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

D2.2 - Implementations of tools for demonstration of data maintenance and access in different test beds

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Abstract: Six different test sites integrate their data maintenance operations with ROSATTE data exchange mechanisms. The present report describes the different data maintenance implementations by describing the safety features maintained, the specific workflow, the technical architecture as well as the user interface.

Keyword list: Road Safety attributes, Road Safety features, digital maps, data exchange, database, data store, public/private cooperation, data maintenance

[1] This is either: Public, restricted to other programme participants, restricted to a group specified by the consortium, confidential

Document Control Sheet

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Executive Summary

In ROSATTE a harmonised data supply from public authorities (those enacting authorities, road network managers or alike) to information providers (i.e. third parties integrating safety related content in digital maps) for safety related road data shall be conceived and trialled [1,3]. During the project test phase, this data supply is implemented between six different test beds for data maintenance operations and two commercial map makers.

The test site for data maintenance operations all rely on operations or at least trials for road data maintenance established prior to the ROSATTE project. Hence they come from very different contexts, but all follow conceptually the high-level specification created in [2].

- Test Site France ASFA (operated by ASFA): A motorway operator integrates the ROSATTE data supply with its operations with regards to temporary (road construction), variable (dynamic signage) as well as static speed limits;
- Test Site France Bali (operated by LROP): In the French Departement Yveline a large scale field test for creating and maintaining a central speed limit data base is ongoing on behalf of the French Ministry for Transport. The operations are tapped to deliver data according to the ROSATTE scheme;
- Test Site Bavaria (operated by OBB): Linked to the Bavarian 'Intermodal Referencing System for Transport related data' (INTREST), a prototype for a centralised road safety attribute data base is created and trialled in several regions, which provide data via ROSATTE data exchange mechanisms;
- Test Site Flanders (operated by AWV): In this region a traffic sign inventory has been created which is integrated with ROSATTE.
- Test Site Norway (operated by NPRA and SRA): In this cross-border test site, two adjacent border regions which collect regularly updates on safety features in the respective national road databases are used as test data supply to ROSATTE coming from their normal operations.
- Test Site London (operated by Transport for London): A speed limit data base is in creation sourced from field surveys of sign posts, which is to be integrated with a larger road data store including accident statistics. This data source is supplying data via ROSATTE exchange.

These operations are described in the following report, with regards to

- The scope of safety features (speed limits, warning signs etc.)
- The workflow of the data maintenance operations
- The technical architecture
- The User interface

While these systems cannot be described exhaustively, the short description shall provide insight on the diversity of data maintenance activities (either fully operational or in trial phase) which are foreseen as providers of safety related data via the ROSATTE data exchange mechanism to improve safety related digital road content in Europe.

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1. Introduction

1.1 ROSATTE Contractual References

ROSATTE is a STREP submitted for the call FP7-ICT-2007-1. The acronym 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 and scope

The ROSATTE project intends to develop the enabling infrastructure and supporting tools that will ensure Europe-wide access to safety road attributes with a focus on incremental updates. This infrastructure is intended to facilitate a continuous supply of such data at a high and steady level of quality from the parties that administer and control the attributes to third parties, and thereby to help maintain near-permanent correctness of such data for use in road safety applications. In addition, the infrastructure will serve administrative internal functions at data providers, which will in turn be beneficial for the system of safety road attributes as a whole. Improved and more extended availability of up-to-date safety road attributes is expected to result in improved and extended functionality of driving assistance systems, and thereby to contribute to more efficient road operations and increased traffic safety.

The flow of data that is addressed in ROSATTE may be seen as a data chain, which is depicted in the upper part of Figure 1. Public road administrations and other road operators, which are seen as the most efficient and reliable source for update information, are at the beginning of the chain. Processes to define, install and change safety road attributes, like issuing of regulations and work orders, are not included in the scope of the project. ROSATTE looks only at the outcome of these processes, and especially at incremental changes in attributes. For this, it will, on the data provider side, study database storage of attribute information and update mechanisms, and methods for extracting the information, both complete data sets and incremental updates.

The extracted information is the input for the data exchange infrastructure. On the user side, the project will study data integration, especially at providers of digital map databases for navigation systems and other driving assistance applications. The data chain from map providers to in-vehicle systems, which is depicted in the lower part of **Figure 1,** is not part of the project scope. Of this chain, especially the part representing incremental updating of the in-vehicle map database at regular, short intervals, will benefit from data

chain that ROSATTE intends to realize while at the same time providing a rationale for the project.

Setting up this chain has a clear benefit for public authorities and road operators through its potential contribution to improving road traffic safety, while giving the industry the opportunity to improve the quality of map databases used in in-vehicle systems, and enabling new safety applications that need map data with Europe-wide complete and up-to-date coverage of road safety attributes.

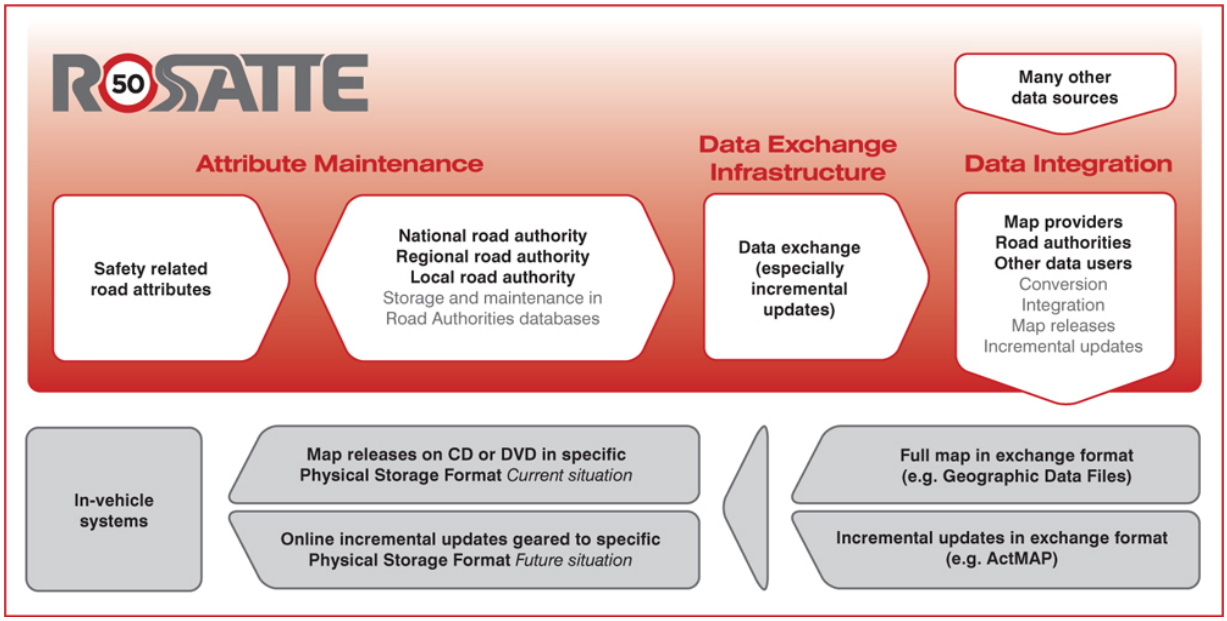


Figure 1: The scope of the ROSATTE project

1.3 ROSATTE Project deliverables available to date

Since the start of the ROSATTE project in 2008, a number of reports have been finalized. Those reports labeled for public dissemination are available via the ROSATTE project website (www.rosatte.eu). The table below gives a comprehensive overview of available reports to date.

D1.1 State of the Art
Describes the current road authorities and infrastructure operator's situation with respect to how safety relevant data is stored, exchanged and updated.
D1.2 Requirements and Overall Architecture
Defines the project scope, user, user requirements and derived system requirements. It also gives suggestions on information model and a high-level system structure.

D2.1 Conceptual specification on how to establish a data store
Presents a conceptual description of the data maintenance operations with regards to functional view (use cases), process view, information view, and component view.
D3.1 Specification of Data Exchange Methods
Presents the exchange specification consisting of a data content specification, a physical exchange format specification, (to be completed) and a service specification.
D5.1 Test and Validation Plan
Describes the processes for validating the objectives of the project on each test site, tackling quality aspects, user requirements and evaluation methods.
In preparation
D3.2'Software Modules for data exchange'
D4.1'Description of applicable and viable data integration methods'

Table 1: Overview of project deliverables available to date[2].

1.4 Objectives of WP2

The objectives of WP2 are:

- To enable the road authorities to access and to maintain safety related data for supply to data users' side (map providers, road authorities, third parties…) in a way, that is efficient and easy to adapt to road authorities' internal processes and workflows.
- To learn from existing implementations and to create examples for replication, how data access and maintenance on the road authority side can be efficiently managed.
- To establish quality management in data capturing, maintenance and delivery compliant with ROSATTE requirements;
- To provide reference implementations for the demonstration of data access and maintenance in the respective test beds

[2] Final versions are available on http://www.ertico.com/en/activities/safemobility/rosatte/publications/publications.htm

1.5 Purpose of Document

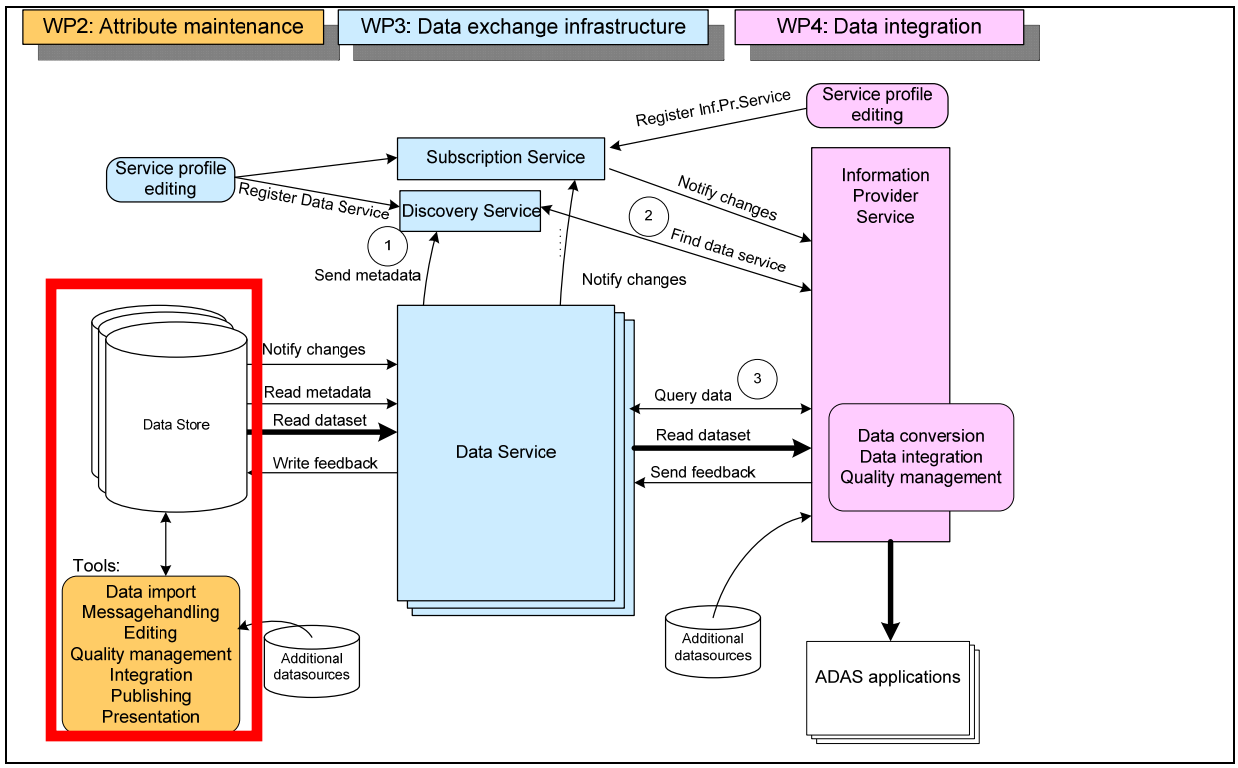


Figure 2: Overview of scope of workpackages [1] – scope of WP2 highlighted by red box

Figure 2 shows the components and the data flow in the ROSATTE project (from D1.2).

- WP 2 is concerned with data maintenance tools, i.e. processes involved to enter and maintain data in the data store. The implementation work in this domain in subject of the present deliverable (D2.2)
- WP 3 is concerned with the extraction of data from the data base and the transfer of data to the information provider (map maker) including the location reference transfer. The implementation work in this domain in subject of the deliverable D3.2.
- WP4 is concerned with the integration of the received data into the information providers database. The implementation work in this domain in subject of the deliverable D4.2.

In D2.1 a conceptual architecture of the data maintenance system has been given by describing such a system in an abstract way from different viewpoints, i.e.

- Functional viewpoint including users and roles, entities and use cases,
- Process viewpoint
- Information viewpoint
- Component viewpoint

These viewpoints provide a conceptual blue print for a data maintenance system as they are being implemented in the ROSATTE test sites to support the trials for the data chain from the enacting authorities to the information provider (commercial map maker).

In different test sites different solutions for the data maintenance system and the data supply to map makers are implemented depending on

- the data source (field survey, regulation etc.) and hence
- the exact type of data maintained to generate safety features from (e.g. signs vs. linear objects),
- existing road data systems, in which the data store for safety features is embedded,
- organisational setup (local data stores synchronised with a central one, vs. a centralised data store)
- the precise workflow in the authorities to be supported by the software

In D2.1 chapter 8, the process and component view of 4 different test sites (Sweden, Flanders, Bavaria, France/ASFA, were sketched briefly.

In D5.1 chapter 5, background is given for each test site with regards to

- coverage
- administrative levels involved
- test site specific assessment objectives

The present document (D2.2) describes the solutions for data maintenance, which have been implemented in each test site.

1.6 Structure of Document

This document is structured by test sites. For each test site, following aspects shall be described

Scope in terms of safety features, workflow at the public authorities to maintain data and the role of the data maintenance tool used to generate data for the ROSATTE data exchange, Technical architecture (component diagram) and User Interface

The parts of the system used to generate data for the ROSATTE data exchange itself is not included here, since it is described in D3.2

2. Overview

Six test sites from different European Countries (Norway, Sweden, Germany, Belgium, France and United Kingdom) are presented in this report delivering safety related road data in a harmonised way via the ROSATTE exchange mechanisms to third parties.

The context of data maintenance operations in each test site is different. This context had been evaluated in [2] to create a conceptual, high level terminology and specification for safety related road data maintenance.

Following differences between test sites are notable:

1. The semantic scope of the data collected and delivered via ROSATTE exchange is diverse:

   Test site Flanders has the broadest scope of safety related data, since an exhaustive inventory of road signs is at the basis of the operations, which includes all kinds of safety related aspects. Most test sites focus on speed limit as well as other safety features (e.g. warning signs, overtaking ban);

   While most test sites focus on static safety attributes, the French test site operated by ASFA also includes temporary safety features (e.g. related to road construction) and variable message signs;

2. The description of safety information in the data maintenance operations differs between point objects (sign posts) or linear objects (linear safety features);

   Two test sites operate data bases as sign posts inventories (Flanders, and Transport for London). All other test sites store and reference data as linear objects;

3. The sourcing of the data differs between test sites;

   Whereas for the initial supply of data often field surveys of sign posts are used, the Swedish/Norwegian operations are closely linked with the enacting of regulation, whereas are ASFA or Flanders geared to follow road maintenance operations;

4. The level of maturity between test site data maintenance operations differs;

   While Sweden, Norway, France (ASFA) and Flanders rely on fully operational systems, France (Bali), Bavaria and London are in a build-up or trial phase.

2.1 Basic road network used and integration of AGORA in the different test sites

Almost every test site has a different situation with regards to the supply and maintenance of the basic road network to which safety features are referenced. Requirements for the data maintenance with regards to the underlying road network and with regards to its maintenance/updating have been stated in D2.1 Conceptual specification on how to establish a data store [2]. In fact, the updating process of the base network, is a fundamental process to be handled in each test site. This process has not been disclosed by the test site operators since map updating in data maintenance itself has not been considered a primary subject of ROSATTE[3].

[3] Some information from test sites is available from D4.1 'Description of applicable and viable data integration methods'

Two out of six test sites rely on own (non-GDF)-conform road network databases. Bavaria has own processes for base map maintenance, but builds these processes on (regularly updated) NavTeq maps (see D4.1).

The logical references to a road network (linkIDs) are also needed to allow AGORA encoding which is required for the transfer via the ROSATTE mechanism. Depending on the networks used, an AGORA encoder own to the test site has been used (where available) or an external encoder is being used (see Table 2).

Navteq and Teleatlas offer such 'external' AGORA encoders accessible via a webservice. These AGORA encoders support different map version, i.e. the linkIDs to be encoded have to be qualified by their map version, otherwise the encoder may not be able to produce a correct result. Assuming that the remote AGORA encoders offer all recent maps as well as the latest map version, this allows a separation/decoupling of map updating in the data maintenance system from the map updating of the AGORA encoders.

By ensuring that each test site has access to AGORA encoding facilities (either locally or remotely) it can be ensured that each test site can provide data to both map providers involved in the project or any other party interested in integrating such data.

Description of the different components used for data exchange in the different test sites and in specific the AGORA encoders are given in Deliverable D3.2 'Software Modules for data exchange', and will therefore not be further detailed here.

Test Site	**Data maintenance tool supplier**	**Base Map**	**AGORA Encoder (local/remote)**
ASFA (France)	Own development	TeleAtlas	Teleatlas (remote)
Bali (France)	Local partner	IGN	LROP (local)
Bavaria (Germany)	PTV AG	INTREST (derived from NavTeq)	Navteq (remote)
Sweden/Norway	Triona	National Road Databases	Triona (local)
Flanders	Local partner	NavTeq	Navteq (remote)
London	TFL/local partner	TeleAtlas (transition towards Open Street Map planned)	TeleAtlas (remote) (own AGORA encoder development planned)

Table 2: Overview of base map and AGORA encoders used in different test sites

Test site ASFA (France)

2.2 Scope of safety features

ASFA test site focuses on speed limit attributes on motorway free flow sections, i.e. decreasing speed limits on junctions or ramps are not taken in account.

Different types of speed limits are supported on the test site, considering:

- Static speed limits on free flow section permanently signposted

  These attributes are captured as linear objects and include implicit speed limits. Starting point and ending point of the linear object are extracted from speed limits described in regulation legal forms. On the field, signs are posted according to the regulation description.

- Temporary speed limits temporarily signposted indicating restricted speed limit for a defined time period (for long period of road works or defined periods of speed control)

  These attributes are captured as linear objects with a starting point and an ending point. These attributes have a specific data description that provides a validity period of the speed limit description (starting date and ending date), extracted from the regulation established in prevision of the restriction.

- Dynamic speed limits whether signposted thanks to a temporary metal sign or displayed using Variable Message Signs (VMS) either fixed or mobile.

  These attributes are captured as linear objects with a starting point and an ending point. The attributes are updated in real time and positioned according to the position of the sign posted on the field during the event.

The following figure illustrates a way of displaying a dynamic speed limit on mobile VMS. These dynamic speed limits are particularly used on motorways for road works, tunnels traffic management, restriction for pollution, speed control for heavy traffic.

Figure 3: Illustration of a dynamic speed limit restriction displayed on a mobile VMS

2.3 Workflow at the enacting authorities/road operator

In the ASFA test site, static and temporary and dynamic speed limits are managed through different workflows at the road operator level

Static speed limits:

At the road network operator side, these data are stored in a Excel-database (xls format). A web user interface recently developed is available at each French motorway Company member of ASFA and enables each operator to modify the data of the network he's operating. The data is modified by the road operator, at a periodic basis, according to the regulation validated by the public authority. A mapping of the static speed limits is available for the road operator on the server www.autoroutes.fr that permits to have a visualisation of the database

Temporary speed limits:

Another web user interface, also developed for the test site, allows entering temporary speed limits according to the specific regulation established for this period (foreseen maintenance operation or planned speed control operation). The starting date and ending date of the restriction are specified in the database. This new data is integrated to the static database according to its period of validity.

Dynamic speed limits:

At the road network operator side, these data are integrated into the network management system. Some dynamic speed limits restrictions are integrated into the permanent regulation submitted to validation by the public authority with static speed limits regulation (for tunnel management or traffic control) and other dynamic speed limit restrictions are part of the low (for road works). They are delivered to the data store operator dynamically through an XML feed (they are related to an event, which can be a real time restriction for works or tunnel traffic control). The feed is automatically refreshed when there is an update (insert, update, delete).

All data types are delivered to Autoroutes-Trafic who is the data store operator in ASFA organisation. Autoroutes-Trafic processes these data which come with referent points to translate them in linear locations. The processed data are stored in a spatial database.

Autoroutes-Trafic will set up a set of web services to publish the safety attributes database to map providers. Error reporting and quality assessment will be done all along the chain.

Following figure illustrates the 3 different workflows for the 3 different speed limits types:

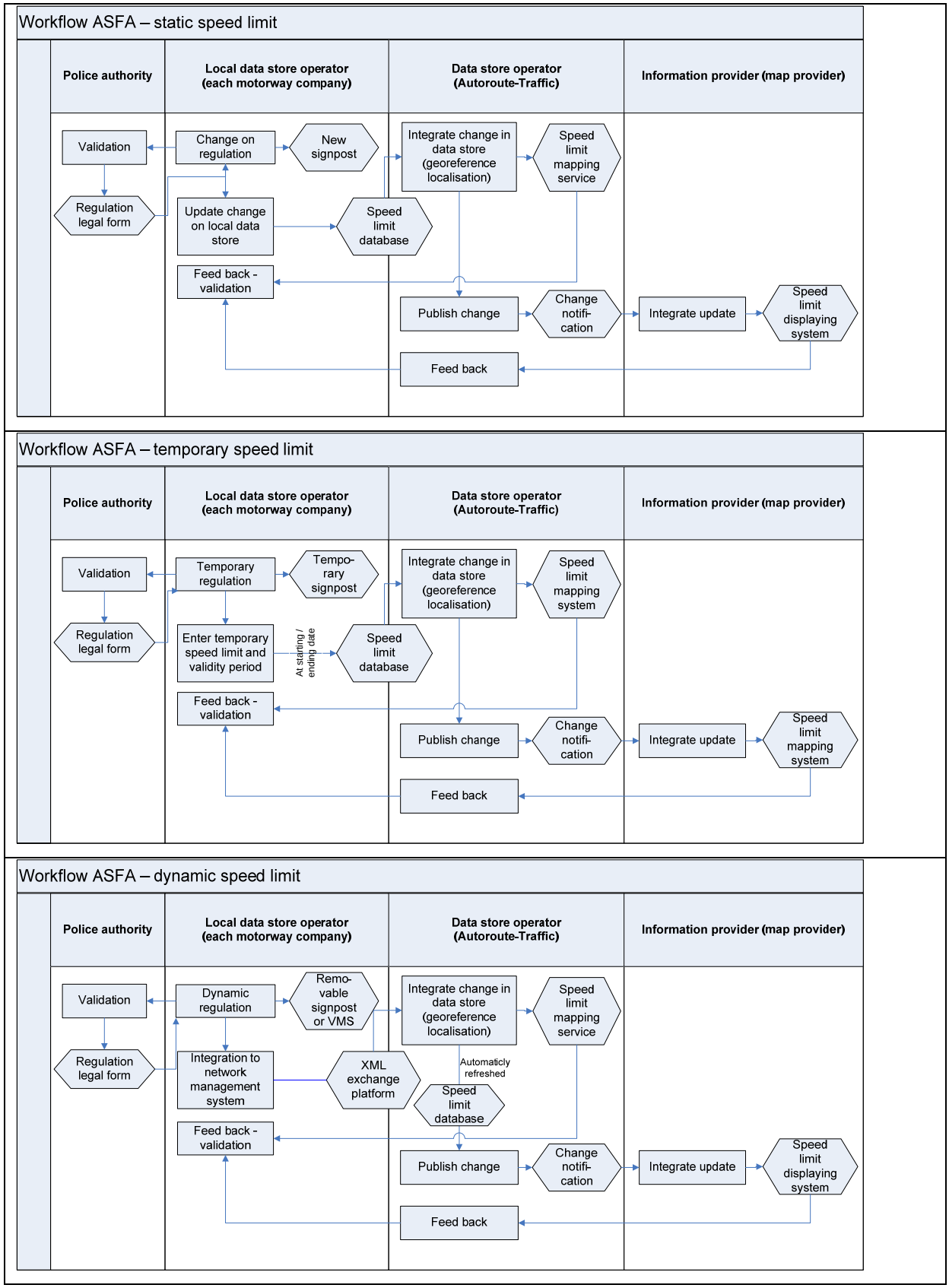


Figure 4: Workflows for the 3 different speed limits types

2.4 Technical architecture

The figure below describes the ASFA technical architecture that is being set up to fulfil the ROSATTE requirements

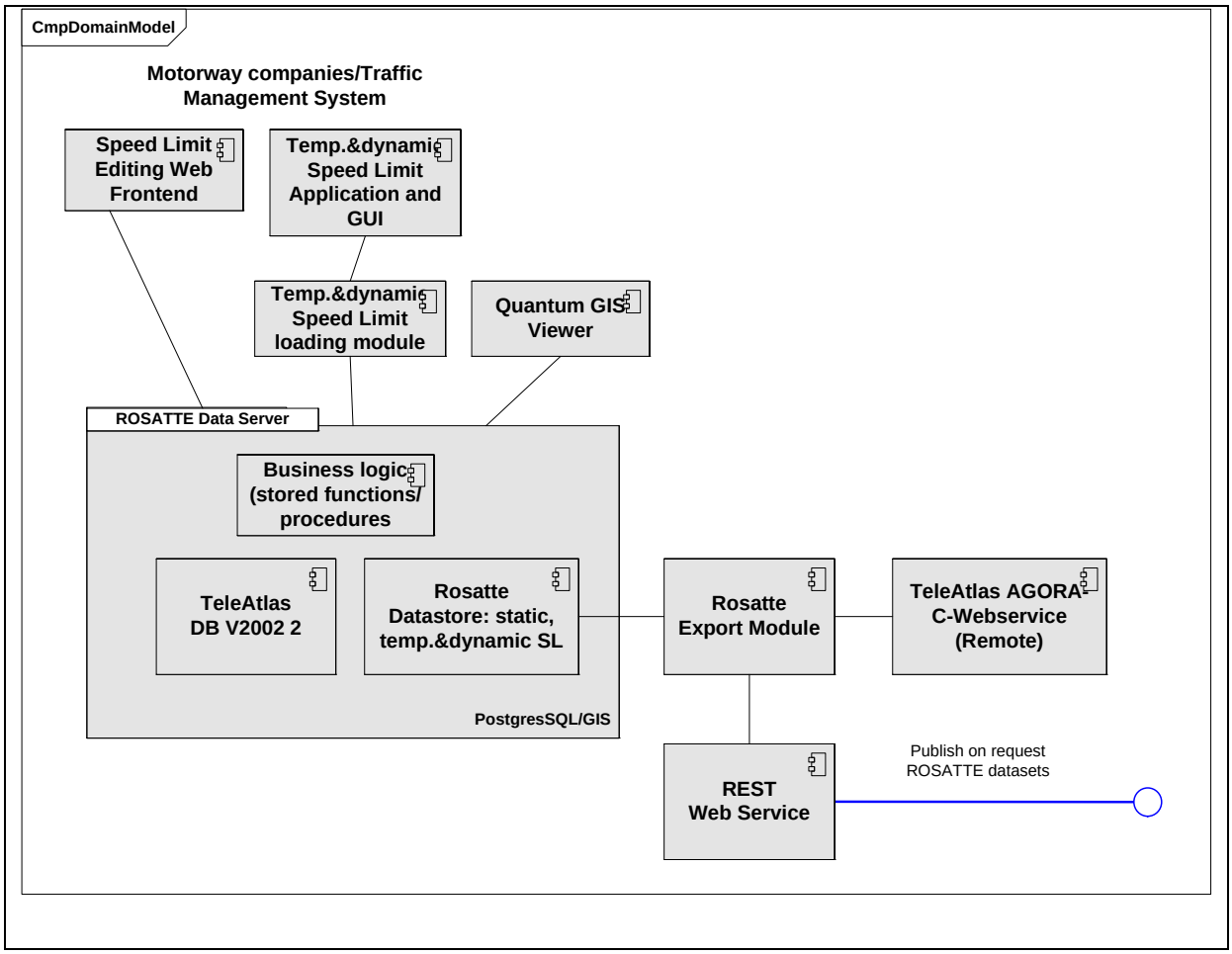


Figure 5: technical architecture ASFA

At the beginning, static speed limits were provided through Excel files. A web based editing tool has been set up through ROSATTE. It allows road operators to directly access to the speed limits stored in the ROSATTE data store. An operator can insert, update or delete a speed limit. Any change and any action on these data are stored into the database. This has been done to be able to provide incremental updates.

