of geospatial technology as one of main targets of the plan.

4.16. LITHUANIA

4.16.1. Road network

Road Network	21320 km
Motorways	309 km
Highways, main and national roads	6389 km
Regional, secondary roads	14626 km
Municipality and private roads	58663 km

4.16.2. Organisational aspects

All Roads of national significance are represented by The Lithuanian road administration under the Ministry of transport and communications.
(Some general information that also might be useful is available on our web site: http://www.lra.lt/en.php/about_lra/general_information/101).

4.16.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit		Available from 2009	Yearly
Traffic signs		State Road Network	Yearly
Lane information (number, width, divider, connectivity)		State Road Network	Yearly
Traffic lights		State Road Network	Yearly
Crossings (pedestrian, tram)		State Road Network	Yearly
Toll barriers, motorway junctions, tunnel access		State Road Network	Yearly

4.16.4. Regulation

Regulations for all traffic signs on the roads national significance are made by The Lithuanian road administration or under its coordination.

4.16.5. Databases – Status

All data about State Road Network is collected in the Lithuanian Road Information System. New Lithuanian Road Information System will be available in 2009.
The main goal of the data base is to create typical information collection, modification and exchange means, which help to solve Lithuanian Road Administration tasks, fulfil obligations and control projects.
There is no National Road Databank, local roads data is collected in the databases which belong to municipalities.

4.16.6. Applications – Status

Lithuanian Road Information System will be based on ESRI software.

4.16.7. Data exchange

Data exchange is based on linear reference systems and ESRI.

4.16.8. Data integration

Lithuanian Road Information System will be integrated with other systems (TIS, PMS, etc.)

4.16.9. Standards used

Data model will support EuroRoads specifications

4.16.10. National projects

Lithuanian Road Administration is taking part in the Lithuanian Geographical Information Infrastructure (LGII) project.
LGII project is part of implementation of INSPIRE directive (Directive of European Parliament and Council, 2007/2/EC).
LGII goal is to develop an official Geographic Information Source System or infrastructure and information environment allowing the incorporation of geographic information into almost any public sector information services.

4.17. LUXEMBOURG

4.17.1. Road network

Road Network	**2875km (public roads)**
Motorways	147km
Highways, main and national roads	837km
Regional, secondary roads	1891km
Provincial roads	No
County roads	No
Communal roads	N/A
Private roads	N/A

4.17.2. Organisational aspects

Luxembourg has two different levels of public authorities:

- National level, represented by the Ministry of Public Works and the National Road Administration and the Ministry of Transport
- Municipal level, represented by 116 local administrations

4.17.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Location to 5m	Public roads	Medium
Traffic signs	N/A	N/A	N/A
Lane information (number, width, divider, connectivity)	Location to 5m	Only for motorways	Medium
Traffic lights	N/A	N/A	N/A
Crossings (pedestrian, tram)	N/A	N/A	N/A

Safety Attributes	Quality	Coverage	Update frequency
Toll barriers, motorway junctions, tunnel access	Complete	Only for motorway junctions	Medium
Gradient (slope)	N/A	N/A	N/A
Transverse gradient (banking)	N/A	N/A	N/A

4.17.4. Regulation

Regulations for speed limits and traffic signs are made by the Ministry of Transport and the Ministry of Public Works.

4.17.5. Databases - Status

Spatial database and ESRI shape files

4.17.6. Applications - Status

ESRI (ARC GIS)

4.17.7. Data exchange

Geo database

4.17.8. Data integration

No integration.

4.17.9. Standards used

N/A

4.17.10. National projects

N/A

4.18. NORWAY

4.18.1. Road network

Norway divides its road network in two different ways,

- Trunk roads and other main roads
- European/national roads, county roads, municipal roads and private roads

Road Network – total length	217 500 km
Highways, main and national roads (European Roads)	6 500 km
Regional, secondary roads (National Roads)	21 000 km
County roads	27 000 km
Municipal roads	38 500 km
Private roads (including forestry roads)	124 500 km
Motorways (minimum 4 lanes)	239 km

4.18.2. Organisational aspects

Regarding the classification and maintenance of the road network, Norway has three different levels of public authorities:

- National level, represented by The Norwegian Public Roads Administration (NPRA)
- County level, represented by 19 different county administrations
- Municipal level, represented by 430 local administrations

4.18.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Location: 10 to 50 m Attributes: not always associated to regulations and signs	All roads	High
Traffic signs	Location 2 to 10 m Attributes: missing association to regulation	European/national/ county roads	High

Safety Attributes	Quality	Coverage	Update frequency
Lane information (number, width, divider, connectivity)	Lane OK Divider OK	European/national/ county roads	Medium
Traffic lights	Ok (not that many) two competing registers	European/national/ county roads	Medium
Crossings (pedestrian, tram)	Not complete	European/national/ county roads	Medium
Toll barriers, motorway junctions, tunnel access	Fairly good	European/national/ county roads	Very low (new road or reshaping)
Gradient (slope)	Derived from geometry, medium	Most European/national roads	Very low (new road or reshaping)
Transverse gradient (banking)	Measured, medium	Most European/national roads	Low (new road or reshaping)

4.18.4. Regulation

Regulations for speed limits and traffic signs are made by either:

- The Norwegian Public Roads Administration
- The municipal Administration
- The police in a few large cities

There is no common database for the storing of documents regarding the regulations. Regulations made by NPRA are stored in a document register as pdf-files.

4.18.5. Databases - Status

NPRA owns and maintains the National Road Data Base (NRDB). This system is design to hold information of all public roads in Norway and their attributes. The data base is accessible through a common API (destined to become open source).

Many municipalities have their own road database. Most of these databases support on only one field of operation, like pavement management, accident analysis or traffic counts. Some municipalities will therefore end up with more than one road database. Seen from a national view point these will be incomplete and poorly standardized.

At the moment, the NPRA conducts talks with 20 or so municipalities to encourage them to use the NRDB instead or together with their local system.

The NRDB runs on an Oracle platform, using Windows- and Web-applications for access. The system does support many off-the shelf applications, such as ESRI through a plug-in API. The system is carefully designed and developed to accommodate all kinds of technologies ad basic user needs.

