



# Implementation plan & Exploitation plan

Project acronym: EDC-11145 EUROROADS/28646  
Deliverable: D8.4 / D9.3  
Nature: Public  
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Date: 2006-10-20  
Status: Final  
Version: 1.0

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# 1 Introduction

This report is a merge of the deliverables D8.4 Implementation plan and D9.3 Exploitation plan. The reason for this is the strong links between actions aimed to promote uptake of EuroRoadS specification framework and actions aimed to achieve a wide-spread use of the results. The project decided not to formally publish D9.2 Draft exploitation plan. Preliminary findings have instead been presented during workshops and in previous versions of this compiled report.

With the knowledge of the increasing demand for harmonised European road data the EuroRoadS project has laid the ground for the establishment of a road data infrastructure supporting an efficient cooperation concerning the establishment and maintenance of road data as well as the exchange of data between different stakeholders – from road administrations and mapping agencies on local, regional and central level via data and service providers to end users. The infrastructure is build upon a common specification framework, including descriptions of data structure, data content, data exchange mechanisms, quality, metadata and terminology. Important basis for this work has been to:

- focus on core European road data (reference information being of interest for many kinds of applications)
- make use of existing international and European standards for efficient structuring, discovery, quality assurance and exchange of road data as well as to facilitate the combination of road data with other data themes,
- find the right balance between a far-reaching harmonisation and to make use of existing road data,
- support the preparations for the implementation of the proposed EU directive on spatial data infrastructure for Europe (INSPIRE).

The vision for EuroRoadS is to realise the access to harmonised public road data for EU25+ by the end of 2012.

The background and the results from EuroRoadS project are described in Chapter 2. More detailed information can be found in referred reports (see References).

Chapter 3 and Chapter 4 describe respectively the implementation and exploitation plans for EuroRoadS.

The implementation and the exploitation plans have been developed in parallel, as there are strong links between these two processes. Nevertheless, the fundamental difference between the implementation phase of EuroRoadS and the exploitation of the solution remains valid, as hereafter described:

The implementation plan proposes recommendations on actions that will enable producers of road data to be able to deliver and exchange data according to the EuroRoadS specifications, including quality and metadata descriptions. Furthermore, the implementation plan includes recommendations on actions that support organisations to develop, organise and restructure databases and processes for handling these databases.

The exploitation plan proposes recommendations to foster the exploitation of road information enabled by the harmonised European road interface and to support a wide use of the European road data infrastructure.

For the implementation, it is argued why, what and how to implement EuroRoadS and recommendations are given to the road data suppliers.

For the Exploitation, the business issues are exposed.

Chapter 5 describes the intention for supporting the implementation and exploitation and a plan for how just after the end of EuroRoadS project in August 2006, to set up a EuroRoadS Forum to promote and further develop the concept of EuroRoadS.

The Conclusion in chapter 6 points out the necessity of a stepwise approach with short-term targets and the necessity to encourage the countries to join EuroRoadS by exchange of best practice of using EuroRoadS results.

## 1.1 The vision

The vision of EuroRoadS is:

“To establish a European-wide public road data infrastructure delivering access to, harmonised and quality assured road information for multipurpose use. That EuroRoadS compliant national road databases will cover EU25+ by end of 2012. That the European Directive establishing an infrastructure for spatial information in the European Community (INSPIRE) will, for the European road network, be based on the EuroRoadS specifications and other results.”

The aim of EuroRoadS results is to be a vehicle for supporting stronger and more efficient cooperation between road and mapping agencies and other parties and to provide plans to support a rapid creation of a harmonised European road data infrastructure.

## 1.2 Stakeholder perspectives

EuroRoadS stakeholders represent different perspectives related to their roles in the information refinement chain. A stakeholder can have more than one role. The figure below illustrates the principles of the information refinement chain and the role of the different stakeholders.