Temporary and dynamic speed limits are provided in the same data feed which is refreshed every 5 minutes. AT Cofiroute side, these two types of speed limits are entered through a dedicated user interface. AT AREA side, the temporary and dynamic speed limits are deduced automatically by the traffic management system. For AREA, only roadworks imply a creation of a temp/dyn speed limit.

The Dynamic/Temporary speed limits data feed is generated every five minutes. Another process load this data feed at regular basis (5 minutes) and update the information in the ROSATTE data store.

ASFA uses a TeleAtlas as digital database. TA tables are stored in a PostgresSQL database server. A ROSATTE database has been created in order to manage speed limits information.

An export module has been written. It does the following actions:

- Extract speed limits information from the ROSATE database, and request for each extracted line, the location information in TA database.
- Send a POST request, for each extracted location in TA database, to TeleAtlas Agora-C web service. If the request is successful an Agora-C binary string is returned.
- Build a ROSATTE dataset in XML format with the extracted information from the DB and the Agora-C locations.

A REST web service has been created to allow map providers to requests ASFA speed limit datasets. The web service uses the export module to extract data, convert locations in Agora-C and build a dataset. The dataset is returned as a response to the request.

The webservice can handle feedback that could be sent by data providers. Due to the lack of experience with feedback from data providers, currently this information is not foreseen to be used further in any way.

2.5 User Interface

A web based user interface has been developed to allow data providers to edit and modify the content of the ROSATTE data store. The screenshot below shows the login page of the user interface:

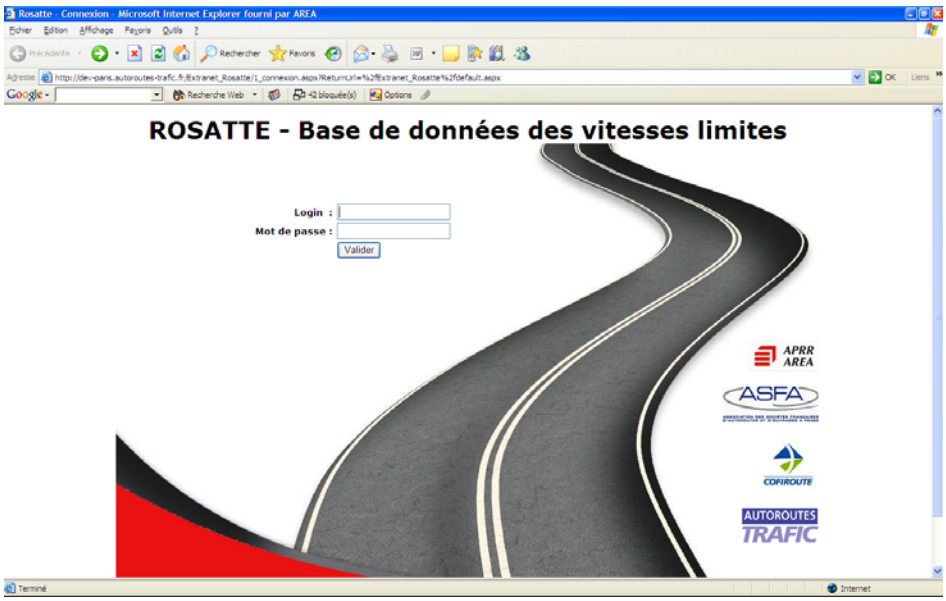
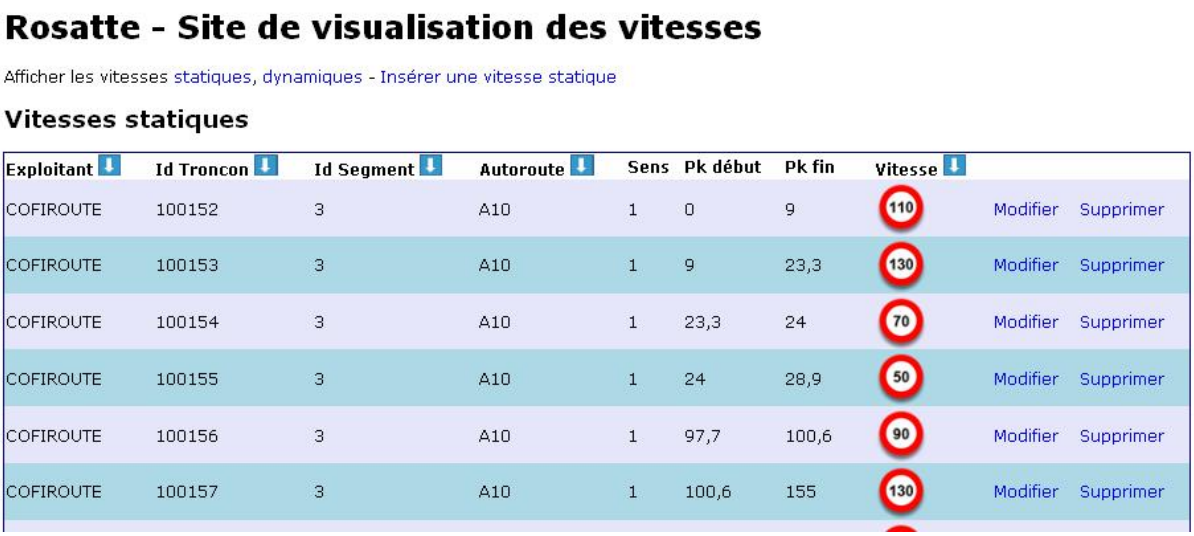


Figure 6: Web user interface login page for static speed limits management



Rosatte - Site de visualisation des vitesses

Afficher les vitesses statiques, dynamiques - Insérer une vitesse statique

Vitesses statiques

Exploitant	Id Troncon	Id Segment	Autoroute	Sens	Pk début	Pk fin	Vitesse		
COFIROUTE	100152	3	A10	1	0	9	110	Modifier	Supprimer
COFIROUTE	100153	3	A10	1	9	23,3	130	Modifier	Supprimer
COFIROUTE	100154	3	A10	1	23,3	24	70	Modifier	Supprimer
COFIROUTE	100155	3	A10	1	24	28,9	50	Modifier	Supprimer
COFIROUTE	100156	3	A10	1	97,7	100,6	90	Modifier	Supprimer
COFIROUTE	100157	3	A10	1	100,6	155	130	Modifier	Supprimer

Figure 7: HMI for static speed limits management

The interface displays a list of the static speed limits currently stored in the central database with their localization (name of the motorway, direction, starting point, ending point, etc) and allows to add, modify or delete these static speed limits.

It is also possible to visualize the list of dynamic speed limits currently in operation, but not to modify it (this is done through the network management system of the concerned motorway company).

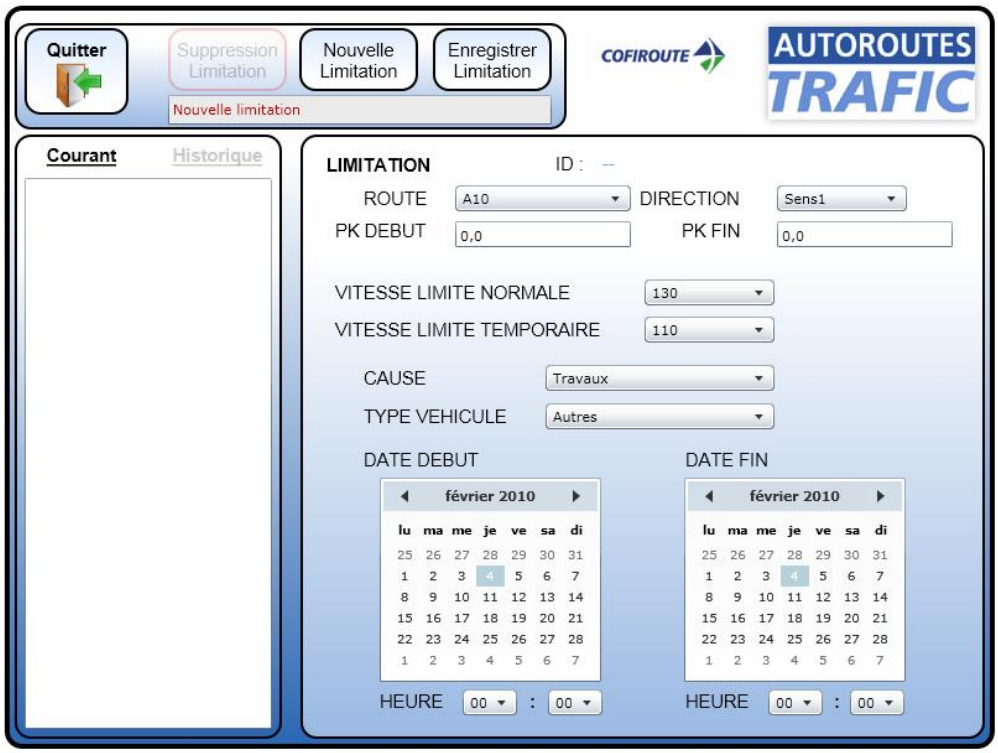


Figure 8: Web based interface for temporary speed limits management

The interface lists the temporary speed limits currently in operation and allows to create new ones or to delete them.

A temporary speed limit comprises a road name, a direction, a starting point, an ending point, the 'regular' speed limit value, the temporary one, the cause for it, the type of vehicles that are concerned if any, and the validity period.

3. Test site BALI (France)

3.1 Scope of safety features

The General Steering Committee for Roads and Bridges (Le Conseil Général des Ponts et Chaussées - CGPC) has been given the task of evaluating the needs and expectations of industrial stakeholders (vehicle manufacturers, vehicle equipment manufacturers, cartographers) and the public authorities in the area of road safety. The task report recommended the following:

- an analysis of the technical and operational terms and conditions for creating a national database containing speed limit updates and an estimate of the capital costs and subsequent management costs;
- implementation of a demonstration/foreshadowing operation in a pilot Department, to foreshadow the management of a future national database (DB), which will make it possible to validate the costs and the interest of partners (service operators, regulation editors…).

The reason for this is that it is acknowledged that a national database of this type is likely to improve the reliability, and therefore the usefulness, of in-vehicle devices providing motorists with speed limit data. We can therefore legitimately expect a positive impact on road safety. Moreover, this database could enable the bodies responsible for speed limits to manage them better on their networks.

Subsequent to the order from the Minister's private staff and the CGPC task report, SETRA suggested to the Road Safety and Traffic Directorate (Direction de la Sécurité et de la Circulation Routières - DSCR) that the programme for 2005 should include a project to demonstrate the feasibility of the collection of speed limit data on a pilot site. This was to take place between 2005 and 2007 and was intended to provide the DSCR with an insight into the benefits of extending the data collection experiment to the rest of the national territory.

The principal objective of the test site BALI is to study the technical and organizational feasibility of a database of this type and to draw up Functional Analysis Documents (FAD) for the creation of a Department scale prototype in the Yvelines. It should be noted that this database includes only so-called "static" speed limits, i.e.:

- speed limits whose value is fixed (generic and specific according to the SpeedAlert classification);
- speed limits that are weather- or time-dependent but whose value is permanent (e.g. the 110 km/h weather speed limit on French motorways) specific)[4].

So-called "dynamic" speed limits which include

- speed limits that depend on the traffic and/or weather conditions which are displayed on Variable Message Signs (VMSs),
- temporary limits (e.g. a lower speed limit on a section with roadworks),

are not stored in the system.

[4] Practically this latter feature has not been implemented for technical reasons.

It could also be used to help managing bodies administer speed limits, or as an Internet communication tool.

The complete success of a system of this type and the quality of the data it contains (exhaustiveness, usefulness, up-to-dateness) depend on a number of factors which must be considered:

- the updating mechanisms for the supporting data are made more complex by the fact that mapmakers who make map do not yet disseminate incremental updates, which increases the risk of errors during processing ;
- the initialization of speed limit data is performed on the basis of data provided by the mapmakers which may lead to some inaccuracies;
- the involvement of all the project's stakeholders, in particular the representatives of the local authorities, is necessary in order to obtain relevant and up-to-date data.

3.2 Workflow at the enacting authorities/road operator

The data that makes up the BALI frame referencing system comes from different sources and is sent to several destinations. The diagram below shows the data flows.

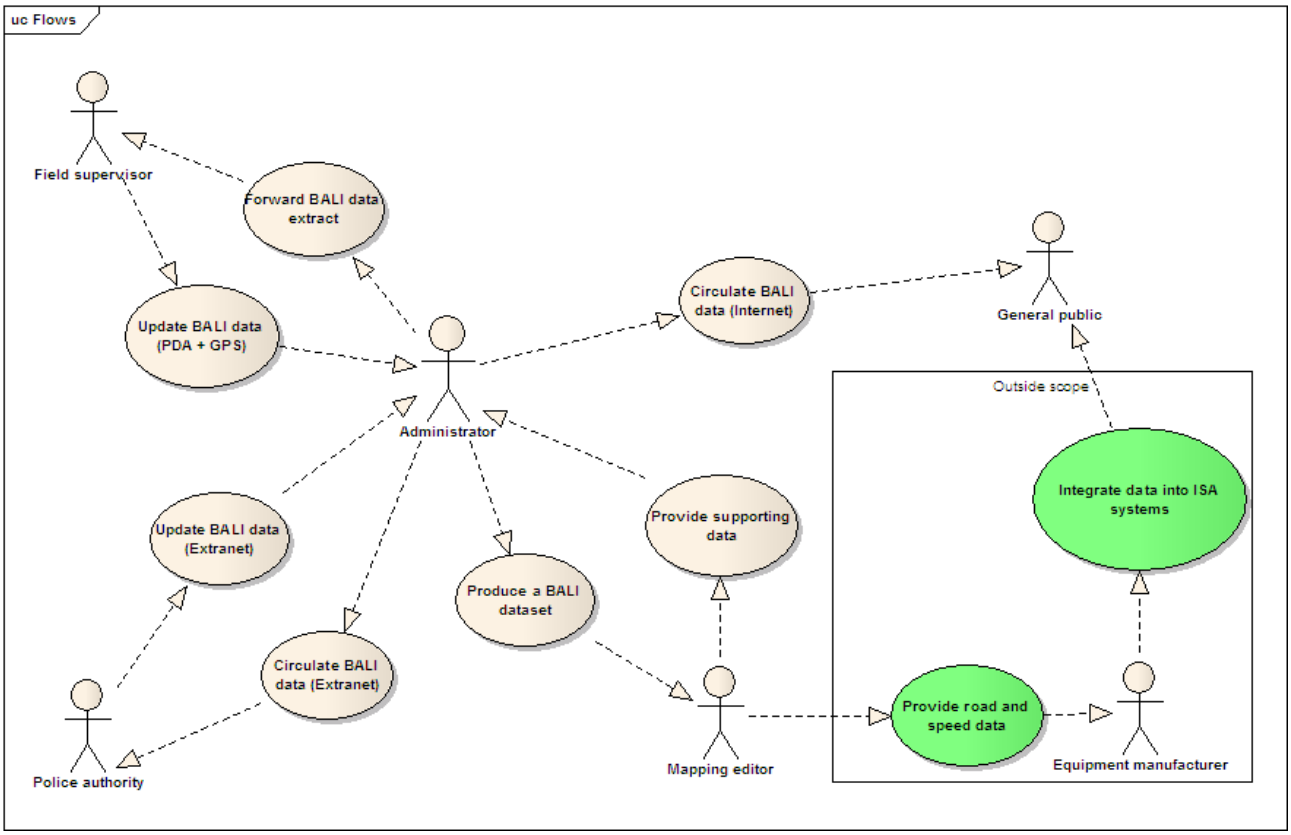


Figure 9: General diagram of the data flows

The architecture of the system is built around a spatial database that contains, in distinct but connected worlds, map data and data that is specific to the projects (e.g. speed limits). The latter are modelled and structured in a way that makes them easy to integrate and update (use of linear referencing). A Geographic Information System is used to handle this database.

The map data producers are responsible for providing the initial map data that shows roads, administrative areas and, other "supporting" data which may provide additional information. This data is be integrated using the procedures used to load and process updates.

Pre-processing will be put in place in order to initialize the database (e.g. creation of generic speed limits only).

Mobile equipment (PDA + GPS for example) with a simple application is used to collect the geographical position of the signs in the field. This data is used to update the central database ("map-matching" in order to reconstruct the travelled route, linear referencing of the identified signs, propagation of information about the network…).

An internet application, connected to a mapping "work" area allows the local authorities or stakeholders with knowledge of changes in regulations and data modification rights to perform local updates. These updates are validated by LROP.

Processing generates data with a simple data model (which can be very similar to the models used by the data producers) from this system, which has been structured in order to update and manage data. The data is then exported in a defined format based on EuroRoadS specifications and IS 17572-3.

An Internet application enables Internet users to consult this map data.

3.3 Technical architecture

The LROP is the project manager of the BALI project and the functional manager of the centralized database. Its responsibilities are:

- to keep the database up to date by integrating data provided by the mapmakers;
- to check the validity and quality of the data input by the representatives of the public authorities;
- to make the data in the database accessible to the other stakeholders.

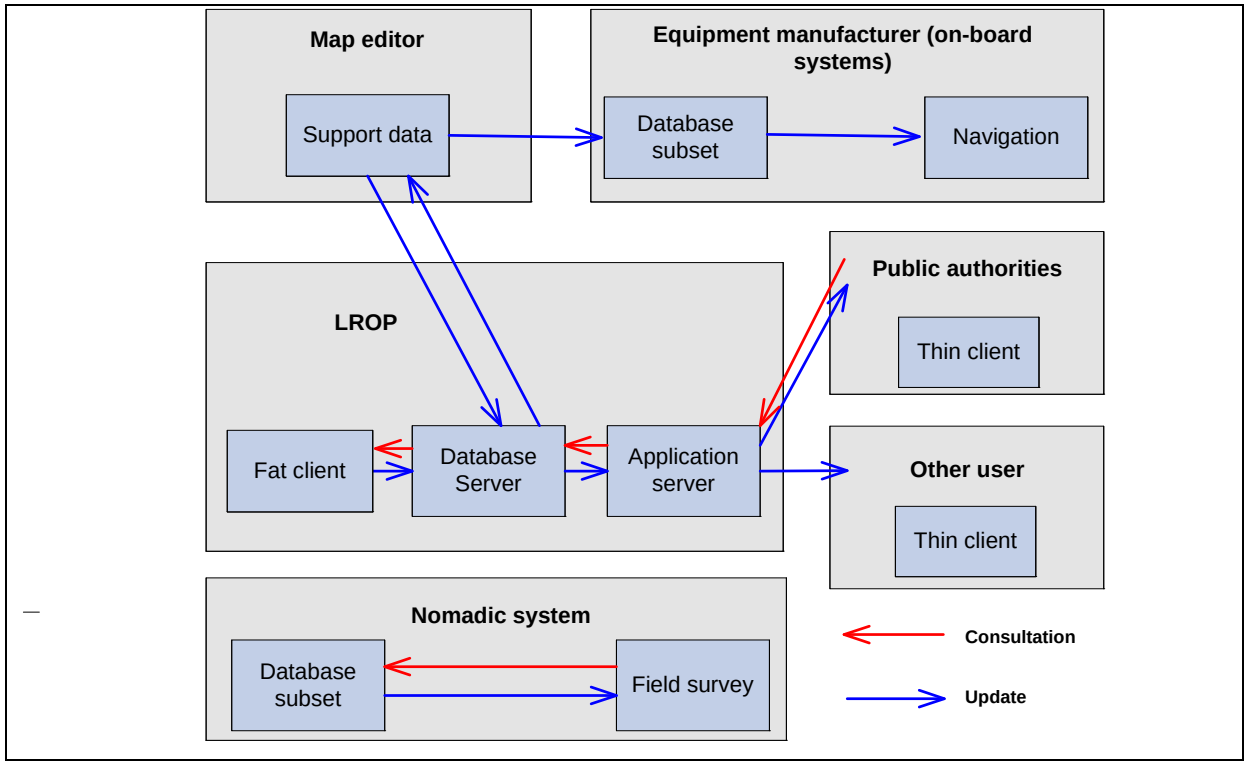


Figure 10: Technical architecture of the system

The target architecture for the server section consists of two servers:

- A "data" server, which stores all the data in the frame referencing system (shared data + business data).
- An "application" server, which houses the tools that make the data available on the Internet.

Several types of client workstation are connected to these two servers and are part of the general architecture:

- Fat client workstation: this is the database administrator workstation. The databases are created and initialized from this workstation. It has GIS software to provide sophisticated functionalities for data updating, consultation, analyses (spatial queries, statistics,…) and for making user-friendly maps ;
- thin client workstation. These workstations are able to access data consultation functions via a simple web browser (Internet Explorer, Mozilla) ;
- thin client for updating via the Internet: these workstations can access data consultation and updating functions via the Internet through a simple web browser.

3.4 User Interface

The general public interface is accessible via a web browser. For the access to the restricted area dedicated to public authorities and administrator there is a login window. The initial view shows the whole *department* map with main roads. The speed limits are displayed with colours on a map. The map layer consists in a vectorial map (Top Adresse©

of IGN) coupled with a raster layer (France Raster© of IGN). A help bubbles (call-out UI-element) is used to display the actual speed limit when the mouse is above a colour line.