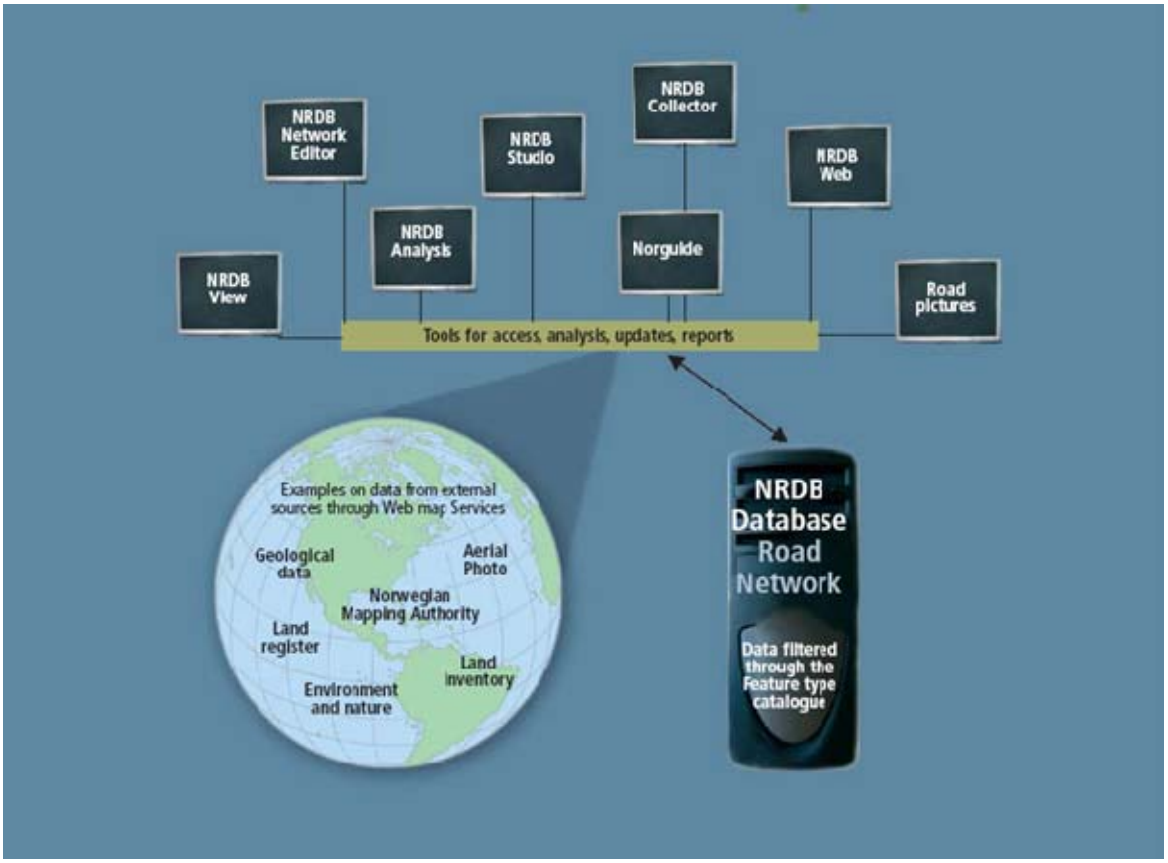
4.18.6. Applications – Status

The NRDB consists of a number of tools adapted to various tasks. Which of these to select depends on the user and user needs. Users can be employees within the Public Roads Administration, the Norwegian Mapping Authority, the Central Bureau of Statistics, counties, police, municipalities, various organizations, building contractors or others.

Other applications are based on GIS/LINE (from a Norwegian vendor) and ESRI that are already used extensively within NPRA. The tools will be used in road planning and management, but also for basic case handling.

Furthermore there are two web applications open to the general public: a route planner and a mapping tool were the public can view selected data, while authorized users can access all NRDB data with limited training.

The figure gives an overview of the different standard clients in NRDB.



Norguide is the Public Roads Administrations route planner that already can be found on the Internet with a new version planned for completion in the second half of 2008.

NRDB Web has been developed as separate versions for the general public and for authorized users. The public version will supplement Norguide with up-to-date road network data such as accident information, traffic volumes, permitted axel load and speed limits. NRDB Web for authorized users will provide easy access to all NRDB data, and the opportunity to create reports.

NRDB Studio is used to retrieve data from the data base with complex filters if needed. The user can obtain desired data to be presented on a map or in a report by specifying the relevant geographical area and data group.

NRDB Studio can be used along with the other applications or as a stand alone client. In addition to a number of standard reports, users will be able to custom design reports in accordance to their needs.

NRDB View is based on the standard GIS/LINE with an additional function that enables it to process NRDB data. Users can define the area in NRDB View, while the data used are provided by NRDB Studio.

The application can be used both for presenting and updating data. The road network can be shown with associated maps or aerial photos, and analysis can be displayed on screen or printed out.

NRDB Network Editor is also based on GIS/LINE and is a program intended for NRDB road network updating to be used by the Public Roads Administration, the Norwegian Mapping Authority and selected municipalities.

This is a specialized program based on a link/node network model. The Network Editor will be used for such tasks as adjusting road network topology and various levels of detail like road level, carriageway level and lane level.

NRDB Analysis is based on ArcGIS from ESRI but with a supplementary extension to handle data from NRDB. ArcGIS is a tool that provides for a number of advanced GIS type studies and map production, and is in particular used with site and preliminary planning as well as transportation and accessibility studies.

NRDB Data Collector is used to register objects along the road network such as traffic signs, noise barriers, ditches, manholes and crash barriers. Registration and supervision is handled in the vehicle or in the office. Data from NRDB is displayed as a simple three-dimensional image on the computer screen. Deviation and condition are continuously registered.

NRDB Video Images provides access to digital pictures of the European, national and county road network for every 20 meter stretch of roadway in both directions. This tool provides the opportunity to inspect any part of the road from the desktop, thereby reducing the need for time-consuming inspections.

4.18.7. Data exchange

The NRDB produces standardized products (maps) and reports on wide range of formats:

- TNE – Transport Network Engine (ESRI-based)
- Geo-database (ESRI-based)
- EuroRoadS – European Standard (under development)
- SOSI – a domestic standard
- Other – report and exchange formats based on linear reference systems coordinates

4.18.8. Data integration

No integrations in external or customer systems. All data is stored according to a standardized feature catalogue.

4.18.9. Standards used

For data storing, data exchange and data integration, ISO standards are in use. Also for data models and API's ISO standards are used as far as possible.

The Feature Catalogue is the standard for storing of road data. It consists of definitions and descriptions of all objects important to the administration. These can include objects the administration own, maintain or that are of significance to operation and maintenance.

The Feature Catalogue offers a standard method of managing definitions and descriptions of road objects, occurrences and conditions that affect the road network and its use. The

Feature Catalogue can be used within all the core areas in an administration and serves three main purposes:

- Makes system development faster, easier and less expensive
- Makes possible arbitrary grouping of data
- Makes flow of data possible between different systems and data bases

A new data model has been developed for storing and managing road related information, called the NRDB road network model. The National road reference system is a common reference system that covers both location and date for all road related information in Norway. In the NRDB road network model and National road reference system the following is handled:

- Road network by level (road level, carriageway level and lane level)
- Network topology and navigability in the road network
- Road network geometry on all levels
- Road routes, metering, and mile posts

Both the NRDB data model and a new link/node based reference system comply with international standards set by ISO/TC 211 and are established in collaboration with i.e. the Swedish Road Administration.

4.18.10. National projects

There are few government initiated projects for in this field. Most projects are carried out by the NPRA alone, but will benefit all authorities in the sector. At the moment the NRDB is further developed to accommodate more user needs and new systems, especially from the ITS-sector. Also, NPRA is developing a brand new document system, which will cooperate closely with the NRDB and make it possible to store regulations and all its road attributes at the same time.