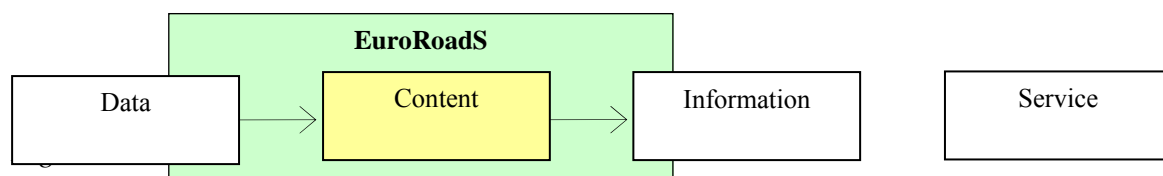


Figure 1.1 EuroRoadS in the information refinement chain

In this model the data is captured and maintained for specific reasons by different organisations – mapping agencies, road administrations, local authorities and others – with a structure and content for their specific needs.

The next step in the information refinement chain is to establish a common infrastructure – the content – giving the basis for cooperation between different data suppliers and users. On a national level this can be established as a national road database being set up and maintained in cooperation between road administrations, mapping agencies, local authorities and others. On a European level, EuroRoadS aims at providing the framework for a pan-European road data infrastructure delivering data content.

Based on the road data content obtained, different information providers adjust the data content and integrate it with other data themes for specific usage e.g. navigation, road charging, traffic planning, map production.

The adjusted information is then being used for development of different services, applications and products adjusted for the end user needs.

### 1.2.1 Road data suppliers

By adopting the EuroRoadS framework of specifications, the data suppliers get a road data exchange mechanism to provide data to potential data customers. For this purpose, they have to build the respective interfaces to their existing transport related data management. It means that a strong co-operation with other authorities is needed, on a national level as well as on a European level. This will be of even higher importance in accordance with INSPIRE.

Typical road data suppliers are mapping agencies and road authorities.

The EuroRoadS project, being composed of partners from both types of public authorities, can be the frontrunners or the locomotive for the implementation of EuroRoadS and they have a special responsibility in this supplier role.

The project partners recognise the importance of further development of the work being achieved within the EuroRoadS project. The specification framework needs to be maintained, and a supplier network further developed.

### 1.2.2 Road data users

The users of road data are a mix of public bodies and commercial companies that have needs for public-sourced road data for applications, products and services that cross local, regional and national boundaries. The users are not end-users but intermediaries, i.e. refining the information for end-user application. Their motivation ranges from public policy aims such as improving road safety or environmental quality to pure commercial purposes.

By using EuroRoadS specification framework, the users adopt a road data exchange mechanism in order to be able to use data from EuroRoadS suppliers. The standard conformity (ISO, GML, etc.) facilitates the use of the exchange framework and reduces the risk of a proprietary isolated solution.

Data users have to make investments to become EuroRoadS compliant and need to be assured that the framework of specifications will be regularly updated and maintained. To reach a comprehensive approach the technical specification framework needs to be complemented by organisational functions (metadata services), technical support, and other operational issues. Efforts necessary for putting in place the required infrastructure and its benefits is outlined in the cost and benefit analysis.

The data users – which can be data suppliers as well – get access to a variety of transport related data presented in a harmonised way using the EuroRoadS framework of specifications. The specification framework is open for extensibility for own specific topics and data types.

### 1.2.3 Service providers

EuroRoadS is also important for commercial exploitation, such as the development of location-based services, of new IT-based forms for traffic and for tourism information. Service and information providers will profit by EuroRoadS for developing these demanded services.

### 1.2.4 The European Commission

Among other stakeholders, the European Commission is the most important. The EuroRoadS project has been funded 50% by the European Commission DG Information Society via the eContent programme. The funding has been motivated by the fact that the lack of a pan-

European road data infrastructure of high quality is an obstacle to the development of more intelligent traffic systems. These systems are necessary in order to increase road traffic safety, improve the environment and make easier life for travellers. The EuroRoadS project has laid the ground for the creation of such an infrastructure.