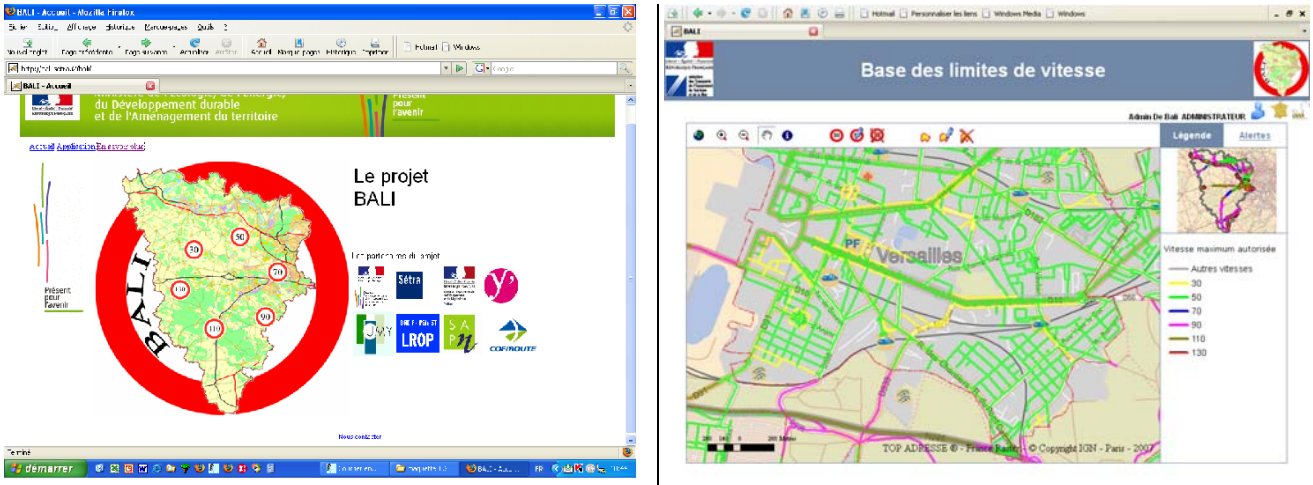


Figure 11: Entrance screen to website Map display

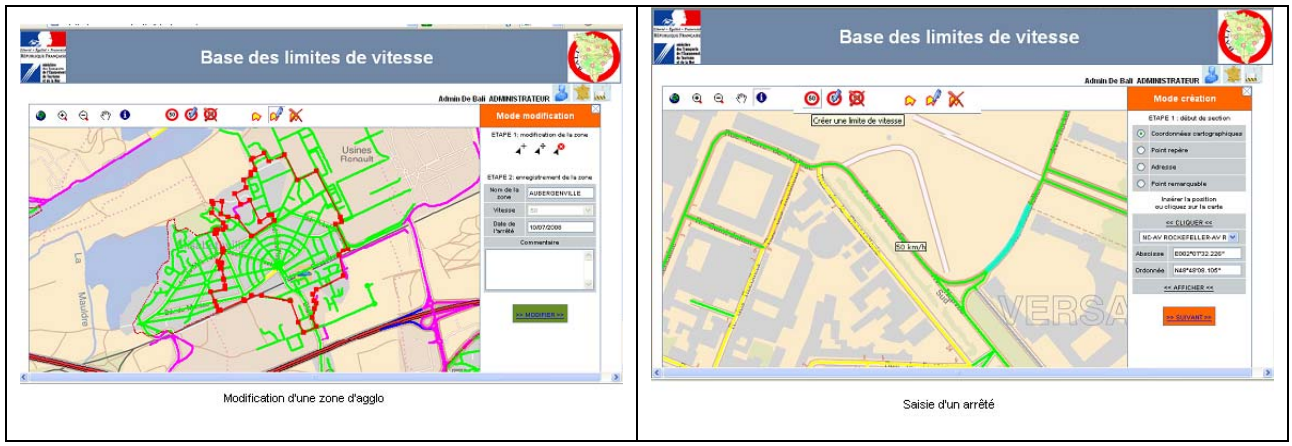


Figure 12: Website UI: Modify a built-up area Create a new SL section

The user is guided through the following steps (see Figure 13):

- The first step is to create a the start of a new speed limit section (by GPS data, address, referent point, interest point)
- The second step is to enter the end of the section
- In a the third step the user is asked to validate and to commit the new speed limit section or zone

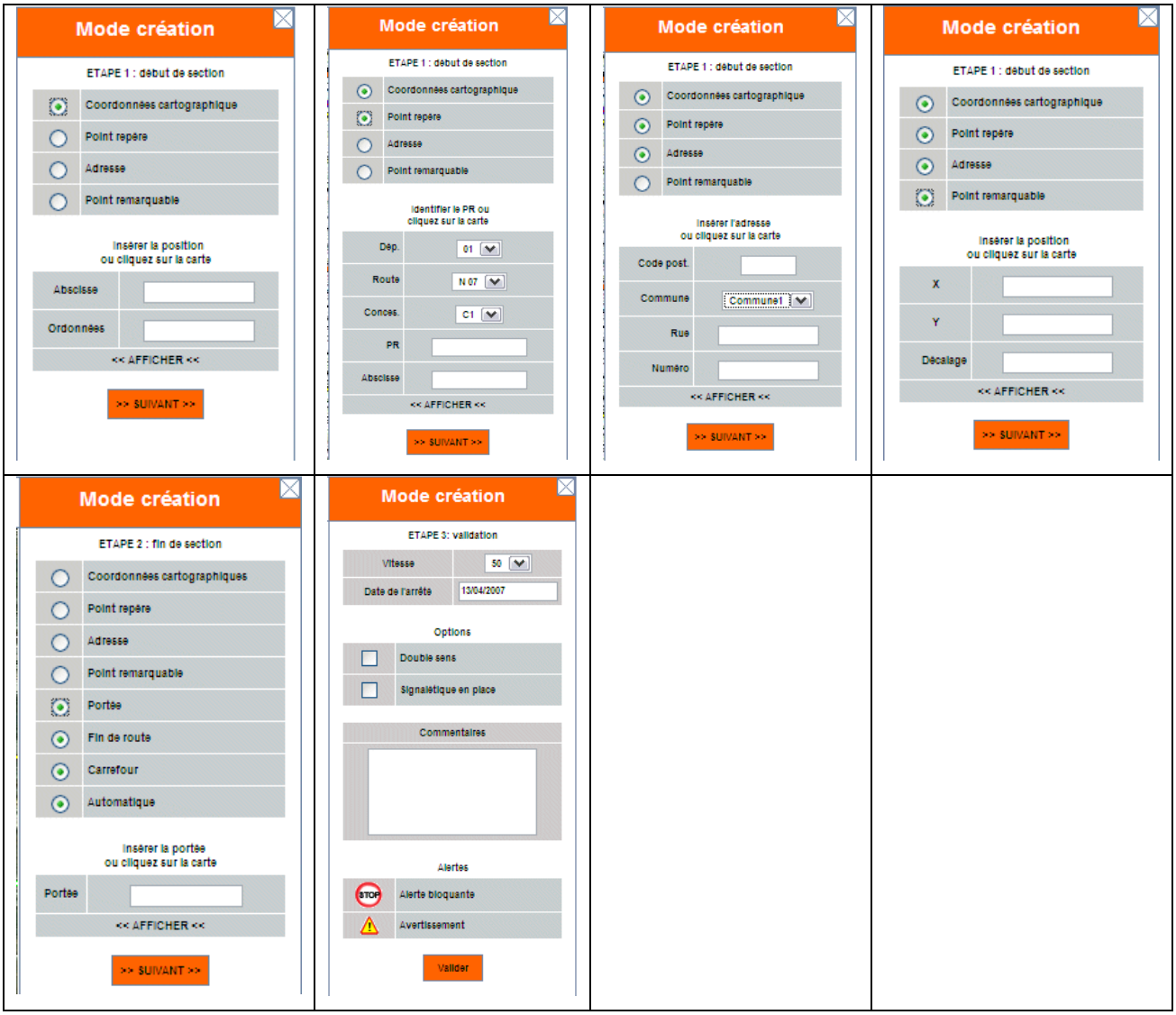


Figure 13: Website User Interface: Entry of new speed limits.

4. Test site Bavaria (OBB)

4.1 Scope of safety features

The data maintenance solution implemented in TS Bavaria supports

- Speed limits,
- Overtaking bans,
- Warnings.

Speed limits	Overtaking bans	Warnings	
30			
40			
50			
60			
70			
80			
90			
100			
110			
120			
30 ZONE *			
*			

Table 3: Overview of types of safety features supported in the Bavarian Data maintenance solution.

The individual safety features supported are provided in Table 3. As restrictions to safety features, time, vehicle and weather are supported. The details of these restrictions are modelled according to the priorities of the Bavarian authorities and therefore present a subset of possible restrictions as defined in the ROSATTE interface (see D3.1).

Since regulation and surveys of road signs are a source for the database, implicit speed limits are not part of the Bavarian safety feature data maintenance solution.

Regarding their geographic extent, safety features can be captured as linear objects or as a zone (assembly of road segments with the respective features and attributes). Zones are applicable for 'Spielstraße' (playground street) or 'Tempo 30 Zone' (speed 30 zone). Maintaining the position of sign posts is currently not supported but could be extended as a separate feature layer.

The initial supply to the data maintenance solution as well as the road network used comes from the Bavarian INTREST database.

4.2 Workflow at the enacting authorities/road operator

Figure 14 shows the process view from D2.1 which also depicts the workflow. The Bavarian data maintenance is created to support local authorities in managing their road regulation orders. As a status quo, only few enacting authorities have a digital inventory of their regulations or have a proper geo-referencing of safety features from regulations to a digital road network.

The method is therefore to centrally provide a road data maintenance solution accessible via a web browser, where no local system installation, data store maintenance or other software administration efforts are necessary to the enacting authority. The solution allows enacting authorities to enter and view all safety features with all relevant attribute details and to position them graphically on a map. Each safety feature holds a reference to the regulation according to the local identification scheme of the enacting authority. The tool is meant to facilitate the regulation process, since

- All road related content of the regulations is directly linked to the geographic location and can be viewed on the available INTREST map.
- Regulations/safety features from other, neighbouring local authorities become transparent.

Further content useful as context for the process of defining/designing the regulation with regards to its road related features can be added through further WMS-layers (e.g. from the Bavarian Street information system BAYSIS or the Bavarian land survey agency).

Usually, the location of the safety feature is defined graphically on the map interface. For the motorway authorities a WMS layer of the stationing system on German classified roads can be displayed. Finally, also the entry of coordinates for start and end of linear locations is possible, as some authorities have these data from their surveying or installation activities.

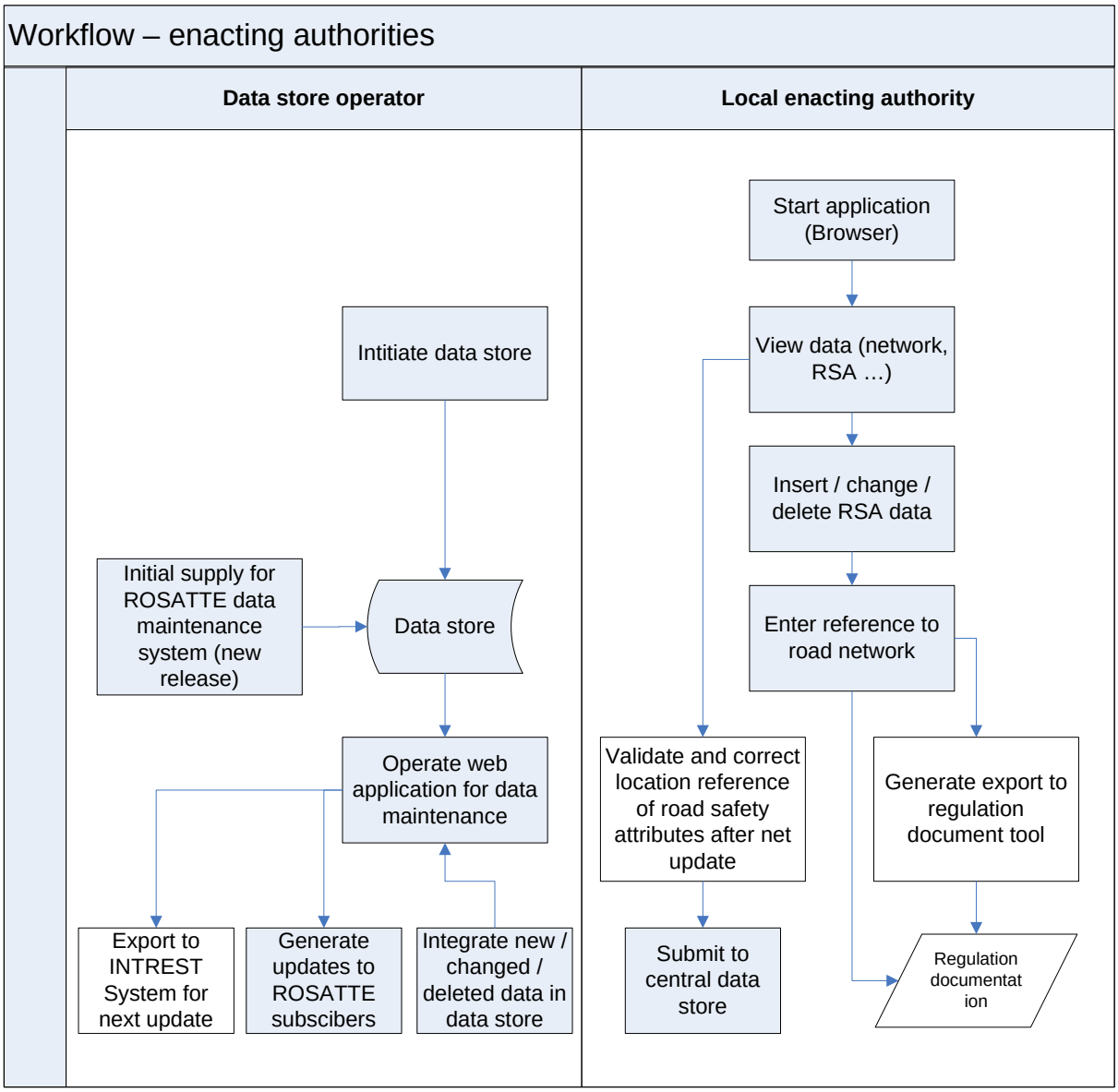


Figure 14: Overview of process view of Bavarian data maintenance (extract from D2.1)

Data maintenance in the system is therefore usually operated by the local authority during the regulation process. As an extension, direct export of data for use at the local authority is foreseen.

The entry of new safety features from regulation follows a standard workflow, where

- firstly location of the safety feature is capture graphically on the map either as a linear object or as a zone.
- Secondly, safety features such as type, value, restrictions are entered
- Finally, administrative details are added, such as a local identifier (enacting authority identifier + regulation order number), date of regulation enaction, date of installation of signposts as well as further textual information can be added.

The respective data entry forms are shown in the 'object details window' (see Figure 18).

4.3 Technical architecture

Figure 15 shows a component view of the Bavarian safety feature maintenance solution.

The Web frontend uses PTV-standard geo-components as the middle ware to view the background map, to geocode addresses for map positioning and for routing, when linear locations shall be defined between a start and end point (PTV xMap, xLocate and xRoute). Safety features are managed through the Safety feature access component, which allows the web frontend to visualise and write safety feature data to the data base (safety feature data store). The web frontend and the safety feature access operate on OGC-standard webservices (WMS, WFS, WFS-T) allowing integrate third party content e.g. WMS from the Bavarian surveying agency or to provide directly safety feature data to third party services. In addition to the safety feature itself, the safety feature access component stores all change operations in the database. This information is used by the snapshot generator to assign data to a certain snapshot at a certain point in time, usually in regular intervals. Changes after a snapshot are then combined to a change log. Both concepts, snapshot and change log are used to allow the REST service to generate data for supply via the ROSATTE interface.

The safety feature referencing service is a component allowing to plug in different referencing services as required by the specific context. In this case, the AGORA service from NavTeq is called to generate an AGORA-C code for each location.

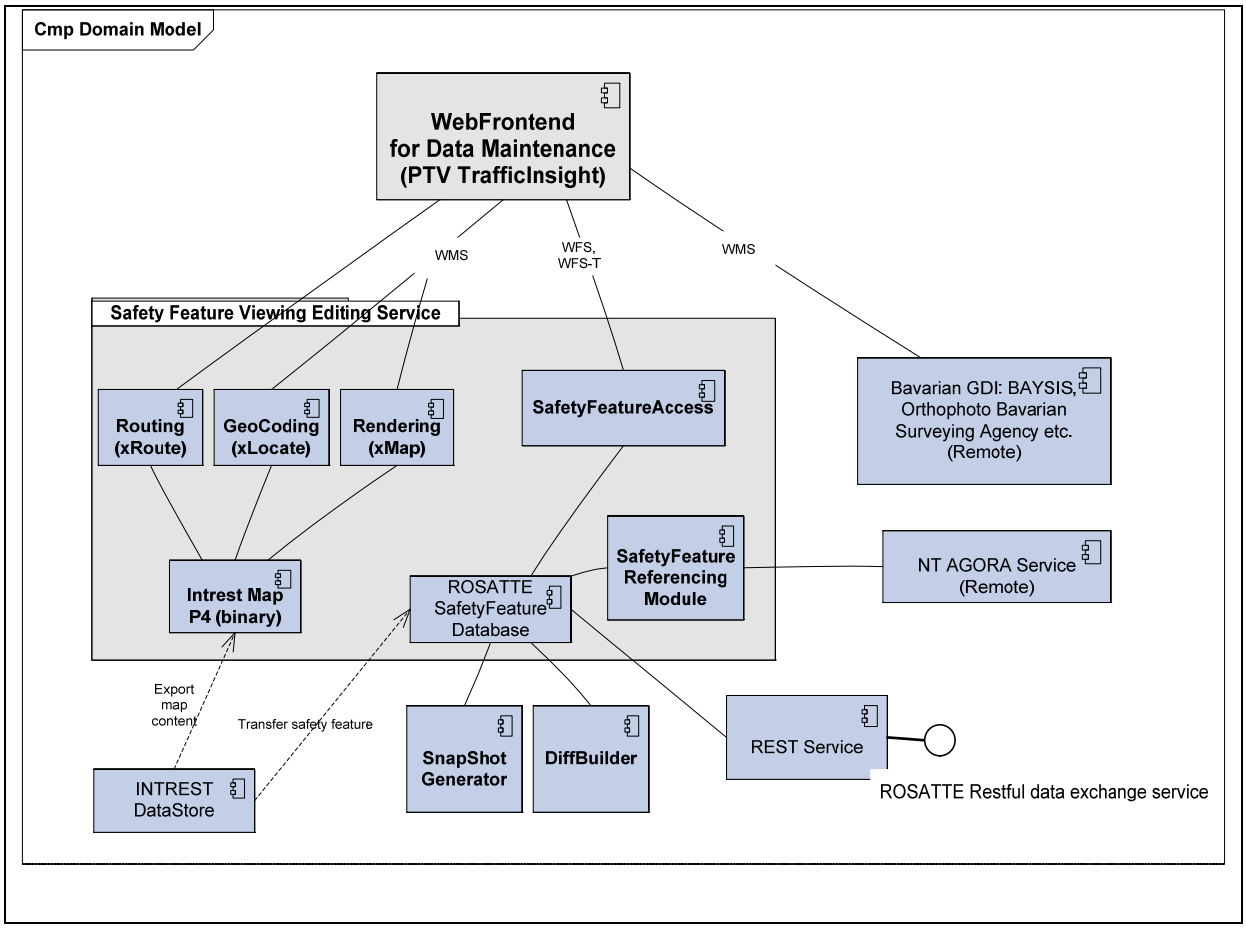


Figure 15: Component view of the Bavarian Safety feature maintenance solution

4.4 User Interface

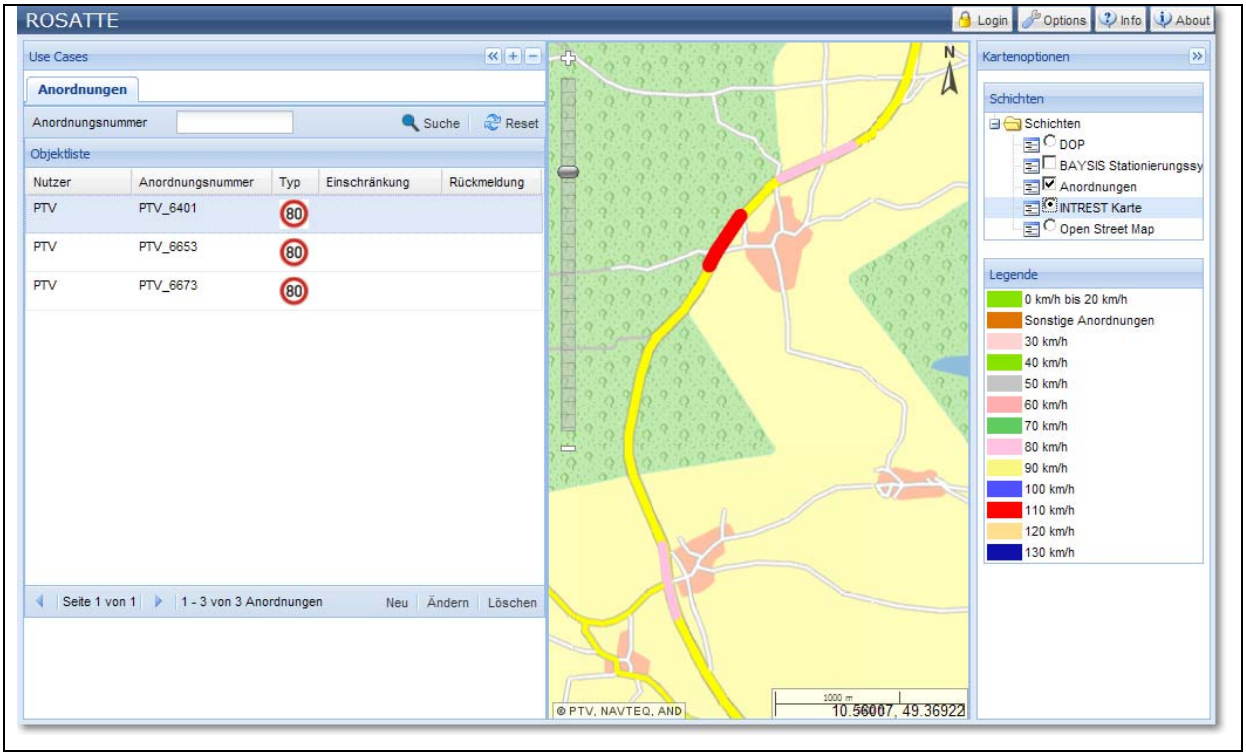


Figure 16: Main view of the Bavarian safety feature data maintenance solution.

The user interface is accessible via a web browser after user login. In the initial view, safety features can be viewed on a map (geographic extent, see Figure 16 and Figure 17) as well as on an object list (main features only, see Figure 16). Map layer control allows to switch map background e.g. to orthophoto. When chosen on the map or in the object list, a details window is displayed, where all attributes can be seen (Figure 18).

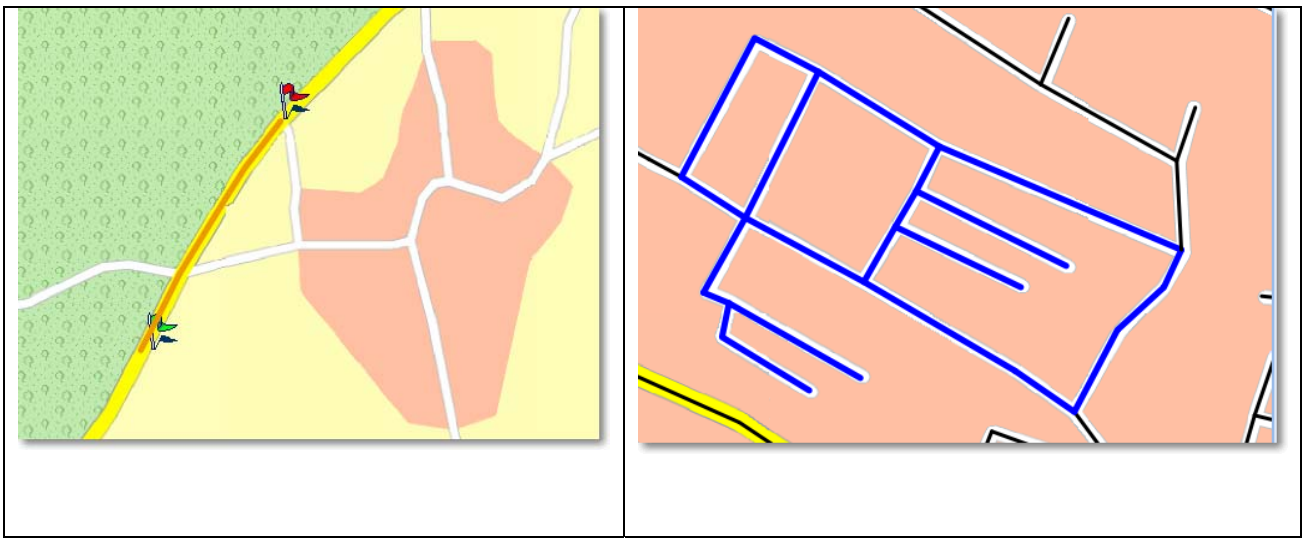


Figure 17: map view with two different location types: linear extent (left) and zone (right)

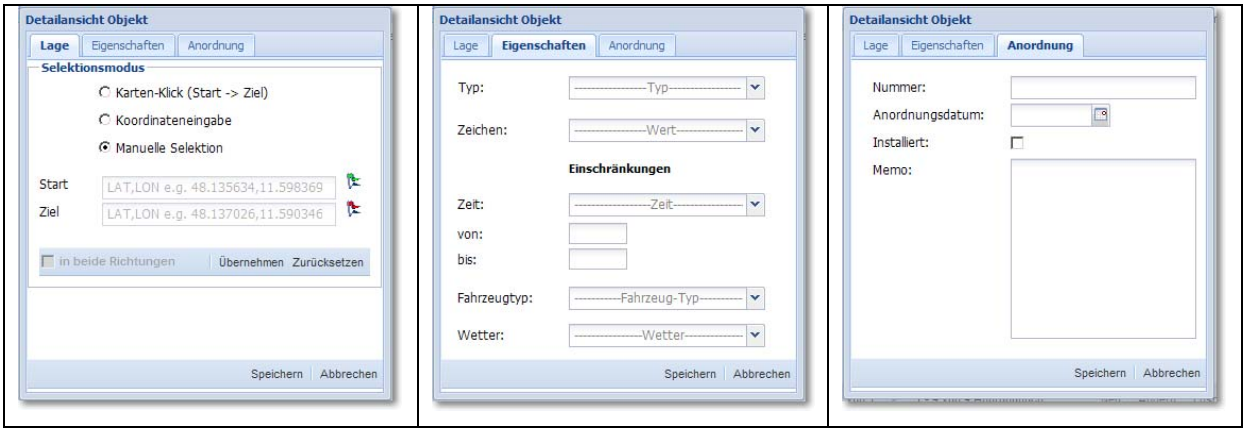


Figure 18: 'Object details window', where all attributes of the safety feature can be entered or changed.

When new safety features are entered or changed, the workflow passes through these steps in the Object details window, until all mandatory data is entered.

5. Test site Flanders (AWV)

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

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. Each city and municipality is responsible for keeping the traffic sign data up to date along their road network, but there is no legal obligation to do so at this moment.

of the Flemish government together with the city of Antwerp.

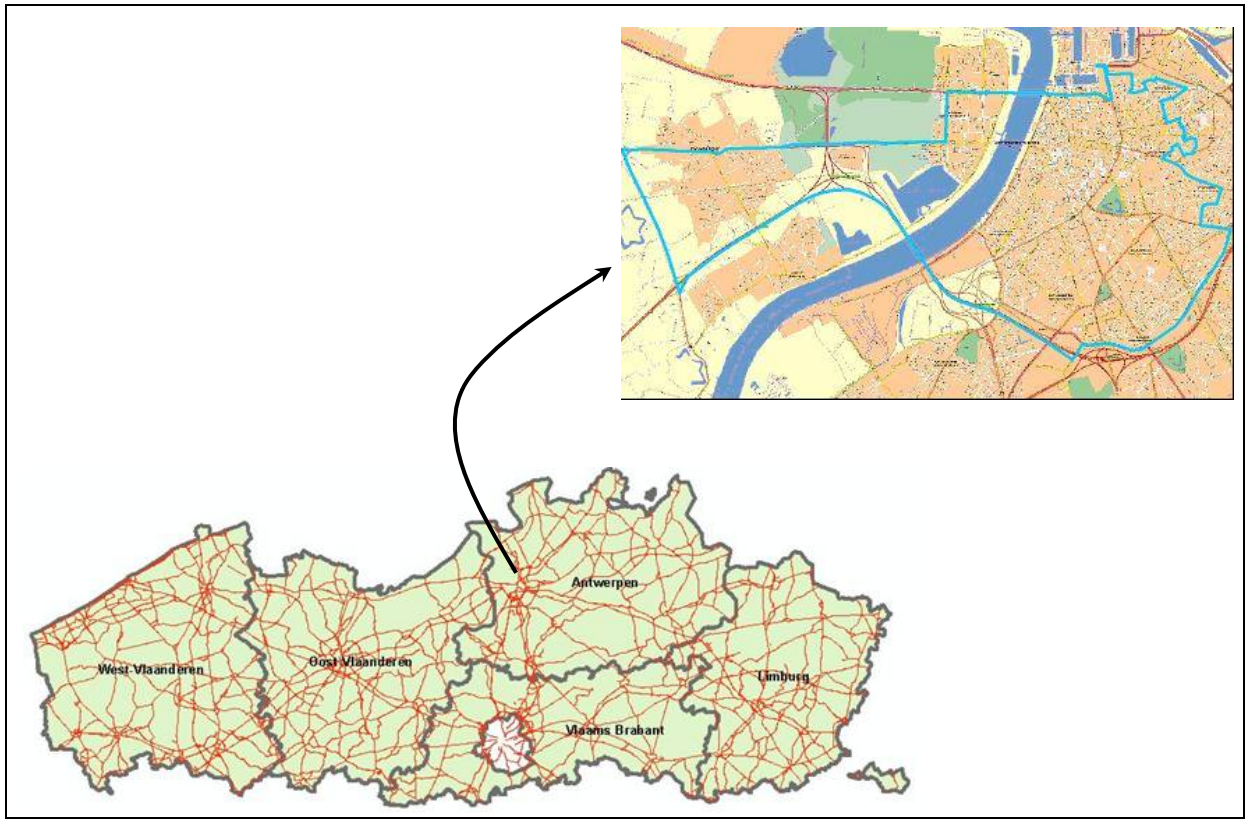


Figure 19: Location of the test site area of Flanders

All road authorities will be using the same tools for updating, as well as the same traffic sign 'libraries'.