The **WiseCar** research project aims at developing mobile ICT products and services for improved safety and efficiency in transport. This shall be obtained by fulfilling the following sub goals:

1. Specifying functional and technological requirement specifications for wireless infrastructure enabling automatic communications between mobile units
2. Developing common information platform for traffic data, enabling both public and private data suppliers and users
3. Developing and testing mobile ICT products, which utilise the above mentioned wireless infrastructure and information platform
4. Developing evaluation methodology for HMI, safety and efficiency effects
5. Dissemination of results by commercializing products and services, scientific and popular science publications at both a national and international level

The project period is 2007 – 2011, and the project is funded by the Norwegian Research Council and the participating partners.

WiseCar is based on three foundation pillars:

- Developing and adjusting technological platform
- Developing methodology of evaluation
- Product development

There is a need for research and test of wireless communication with and between vehicles in motion. Research needs cover open standards, capacity in regional digital net, data

security, interface with the vehicles internal systems and systems for operation and administration of communication. CALM will represent an important premise for realization of products and services which are based on dynamic updating and real time information. The project aims at developing a system for handover within the same communication medium; handover between base stations in a WLAN network. This represents an important research challenge.

A common information platform which integrates traffic data with information relevant for traffic safety will be developed. This platform should be available for both private and public partners in order to support product and service development and refinement. Several national databases will be of importance; databases which cover static information about the infrastructure, dynamic information about incidents, digital maps with point of interests, etc. Two main challenges will be to provide access to the information platform for SMEs and including data from numerous small information suppliers.

There are no complete established and common accepted methodology for testing and evaluating products and services for use in traffic. Some guidelines for evaluation of Human-Machine-Interface are used both in EU and US. These are however somewhat superficial.

Thus, there is a need for developing a methodology which covers both efficiency and traffic safety consequences of products and services. It is not sufficient for products to have a good and intuitive interface it the product on the other hand distract the driver too much and thus creates possible unsafe situations. Important evaluation measures are behavioural consequences of using the products and services, and how this behaviour affects the efficiency and traffic safety. These evaluation measures are important in order to estimate the products' market potential in early phase innovation.

A methodology which takes these considerations into account will be developed within the WiseCar project. The methodology will provide tests for HMI, efficiency and safety effects. This requires professional skills and laboratory facilities in several areas, among them:

- Traffic; performance, efficiency, etc.
- Human factors; HMI, mental capacity, risk factors and handling, etc.
- Methods for measuring and investigating behaviour

The WiseCar methodology will employ the behavioural laboratory at SINTEF and NTNU, which consists of a driving simulator for both private and heavy goods vehicles, an instrumented personal vehicle and road side traffic registering equipment.

The WiseCar project aims at developing mobile ICT products and services for improved safety and efficiency in transport. Thus, product development will be an important part of the project. We have developed a unique cooperation model for facilitating the creative process. SMEs, public bodies and research partners cooperate in this model. The SMEs are partly competitors and partly operating at different levels in the value chain.

Based on the development of the presented technological platform, numerous new and refined products and services can be realized. Product examples are:

- Driver training products
- E-learning products
- CALM products
- Location based services
- Intelligent Speed Adaptation products
- Infotainment products

It will be a main objective to include dynamic elements in existing products in addition to the development of new products. The WiseCar project is in its early stage. However, the first product has already been introduced in the Norwegian marked. This product, VIIsa, is a Norwegian ISA product.

The WiseCar project will be carried out by a Norwegian consortium consisting of partners from industry, research institutes and public sector.

In order to fulfil the main goals, WiseCar should in addition cooperate with international partners and projects. We will try to establish a close relationship with the ongoing EU projects CVIS and SAFESPOT, and will in addition establish a new consortium which aims at the applying for a new EU project based on the WiseCar model.

4.19. PORTUGAL

4.19.1. Road network

Portugal divides its road network in:
- National road network (NRN);
- Municipal roads.

According to the National Road Plan (NRP) classification, the national road network includes:
- main roads (so called, *Itinerários Principais*, IPs);
- complementary roads (so called, *Itinerários Complementares*, ICs);
- national roads (so called, *Estradas Nacionais*, ENs).

In the NRP, another category of roads is considered:
- regional roads (secondary roads, designated as *Estradas Regionais*, ERs).

Length of the national road network (km)
(as defined in the NRP)

1. National Road Network	11 300	
1.1 Main roads - IPs	2 600	2 197
1.2 Complementary roads - ICs	3 400	1 396
1.3 National roads - ENs	5 300	
Motorways **(included in 1.1 and 1.2)**	*3 300*	*2 716*
TERN- European Roads **(1.1 and 1.2)**	*2 800*	
2. Regional, secondary roads	5 100	

By the end of 2007, 2 197 km of main roads and 1 396 km of complementary roads, were under operation. This total, 3 583 km, includes 2 716 km of motorways under operation: 1

607 km are tolled motorways; 909 km are shadow tolled motorways; 200 km are free motorways.

Concerning municipal roads, we have no data available (you can try to contact the STATISTICS PORTUGAL, at the following address: www.ine.pt).

4.19.2. Organisational aspects

Concerning the national road network, a lot of changes occurred recently in the Portuguese road administration.
A new model for the organization, management and financing of the national network has been set up by the end of 2007.

This new model makes a separation between:

- regulatory and supervision functions - committed to a new public body, Institute for Road Infrastructures - InIR, IP (National Road Authority); and
- maintenance and operation functions – committed to the former existing body, Estradas de Portugal - EP, EPE (National Road Administration).

At the same time, a change had happened in the legal format and functions of the former existing body, which is since then, a concessionary company for the National Road Network, named Estradas de Portugal – EP, SA.

InIR, IP has as main functions:

- the regulation, standardisation and supervision of the national road network;
- the supervision of contract concessions and sub-concessions;
- the supervision of the National Road Plan implementation;
- acting as official representative of Government in international road sector affairs.

All these functions must be developed taking in mind the importance of assuring efficiency, equity, quality and safety of road infrastructure, with a special focus on road users.

EP, SA as referred, became a state owned corporation (100%) for the National Road Network, under the conditions of a 75 years contract concession.
The concessionary corporation will be completely financed out of State budget and no state guarantees will be allowed.
Funding will be based on toll revenues, credit loans and revenues from a fee imposed on road fuel consumption (CSR).
The concessionary had permission for holding sub-concessions and to make the promotion of the use of public-private partnerships (PPPs)

4.19.3. Safety attributes - Status

For this information, please contact Mr. João Morgado, in the following e-mail address: joao.morgado@estradasdeportugal.pt.

4.19.4. Regulation

Regulations for speed limits are made by Ministery of Interior.
Regulations for traffic signs are made by Ministery of Interior.