There is also a strong link between EuroRoadS and INSPIRE; an initiative to make interoperable spatial information readily available in support both national and European Community policies and to enable the public to access to this information. The transportation network is one of the data themes that are given the highest priority in the proposed INSPIRE-Directive and EuroRoadS will underpin the related specification work. The results from EuroRoadS has already been used within the INSPIRE Drafting team on Data specifications.

### 1.2.5 Reference groups

Within the EuroRodS project there have been three reference groups representing the umbrella organisations for road data providers and road data users:

- EuroGeographics representing the interests of the European National Mapping and Cadastral Agencies (NMCA).
- CEDR representing the National Road Administrations in Europe (NRA)
- ERTICO is a Europe-wide, non-profit, public/private partnership for the implementation of Intelligent Transport Systems and Services (ITS).

These reference groups are interested in supporting their members for a better application and exploitation of data and help to develop a harmonised and quality assured road data infrastructure for Europe. Their interest is as well to create interoperability between existing national and regional datasets.

## 2 Background for implementation and exploitation

The implementation and exploitation plan is based on a number of fact findings, studies and analysis of the actual situation. These include market analysis and user requirement investigations as well as assessment of the state of the art concerning the availability and handling of road data.

### 2.1 The market and the user requirements

The identification of the potential market is described in a market analysis report. EuroRoadS has concentrated on meeting the core data needs for the following applications:

- Navigation systems (authoritative updates to basic road network data),
- Advanced driver assistance systems (ADAS - enhanced network data including greater accuracy, full lane detail, official and posted speed limits, accident statistics and other safety attributes),
- Logistics management systems,
- Fleet/commercial vehicles (specific attributes for trucks),
- Tolling and road charging (e.g. official road charging data for the respective parts of the network),
- Road asset and traffic management (basic data for monitoring, maintenance, operation, environmental impact etc.),
- Planning and reporting linked to EU- transportation and environmental directives.

In addition there are other emerging business developments seeking more versatile use of the EuroRoadS information i.e. telecommunications, local tourist information services, online map websites.

Of specific interest is that there is a substantial demand for road data held by public bodies with a uniform data definition, structure and availability across Europe. Furthermore there is a need for quality assured road data with frequent updates.

### 2.2 Business framework

An analysis of the business environment in terms of potential business actors from public and private sector, a cost and benefit analysis as well as a definition of a business case have been developed to provide necessary information for the establishment of an implementation and exploitation plan.

The scope of the cost and benefit analysis has been to describe the costs and benefits for implementing and exploiting a pan-European road data infrastructure. It has not been possible to quantify the costs and benefits, but to describe the conditions in general terms. The conclusions from the analysis are:

- The costs for technical implementation for data suppliers depend on the current level of development regarding road data information. Therefore, it is not possible to estimate common efforts.

- The efforts for organisational implementation must also be considered by road data suppliers and road data users, as each organisation has to create an internal organisation able to handle the EuroRoadS framework of specifications.
- A number of efforts have been identified for data suppliers to make use of the EuroRoadS specification framework including training and support needed for delivery of road data according to the EuroRoadS format.
- Main benefits for road data suppliers are:
  - Increased interoperability between different data suppliers,
  - A basis for developing national road database for countries aiming to set up a national/regional road data infrastructure,
  - A more efficient cooperation between national mapping agencies and national road administration and easier access to publicly held road information.
- Main benefits for road data users are:
  - Easier access to publicly held road information,
  - Higher (better specified) quality of the road data,
  - Easier integration of road data coming from different sources as well as between road data and other data themes such as addresses.

The scope of the business case analysis is to propose recommendations for a successful business development at European level. To achieve this, the business case has extended the previous market analysis with emphasis on user needs and potential customers. Based on these studies, possible business models and initial steps necessary for the implementation of the EuroRoadS specification framework have been identified.

The conclusions of the business case analysis are described more in detail in chapter 4.