The test site will be located in the Antwerp region. The closed trajectory of about 30 km contains highways, main roads and regional roads, as well as roads under the jurisdiction of the city of Antwerp. So there are 2 organisational levels involved: the Agency of roads and traffic

After extracting the initial snapshot of the traffic sign database for the test site area, both road authorities will insert a number of updates into the traffic sign database:

- inserting new traffic signs
- adjusting existing traffic signs
    - by location
    - by attributes
- delete existing traffic signs

The ROSATTE extraction tool then can generate an xml file with the updates:

- User selects a number of traffic signs
- User specifies the location where the path where the ROSATTE XML must be stored

- The system compaires each traffic sign with the previous extraction
- The system calculates the SafetyFeatures and locations of the changed traffic signs
- The locations become AGORA-C encoded
- The system stores the SafetyFeatures in the xml file
- The system provides an update of the data in the ROSATTE Extraction part of the database.

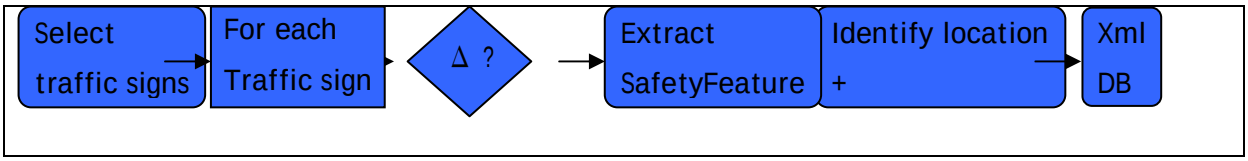


Figure 20: The ROSATTE extraction tool

5.1 Technical architecture

The following figure shows the architecture of the ROSATTE extraction tool. The left part (in grey) is the Flemish traffic sign database editor, with the following components:

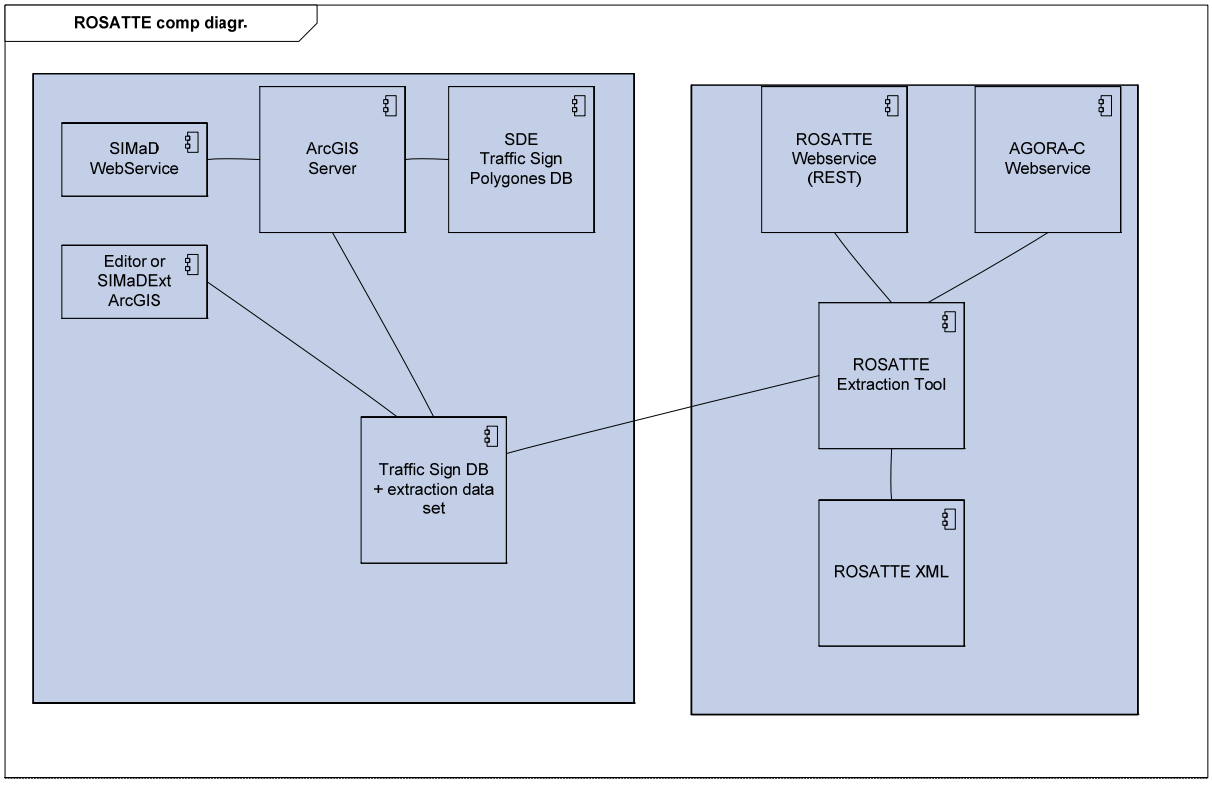


Figure 21: Architecture of the ROSATTE extraction tool

- EditGIS-application: a user is able to select, open and edit a dataset of traffic signs with this application. A dataset is a group of traffic signs that belong to a road authority (e.g. municipality), or a subdivision of a road authority (e.g. a district of AWV).

- SIMaDExt-ArcMap: this is also for editing traffic sign datasets, but this time using an ArcGIS desktop client.
- SIMaD WebService: to create the polygones for the traffic sign databse using an ArcSDE polygone layer. This webservice uses ArcObjects in ArcGIS Server to create polygones and to store them in a polygone layer.
- ArcGIS Server : ArcObjects functionalities are used for the SIMaD Webservice.
- SDE: Storage of the polygones in an SDE database to visualise the traffic signs in a GIS.
- DB: Storage of the traffic sign data.

The ROSATTE extraction tool (on the right) has the following components:

- AGORA-C Webservice: for the encoding of the location of a SafetyFeature.
- ROSATTE Webservice: in order to get the location parameters which will be provided to the Agora-C Webservice, it is necessary to make use of ArcObjects. More specific, ArcObjects functionalities are used to locate each traffic sign relative to the start- and end node of the road segment to which the traffic sign is assigned to. When another version of the underlying road map is used, this webservice will be able to assign traffic signs to the 'new' road segment. This also offers a solution to the problem when traffic signs have no Navstreets LinkID at all. This is the case for the traffic signs along regional roads and highways (AWV-roads). Instead of the Navstreets LinkID, these traffic signs have the national road number as an attribute. Using the so called 'transportnetwerk' (= Navstreets enriched with the national road numbers, road authority, european road number, …) it is possible to translate the national road number into a LinkID, which in turn is used for the Agora-C webservice.
- ROSATTE extraction tool: to extract the SafetyFeatures of the Flemish traffic sign database to the SafetyFeatures of the ROSATTE extraction part of the database.
- DB – ROSATTE Extraction: this database stores the SafetyFeatures extracted from the Flemish traffic sign database. These SafetyFeatures will be used to generate the SnapShot ROSATTEDataset as well as the update ROSATTEDatasets.
- ROSATTE xml: xml export file as specified in D3.1.

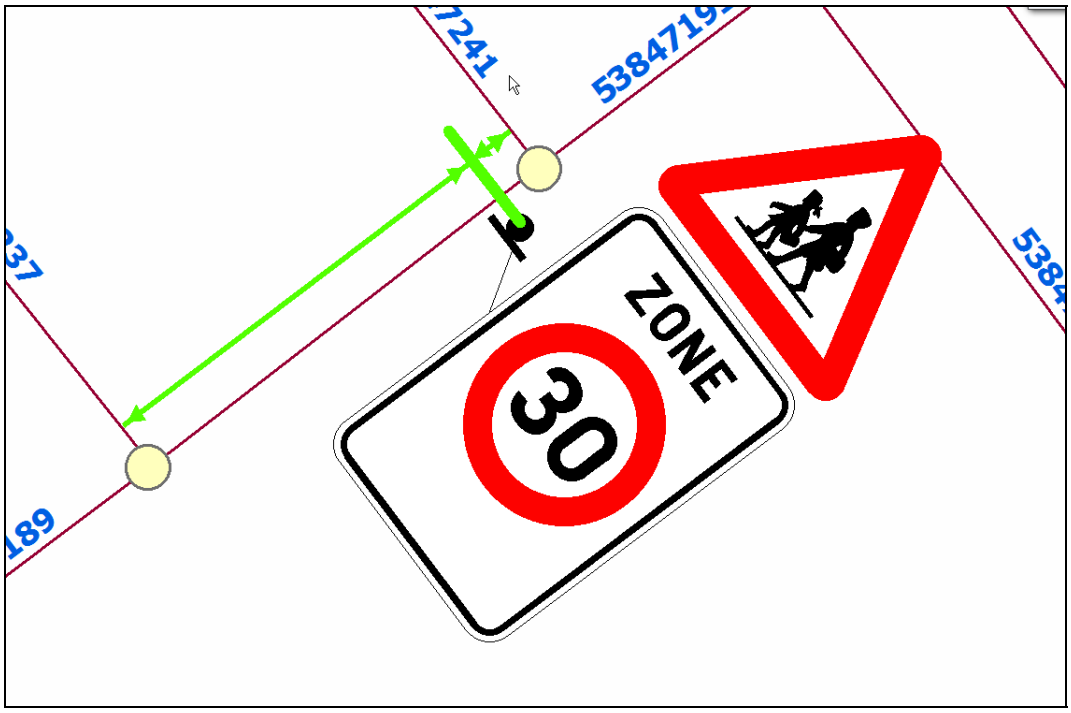
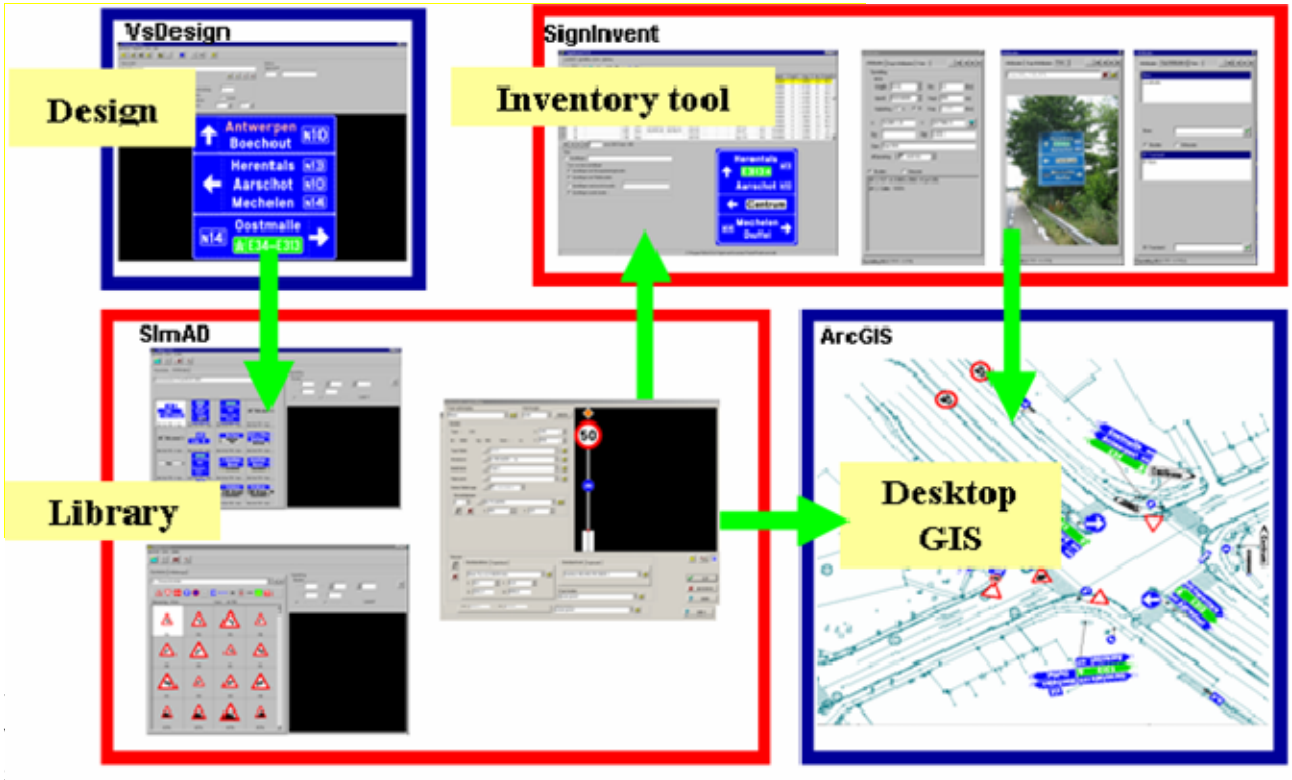
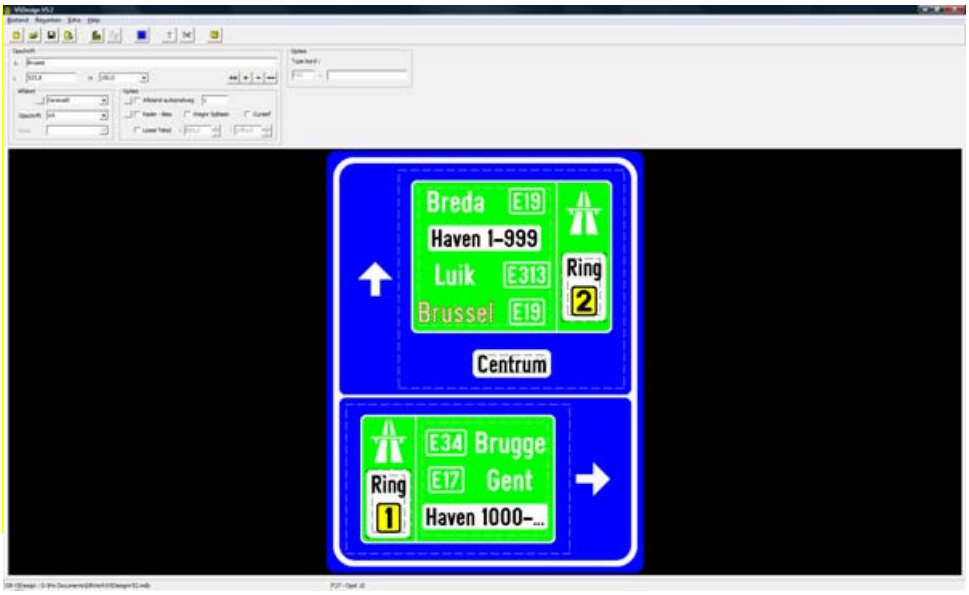


Figure 22: Relative location of a traffic sign along a road segment

5.2 User Interface

Figure 6 shows the different tools that are used.



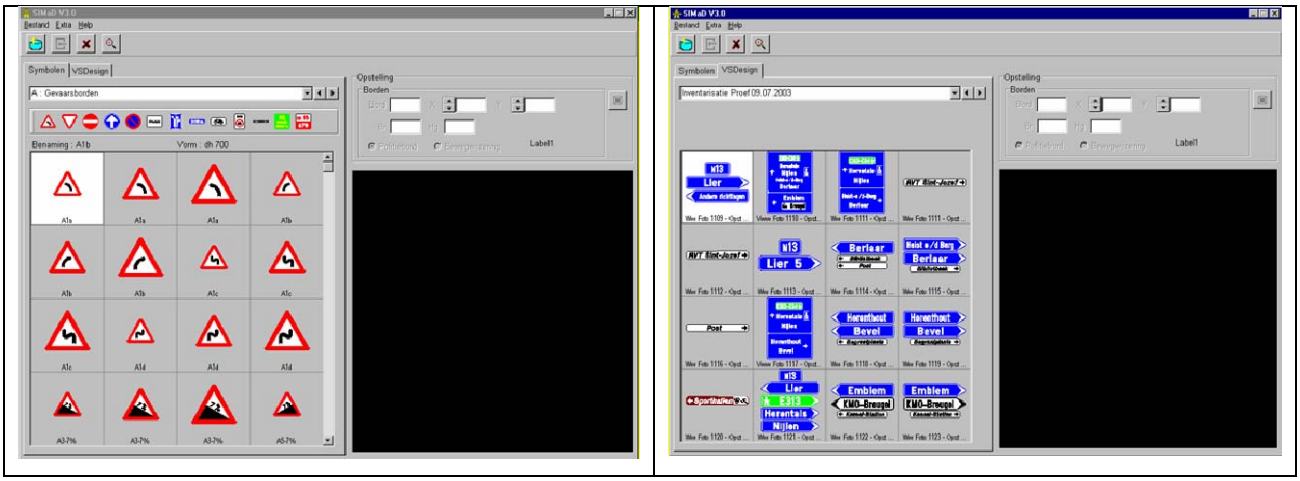


5.2.2 SIMaD

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.



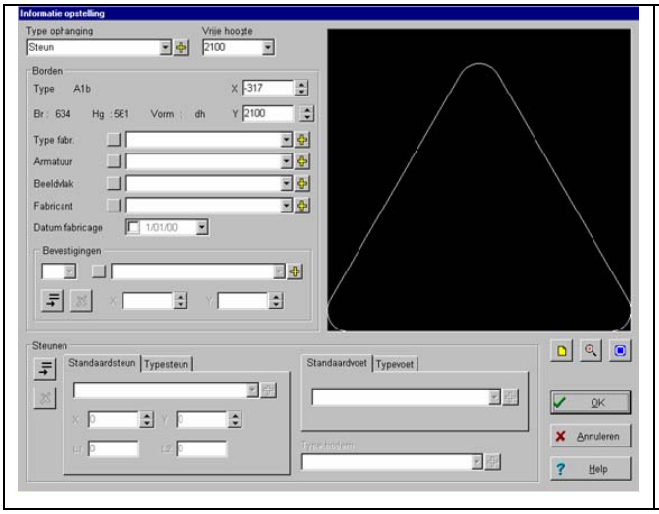


Figure 25: SIMaD User Interface

5.2.3 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.

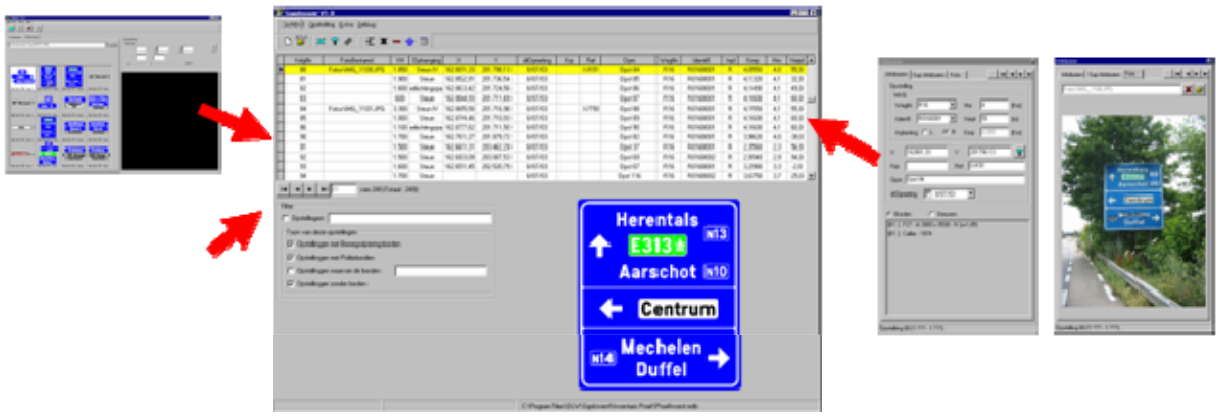


Figure 26: Making an inventory with SignInvent

5.2.4 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.

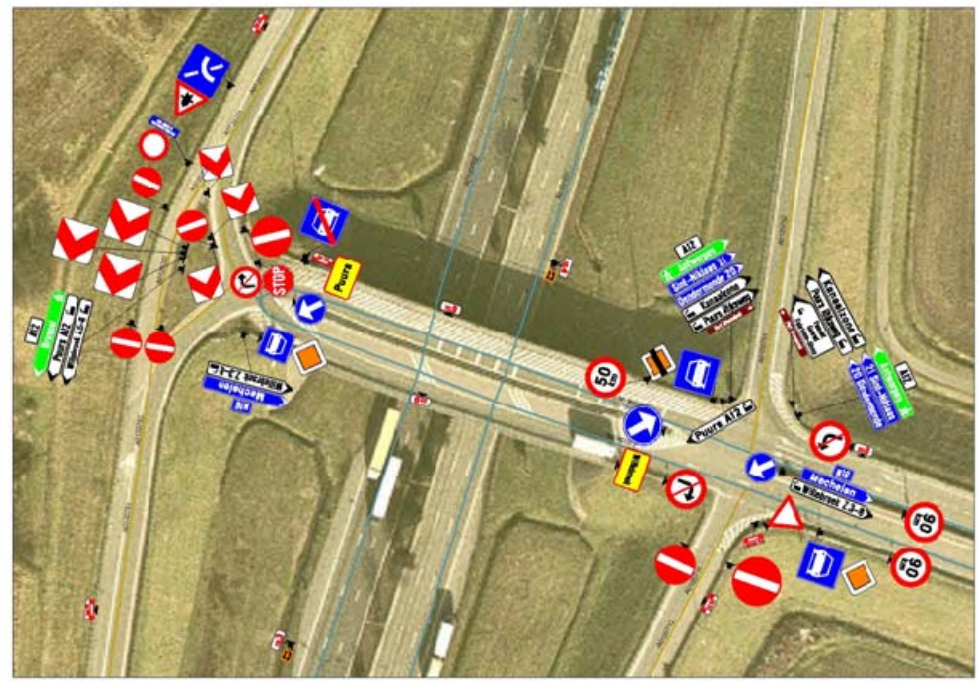


Figure 27: View on the traffic sign database using ArcGIS

Since the first of May 2009, the traffic sign database provides a Webbased GIS viewer where the road authorities can consult their data.

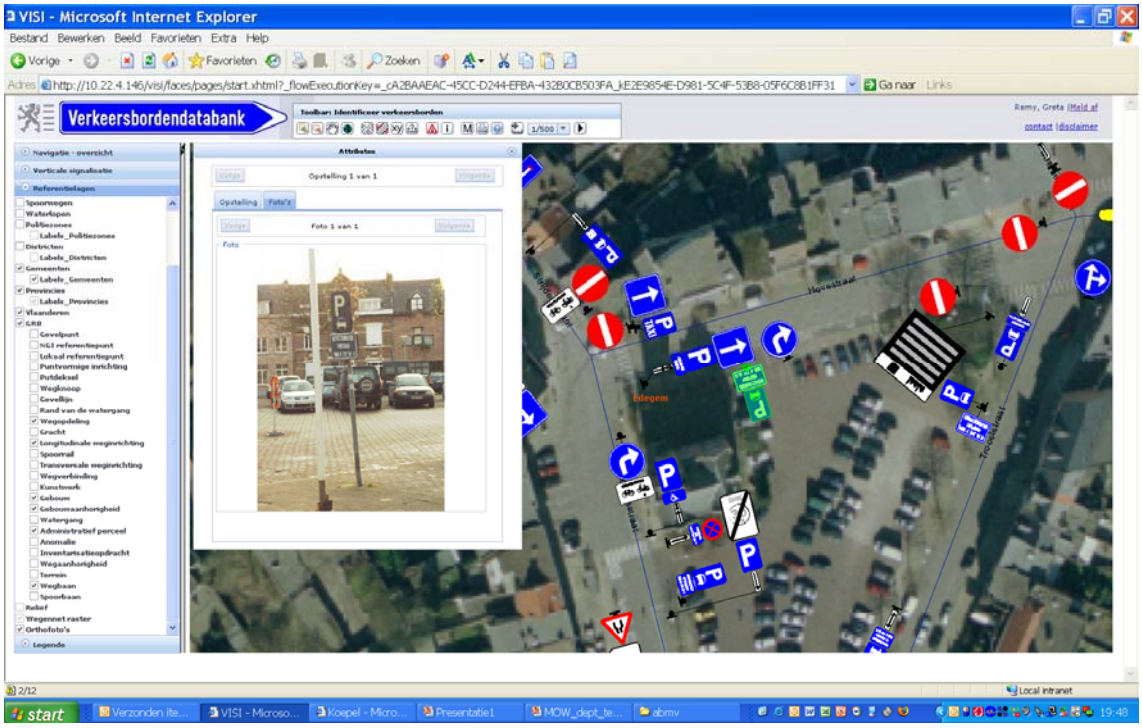


Figure 28: The webbased viewer of the traffic sign database

The combination of VsDesign, SIMaD and SignInvent, necessary for updating the traffic sign database, together with the GIS interface, is also operational. Each road authority can keep his database up to date using these tools that are provided by the Flemish government.

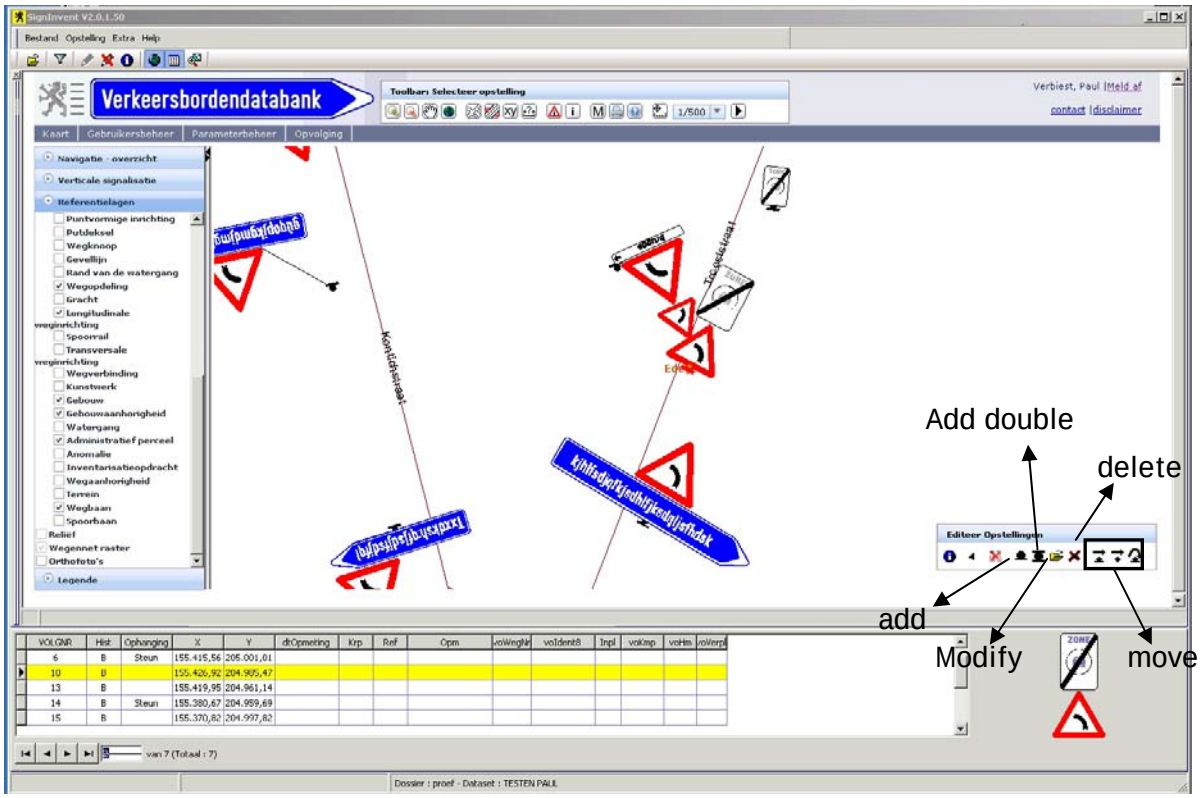


Figure 29: The EditGIS or editor of the traffic sign database

6. Test site Sweden/Norway (SRA, NPRA)

6.1 Scope of safety features

The test will focus on speed limits and a few more safety features that can be derived from traffic rules. The features are defined in the table below.