4.19.5. Databases – Status

- **Road database**

For database information concerning the national road network, please contact Mr. João Morgado, in the following e-mail address: joao.morgado@estradasdeportugal.pt.

Following information is available on municipality level (case of Lisbon and Porto):

Municipalities	Lisbon	Porto
- geographic representation	Shape (shape points)	centre line
- lane related data	single/dual carriage	single/dual carriage
- physical infrastructure	bridge/tunnel, guard rails	bridge/tunnel
- technical infrastructure	traffic signs, traffic lights	traffic lights

The information is stored with geographic coordinates.

For the municipality of Lisbon, a GIS database exits for the road network with a permanent updating system, including road planning information.
It is possible to apply for regular road data updates from the municipalities.

4.19.6. Applications – Status

For database information concerning the national road network, please contact Mr. João Morgado, in the following e-mail address: joao.morgado@estradasdeportugal.pt.

For information concerning Trânsito em Directo (Traffic in direct on the EPE website), please contact: Mr. António Rodrigues - antonio.rodrigues@estradasdeportugal.pt.

- Lisboa Interactiva

http://lisboainteractiva.cm-lisboa.pt/

4.19.7. Data exchange

For database information concerning the national road network, please contact Mr. João Morgado, in the following e-mail address: joao.morgado@estradasdeportugal.pt

4.19.8. Data integration

For database information concerning the national road network, please contact Mr. João Morgado, in the following e-mail address: joao.morgado@estradasdeportugal.pt

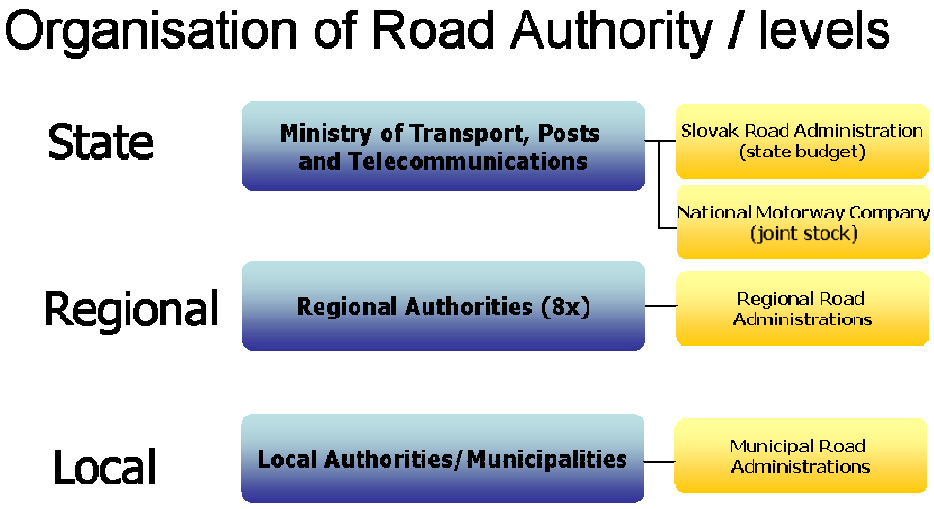
4.20. SLOVAKIA

4.20.1. Road network

Road Network **(Motorways, 1st , 2nd , 3rd class roads, urban roads)**	43 776 km INTERNATIONAL ROADS "E" 1 537 km thence: MOTORWAYS 324 km ROADS 1213 km INTERNATIONAL ROUTES "TEM" 932 km thence: MOTORWAYS 320 km ROADS 612 km
Motorways	OPERATED - D1, D2, D4 328 km FEEDERS 6 km
Highways, main and national roads	1st CLASS ROADS 3 359 km
Regional, secondary roads	2nd CLASS ROADS 3 742 km
Provincial roads	
County roads	3rd CLASS ROADS 10 399 km
Communal roads **Urban roads**	 25 942 km
Private roads	

4.20.2. Organisational aspects

The Slovak Road Administration (SSC) is an organisation established by the Ministry of Transport, Posts and Telecommunications of the Slovak Republic (MTPT) that executes for motorways, express ways, 1st, 2nd and 3rd class roads transport planning, keeping of central technical databases, central databank, technical development, including related conceptual, coordination and methodological activities, administration of 1st class roads and land owned by the Slovak Republic, including investment activity for 1st class roads. The SSC cooperates with other organisations of road administration as e.g. the National Highway Company (NDS, a.s.), Regional Road Administrations, Municipal Road Administrations.
http://www.ndsas.sk/index/index.php
http://www.ssc.sk/user/view_page.php?page_id=1170



Administration of Motorways, 1st, 2nd and 3rd class Roads:
At the State level are operated 3 087 km Roads by Slovak Road Administration and 571 km Roads by National Motorway Company. Together 14 175 km of Roads are operated by Regional Road Administrations and Municipal Road Administrations (town Bratislava and Košice).
Urban Roads:
The Urban Roads (25 942 km) are operated by Municipal Road Administrations.

4.20.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	according to regulations and traffic signs location: accuracy up to 1 m	all roads except of urban roads	very high
Traffic signs	all traffic signs types, not completed location: up to 1 m	according to the fact, that collection started in 2007, all new road sections 100% coverage the other only main traffic signs (speed limit, right of way, limits for overtaking,...)	medium

Safety Attributes	Quality	Coverage	Update frequency
Lane information (number, width, divider, connectivity)	OK, location: up to 1 m	all roads except of urban roads	very high
Traffic lights	not completed, location: up to 1 m	all roads except of urban roads	medium
Crossings (pedestrian, tram)	not completed, location: up to 1 m	all roads except of urban roads	medium
Toll barriers, motorway junctions, tunnel access	OK	all roads except of urban roads	very high
Gradient (slope)	measured by Profilograph, medium	evaluated only upon requests, few road sections	new source / technology prepared
Transverse gradient (banking)	obtained from road designs	few road sections	new source / technology prepared

4.20.4. Regulation

Regulations for speed limits and traffic signs are made by either:

- State Authorities:
  - The Ministry of Transport, Posts and Telecommunications,
  - Regional Departments of Transport and Roads,
  - Districts Departments of Transport and Roads,
  - Municipal Departments of Transport and Roads,
- The Police department

4.20.5. Databases - Status

The Slovak Road Administration, SRA, owns and maintains the National Road Data Bank. This system is design to hold information of whole Road Network in Slovakia (except urban roads) and their attributes. Accessibility depends on demand ability and the licence agreement is needed.
The data form national central database is not charged for organisations involved in Road management. There are some not cleared instructions for commercial usage of this data.