## 2.3 State of the art of road data in Europe

A survey of the current situation of road databases in Europe has been carried out among the national mapping agencies and the national road authorities. The survey shows a big diversity between the responding agencies concerning the development of national road data infrastructures in Europe. The survey focused on the current situation and development plans for the technical content and standards of national road databases. Another issue has been to clarify the actual cooperation between national organisations.

Some countries like Norway and Sweden have established a national road data infrastructure. The infrastructures are based on national standards – being developed using European and international standards – describing the network and data content, agreements between data suppliers (road administrations, mapping agencies, municipalities and other stakeholders) as well as processes for updates and delivery of data. The national road data bases built on the infrastructure includes many attributes necessary to support a wide range of applications. There is also a well functioning cooperation between neighbouring countries.

Also a number of other countries have started up the development of a national road database with an infrastructural approach including explicit topology and some basic attributes.

Other countries have not started up yet and are still considering how to develop a road database on a national level. Already today there are a number of road and mapping agencies having expressed benefits from making use of the EuroRoadS specification framework.

## 2.4 EuroRoadS specification framework

The main objective for the project has been to build a platform for a European road data infrastructure through a specification framework. The framework consists of specifications for data content and data exchange. The EuroRoadS specification framework is built and maintained taking full advantage of national road data solutions as well as existing standards. It will make national data available to the market in a harmonised, interoperable and quality assured way.

The EuroRoadS project has developed and established a specification framework describing:

- data structure (road network information model),
- data content (core European road data),
- data exchange mechanisms (exchange model and format),
- a model for handling of evaluation and quality control of road data in the information chain (from data producers to end users),
- a metadata catalogue,
- a terminology catalogue.

EuroRoadS has based its specifications on existing standards from the ISO 19 000 series and OGC, but also implemented specifications from GDF and existing national road data standards and specifications.

The project has focused on core road data, but made it easy to handle additional objects and attributes and also to link the information to other data themes, such as administrative boundaries, geographical names and hydrology.

The project has made in-depth studies on – and delivered efficient mechanisms – to find the right balance between far-reaching harmonisation and to make use of existing road data in different public organisations. This includes introduction of different conformance levels.

An extended quality model based on ISO 19 113 has been developed. The developed quality model allows a full quality control of road data throughout the complete information chain from data acquisition to final applications.

The project has been using – and gained experiences from the use of – commercial available schema translation tools in order to translate existing national data models to EuroRoadS data model.

The specifications enable a uniform and efficient data transfer between producers and suppliers of road data and providers of usable information and services for end users. EuroRoadS specification framework is based on the following main principles:

- To involve all relevant stakeholders in the entire process from describing user requirements to the development of specifications and other solutions,

- To make use of existing data and create efficient tools to achieve seamless interoperability between existing databases – not to set up a European database,
- To use existing standards to describe data model, referencing systems, exchange model and exchange format, quality, metadata and terminology,
- To set up efficient quality models to support safe-guarded handling of road data,
- To focus on core European road network data and create efficient solutions making it easy to add other kinds of road data and to combine the road data with other data themes, such as data on administrative boundaries, geographical names, hydrology, etc.

## 2.5 Results from tests and demonstrations

An important task for the EuroRoadS project has been to carry out practical demonstrations verifying that the specifications function well for different use cases, that the quality model gives expected results and can be used in practice and that the metadata catalogue can be implemented in a practical solution and give expected information to the users.

The project has developed a prototype and carried out test to show that the specification framework can be implemented in a realistic working platform supporting end-user services. The demonstration activities include the following components: capture and maintenance of speed limit data, data processing and integration, metadata server and services, and an end user application “SpeedAdvice”.

The demonstration covers the whole information chain from data capture and maintenance to the final application. However, only the transfer of data from the data supplier to the data integrator or application developer is specified under EuroRoadS. The demonstrator also includes elements that are covered by the EuroRoadS specification framework – in particular data maintenance and data processing towards a final end-user application.