All features should be able to propagate in the data chain according to the Update-specification i.e. Add, Modify and Remove.

Safety Feature	Description	Source	Will be tested in
SpeedLimit static fixed (explicit (signposted) S1 or implicit G1)	As the source usually is a traffic rule, it doesn't matter if the speed limit is explicitly signposted or not. Most of them are, but for example when an urban area signpost exists but no speed limit sign post, 50 km/h is default in Sweden	Traffic rules and maybe NVDB based on field survey in Norway	The whole test area
SpeedLimit variable fixed (explicit, signposted S2)	Speed limits, fixed signposted indicating a variable speed limit. A typical application is a specific speed limit rule during school hours. Outside the school hours, the default speed limit for the area will apply	Traffic rules	The whole test area
RestrictionsFor Vehicles PropertyType: MaximumHeight		NVDB based on field survey	The whole test area
WarningSign WarningSignType: MooseCrossing		NVDB based on field survey	In Norway
WarningSign WarningSignType: DangerousCurve		NVDB based on field survey	In Norway
DirectionToBe Followed	The opposite to Forbidden driving direction	Traffic rules	The whole test area
Prohibited turn		Traffic rules	The whole test area
ObligationToStop	New safety feature not specified in D3.1, but an interesting test because it should be easy to add new SafetyFeature to the codelist	Traffic rule	The whole test area

Table 4: Supported Safety Features for Test site Sweden/Norway

6.2 Workflow at the enacting authorities/road operator

There are some differences in how Sweden and Norway handles traffic regulations.

6.2.1 Workflow at the enacting authorities/road operator in Sweden

The following figure illustrates the typical traffic regulation workflow in Sweden:

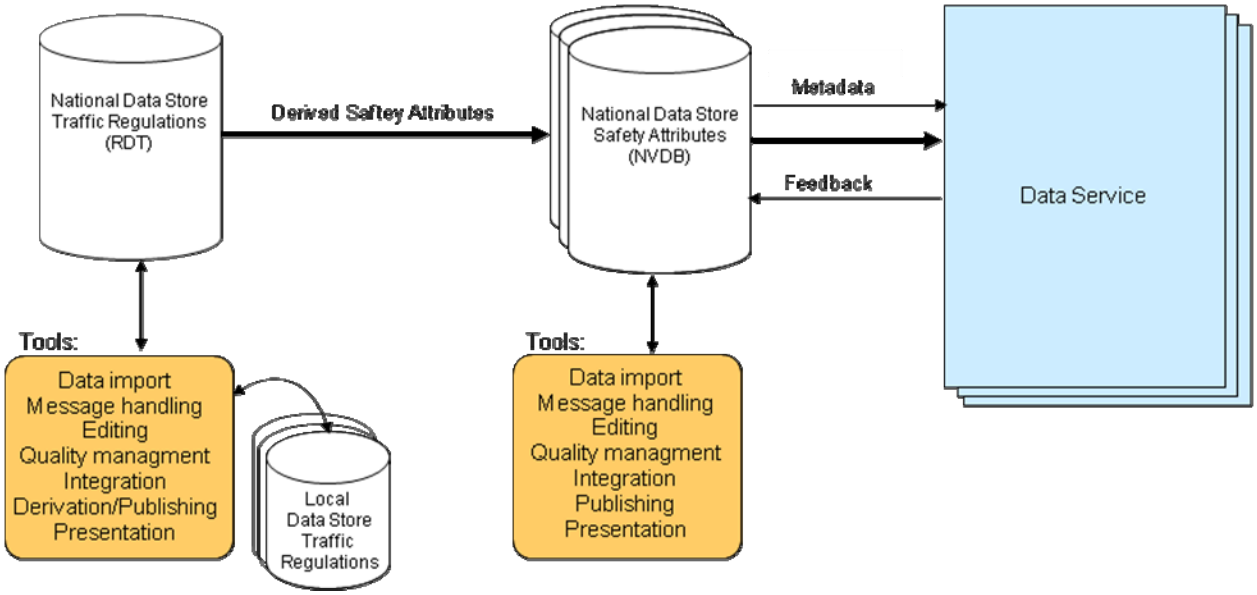


Figure 30: Traffic regulations (Sweden)

6.2.2 Workflow at the enacting authorities/road operator in Norway

The following figure illustrates a typical speed limit regulation workflow in Norway:

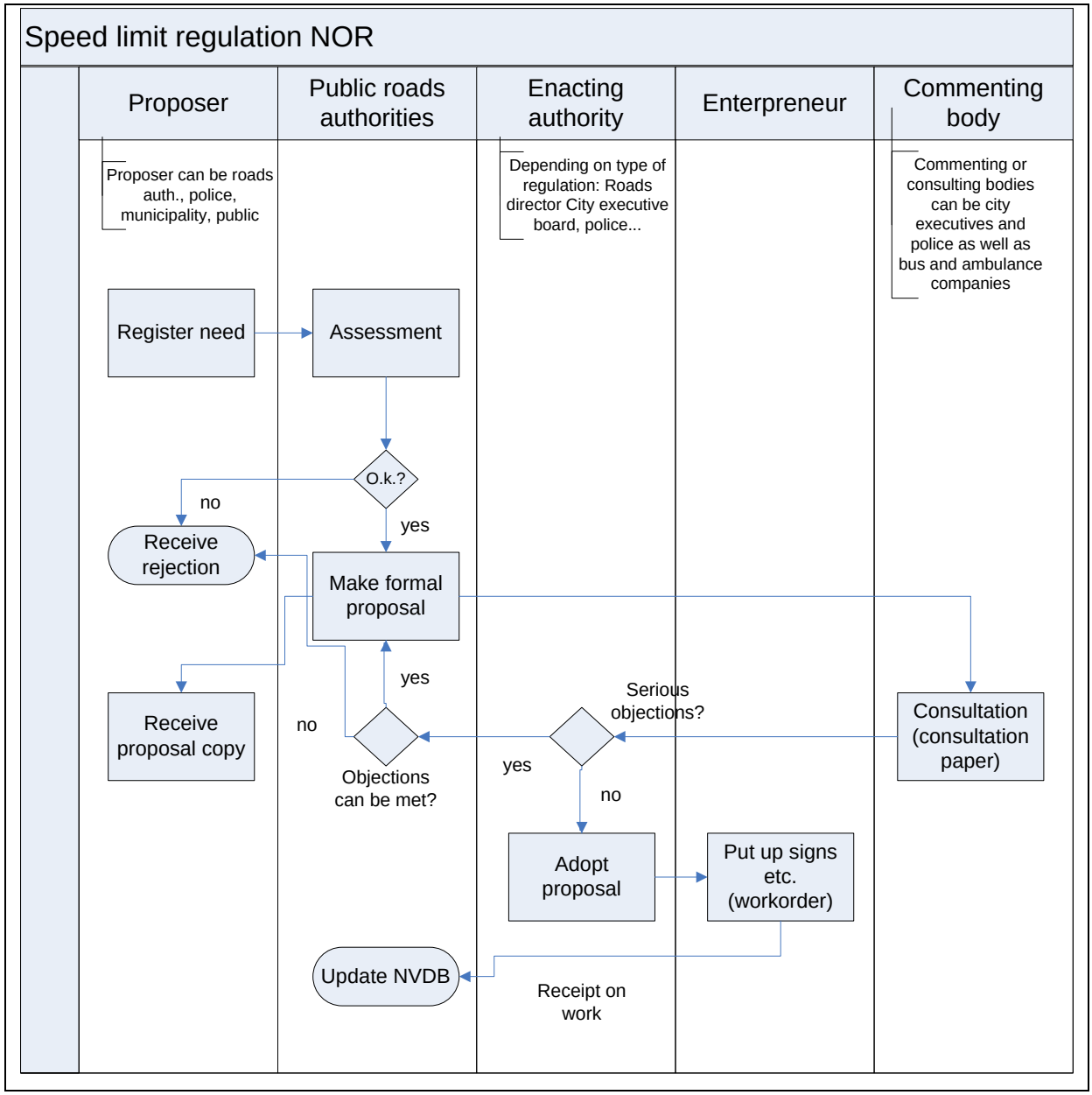


Figure 31: Speed limit regulation (Norway)

Regional authorities and municipalities may also update NVDB according to their responsibility as a road owner. But during the test period the work flow will be simplified, and updates will be done by NPRA only.

Regulations are needed for all traffic signs, and the workflow is almost identical.

6.2.3 Roles running the test site

Roles and actors in the list below relates to the work in running the test site.

Role	Actor	Description of work
Test site coordinator		Manage the test site
Local authority, Sweden	Strömstad	Register traffic regulations on local roads in RDT (some data in the initial supply comes from RDT. Simulated changes are introduced by SRA in the test phase
Local authority Nor	Fredrikstad, Halden and Sarpsborg	Register traffic regulations on municipality and private roads (this will be done by NPRA in the test phase
Central authority Sweden	SRA	Derive safety attributes from traffic regulations Register traffic regulations in RDT (initial supply) and other attributes in NVDB regarding national roads Send safety and location referencing attributes to Map providers/Information providers
Central authority Norway	NPRA	Derive safety attributes from traffic regulations (simulation in the test phase) Register attributes in NVDB regarding national roads Send safety and location referencing attributes to Map providers/Information providers
Software Provider	Triona	Develops the software (TNE[5] and TNE extensions) used by SRA and NPRA to send data to Map Providers
TNE host	Triona	Hosts TNE for NPRA

Table 5: Roles and actors in TS Sweden

6.3 Technical architecture

Two central repositories exist in the test site, NVDB in Sweden and NVDB in Norway. Sweden does also have a national data base for traffic regulations (RDT) operating from 2010.

TNE in Norway and TNE in Sweden can be defined as part of the ROSATTE Infrastructure (data store). Download services will be implemented both in Norway and in Sweden. For the testing phase the TNE-module for Norway is set up in Sweden by Triona.

6.3.1 Creation of a ROSATTE data store

Figure 30 shows a component view of the solution for generation of a ROSATTE data store. The principles are the same for both the Swedish and the Norwegian test sites.

Data from the national road database (NVDB) is downloaded to a *NVDB – Geodatabase* on the ROSATTE server. The types of data downloaded are the following:

[5] Transport Network Engine, a Triona Product to analyse and present road network data from NVDB

The basic road network including geometry and topology

- Road network attribution which is significant for AGORA, this includes
- Road number
- Road name
- Road category
- Functional road class
- Roundabout
- Motorway
- Driving direction
- Road network attribution which represents the safety features
- Speed limit
- Traffic signs
- Update information

From the data above, three datasets are created:

- A dynamically segmented road network with homogeneous (with regards to all AGORA attributes [2]) road elements which is used by the *AGORA Encoder*. This data is labelled *AGORA Network* in Figure 15 below. The content of this dataset differs between the Swedish and the Norwegian test sites
- A *ROSATTE Converter* transforms the data from the *NVDB – Geodatabase* into the *ROSATTE data store*. The *ROSATTE data store* has the same structure for both the Swedish and the Norwegian test sites and contains two types of ROSATTE safety features: (1) Point features (traffic signs), (2) Linear features (speed limits)
- An update log describing what safety features was updated (add, modify, delete), when they were updated and by whom.

Besides from being a geodatabase feature (i.e. suitable for map presentation), every safety feature in the *ROSATTE data store* contains the ROSATTE GML representation including the AGORA location and is therefore ready for publishing on the web.

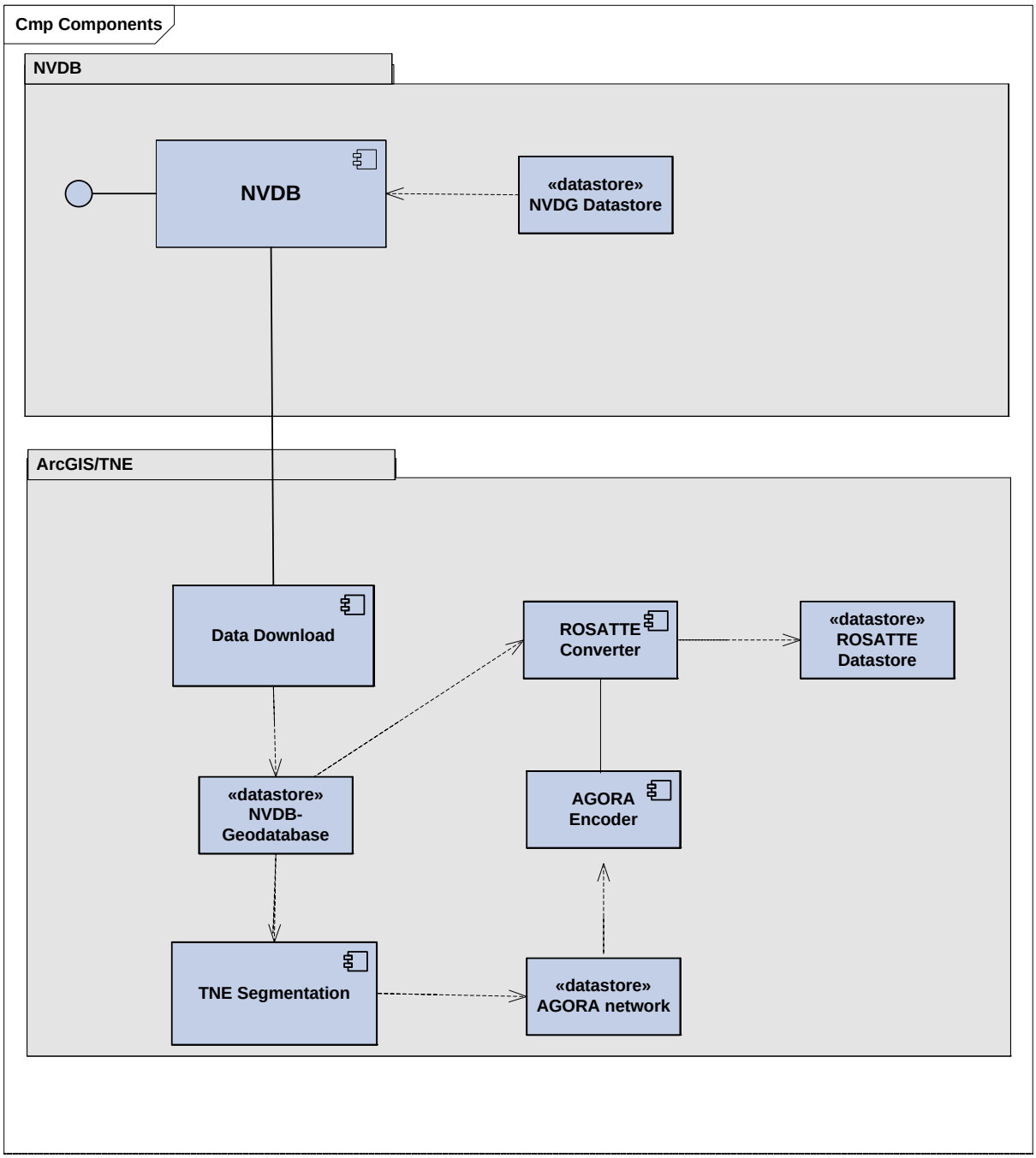


Figure 32: Component view of the creation of a ROSATTE Datastore for the Swedish and Norwegian test sites

6.3.2 *Technical architecture in Sweden*

The following figure illustrates the conceptual infrastructure in Sweden, grouped according to WP1.

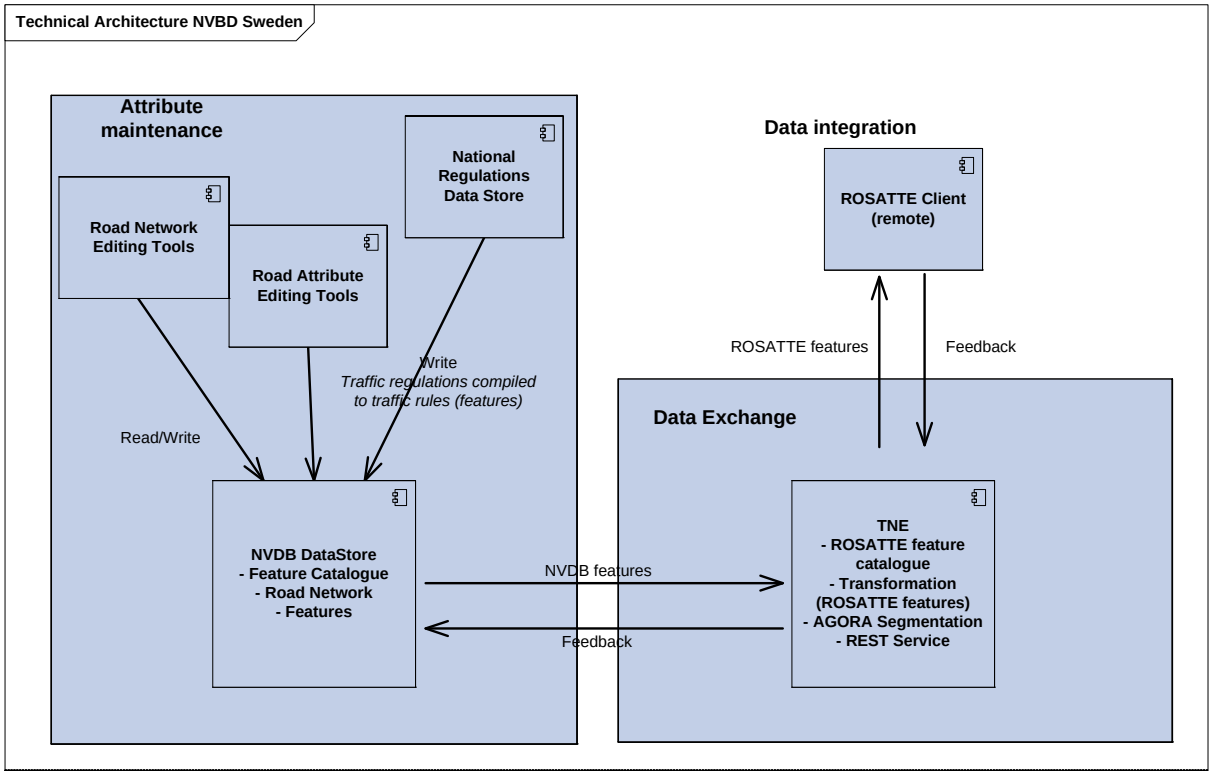


Figure 33: Technical architecture overview - NVDB in Sweden

6.3.3 *Technical architecture in Norway*

The following figure illustrates the infrastructure in Norway, grouped according to WP1.

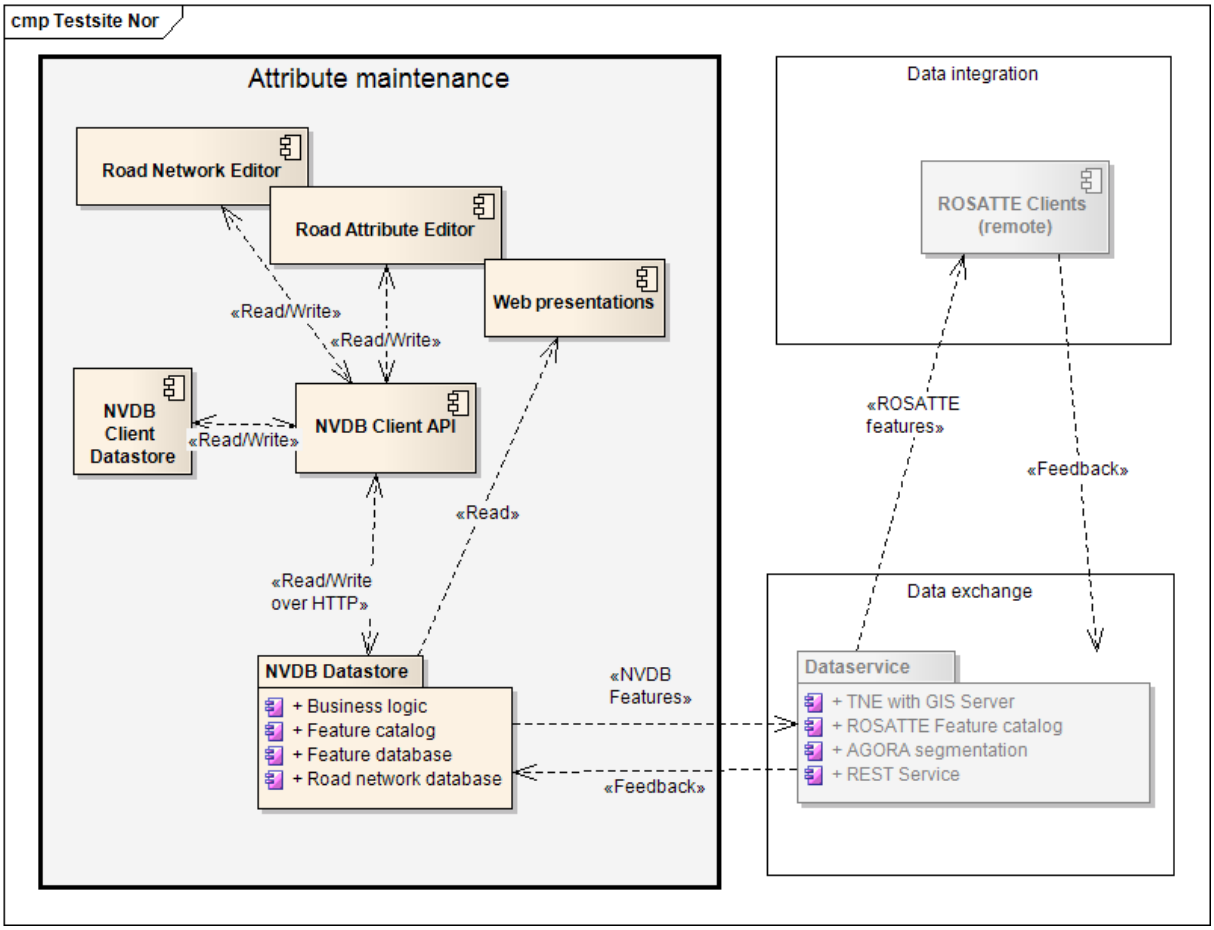


Figure 34: Technical architecture in NVDB in Norway

6.4 *User Interface*

Sweden and Norway have different applications for data updating.

6.4.1 *User Interface in Sweden*

The Swedish national road database (NVDB) was established approximately ten years ago. NVDB holds a complete common road network (State roads, Municipal roads, Private roads, Forestry roads and Bicycle paths) and a significant set of road data (speed limit, road width, road number, road name, functional road class, height restriction etc) at a basic level.

The road network in NVDB is a common resource for the national road database as well as for "in-house" specific applications with databases of more detailed technical information.

The Swedish Road Administration (SRA) manages NVDB but is depending of many partners – municipalities, private road associations, forestry industry – when updating the database.

Users are provided access to the data base through different applications adapted to their needs. Different levels of data access are available depending on user identification, with only selected personnel being authorized to update the data base.

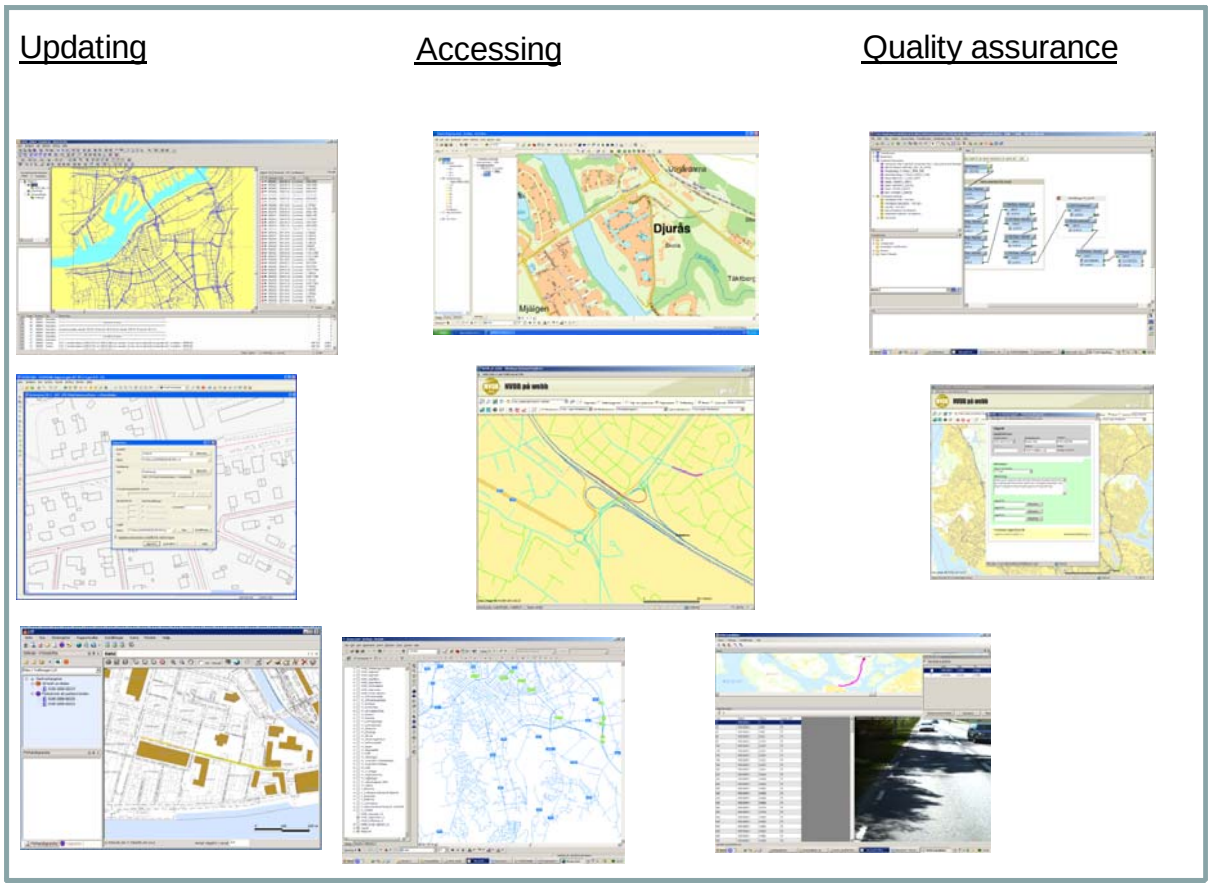


Figure 35: Different clients in NVDB (Sweden)

The digital maps viewed in the different applications are mainly delivered the Swedish Mapping, Cadastral and Land Registration Authority (Lantmäteriet) and the maps are stored on servers at SRA. The map store is updated regularly to ensure that users always have access to updated map data.