- Road database [3]

The road geometry is measured, managed and archived at the national level. Data are stored in central database (MS SQL database is used), paper maps, digital images and digital construction data at the review stage are also stored.
The following road information is available in the database:

- geographic representation (centre line, shape, slope (from x, y, z coordinates))
- lane related data (number of lanes, lane width, single/dual carriage, lane divider, divider type, lane connectivity, shoulders)
- pavements (road surface type, surface quality status, bearing capacity, evenness, skid resistance)
- intersection data (priority regulation)
- physical infrastructure (bridge/tunnel, underpasses, culverts, railway crossings, ferries, fords, guard rails)
- service infrastructure (parking places, rest areas, petrol stations, bus stops)
- technical infrastructure (traffic signs, direction signs, traffic lights, variable message signs, traffic counters, traffic cameras, meteo stations, etc.)
- legal restrictions (legal speed limit, parking/stop restrictions, drive/turn restrictions, weight, width and height restrictions
- crossings with other modes (pedestrian, bicycle, tram)

These data attributes are stored with geographic coordinates. The spatial reference system consists of representing each road crossing by a node. Accurate information position is done with a Differential Global Positioning System, DGPS. The SSC updates continuously road data using a GIS (ESRI).
Access to the road data is provided by the SSC. No special restriction for publishing speed limits.

4.20.6. Applications - Status

For central Database administration ESRI GIS is used; ArcGIS 9.2, there are several Applications (according to data types) as extensions developed and used.
The whole system is client- server architecture based. At this time web oriented projects are prepared through ArcGIS Server to launch services for users.
For other data management (data not included in central database) several separated desktop applications are used (traffic engineering, traffic accidents, etc.).

- Mapy počasia a zjazdnosti

Design by MaxMedia, powered by Weldun Advanced Application Server v 2.1

4.20.7. Data exchange

Provision of road information
According to the Act No 211/2000 Coll. of the National Council of the SR on free access to information and on amendments of certain Acts a citizen may search at SSC information the publication of which are not explicitly excluded by other regulations and that is available to SSC, i. e. that is located at SSC. It is impossible to search for information that does not yet exist (e.g. creation of new information such as analyses, summaries etc.) and draft regulations or documents with conceptual and strategical character that were not subject of the approbation procedure.

The information is made available upon application that may be delivered to the SSC. The application should indicate the type of information requested, the way of its provision.

Provision of data exchange
The National Road Data Bank provides data exchange in various formats (according to users needs and requests):
- personal geodatabase (mdb),
- shape (shp),
- xml.

Other outputs standardized and special are made in several other formats as follows: xls, pdf, dbf, jpg and others.

4.20.8. Data integration

All data are integrated in ESRI geodatabase; National Road Data Bank contains other groups of data, which are classified as auxialliary data – orthophotos (JPG + JGW) and objects from state vector digital map – boundaries of state, districts, municipalities, vegetation, water, railways (SHP).

4.20.9. Standards used

For data model, data storage, exchange and integration ISO standards are used as far as possible, e.g. the reference network of roads is compatible with EN ISO 14825 :2004 Intelligent transport systems - Geographic Data Files – Overall data specification.

4.20.10. National projects

There are projects contracted by Slovak Road Administration and approved by Ministry of Transport, Posts and Telecommunications focused on:
-further development of National Road Data Bank (web services, improvement of application functionality, new technologies for data collection and elaboration – e.g. “Mobile Road Mapping”)
-development of Management Systems (including of PMS into central database and ESRI/GIS platform)
-development of Transport Management Systems (project of National Transport Information Centre Development/Unique System of Transport Information)

4.21. SLOVENIA

4.21.1. Road network

Republic of Slovenia divides its public roads as shown in the table bellow:

Road category	Public Authorities	Length in km
Motorways	Slovene Roads Agency	505

Road category	Public Authorities	Length in km
High-speed roads	Slovene Roads Agency	74
Two-lane high-speed roads	Slovene Roads Agency	27
Main roads	Slovene Roads Agency	929
Regional roads	Slovene Roads Agency	4887
Local roads	Local administrations	13811
Public paths	Local administrations	18326

* Data for private roads are not collected.

** There is additional 12683 km of forest roads the data of which is collected by Slovenian Forest Service - see their PDF - http://www.zgs.gov.si/fileadmin/zgs/main/img/PDF/PDF_BROSURE/Brosura_ANGL.pdf

4.21.2. Organisational aspects

There are two levels of public authorities for roads in Slovenia:

- National level (covering all motorways, highways, main and regional roads), represented by Slovene Roads Agency ("Direkcija RS za ceste" - see http://www.dc.gov.si/en/roads)

- Municipial level (covering all local roads and public paths), represented by 102 municipalities or local administrations.

4.21.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update Frequency
Speed Limit	Location accuracy: +/-100 to 150 m Attributes: not always associated to regulations and signs	National level roads only	Medium
Traffic Signs	Location accuracy: +/-10 to 15 m	National level roads only	Medium

Safety Attributes	Quality	Coverage	Update Frequency
Lane info (number, width, divider, connectivity)	Lane OK Devider OK	National level roads only	High
Traffic Lights	Medium, Not complete	National level roads only	Medium
Crossings (pedestrians, tram)	OK, Not complete	National level roads only	Medium
Toll barriers, motorways junctions, tunnel access	OK	National level roads only	Low (new road or reshaping)
Gradients (slope)	Derived from geometry, medium	National level roads only	Low (new road or reshaping)
Traverse gradient	Measured, medium	National level roads only	Low (new road or reshaping)

4.21.4. Regulation

Regulation for speed limits is made by national level or local level administration, depending on the road category.

4.21.5. Databases - Status

Presently - which might change if the new proposed law dividing national level into dozen of new regions shall be accepted by the majority in the parliament and the Slovene Roads Agency shall be dismantled - Slovene Roads Agency owns and maintains the **National Roads Data Bank**.

Municipalities have their own road databases for their own purposes, and partially because they are obliged by the present law that each and all of the 102 municipalities must send each year a report to the Slovene Roads Agency.

4.21.6. Applications - Status

The National Roads Data Bank at the Slovene Roads Agency runs on an Oracle platform to manage the records, which are being collected from its beginning in 1974 onwards - see http://www.dc.gov.si/en/roads. In recent years Oracle database serves also GIS applications, desktop ones, and the intrAnet map application for end-users, alongside with the video-almanach application which enables end-users to view all national roads videotaped from the cars driving all over the country, which is made every second year in the recent years.

4.21.7. Data exchange

Different reports are made separately for attributive-only data, on one hand, and, for data in GIS formats.

4.21.8. Data integration

Attributive-only data, on one hand, and, data in GIS formats are in the process of integration.

4.21.9. Standards used

ISO standards are used.

4.21.10. National projects

There is a cross-sector project with Slovene Roads Agency as one of the partners, carried out by the Slovene Surveying and Mapping Authority, called "Consolidated Cadastre of Public Infrastructure" where GIS data from all kinds of public infrastructure (railways, roads, airports, electricity, telecomunication, etc) is being put in one place in order to be easier to access by the commercial and non-commercial end-users.