Server and client communication is mainly file based (XML) using on the Swedish standard for road and railroad (SS 63 70 0x - domestic standards based on ISO 191xx).

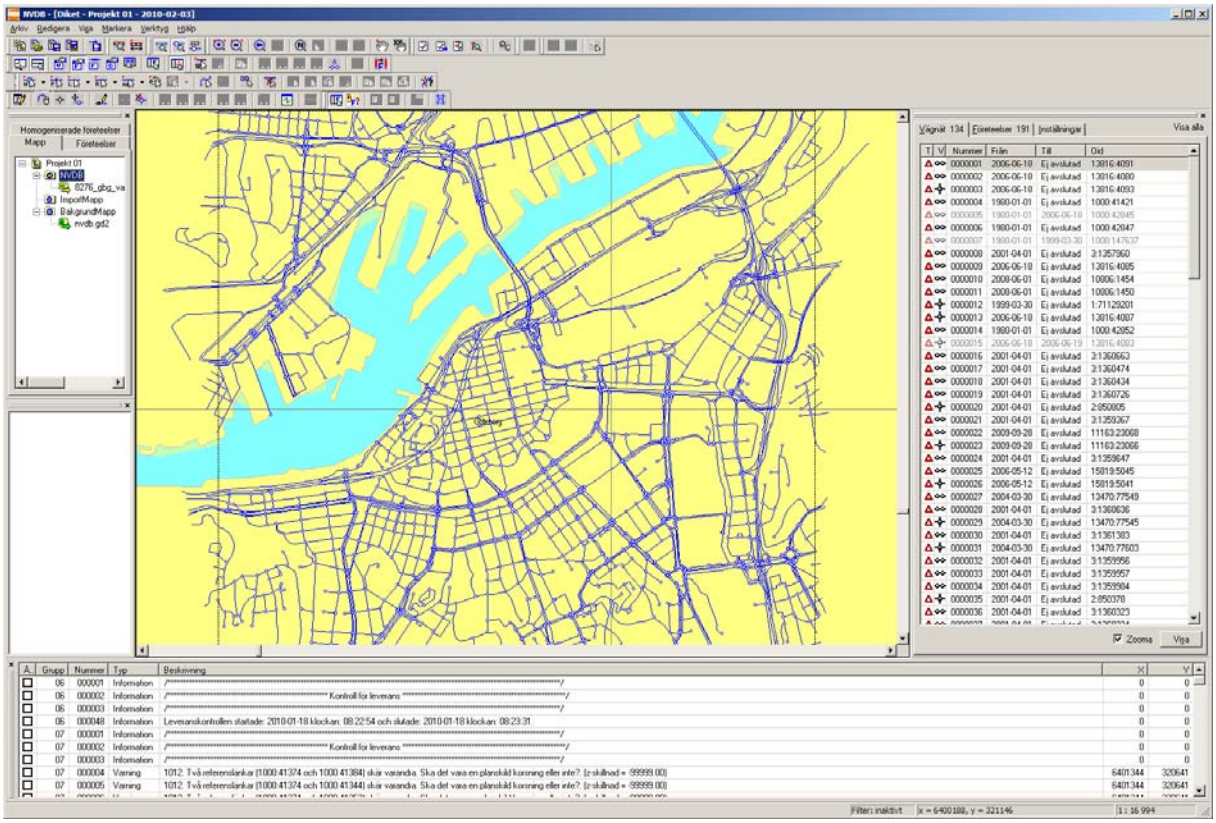


Figure 36: Road network and feature updating using Update Dialogue (Sweden)

6.4.2 User Interface in Norway

The NVDB I Norway is a new data base containing both road and traffic data. Users are provided access to the data base through different applications adapted to their needs. These tools are intended to efficiently manage, operate, maintain and develop the public road network as well as enhancing vehicle and road user supervision.

The NVBD has been developed by the Norwegian Public Roads Administration primarily for its own use, but is also available for external users such as other public authorities, municipalities and organizations as well as the general public.

Different levels of data access will be available depending on user identification, with only selected personnel being authorized to update the data base.

The digital maps viewed in the different applications are mainly from the Norwegian Mapping and Cadastre Authority and are stored on their servers. This ensures that users always have the latest updated map data. We get access to the maps using Web Map Services (WMS).

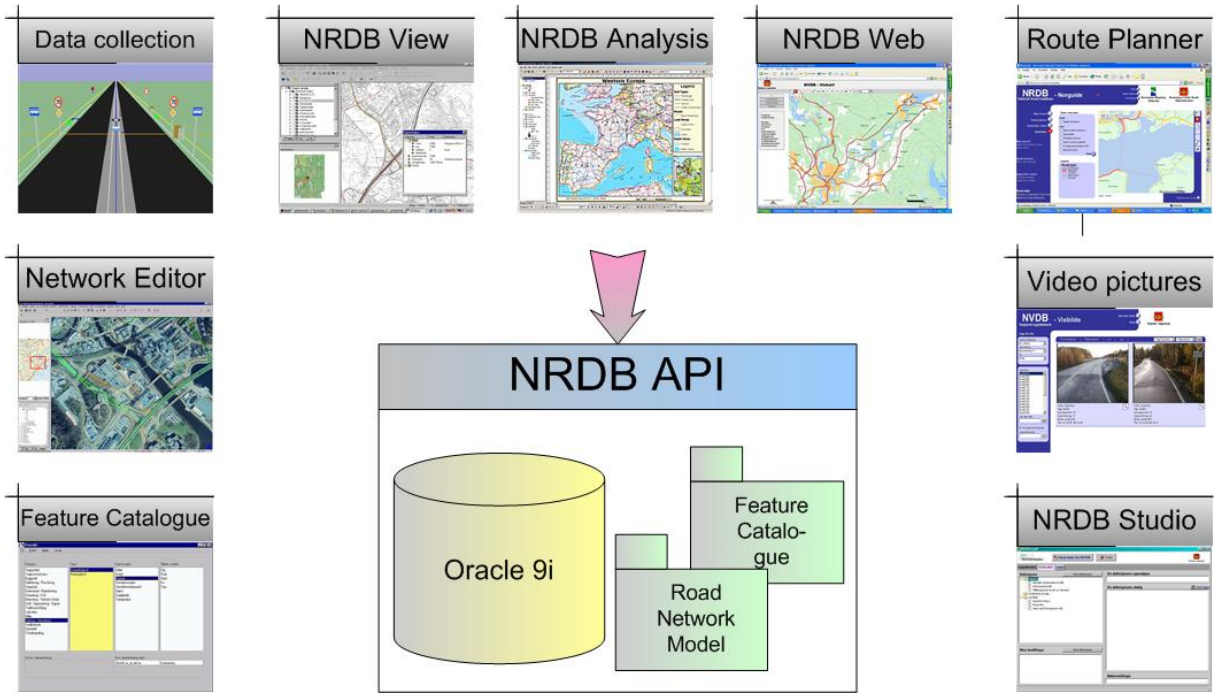


Figure 37: Different clients in NVDB (Norway)

NVDB View and NVDB Network Editor are based on GIS/LINE (a GIS-tool from a Norwegian vendor). NVDB Analysis is based on ArcGIS from ESRI. These tools may be used for updating of the road network itself and also the different features in the database through an extension called Update Dialogue.

All server and client communication is carried out via the HTTP protocol. This means that NVDB can be accessed from a computer anywhere in the world as long as you are connected to the Internet.

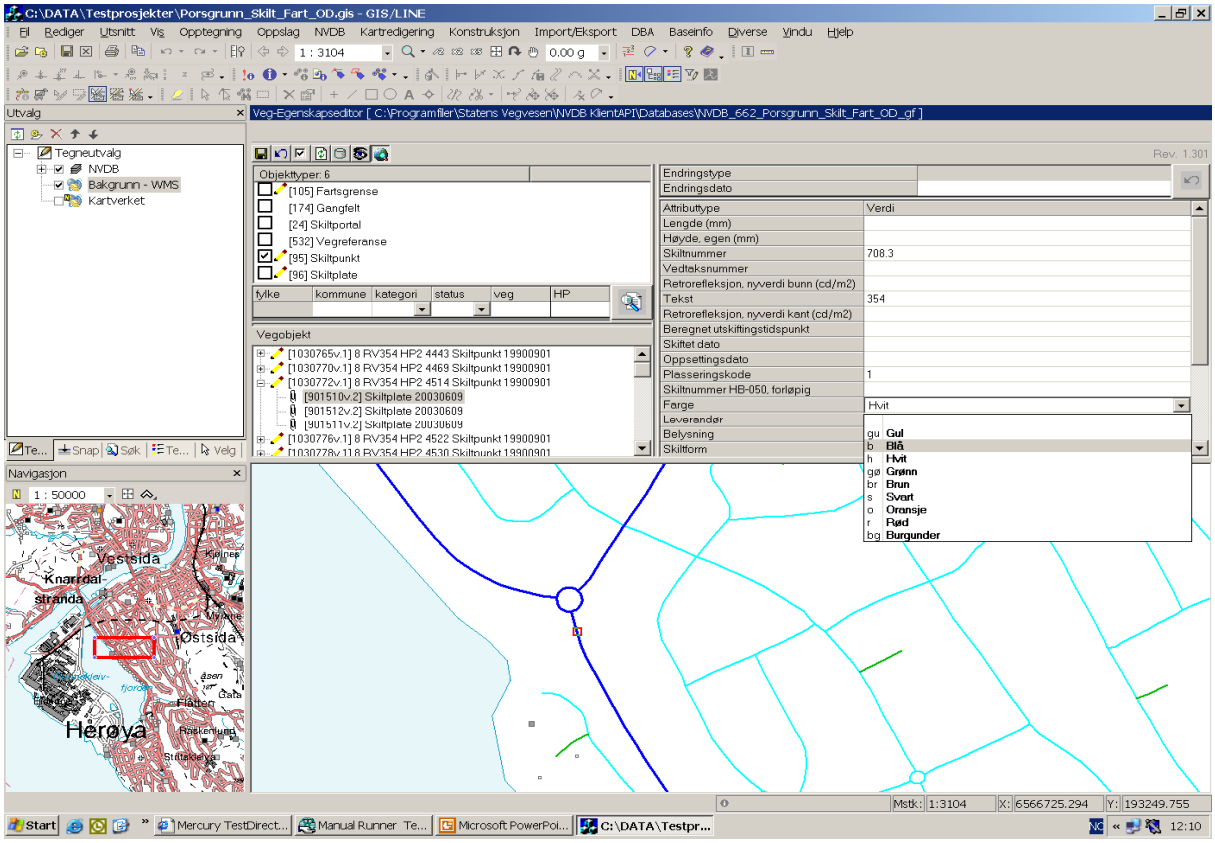


Figure 38: Feature updating using Update Dialogue (Norway)

7. Test site London (Transport For London, TFL)

7.1 Scope of safety features

TfL is collecting speed limit signs as point records. Each sign record can hold the data for two sign plates facing in opposite directions. These two plates are referred to as primary (facing the driver on left-hand side of the road) and secondary (facing the driver on the right hand side of the road). For each primary and secondary sign plate, a state of the sign is also recorded in the fields PSignData and SSigndata respectively.

One issue encountered in collecting speed limits in London was how to represent National Limits. National limits are represented by a single image of a white sign with a diagonal black line across the sign face from top right to left bottom.

e.g. 

National limits vary on the nature of the carriageway (either: Single, Dual, Motorway), and according to the vehicle driving on the road (i.e. car, bus, goods vehicles, etc.). For National limits, speed limits were recorded using the following variables to recognise the fact the limit may be different depending on what type of road the limit is on, and also, what type of vehicle is using the road:

- **NS** = National Speed Limit on a *Single* Carriageway
- **ND** = National Speed Limit on a *Dual* Carriageway
- **NM** = National Speed Limit on a *Motorway*

Fields to describe safety features are used are listed below:

ISA_Terminal Browser

SID	PSpeed	SSpeed	PSignData	SSignData	Checked	FNote	TOID	Xcoord	Ycoord	Status	Borough	TMO_Title	Published_Date	Effective_Date
4,173	20	30	Operational	Operational	Checked	F	400000003025125	530,266.79	185,726.92		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009
4,174	30	20	Operational	Operational	Checked	F	400000003065929	530,078.98	185,391.3		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009
4,175	20	30	Operational	Operational	Checked	F	400000003065929	530,072.56	185,381.68		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009
4,176	30	20	Operational	Operational	Checked	F	400000003035532	530,006.19	185,305.3		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009
4,177	20	30	Operational	Operational	Checked	F	400000003035532	530,005.87	185,290.85		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009
4,178	20	30	Operational	Operational	Checked	F	400000003025061	529,875.17	185,088.23		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009
4,179	30	20	Operational	Operational		F	400000003025061	529,879.53	185,094.13		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009
4,180	30	20	Operational	Operational	Checked	F	400000003015318	529,720.9	185,180.19		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009
4,181	20	30	Operational	Operational	Checked	F	400000003015318	529,716.4	185,191.73		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009
4,182	20	30	Operational	Operational	Checked	F	400000003060320	529,650.24	185,320.46		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009
4,183	30	20	Absent	Absent	Checked	F	400000003060320	529,658.39	185,313.33		Islington	THE ISLINGTON (.	26/08/2009	27/08/2009

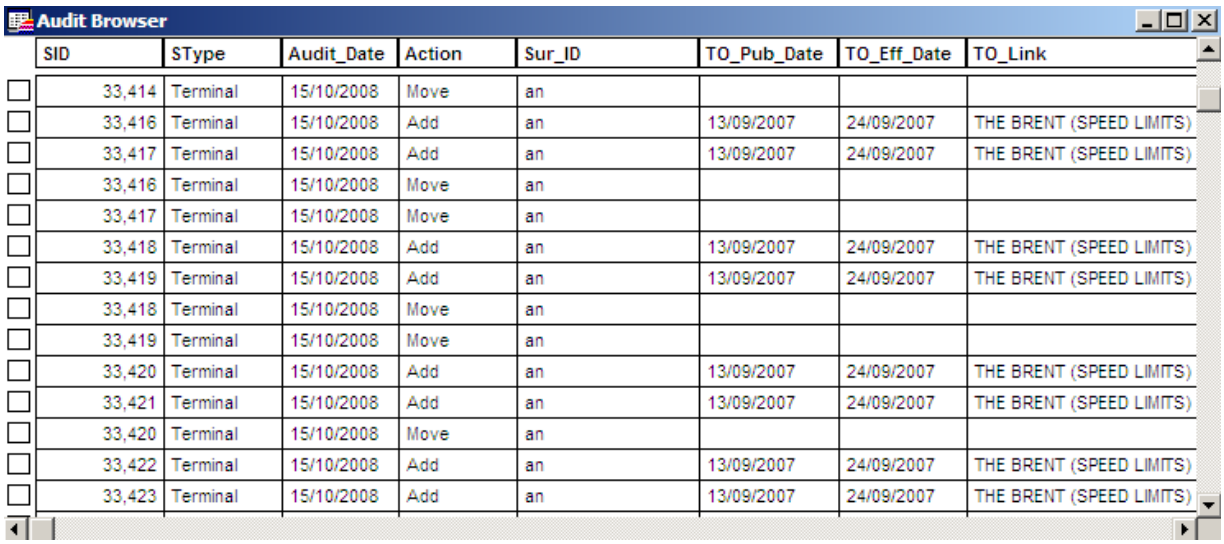
Figure 39: View on Safety feature record in TFL database

SID	Sign ID
PSpeed	Primary Speed (speed limit facing driver on left-hand side of road)
SSpeed	Secondary Speed (speed limit facing driver on right-hand side of road)
PSignData	State of Primary Speed sign plate

SSignData	State of Secondary Speed sign plate
Checked	indicates whether sign was checked and confirmed on site
FNote	True/False – if a field note record is attached
TOID	Topographical Identifier (which link the sign relates to in the Ordnance
Survey map) - this is only updated once back in the office	
Xcoord	X-coordinates
Ycoord	Y-coordinates
Status	whether sign is current or has been removed
Borough	Borough where sign is located
TMO_Title	Title of Traffic Management Order
Published_Date	date TMO was published
Effective_Date	date TMO is effective from

Table 6: data content captured and maintained in TFL operations on safety features

In addition, another table collects audit information regarding any changes made. This includes addition of new signs, modification of existing signs and deletion of existing signs:



SID	SType	Audit_Date	Action	Sur_ID	TO_Pub_Date	TO_Eff_Date	TO_Link
33,414	Terminal	15/10/2008	Move	an			
33,416	Terminal	15/10/2008	Add	an	13/09/2007	24/09/2007	THE BRENT (SPEED LIMITS)
33,417	Terminal	15/10/2008	Add	an	13/09/2007	24/09/2007	THE BRENT (SPEED LIMITS)
33,416	Terminal	15/10/2008	Move	an			
33,417	Terminal	15/10/2008	Move	an			
33,418	Terminal	15/10/2008	Add	an	13/09/2007	24/09/2007	THE BRENT (SPEED LIMITS)
33,419	Terminal	15/10/2008	Add	an	13/09/2007	24/09/2007	THE BRENT (SPEED LIMITS)
33,418	Terminal	15/10/2008	Move	an			
33,419	Terminal	15/10/2008	Move	an			
33,420	Terminal	15/10/2008	Add	an	13/09/2007	24/09/2007	THE BRENT (SPEED LIMITS)
33,421	Terminal	15/10/2008	Add	an	13/09/2007	24/09/2007	THE BRENT (SPEED LIMITS)
33,420	Terminal	15/10/2008	Move	an			
33,422	Terminal	15/10/2008	Add	an	13/09/2007	24/09/2007	THE BRENT (SPEED LIMITS)
33,423	Terminal	15/10/2008	Add	an	13/09/2007	24/09/2007	THE BRENT (SPEED LIMITS)

Figure 40: Audit Browser View

SID	Sign ID
SType	Denotes what type of sign the record refers to (i.e. 'Terminal' or 'Repeater' sign)
Audit_date	Date field for date that change was made
Action	What action has been taken on sign (i.e. 'add', 'move', 'remove', 'edit', 'reinstate')
Sur_ID	Surveyor ID. Denotes the surveyor that made the changes.
TO_Pub_Date	Date field for the date when the Traffic Order was published.
TO_Eff_Date	Date field for the date when the Traffic Order was/is effective from
TO_Link	Link to the Traffic Order at the London Gazette.

Table 5: data content captured and maintained in TFL operations on safety features audit

7.2 Workflow at the enacting authorities/road operator

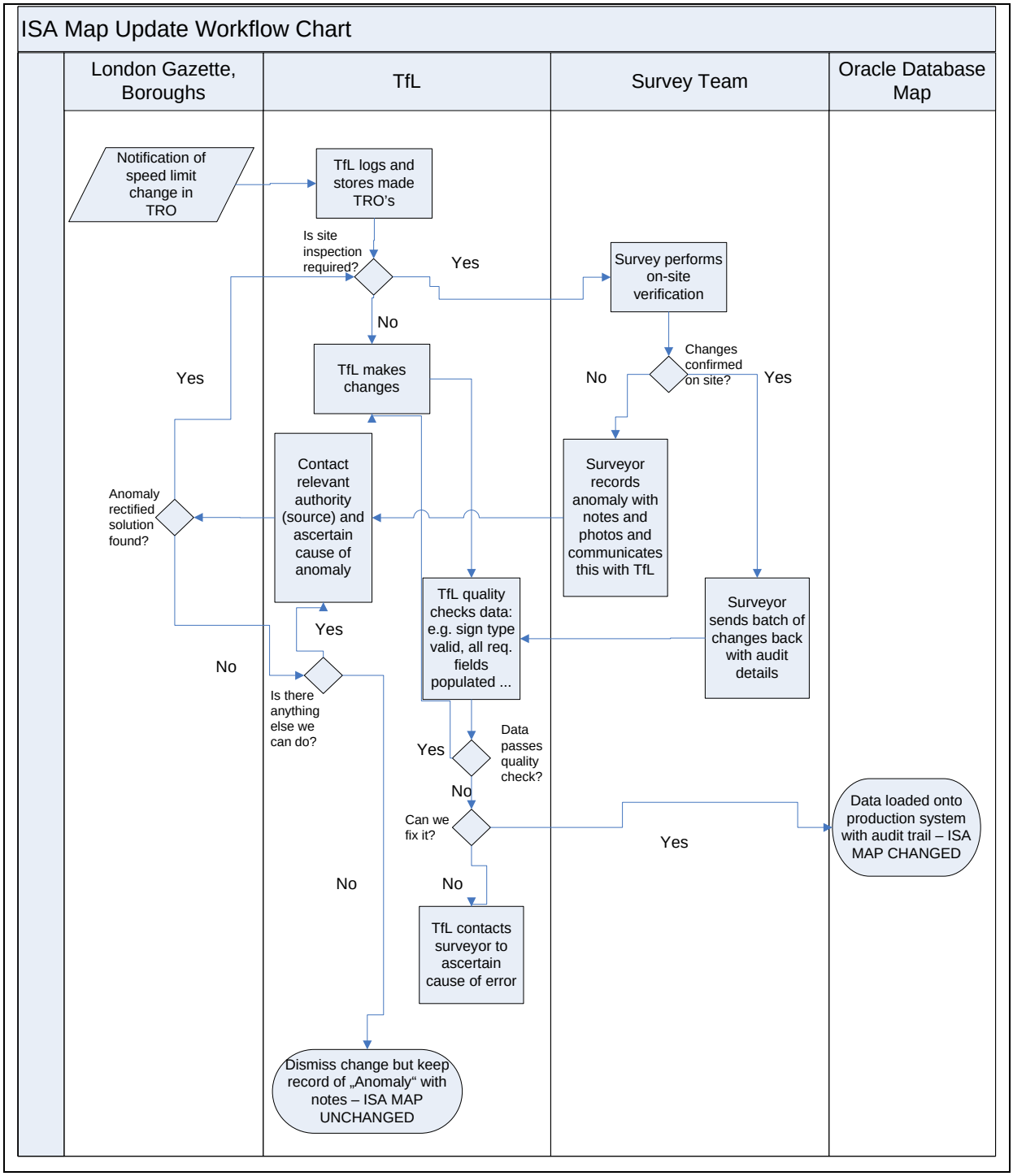


Figure 41: Workflow for data capturing and maintenance at TFL

Currently TfL captures data for the digital speed limit map in the following way:

- Email feeds are received from the London Gazette of all new Traffic Management Orders (TMO) created with the words "speed" or "speed limit" in the content.

- These orders are sorted through to determine which orders indicate an actual change in speed limit
- A survey team will then conduct an on-site survey to map out the new speed limit signs according to how they appear on-site (i.e. map matches real world situation and not specifically the traffic order).
- Data is collected using a MapBasic application developed in-house for the collection of speed limit signs
- Data is then returned to the office whereby undergoes a series of data checks:
    - A sign is present where needed.
    - All required fields are complete
    - The sign ID has not been used before
    - All signs bisect the road
    - The map remains logical with the new limit being consistent with the surrounding areas.
- Once passed the data is then loaded into the Live Oracle database system

If the data does not pass validation, errors are checked and passed back to the highway authority in question.

To ensure a comprehensive audit trail the collection application requires a surveyor to enter their initials before undertaking any data collection.

When a surveyor goes out on site they will have the MapBasic collection application loaded onto a tablet PC. As a base layer the surveyors use Aerial Photography of London to use as a reference for placing the signs. In accordance with the Map Maintenance contract, the surveyors are required to collect signs within 1m of their on road position.

Signs are collected as points with a vector drawn out perpendicular across the road.

Once back in the office these signs point and vector objects are overlaid over the Ordnance Survey(OS) ITN2 (Integrated Transport Network) layer and used to then bisect the OS road links (TOIDS) to assign the correct speed limit to the correct section of road.

If whilst on site any anomalies are found, another table FIdNotes.Tab is used to document what the problem is with reference to a specific location. Each record in this table also has the option of attaching a link to a photograph.

Once the signs have been used to convert the OS map it is then passed through a validation application to ensure that certain rules are met and a certain level of accuracy is obtained.

Once the data has passed through the validation it is then loaded into the system as Live data.

In order to ensure the contractor is collecting the speed limit signs to the required accuracy, regular site audits are conducted.

7.3 Technical architecture

TFL is currently building a digital map system into an existing system known as ACCSTATS. ACCSTATS is Oracle database system of all injury collisions on London's roads.

The system is available to internal (TfL) and external (e.g. Boroughs, Met Police) users and accessible via password and username (internal) as well as a key fob token (external).

There are three environments, Production, Test and Development.

It is intended that Open Street Map will be used as the mapping layer. This is because Ordnance Survey has prohibitive copyright laws which make sharing the data problematic. An Agora encoder is currently being developed for dynamic location referencing. The Map System will generate xml files of the attribute data and Agora location codes for sharing with other members of the ROSATTE consortium and for conversion into different map types. A web service will be used to share this information, possibly a web-page such as www.tfl.gov.uk/ROSATTE (does not exist yet!)

Feedback is done manually at the moment although a web service is being developed to automate this. However, our experience is that manual intervention will still be needed as clarification can be difficult without being able to discuss issues.

In order to ensure quality, along with any XML updates (incremental or whole map) a report will be generated detailing:

- Length of road changed by speed limit (i.e. from x limit to x1 limit)
- An image of speed limit changes by continuous areas of change (aspirational). This will show a before and after image for comparison at the Map Providers side.

7.4 User Interface

The following images show screen shots of the user interface of the initial test system for storing and updating the digital speed limit map of London.

Figure 45 illustrates the sign loading page of the system. Signs will be selected from the folders and dropped into the window below.