4.22. SWEDEN

4.22.1. Road network

The database holds a common road network that can be divided into

- State roads
- Municipal roads
- Private roads
- Forestry roads
- Bicycle paths

Road Network	576 470 km
Motorways	1 840 km
Highways, main and national roads	17 010 km
County, secondary roads	11 390 km
County, tertiary roads	69 600 km
Municipal roads	42 030 km
Private roads	230 810 km

Forestry roads	203 420 km
Bicycle paths ("build up phase")	370 km

4.22.2. Organisational aspects

The Swedish Road Administration (SRA) is the national authority for state roads and with a sectorial responsibility for the road transport system. SRA manages the National Road Data Base (NVDB). The responsibility for planning, construction, operation, and maintenance of the different parts of the road network is divided

- State roads - SRA.
- Municipal roads – different municipalities
- Private roads – private road associations
- Forestry roads – forestry industry
- Bicycle paths – SRA and the different municipalities

4.22.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	The information is based on existing traffic regulations for state roads and municipal roads. Location under 10m	All roads	Very high
Traffic signs	Different features based on traffic regulations e.g. high restriction, turn restriction,.. Location under 10m	Partly based on quality classes	High
Lane information (number, width, divider(implicit))	Could be derived from the Pavement Management System and NVDB Poor quality	State roads	Medium
Traffic lights	Not complete Location under 10m	Partly for state roads	Medium

Safety Attributes	Quality	Coverage	Update frequency
Motorway junctions, tunnel access	Complete. Motorway junctions are given unique numbers Location under 10m	All roads	Low
Gradient (slope)	± 0,4 % Location under 10m, where exists	State roads	Low
Transverse gradient (banking)	± 0,4 %, only one direction Location under 10m, where exists	State roads	Low

4.22.4. Regulation

Traffic regulations are decided by either

- Municipal authorities
- County administrative boards
- SRA
- Local Swedish police authorities

4.22.5. Databases - Status

The Swedish national road database (NVDB) is a complete road database for Sweden. That means all roads, streets, ferry routes, and other routes or places used by motorized vehicles (snow mobiles excluded) are included. It is even possible to enter bicycle paths for those that so choose. Paths created for pedestrians are not included in the NVDB. There are varying requirements for the level of quality of a road's attributes based on the road's perceived level of importance from a general transportation perspective.

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. It also provides an effective channel for data exchange between different organizations. The NVDB is available to both commercial and public organizations.

The principle construction of the NVDB consists of two parts. The first part, the road network, describes the geometry and topology of the network. The second part, the connected features, describes the road's properties e.g. information on the road name, road's width, speed limit.

The Swedish NVDB is constructed at the carriageway level.

Information available in the database:
- geographic representation road network (centre line)
- pavements (road surface type, surface quality status (only for governmental roads))
- intersection data (simple intersection (single node), complex intersection (several nodes), roundabouts), roundabouts smaller the 20 meters (single node with a mention that it is a roundabout), roundabouts bigger then 20 meters (several nodes), special coding for ferry connections,…
- physical infrastructure (bridge, tunnel, guard rails (only for governmental roads))
- technical infrastructure (traffic signs (incomplete) and direction signs (incomplete))
- traffic regulations

Each information is stored in the database with geographic coordinates using the grid projection SWEREF 99 TM.

4.22.6. Applications – Status

The National Road Database (NVDB) runs on an SQL Server platform, using Windows- and Web-applications for access.

The Swedish Road Administration has chosen to work with TNE© when analyzing and presenting data. TNE© supports many off-the shelf applications, such as ESRI.

The database is built on existing national (SS 63 70 0x) and international (ISO) standards.

4.22.7. Data exchange

The NVDB-system handles standardized products and reports on wide range of formats:
- SS 63 70 0x – domestic standards based on ISO 191xx and XML
- TNE – Transport Network Engine (ESRI-based)
- Personal Geodatabase (ESRI-based)
- Shape (ESRI)
- Other – system related exchange formats
- EuroRoadS – European Standard (under development)

4.22.8. Data integration

Data integration with external systems is performed using the domestic standards (SS 63 70 0x). Data integration with internal systems is performed using XML-based services.

4.22.9. Standards used

For data storing, data exchange and data integration, domestic standards (SS 63 70 0x) are in use. Also for data models and services standards are used as far as possible.

4.22.10. National projects

There are a number of ongoing projects in this field. The projects range from in-house projects within SRA via projects in cooperation with other authorities in the sector to projects in cooperation with the industry sector.

RDT
The Swedish Road Administration has been commissioned by the Government to set up a nationwide database for Swedish traffic regulations (RDT). By the mid of the year 2010 a complete database is to be in place where users of the information always will be able to access current data.
The role of the Swedish Road Administration is to develop and administrate RDT and support system users such as municipal authorities, county administrative boards and local Swedish police authorities.
The technical system for the RDT will be built up in stages. During the initial stage the RDT will receive traffic regulations in the form of documents publicly notified on the Internet. In the second stage it is planed to include regulations from authorities using commercial systems producing traffic regulations in a structured manner (XML documents). This will enable a automatic interpretation of the information to traffic rules, meaning that it can be stored in NVDB and used as IT support in vehicles at a later stage (see BEATA).

BEATA
BEATA is a system with purpose to derive information regarding traffic regulations from the RDT database and make it available for users of NVDB. The system is planned to be operational at the end of 2008.

SOLVI (Swedish IVSS Intelligent Vehicle Safety Systems programme)
SOLVI stands for Safe Operations of Large Vehicles Initiative and it is part of the Swedish IVSS-programme. In SOLVI, ADAS applications and safe navigation designed for heavy vehicles will be developed and tested. Truck attributes and dynamic data will be collected and used in these applications. The overall goal is to investigate if and how these kinds of systems can contribute to safer and more efficient transportation.

VV Geoportal
VV Geoportal is an implementation of the EU requirements associated with the INSPIRE directive stating that road authorities shall implement services (discover, view, down load, etc.) for transportation data.

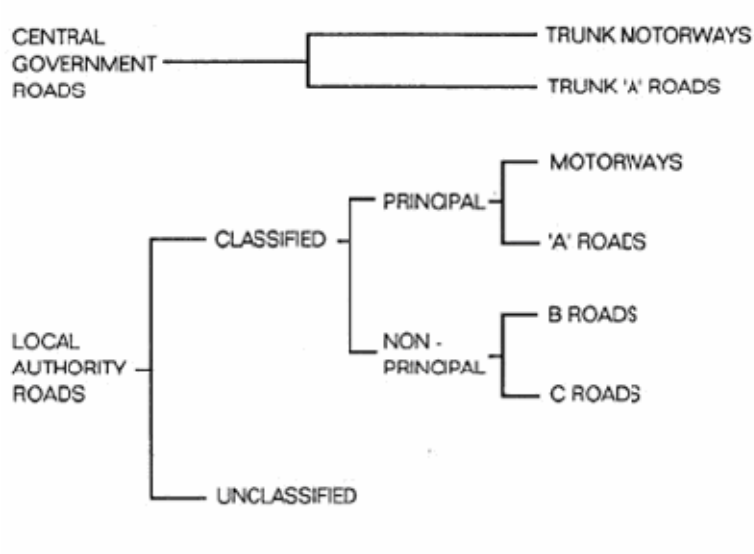
4.23. UNITED KINGDOM

Highways Agency in England has not been able to contribute to the state-of-the-art due to lack of resources.