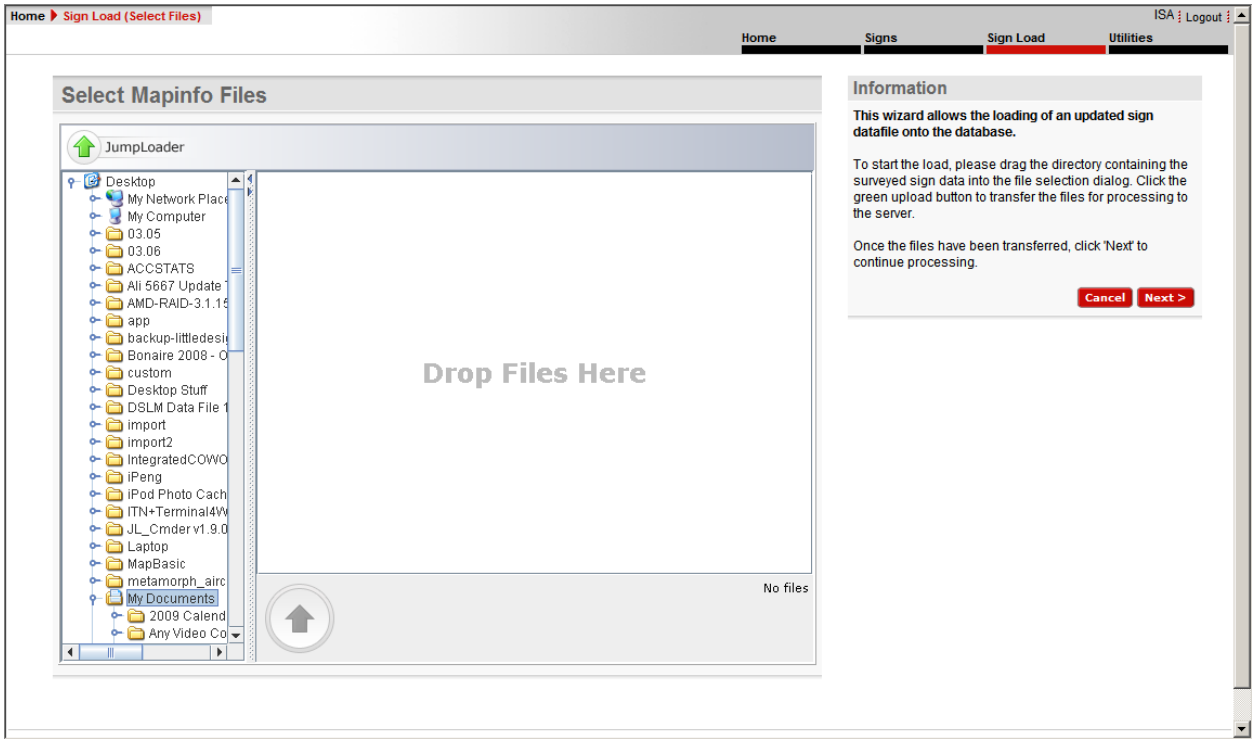


Figure 42: Sign loading page

The next figure (Figure 43) shows the final page of the sign loading process whereby changes are confirmed and then updated to the system

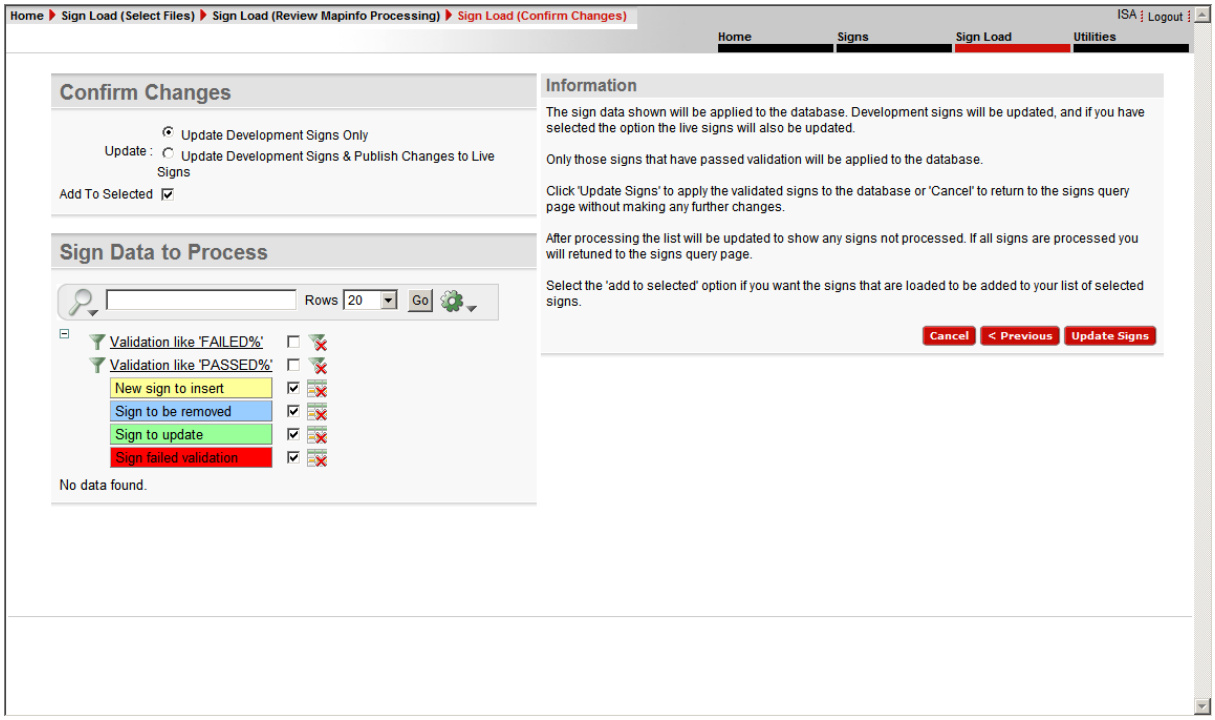


Figure 43: Final Sign loading page – confirm changes

Figure 44 and Figure 45 show a list of different signs displayed as a table and as a map respectively.

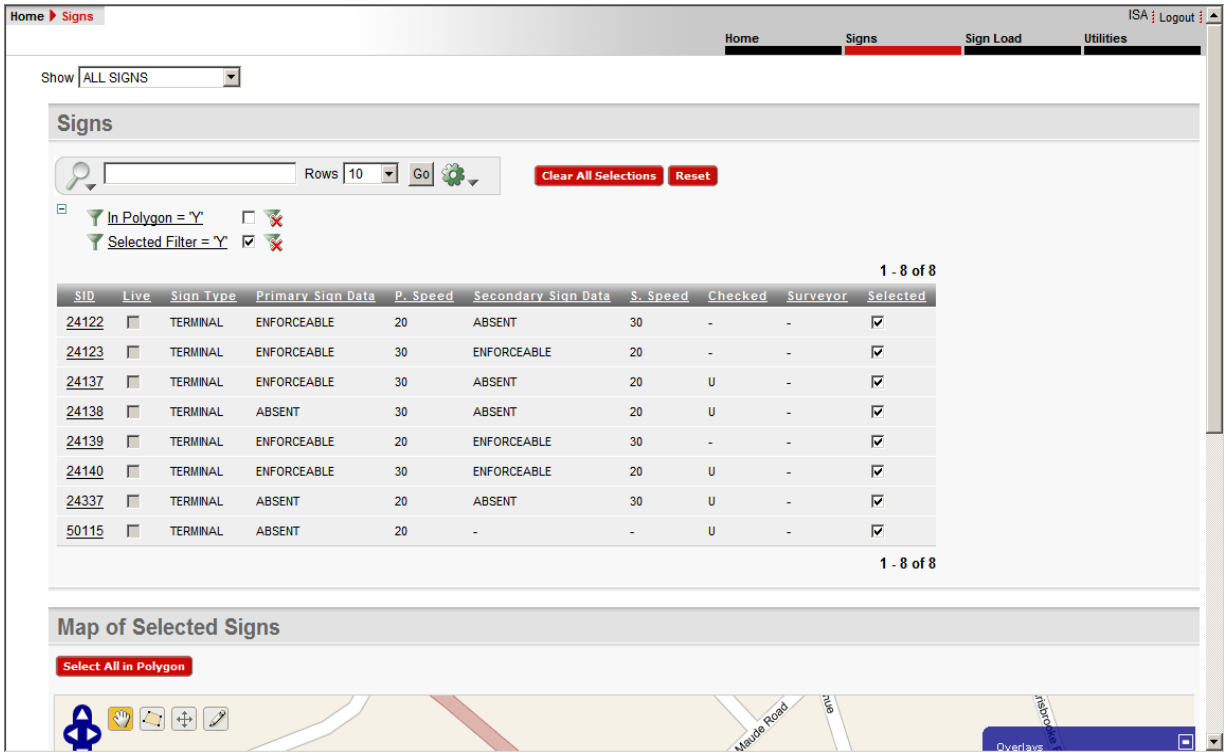


Figure 44: Signs table

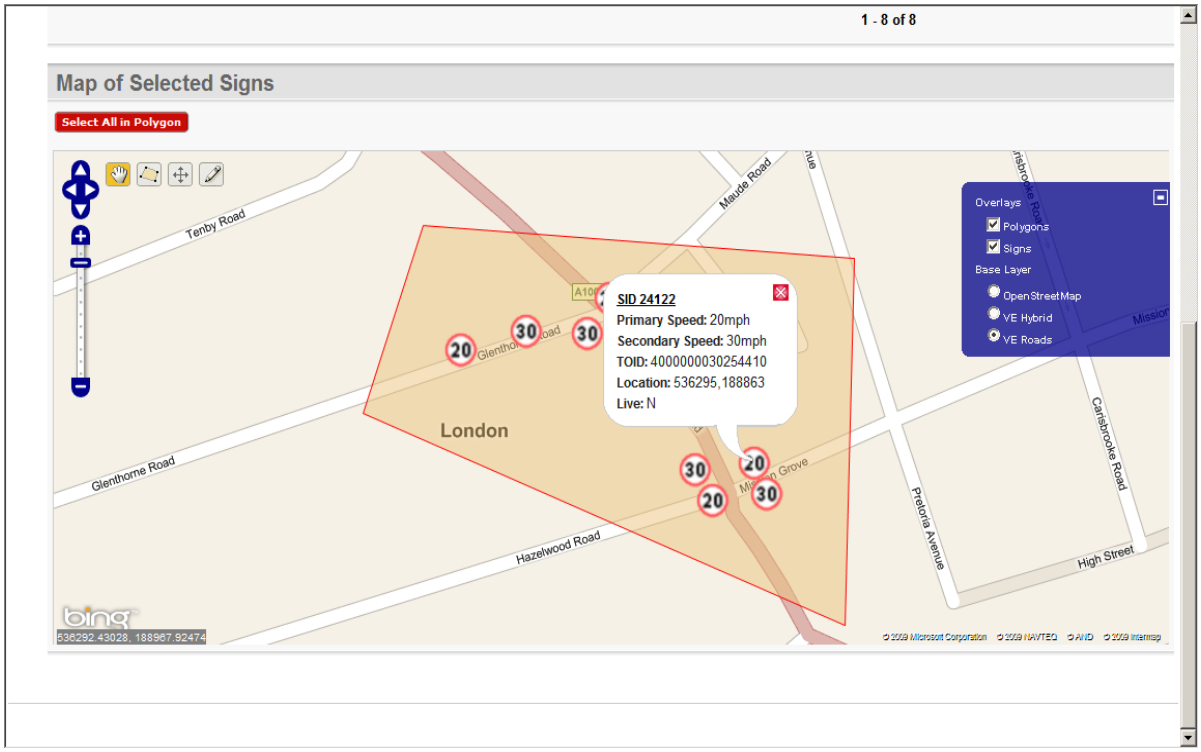


Figure 45: Signs mapping

The last of the user interface figures (Figure 46) shows the view of a specific sign. When this page is brought up all the details of a specific sign are brought up along with an aerial photography view of the area.

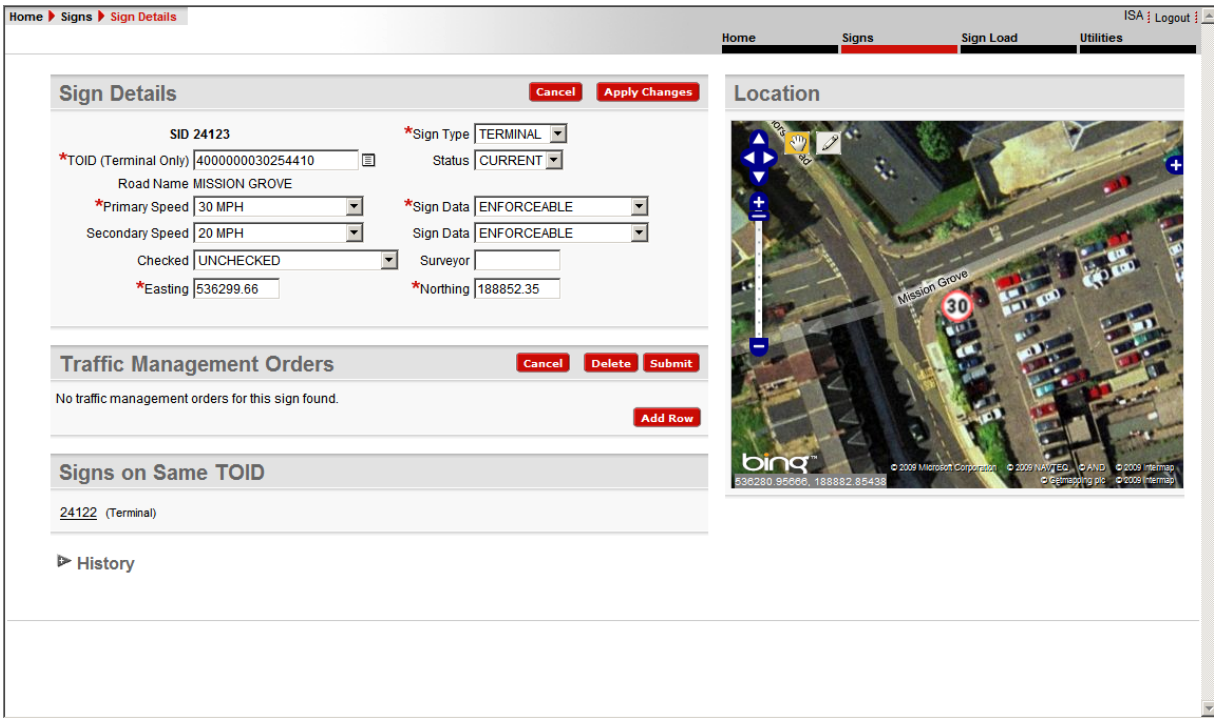


Figure 46: Sign details

8. References

[1] ROSATTE Deliverable 1.2, 'Requirements and Overall Architecture', 28.8.2008, EU-Project, 7th Framework Programme –Specific Programme Cooperation – Theme 3 "Information and Communication Technologies", Grand Agreement Number 213467

[2] ROSATTE Deliverable 2.1 'Conceptual specification on how to establish a data store'. 3.3.2009, EU-Project, 7th Framework Programme – Specific Programme Cooperation – Theme 3 "Information and Communication Technologies" Grand Agreement Number 213467

[3] ROSATTE Deliverable 3.1 'Specification of data exchange methods', 31.8.2009, EU-Project, 7th Framework Programme – Specific Programme Cooperation – Theme 3 "Information and Communication Technologies", Grand Agreement Number 213467

[4] ROSATTE Deliverable D4.1 'Description of applicable and viable data integration methods' draft version 0.8, release date 31.3.2010, EU-Project, 7th Framework Programme – Specific Programme Cooperation – Theme 3 "Information and Communication Technologies", Grand Agreement Number 213467

Final version are made available at:

http://www.ertico.com/en/activities/safemobility/rosatte/publications/publications.htm

9. Appendix

9.1 Mapping of Sign/board catalogue from TS Flanders to ROSATTE Data catalogue

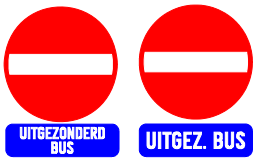
Bord.Type	Properties
A1a|A1b|A1c|A1d	• SF.Type = "WarningSign" • SF.Property[0] : WarningSignType = "DangerousCurve"
A3|A5	• SF.Type = "WarningSign" • SF.Property[0] : WarningSignType = "Slope"
A7a|A7b|A7c	• SF.Type = "WarningSign" • SF.Property[0] : WarningSignType = "NarrowingRoad"
A9	• SF.Type = "WarningSign" • SF.Property[0] : WarningSignType = "MovingBridge"
A11	• SF.Type = "WarningSign" • SF.Property[0] : WarningSignType = "Danger"
A13	• SF.Type = "WarningSign" • SF.Property[0] : WarningSignType = "UnevenRoadSurface"
A14	• SF.Type = "WarningSign" • SF.Property[0] : WarningSignType = "UnevenRoadSurface"
A15 + GIII-Ijzel 	• SF.Type = "WarningSign" • SF.Property[0] : WarningSignType = "SlipperyRoad" • SF.ConditionSet[0] o SF.Condition[0] : WeatherCondition = "Ice" o SF.Condition[1] : WeatherCondition = "Snow" o Condition[0] OR Condition[1] • SF.ConditionSet[1] : o SF.Condition[0] : TimeCondition → validityPeriod = FuzzyTimeCondition = "Winter" • ConditionSet[0] AND ConditionSet[1]

Bord.Type	Properties
A15 + GIII 	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”SlipperyRoad” • SF.Condition[0] : WeatherCondition = “Rain”
A15 + GIII 	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”SlipperyRoad” • SF.Condition[0] : WeatherCondition = “Wet”
A15 + GIII 	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”SlipperyRoad” SF.Condition[0] : *issue*: there are also other causes of slippery roads, such as fallen leaves, beets, … that are not available in the ROSATTE specifications
A17	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”GravelOnTheRoad”
A19	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”RockFall”
A21	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”PedestriansCrossing”
A23	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”Children Playing”
A25	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”CyclistsCrossing”
A27	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”AnimalsCrossing”
A29	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”AnimalsCrossing”

Bord.Type	Properties
A31	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”ConstructionWork”
A33	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”TrafficLightsAhead”
A35	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”AirTraffic”
A37	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”SideWind”
A39	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”TwoWayTraffic”
A41	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”RailwayCrossing”
A43	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”RailwayCrossing”
A45	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”RailwayCrossing”
A47	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”RailwayCrossing”
A49	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”RailwayCrossing”
A51 + GIII 	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”Danger” • SF.Condition[0] : WeatherCondition = “Fog”
A51 + GIII 	• SF.Type = “WarningSign” • SF.Property[0] : WarningSignType = ”Danger” • SF.Condition[0]: *issue* : also other causes of danger can be indicated, such as fire brigade.

Bord. Type	Properties
B5 	• SF.Type = “PassingWithoutStoppingProhibited”
B5 + M1 	• SF.Type = “PassingWithoutStoppingProhibited” • SF.Condition[0] : VehicleCondition = “Bicycle”
B5 + M8 	• SF.Type = “PassingWithoutStoppingProhibited” • SF.Condition[0] : VehicleCondition = “Bicycle” • SF.Condition[1] : VehicleCondition = “Moped” • Condition[0] OR Condition[1]

Bord. Type	Properties
C1 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[1] : VehicleCondition = “Not(Lightrail)” • Condition[0] AND Condition[1]
C1 + M2 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[1] : VehicleCondition = “Not(Lightrail)” • SF.Condition[2] : VehicleCondition = “Not(Bicycle)” • Condition[0] AND Condition[1] AND Condition[2]

Bord.Type	Properties
C1 + M3 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[1] : VehicleCondition = “Not(Lightrail)” • SF.Condition[2] : VehicleCondition = “Not(Bicycle)” • SF.Condition[3] : VehicleCondition = “Not(Moped)” • Condition[0] AND Condition[1] AND Condition[2] AND Condition[3]
C1 + GIV 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[1] : VehicleCondition = “Not(Lightrail)” • SF.Condition[2] : VehicleCondition = “Not(PublicBus)” • Condition[0] AND Condition[1] AND Condition[2]
C3 	• SF.Type = “ClosedToAllVehiclesInBothDirections” • SF.Condition[0] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[1] : VehicleCondition = “Not(Lightrail)” • Condition[0] AND Condition[1]
C3 + M2 	• SF.Type = “ClosedToAllVehiclesInBothDirections” • SF.Condition[0] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[1] : VehicleCondition = “Not(Lightrail)” • SF.Condition[2] : VehicleCondition = “Not(Bicycle)” • Condition[0] AND Condition[1] AND Condition[2]
C3 + M3 	• SF.Type = “ClosedToAllVehiclesInBothDirections” • SF.Condition[0] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[1] : VehicleCondition = “Not(Lightrail)” • SF.Condition[2] : VehicleCondition = “Not(Bicycle)” • SF.Condition[3] : VehicleCo dition = “Not(Moped)” • Condition[0] AND Condition[1] AND Condition[2] AND Condition[3]

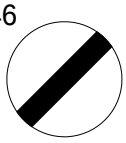
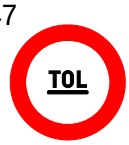
Bord.Type	Properties
C3 + GIII 	• SF.Type = "ClosedToAllVehiclesInBothDirections" • SF.Condition[0] : VehicleCondition = "Not(Pedestrian)" • SF.Condition[1] : VehicleCondition = "Not(Lightrail)" • SF.Condition[2] : • Condition[0] AND Condition[1] AND Condition[2] • *issue*: many different subsigns are possible, other than the ones captured in the ROSATTE specification o 
C5 	• SF.Type = "NoEntry" • SF.Condition[0] : VehicleCondition = "Not(Bicycle)" • SF.Condition[1] : VehicleCondition = "Not(Moped)" • SF.Condition[2] : VehicleCondition = Not(MotorCycle) • SF.Condition[3] : VehicleCondition = Not(Pedestrian) • SF.Condition[4] : VehicleCondition = Not(Lightrail) • Condition[0] AND Condition[1] AND Condition[2] AND Condition[3] AND Condition[4]
C5 + GIV 	• SF.Type = "NoEntry" • SF.Condition[0] : VehicleCondition = "Not(Bicycle)" • SF.Condition[1] : VehicleCondition = "Not(Moped)" • SF.Condition[2] : VehicleCondition = Not(MotorCycle) • SF.Condition[3] : VehicleCondition = Not(Pedestrian) • SF.Condition[4] : VehicleCondition = Not(Lightrail) • SF.Condition[5] : *issue* Min. 2 / 3 people inside the vehicle • (Condition[0] AND Condition[1] AND Condition[2] AND Condition[3] AND Condition[4]) OR Condition[5]
C7 	• SF.Type = "NoEntry" • SF.Condition[0] : VehicleCondition = "MotorCycle"

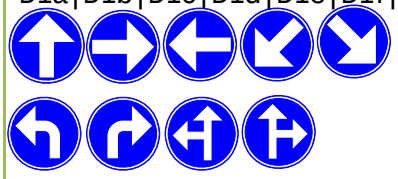
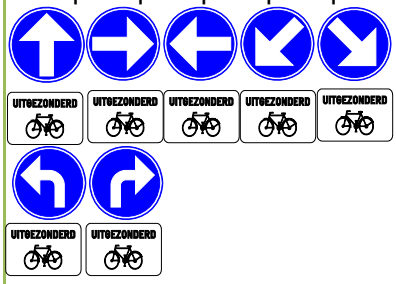
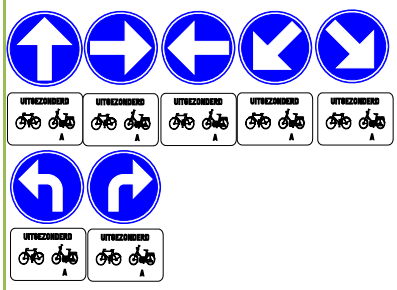
Bord.Type	Properties
C9 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Moped”
C11 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Bicycle”
C13 	• SF.Type = “NoEntry” • SF.Condition[0]: VehicleCondition = “ Drivers of teams ”
C15 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Horseman”
C17 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Drivers handcarts”
C19 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Pedestrian”
C5-C7 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Not(Bicycle)” • SF.Condition[1] : VehicleCondition = “Not(Moped)” • SF.Condition[2] : VehicleCondition = Not(Pedestrian) • SF.Condition[3] : VehicleCondition = Not(Lightrail) • Condition[0] AND Condition[1] AND Condition[2] AND Condition[3]
C9-C11 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Bicycle” • SF.Condition[1] : VehicleCondition = “Moped” • Condition[0] OR Condition[1]

Bord.Type	Properties
C5-C7-C9 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Not(Bicycle)” • SF.Condition[1] : VehicleCondition = Not(Pedestrian) • SF.Condition[2] : VehicleCondition = Not(Lightrail) • Condition[0] AND Condition[1] AND Condition[2]
C7-C9 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Motorcycle” • SF.Condition[1] : VehicleCondition = “Moped” • Condition[0] OR Condition[1]
C11-C19 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Bicycle” • SF.Condition[1] : VehicleCondition = “Pedestrian” • Condition[0] OR Condition[1]
C5-C7-C13 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “Not(Bicycle)” • SF.Condition[1] : VehicleCondition = “Not(Moped)” • SF.Condition[2] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[3] : VehicleCondition = Not(Lightrail) • Condition[0] AND Condition[1] AND Condition[2] AND Condition[3]
Other C5,C7,…,C19 combinations	
C21 	• SF.Type = “Re strictionForVehicles” • SF.Property[0] : MaximumLadenWeight = ”Gewichts-waarde”
C22 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “PrivateBus”

Bord.Type	Properties
C23 	• SF.Type = “NoEntry” • SF.Condition[0] : VehicleCondition = “DeliveryTruck” • SF.Condition[1] : VehicleCondition = “Tanker” • SF.Condition[2] : VehicleCondition = “TransportTruck” • Condition[0] OR Condition[1] OR Condition[2]
C23 + GVIIa 	• SF.Type = “RestrictionForVehicles” • SF.Property[0] : MaximumLadenWeight = “Gewichts-waarde” • SF.Condition[0] : VehicleCondition = “DeliveryTruck” • SF.Condition[1] : VehicleCondition = “Tanker” • SF.Condition[2] : VehicleCondition = “TransportTruck” • Condition[0] OR Condition[1] OR Condition[2]
C24a 	• SF.Type = “NoEntry” • SF.Condition[0] : LoadCondition = “OtherDangerousLoad”
C24b 	• SF.Type = “NoEntry” • SF.Condition[0] : LoadCondition = “ExplosiveLoad”
C24c 	• SF.Type = “NoEntry” • SF.Condition[0] : LoadCondition = “WaterPollutingLoad”
C25 	• SF.Type = “RestrictionForVehicles” • SF.Property[0] : MaximumLength = ”Lengte-waarde”
C27 	• SF.Type = “RestrictionForVehicles” • SF.Property[0] : MaximumWidth = ”Breedte-waarde”

Bord.Type	Properties
C29 	• SF.Type = “RestrictionForVehicles” • SF.Property[0] : MaximumHeight = ”Hoogte-waarde”
C21, C22, C23, C24 C25, C27, C29 with sign beneath defining a distance	*Issue:* The distance to the location where the restriction is valid, is defined by the lower sign. With the current ROSATTE specification it is not possible to provide this property together with the safety feature.
C31a|C31b|C33 	• SF.Type = “ProhibitedTurn” • SF.Condition[0] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[1] : VehicleCondition = Not(Lightrail) • Condition[0] AND Condition[1]
C31a|C31b|C33+M2 	• SF.Type = “ProhibitedTurn” • SF.Condition[0] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[1] : VehicleCondition = Not(Lightrail) • SF.Condition[2] : VehicleCondition = “Not(Bicycle)” • Condition[0] AND Condition[1] AND Condition[2]
C31a|C31b|C33+M3 	• SF.Type = “ProhibitedTurn” • SF.Condition[0] : VehicleCondition = “Not(Pedestrian)” • SF.Condition[1] : VehicleCondition = Not(Lightrail) • SF.Condition[2] : VehicleCondition = “Not(Bicycle)” • SF.Condition[3] : VehicleCondition = “Not(Moped)” • Condition[0] AND Condition[1] AND Condition[2] AND Condition[3]
C35 	• SF.Type = “StartOfProhibitionOfOvertaking”
C37 	• SF.Type = “EndOfProhibitionOfOvertaking”

Bord.Type	Properties
C39 	• SF.Type = “StartOfProhibitionOfOvertaking” • SF.Condition[0] : VehicleCondition = “DeliveryTruck” • SF.Condition[0] : VehicleCondition = “Tanker” • SF.Condition[0] : VehicleCondition = “TransportTruck” • Condition[0] OR Condition[1] OR Condition[2] *Issue*: a weight condition should also be specified as a condition
C41 	• SF.Type = “EndOfProhibitionOfOvertaking”
C43|C43km 	• SF.Type = “StartOfSpeedLimit” • SF.Property[0] : MaximumSpeedLimit = “Snelheids-waarde”
C43|C43km + GIII 	• SF.Type = “StartOfSpeedLimit” • SF.Property[0] : MaximumSpeedLimit = “Snelheids-waarde” • SF.Condition[0] : WheatherCondition = “Air-Pollution”
	Geeft GEEN aanleiding tot de extractie van een ROSATTE SafetyFeature.
C45|C45km 	• SF.Type = “EndOfSpeedLimit”
C46 	• SF.Type = “EndOfProhibitionOrRestriction”
C47 	• SF.Type = “PassingWithoutStoppingProhibited”

Bord.Type	Properties
D1a|D1b|D1c|D1d|D1e|D1f|D3a|D3b 	• SF.Type = "DirectionToBeFollowed" • SF.Condition[0] : VehicleCondition = "Not(Pedestrian)" • SF.Condition[1] : VehicleCondition = "Not(Lightrail)" • Condition[0] AND Condition[1]
D1a|D1b|D1c|D1d|D1e|D1f + M2 	• SF.Type = "DirectionToBeFollowed" • SF.Condition[0] : VehicleCondition = "Not(Pedestrian)" • SF.Condition[1] : VehicleCondition = "Not(Lightrail)" • SF.Condition[2] : VehicleCondition = "Not(Bicycle)" • Condition[0] AND Condition[1] AND Condition[2]
	• SF.Type = "DirectionToBeFollowed" • SF.Condition[0] : VehicleCondition = "Not(Pedestrian)" • SF.Condition[1] : VehicleCondition = "Not(Lightrail)" • SF.Condition[2] : VehicleCondition = "Not(Bicycle)" • SF.Condition[3] : VehicleCondition = "Not(Moped)" • Condition[0] AND Condition[1] AND Condition[2] AND Condition[3]

Bord.Type	Properties
F1/F1a/F1b 	• SF.Type = "StartOfBuiltUpArea" • SF.Property[0] : MaximumSpeedLimit = "50 km/u"

Bord.Type	Properties
F3/F3a/F3b 	• SF.Type = “EndOfBuiltUpArea”
F1/F1a/F1b + C43-30km/u 	• SF.Type = “StartOfBuiltUpArea” • SF.Property[0] : MaximumSpeedLimit = “30 km/u”
F5 	• SF.Type = “StartOfMotorWay” • SF.Property[0] : MaximumSpeedLimit = “120 km/u”
F7 	• SF.Type = “EndOfMotorWay”
F9 	• SF.Type = “StartOfRoadForMotorVehicles”
F11 	• SF.Type = “EndOfRoadForMotorVehicles”
F12a 	• SF.Type = “StartOfBuiltUpArea” • SF.Property[0] : MaximumSpeedLimit = “20 km/u”
F12b 	• SF.Type = “EndOfBuiltUpArea”

Bord.Type	Properties
F17 	• SF.Type = “NoEntry” • SF.Condition[0] : LaneCondition → “StartLane” + “LaneExtension” • SF.Condition[1] : VehicleCondition = “Not(PublicBus)” • SF.Condition[2] : VehicleCondition = “Not(SchoolBus)” • SF.Condition[3] : VehicleCondition = “Not(Taxi)” • SF.Condition[0] AND SF.Condition[1] AND SF.Condition[2] AND SF.Condition[3]
F17 	• SF.Type = “NoEntry” • SF.Condition[0] : LaneCondition → “StartLane” + “LaneExtension” • SF.Condition[1] : VehicleCondition = “Not(PublicBus)” • SF.Condition[2] : VehicleCondition = “Not(SchoolBus)” • SF.Condition[3] : VehicleCondition = “Not(Taxi)” • SF.Condition[4] : VehicleCondition = “Not(Bicycle)” • SF.Condition[0] AND SF.Condition[1] AND SF.Condition[2] AND SF.Condition[3] AND SF.Condition[4]
F17 	• SF.Type = “NoEntry” • SF.Condition[0] : LaneCondition → “StartLane” + “LaneExtension” • SF.Condition[1] : VehicleCondition = “Not(PublicBus)” • SF.Condition[2] : VehicleCondition = “Not(SchoolBus)” • SF.Condition[3] : VehicleCondition = “Not(Taxi)” • SF.Condition[4] : VehicleCondition = “Not(EmployeeVehicle)” • SF.Condition[0] AND SF.Condition[1] AND SF.Condition[2] AND SF.Condition[3] AND SF.Condition[4]

Bord.Type	Properties
F18 	• SF.Type = "NoEntry" • SF.Condition[0] : LaneCondition → "StartLane" + "LaneExtension" • SF.Condition[1] : VehicleCondition = "Not(Lightrail)" • SF.Condition[2] : VehicleCondition = "Not(PublicBus)" • SF.Condition[3] : VehicleCondition = "Not(EmergencyVehicle)" • SF.Condition[0] AND SF.Condition[1] AND SF.Condition[2] AND SF.Condition[3]
F18 	• SF.Type = "NoEntry" • SF.Condition[0] : LaneCondition → "StartLane" + "LaneExtension" • SF.Condition[1] : VehicleCondition = "Not(Lightrail)" • SF.Condition[2] : VehicleCondition = "Not(PublicBus)" • SF.Condition[3] : VehicleCondition = "Not(EmergencyVehicle)" • SF.Condition[4] : VehicleCondition = "Not(Taxi)" • SF.Condition[0] AND SF.Condition[1] AND SF.Condition[2] AND SF.Condition[3] AND SF.Condition[4]
F18 	• SF.Type = "NoEntry" • SF.Condition[0] : LaneCondition → "StartLane" + "LaneExtension" • SF.Condition[1] : VehicleCondition = "Not(Lightrail)" • SF.Condition[2] : VehicleCondition = "Not(PublicBus)" • SF.Condition[3] : VehicleCondition = "Not(EmergencyVehicle)" • SF.Condition[4] : VehicleCondition = "Not(Bicycle)" • SF.Condition[0] AND SF.Condition[1] AND SF.Condition[2] AND SF.Condition[3] AND SF.Condition[4]

Bord.Type	Properties
F18 	• SF.Type = "NoEntry" • SF.Condition[0] : LaneCondition → "StartLane" + "LaneExtension" • SF.Condition[1] : VehicleCondition = "Not(Lightrail)" • SF.Condition[2] : VehicleCondition = "Not(PublicBus)" • SF.Condition[3] : VehicleCondition = "Not(EmergencyVehicle)" • SF.Condition[4] : VehicleCondition = "Not(EmployeeVehicle)" • SF.Condition[0] AND SF.Condition[1] AND SF.Condition[2] AND SF.Condition[3] AND SF.Condition[4]
F49 	• SF.Type = "PedestrianCrossing"
F97 	• SF.Type = "WarningSign" • SF.Property[0] : WarningSignType = "NarrowingRoad"

Bord.Type	Properties
F4a|ZC43 	• SF.Type = "StartOfBuiltUpArea" • SF.Property[0] : MaximumSpeedLimit = "Snelheids-waarde"
F4b|ZC45 	• SF.Type = "EndOfBuiltUpArea"
ZCxx (all other zonal signs)	*Issue*: Zonal Signs other than speed limits can not be exchanged in the current ROSATTE specification

9.2 Mapping of Feature typs in Norwegian DB to ROSATTE data catalogue

Feature type mapping in Norway

All NVDB datatypes have one or more road references. Length features have two or more. All ROSATTE types are derived from GenericSeafetyFeature.

NVDB Name	NVDB Type	NVDB Attributes	ROSATTE Type	ROSATTE attributes
Speed limit	105		SpeedLimit	
		SpeedLimit		MaximumSpeedLimit
Variable Speed Limit	721		SpeedLimit	
		SpeedLimit		MaximumSpeedLimit
		FromDate		Month.start
		FromClock		Time.begin
		ToDate		Month.start + month.length
		ToClock		Time.begin + time.lengthSeconds
Sign plate	96		WarningSign	
		RegulationNumber		Source=Regulation or Fixed
		Sign number (limited to curve waring and moose crossing)		PropertyValue.Type=WarningSignType propertyValue.Value=DangerousCuve or MooseCrossing
		Value		propertyValue
Height restriction	591		Restriction for vehicles	
		Height		Maximum height

9.3 Mapping of Sign/board catalogue from TS ASFA including properties to ROSATTE data catalogue

Bord.Type	Properties
	type = **SpeedLimit** Property[0] : MaximumSpeedLimit
	type = **SpeedLimit** Property[0] : MaximumSpeedLimit
	type = **SpeedLimit** Property[0] : MaximumSpeedLimit
	type = **SpeedLimit** Property[0] : MaximumSpeedLimit
	type = **SpeedLimit** Property[0] : MaximumSpeedLimit
	type = **SpeedLimit** Property[0] : MaximumSpeedLimit

9.4 Mapping of Safety Feature catalogue from TS Bavaria to ROSATTE data model

Note: For reasons of clearness, linear safety attributes are described below by their (beginning) road sign. In the Bavarian datastore positions of road signs may be stored as additional features, but are neither stored independently from safety features nor transferred as such to information providers (map makers). Instead the linear safety features are the central concept for storage and transfer.

Ambiguous mappings are marked by notes

Where no direct mapping to ROSATTE data model is possible, usually no mapping is done at all

Safety feature (as denoted by start sign)	Corresponding sign Code in German Regulation (Straßenverkehrsordnung, StVo)	Description (German)	**ROSATTE Datamodel Property**
	Z274-53	Zul. Höchstgeschwindigkeit nach StVO 30 km/h	SF.Type = SpeedLimit SF.Property: : MaximumSpeedLimit
	Z274-54	Zul. Höchstgeschwindigkeit nach StVO 40 km/h	Idem
	Z274-55	Zul. Höchstgeschwindigkeit nach StVO 50 km/h	Idem
	Z274-56	Zul. Höchstgeschwindigkeit nach StVO 60 km/h	Idem
	Z274-57	Zul. Höchstgeschwindigkeit nach StVO 70 km/h	Idem
	Z274-58	Zul. Höchstgeschwindigkeit nach StVO 80 km/h	Idem
	Z274-59	Zul. Höchstgeschwindigkeit nach StVO 90 km/h	idem
	Z274-60	Zul. Höchstgeschwindigkeit nach StVO 100 km/h	Idem
	Z274-61	Zul. Höchstgeschwindigkeit nach StVO 110 km/h	Idem
	Z274-62	Zul. Höchstgeschwindigkeit nach StVO 120 km/h	Idem
 *	Z274-1-50	Anfang Tempo 30-Zone, zul. Höchstgeschwindigkeit 30 km/h	Zone (set of adjacent streets) has no correspondance in ROSATTE DM. Transfer of street segments in zone in zone as individual safety feature SF.Type = “SpeedLimit” /

Safety feature (as denoted by start sign)	Corresponding sign Code in German Regulation (Straßenverkehrsordnung, StVo)	Description (German)	**ROSATTE Datamodel Property**
			SF.Property: MaximumSpeedLimit
 *			No correspondence in ROSATTE DM (traffic calmed area, walking speed (5km/h)) [6]
	Z276	Überholverbote verbieten Führern von Kraftfahrzeugen aller Art	SF.Type = "ProhibitionOfOvertaking"
	Z277	Kraftfahrzeugen mit einem zulässigen Gesamtgewicht über 3,5 t, ein- schließlich ihrer Anhänger, und von Zugmaschinen, ausgenommen Personenkraftwagen und Kraftomnibusse, mehrspurige Kraftfahrzeuge und Krafträder mit Beiwagen zu überholen. Ist auf einem Zusatzschild ein Gewicht, wie "7,5 t", angegeben, so gilt das Verbot nur, soweit das zulässige Gesamtgewicht dieser Verkehrsmittel die angegebene Grenze überschreitet.	SF.Type = "ProhibitionOfOvertaking" SF.Condition[0] : VehicleCondition = "DeliveryTruck" SF.Condition[1] : VehicleCondition = "Tanker" SF.Condition[2] : VehicleCondition = "TransportTruck" Condition[0] OR Condition[1] OR Condition[2]
	Z101	Gefahrenstelle, kann mit einem Zusatzschild die Gefahr näher bezeichnen.	SF Type: WarningSign SF.Property: WarningSignType = Danger

[6] Mapping of this road sign in site in TS Flanders does not correspond to German RoadTrafficRegulation

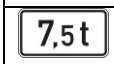
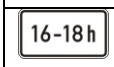
Safety feature (as denoted by start sign)	Corresponding sign Code in German Regulation (Straßenverkehrs ordnung, StVo)	Description (German)	**ROSATTE Datamodel Property**
	Z102	Kreuzung oder Einmündung mit Vorfahrt von rechts	SF Type: WarningSign SF.Property: WarningSignType = DangerousIntersection
	Z103-10, Z103-20	Kurve Links oder Rechts	SF Type: WarningSign SF.Property: WarningSignType = DangerousCurve
	Z105-10, Z105-20	Doppelkurve Links oder Doppelkurve Rechst	SF Type: WarningSign SF.Property: WarningSignType = DangerousCurve (note: double curve not represented!)
	Z108-xx 50 bis 71	Gefälle von 4% bis 25%	SF Type: WarningSign SF.Property: WarningSignType = Slope Note: no distinction of rising or falling slope
	Z110-xx 50 bis 71	Steigung von 4% bis 25%	SF Type: WarningSign SF.Property: WarningSignType = Slope Note: no distinction of rising or falling slope
	Z112	Unebene Fahrbahn	SF Type: WarningSign SF.Property: WarningSignType = UnevenRoadSurface
	Z113	Schnee- oder Eisglätte	SF Type: WarningSign SF.Property: WarningSignType = SnowIceorBlackice
	Z114	Schleudergefahr bei Nässe oder Schmutz	SF Type: WarningSign SF.Property: WarningSignType = SlipperyRoad
	Z115	Steinschlag	SF Type: WarningSign SF.Property: WarningSignType = Rockfall

Safety feature (as denoted by start sign)	Corresponding sign Code in German Regulation (Straßenverkehrs ordnung, StVo)	Description (German)	**ROSATTE Datamodel Property**
	Z116	Splitt, Schotter	SF Type: WarningSign SF.Property: WarningSignType = GravelontheRoad
	Z117-10, Z117-20	Seitenwind	SF Type: WarningSign SF.Property: WarningSignType = SideWind
	Z120	Verengte Fahrbahn	SF Type: WarningSign SF.Property: WarningSignType = NarrowingRoad
	Z121-10, Z121-20	Einseitig (rechts/links) verengte Fahrbahn	SF Type: WarningSign SF.Property: WarningSignType = NarrowingRoad
	Z123	Baustelle	SF Type: WarningSign SF.Property: WarningSignType = ConstructionWork
	Z124	Stau	SF Type: WarningSign SF Property: Congestion
	Z125	Gegenverkehr	SF Type: WarningSign SF.Property: WarningSignType = TwoWayTraffic
	Z128	Bewegliche Brücke	SF Type: WarningSign SF.Property: WarningSignType = MovingBridge
	Z129	Ufer	No correspondence in ROSATTE DataModel (Danger - Shore)
	Z131	Lichtzeichenanlage	SF Type: WarningSign SF.Property: WarningSignType = TrafficLightsahead
	Z133-10, Z133-20	Fußgänger	No correspondence in ROSATTE DataModel (Danger - Pedestrians)
	Z134-10, Z134020	Fußgängerüberweg	SF Type: WarningSign SF.Property: WarningSignType = PedestriansCrossing

Safety feature (as denoted by start sign)	Corresponding sign Code in German Regulation (Straßenverkehrsordnung, StVo)	Description (German)	**ROSATTE Datamodel Property**
	Z136-10, Z136-20	Kinder	SF Type: WarningSign SF.Property: WarningSignType = ChildrenPlaying
	Z138-10, Z138-20	Radfahrer kreuzen	SF.Type: WarningSign SF.Property: WarningSignType = CyclistsCrossing
	Z140-10, Z140-20	Viehtrieb, Tiere	No correspondence in ROSATTE DataModel (Cattle)
	Z142-10, Z142-20	Wildwechsel	SF.Type: WarningSign SF.Property: WarningSignType = AnimalsCrossing
	Z144-10, Z144-20	Flugbetrieb	SF.Type: WarningSign SF.Property: WarningSignType = Airtraffic
	Z150	Bahnübergang mit Schranken oder Halbschranken	SF.Type: WarningSign SF.Property: WarningSignType = RailCrossing Note: No distinction between bars or no bars at crossing
	Z151	Unbeschrankter Bahnübergang	SF.Type: WarningSign SF.Property: WarningSignType = RailCrossing Note: No distinction between bars or no bars at crossing

Conditions

	Z1007-30	Bei Schneeglätte	
	Z1048-10	für PKW	SF Condition : Vehicle Condition = PassengerCar
	Z1048-11	für PKW mit Anhänger	SF Condition : Vehicle Condition = CarwithTrailer
	Z1048-12	für LKW	SF Condition : Vehicle Condition = TransportTruck

	Z1048-13	für LKW mit Anhänger	No correspondence in ROSATTE DataModel (TransportTruck With Trailer)
	Z1048-14	Für Sattelzug	No correspondence in ROSATTE DataModel (???)
	Z1052-35	Für Fahrzeuge mit einer zul. Gesamtgewicht von 7,5 t	SF.Property: MaximumWeight
	Z1052-31	Verbot für Fahrzeuge mit wassergefährdender Ladung	SF.Condition: LoadCondition: WaterpollutingLoad
	Z1042-xx	Begrenzung gilt innerhalb der Zeitperiode xx-xx h	SF.Condition:TimeCondition = timeinterval
	Z1052-36	Bei Nässe	SF.Condition: WeatherCondition = Wet

9.5 Mapping of Feature types in Swedish NVDB to ROSATTE data catalogue

Feature type mapping in Sweden

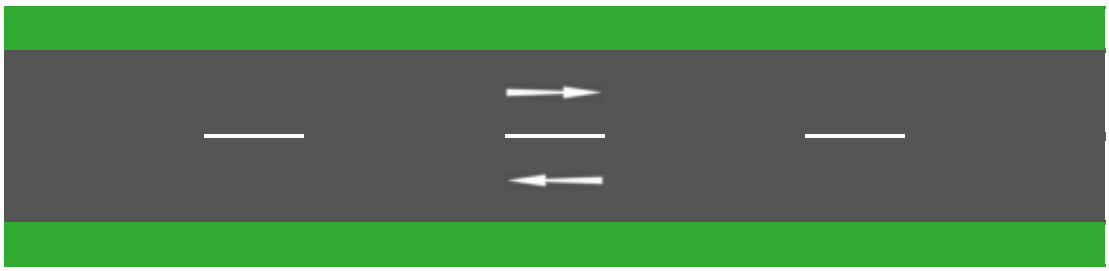
NVDB Name	NVDB Attributes	ROSATTE Type	ROSATTE attributes
Hastighetsgräns		SpeedLimit	
	Högsta tillåtna hastighet		MaximumSpeedLimit
Höjdhinder		Restriction for vehicles	
	Fri höjd		Maximum height
Förbjuden färdriktning		DirectionToBe Followed[7]	
Stopplikt		ObligationToStop	

[7] The opposite direction to “Förbjuden färdriktning”

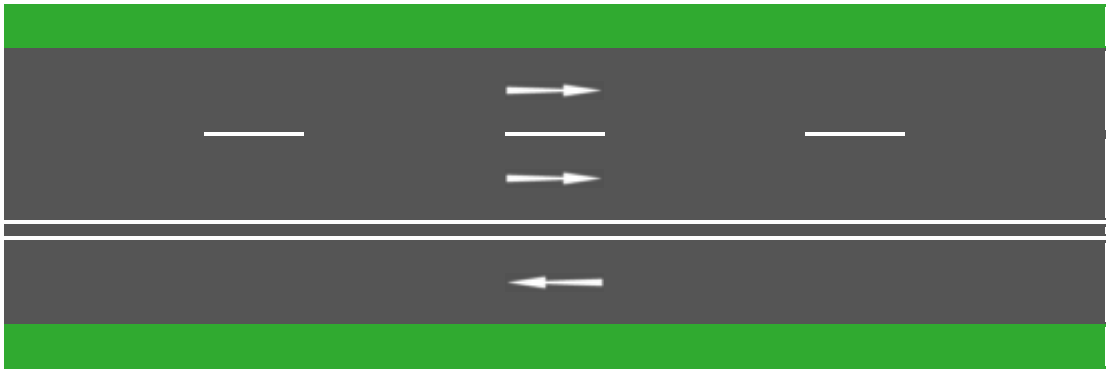
9.6 Mapping National Limit Speed Signs

Motorways are defined as roads that are signed as "motorway" and have blue signs. Additionally their road's number is prefixed with "M" or suffixed with "(M)".

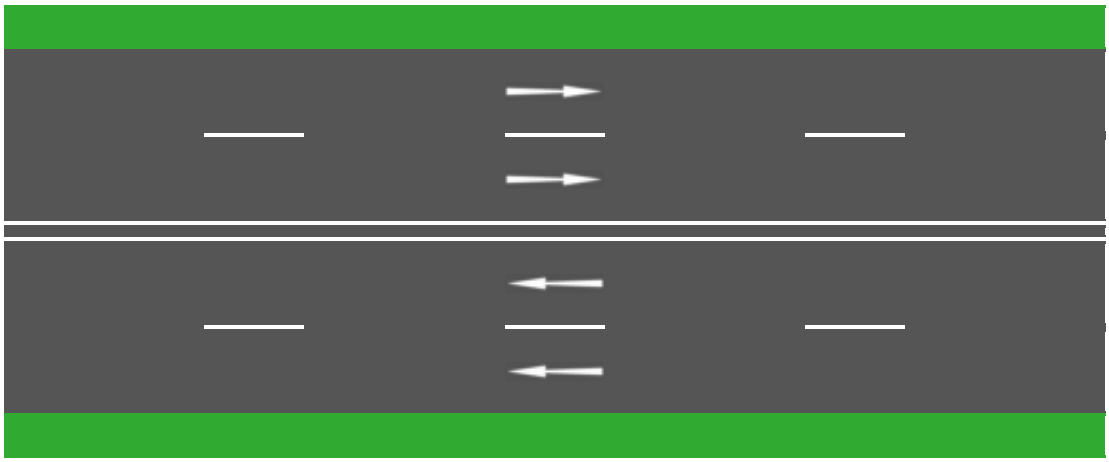
While most drivers are clear about what a motorway is, some are confused about the definition of a dual carriageway. For a road to be classed as a dual carriageway, the two directions of traffic flow must be physically separated by a central reservation. A road where the two directions of flow are separated only by lines painted on the road surface is a single carriageway, regardless of the number of traffic lanes that may be available to the traffic in each direction. So a road with three or four lanes is still a single carriageway if there is no central reservation. The following diagrams should clarify this point:



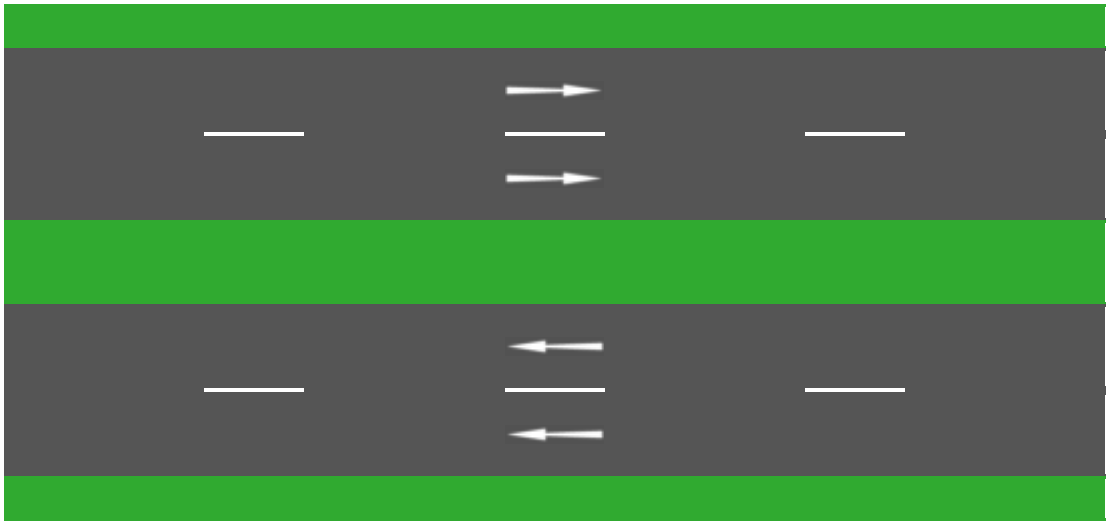
Single carriageway with 2-lanes



Single carriageway with 3 lanes (e.g. two lanes uphill)



Single carriageway with 4 lanes



Dual carriageway with 2 lanes in each direction

The following table indicates which speed limits apply to different vehicles types on different road types:

National Speed Limits (outside built-up areas)

Type of vehicle	Speed Limit (miles per hour)		
	Single Carriageway	Dual Carriageway	Motorway
Cars, motorcycles, and car-derived vans up to 2 tonnes maximum laden weight	60	70	70
Cars (inc. car-derived vans and motorcycles) towing caravans or trailers	50	60	60
Buses, coaches and mini-buses (not exceeding 12 metres in length)	50	60	70
Goods vehicles not exceeding 7.5 tonnes maximum laden weight	50	60	70 *
Goods vehicles exceeding 7.5 tonnes maximum laden weight	40	50	60

* The speed limit is 60mph if the vehicle is articulated or towing a trailer.