Each country of the United Kingdom has its own separate road administration. [3]

In England, Scotland and Wales, the Highway Authorities for trunk roads and motorways are the Highways Agency, Transport Scotland and Transport Wales respectively. All other roads in Great Britain (England, Scotland and Wales), A, B roads and minor roads are

maintained by local authorities. An executive agency of the Regional Development Department, called the Roads Service has the responsibility for Northern Ireland.
In parts where there is a two tier system (County and District), some or all powers may be devolved to the lower authority, particularly urban roads. Additionally, highways management may be contracted out to a private company (although the Highway Authority retains legal responsibility for this service). Neighbouring authorities may also have a formal agreement to manage their roads together.



England:
In England, the Trunk motorways and primary A roads, which, are the responsibility of the Highways Agency, which acts on behalf of the Secretary of State for Transport. The agency has the responsibility for maintaining the 7754 km of the road network, divided into fourteen operational areas.
Non-trunk roads are the responsibility of individual Authorities, in most cases the highest level of local authority (County Council, Metropolitan Borough Council, London Borough Council, or Unitary Authority). Each Local Authority has its own road data responsibility for the maintenance and the construction of the street on their territory.

Northern Ireland:
In Northern Ireland, the Roads Service acts on behalf of the Secretary of State for Northern Ireland and is responsible for the management of the whole road network, including the Trunk Roads and Motorways (of which there are very few in the Province). The Service is responsible for over 24,800 km of public roads together with footways, bridges, street lights and public car parks.

Scotland and Wales:
Trunk roads and motorways in Scotland and Wales are the responsibility of Transport Scotland and Transport Wales while local roads are managed by local authorities; those in Wales by the Welsh Assembly Government and in Scotland by the Scottish Executive. The Roads Network Management (RNM) division under the responsibility of Transport Wales also operates, manages and maintains the network infrastructure including structures, lighting, signals and level crossings.
In both Scotland and Wales there is a system of single tier local authorities with local road responsibility.
http://www.transportscotland.gov.uk/
http://new.wales.gov.uk/

4.23.1. NORTHERN IRELAND

4.23.1.1. Road network

Road Network	Northern Ireland (km)
Motorways	133
Highways, main and national roads	1,093 Trunk road 'A' Class Roads
Regional, secondary roads	2,273 other 'A' Class Non-Trunk Roads
Provincial roads	2,889 'B' Class Roads
County roads	4,705 'C' Class Roads
Communal roads	15,138 Unclassified Roads
Private roads	Not recorded

4.23.1.2. Organisational aspects

As an executive agency of the Department for Regional Development, Roads Service has the responsibility for the development, maintenance and management of all public roads in Northern Ireland, regardless of class or function. Roads Service currently is responsible for over 25,100 km of public roads together with footways, bridges, streetlights and public car parks.
http://www.roadsni.gov.uk/

4.23.1.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Location related to legal order	All roads	Very High
Traffic signs	Mainly good	All roads	Medium
Lane information (number, width, divider, connectivity)	Lane & Direction - No, Divider - OK	All roads	Medium

Safety Attributes	Quality	Coverage	Update frequency
Traffic lights	Controlled centrally for whole of NI	All roads	Very High
Crossings (pedestrian, tram)		All roads	Medium
Toll barriers, motorway junctions, tunnel access		All roads	Low
Gradient (slope)	No		
Transverse gradient (banking)	No		

We have had problems completing the above table, as it was not clear to us exactly what was required. Are we to report on information held on computer systems and databases or whether it is just what is available on GIS – we have assumed it is the former.

The position at Roads Service is that centre-line data for about 80% of all roads in Northern Ireland is now available on GIS systems and the rest should be complete shortly. We are about to initiate a lot of work combining the road line data with our client maintenance and other databases to have it available eventually on GIS layers. Some work has already been completed or underway.

4.23.1.4. Regulation

Regulations for speed limits and traffic signs are made by Roads Service acting on behalf of the Northern Ireland Department for Regional Development

4.23.1.5. Databases – Status

Most of the data for management and maintenance of the public road network is owned and maintained by Roads Service on its Client Database, The Atlas version of Highways by EXOR and this will be moving shortly to a web based system. There are studies underway to merge the data contained within it onto the GIS system. There are other stand-alone databases contained some operations such as traffic signals that have yet to be merged.

- Road data

The following information is available in the GIS and Highways databases:

- Geographic representation (centre line, shape)
- Lane related data
- Pavements
- Intersection data

- Physical infrastructure (bridge/tunnel)
- Technical infrastructure (utility service details)
- Legal restrictions (parking/stop restrictions)
- Crossings with other modes (bicycle)
- Traffic Collision Data
- Traffic Counts
- Winter Gritting Routes
- Street Lighting
- Traffic Calming Schemes
- EuroRAP Road Protection Scores and Risk Rate mapping

These data attributes and their corresponding geographic coordinates are stored on a web-based GIS developed by GDC and Pitney Bowes MapInfo. Formal procedures to access road data are being developed. A rolling 5-year programme to update the highway inventory on the system should be completed by August 2008.

Road information (road network and road attributes) is stored in the database with geographic coordinates and road stretch reference numbers. The road links are described with road name, km, and start of road offset. Currently, there is no handling fee to get the road data.

Restrictions to publish legal speed limit are governed by the Northern Ireland Traffic Signs Regulations. Roads Service currently only has a duty to maintain the signage on the highway. Any databases are for internal management of the signs and are currently not on a GIS system therefore there are little OS grid positions, location and direction of limits.

4.23.1.6. Applications – Status

The Client database runs on an Oracle platform, using Windows and shortly web applications to access. The system does not support many off-the-shelf applications as it was originally developed in-house to meet Roads Service's specific needs and further developed when required by EXOR

4.23.1.7. Data exchange

The system produces many standardised reports on the condition of and other information on the network.

4.23.1.8. Data integration

There is no integration with external or customer systems. All data is recorded against standardised terminology.

4.23.1.9. Standards used

ISO standards used as far as possible, although there may be some Imperial measurements used in comment areas.

4.23.1.10. National projects

As stated earlier, there are moves actively underway to integrate as much information as possible form the Client database into GIS systems and as well as developments to accommodate more user needs such as ITS and EuroRAP. New public web site will contain much more 'live' information such as traffic flows and roadworks. Some consideration is being given to the possibility of making speed limits available digitally.

4.23.2. WALES

4.23.2.1. Road network

Road Network	**34062 All roads**
Motorways	133 Motorways
Highways, main and national roads	1578 A trunk Roads
Regional, secondary roads	
Provincial roads	2736 A non trunk roads
County roads	12765 B and C roads
Communal roads	16851 unclassified roads
Private roads	

4.23.2.2. Organisational aspects

The Welsh Assembly Government manages the motorways and A trunk roads in Wales, All other roads are managed by the Local Authorities.

4.23.2.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit		No available data	
Traffic signs		No available data	

Safety Attributes	Quality	Coverage	Update frequency
Lane information (number, width, divider, connectivity)		No available data	
Traffic lights		No available data	
Crossings (pedestrian, tram)		No available data	
Toll barriers, motorway junctions, tunnel access		No available data	
Gradient (slope)	From scanner survey	Motorway and trunk roads	2 years
Transverse gradient (banking)	From scanner survey	Motorway and trunk roads	2 years

4.23.2.4. Databases – Status

The following information is available in the database:
- geographic representation (centre line, shape)
- physical infrastructure (bridge/tunnel)
- road construction

Data for motorways and trunk roads is held on TWIS (Transport Wales Information System) and structures on SMS Structures Management System).

TWIS is a bespoke web based system displaying road data, maintenance data and collision data on Ordinance Survey mapping, it is not a true GIS system. The data is updated regularly as and when new data becomes available.

SMS is a web delivered commercial programme customised for Welsh Assembly use. The data is continuously updated in line with the structure inspection programme.

4.23.2.5. Applications – Status

TWIS is a bespoke system overlaying data using OS maps not a true GIS system.
SMS is a customised web delivered commercial system again using OS maps but not a true GIS.

4.23.2.6. National projects

TWIS is under constant development with the ultimate goal of creating a hub connecting the existing and proposed disparate datasets.

4.23.3. SCOTLAND

4.23.3.1. Road network

Road Network	54 858 km
Motorways	559 km
Highways, main and national roads (A class roads)	10 271 km
Regional, secondary roads (B and C class roads)	17 878 km
Unclassified Roads	26 150 km
Provincial roads	-
County roads	-
Communal roads	-
Private roads	-

4.23.3.2. Organisational aspects

Regarding the classification of the road network, Scotland has three different levels of public authorities:
The road network is the shared responsibility of Central Government (Scottish Ministers) and Local Authorities. The motorway and trunk road network are the Scottish Ministers responsibility and is delivered through a National Transport Agency, Transport Scotland.

4.23.3.3. Safety attributes - Status

Safety Attributes	Quality	Coverage	Update frequency
Speed limit	Good Sign Posted, in line with National Standards	All trunk, single and dual carriageway roads	Regular
Traffic signs	Good Sign Posted, in line with National Standards	All roads	Regular
Lane information (number, width, divider, connectivity)	Good Marked in line with National Standards	All motorways and A class roads. Some B and C class roads	Regular

Safety Attributes	Quality	Coverage	Update frequency
Traffic lights	Good Marked in line with National Standards	All roads	Regular
Crossings (pedestrian, tram)	Fairly Good	All roads	Regular
Toll barriers, motorway junctions, tunnel access	Good	Motorways and A class roads	Regular
Gradient (slope)	Good for motorways and A class roads	Motorways and A class roads	Regular
Transverse gradient (banking)	Good for motorways and A class roads	Motorways and A class roads	Regular

4.23.3.4. Regulation

Regulations for speed limits and traffic signs are made by either:

- Transport Scotland, in line with UK legislation
- Local Authorities, in line with UK legislation

4.23.3.5. Databases – Status

Transport Scotland uses the Scottish Executive Road Information System (SERIS) as its Asset Management System. This system holds information about the entire Trunk Road Network for Scotland. It is Transport Scotland's road information system containing data on the physical characteristics, condition of the trunk road network and accidents. SERIS is comprised of many modules, including a Pavement Management System (PMS), Routine Maintenance Management System (RMMS), Structures Management System (SMS), and an Accident Management System (AMS). Local Authorities operate their own PMS and RMMS systems.

Traffic count information is a part of the Scottish Roads Traffic Database (SRTDb), Transport Scotland's database of traffic and traffic-related data and is a system which collects, validates, stores and disseminates traffic count data and related outputs for the trunk road network in Scotland. Traffic count information is a part of the Scottish Roads Traffic Database (SRTDb), Transport Scotland's database of traffic and traffic-related data and is a system which collects, validates, stores and disseminates traffic count data and related outputs for the trunk road network in Scotland.

The Trunk Road Bridge Database (TRBDb) is a computer based bridge management system containing an inventory of information on all trunk road structures. This is currently being incorporated into the new SMS. This will also include further performance measures, a whole life costing tool, prediction models, and a decision support tool for short and long-term AM planning.

Scotland is part of a euro-regional group called Streetwise which incorporates the national administrations of the UK and ROI (http://www.streetwise-info.org). STREETWISE is one of 8 or so Euro-Regional projects deploying traffic control and travel information facilities on the Trans European Road Network (TERN). STREETWISE is part of the EU funded TEMPO programme, which aims to stimulate a harmonised and synchronised deployment of Intelligent Transport Systems and services on the TERN. The current stream of available funding from the EU is under a banner called "EASYWAY" and effectively if a Euro-region develops or implements work under an agreed heading of EASYWAY, funding is available from Europe. One of these headings is sharing of data to better manage cross-border travel. The system being implemented within STREETWISE wise is called Datex2 and this will enable Traffic Scotland to share data with cross border agencies in an agreed and efficient manner.

4.23.3.6. Applications – Status

SERIS was developed in partnership with WDM. SERIS runs on a SQL Server 2005, SRTDb runs on a SQL Server 2000, and TRBDb runs on INGRES. We use ESRI for GIS software and xml to go between RMMS and CCMS.

4.23.3.7. Data exchange

Drivers on Scotland's trunk roads are provided with up-to-the-minute information about road conditions by Traffic Scotland (formerly NADICS). Traffic Scotland manages Scotland's intelligent transport system, which provides a continuous service to the public. Its key functional areas are monitoring, controlling and informing road users.

The Contract Control and Management System (CCMS) is a computer-based financial management system supplied and operated by the Trunk Road Operating Companies (OCs) who are contracted to manage and maintain the Trunk Road Network under 5 year term maintenance contracts. The system gives everyone working on the contract, including Transport Scotland and an independent Performance Audit Group (PAG), access to information about how operations and works contracts are being managed and where money is being spent.

The Routine Maintenance Management System (RMMS) is a computer-based system operated by the OC, to record and report on details of the network, including where it has been inspected and routinely maintained. RMMS also links to the CCMS and is accessible by Transport Scotland and PAG.

Datex2 is a system being implemented within STREETWISE and will enable Traffic Scotland to share data with cross border agencies in an agreed and efficient manner

Traffic Scotland will also have a database of all of the infrastructure on the network, e.g. variable message signs, CCTV etc.

4.23.3.8. Standards used

For data storing and data exchange ISO standards are in use. All systems storing data use the latest software technology.

4.23.3.9. National projects

Transport Scotland is developing and integrating new modules into SERIS, such as SMS.

Transport Scotland is also benchmarking asset management systems through involvement with the World Road Association (PIARC).

Transport Scotland is developing more national projects through the UK Roads Liaison Group and national benchmarking clubs.