## 2.6 Feedback from workshops

For all interested public and private parties, workshops have been held during the EuroRoadS project period. The aim for these workshops has been to present the provisional results of the project and to get feedback, as well as to encourage the interest in the upcoming work for the implementation and exploitation of EuroRoadS.

Some of the technical conclusions from the workshops express that:

- EuroRoadS is built on a suitable technical approach making use of existing standards and a good starting point for the establishment of European road data infrastructure.
- EuroRoadS demonstrates an important harmonisation exercise within the INSPIRE theme transport networks.
- EuroRoadS demonstrates the feasibility and advantages of an interoperability-based solution for sharing spatial data.
- EuroRoadS has thoroughly tackled the quality issues covering the whole data process from data capturing to end user applications.

- To make EuroRoadS happen the specifications must be accepted and further developed. The foreseen implementation rules for INSPIRE might give the necessary frame or it might be necessary to set up formal CEN or ISO standards.

Other conclusions from the workshops are that:

- It is important to focus on benefits on the national/regional level. This includes adoption and translation of specifications and development of organisational cooperation etc.
- EuroRoadS contributes to a pro-active dialogue between mapping agencies and road administrations, which will lead to more efficient handling of road information.
- The commercial framework needs further investigation to better clarify the requests of road data suppliers

## 3 Implementation plan

The implementation of EuroRoadS concerns first of all the data suppliers, especially the national mapping agencies and the national road administrations. They are encouraged to adopt the EuroRoadS concept as a harmonised European infrastructure for easy access to public road data. In that sense, they will be able to deliver and exchange data according to the EuroRoadS specifications, including quality and metadata descriptions.

This chapter will explore the reasons for adapting the EuroRoadS concept and give recommendations on how to proceed.

### 3.1 Why implementing?

There are several strong reasons for harmonising the road data in Europe and develop a common road data infrastructure.

#### 3.1.1 Increasing demands for geographic information

There is an increasing demand for pan-European geographic information. Several European directives, communications and programmes require harmonised, seamless, and quality assured geographic data. This includes the requirements coming from directives within the environmental and transport areas as well as Global Monitoring of Environment and Security (GMES) and Galileo.

Efficient governance on the national level requires road data for different cross border applications, such as transport planning and handling of permissions for transport of heavy and dangerous goods.

Also the development of services and applications within ITS and related areas request pan-European road data. The EC programme eContent+ aims to support the development of new applications build on public information. Many of the projects being carried out within the programme claims for harmonised European data.

#### 3.1.2 Spatial Data Infrastructure

There is a need to develop the spatial data infrastructure (SDI) in order to meet the demands for interoperability between geographic information and between different sectors and data themes. One of the driving forces for EuroRoadS is to encourage a closer collaboration between especially the mapping agencies and the road administrations. By working together and avoid duplication of work it is possible to reduce cost for development and maintenance of data.

On the European level the proposed INSPIRE directive aims at giving the legal framework for an infrastructure for spatial information, which will make available relevant and harmonised geographic information. The directive focuses on information of importance for environmental planning and monitoring. Road data information is of importance for measurement of traffic noise, pollution and energy consumption, management and monitoring of traffic, road tolling and pricing, transport planning, emergency and security. EuroRoadS is a valuable input to the implementation of INSPIRE concerning road data.

### 3.1.3 Intelligent Transport Systems

The contribution of EuroRoadS for projects and developments within ITS, such as ADAS, will consist of mechanisms to make the road data infrastructure available and maintained by maximising the use of public sector data, taking advantage of a partnership between the public and private sector. The establishment of an efficient public private partnership for the provision and updating of features and attributes for road networks, will lead to better quality, lower costs, and easier integration of data from different sources.

By that, it will expand the market for in-car navigation, fleet management and other commercial applications as well as to support road administrations, municipalities and other actors dealing with road maintenance, traffic safety and other official duties.

The support of cross-border road data exchange has been the most important task for the EuroRoadS project.

### 3.1.4 Supporting a common European development

Existing road databases in Europe show a great diversity in content and quality. However, there is an ongoing process to establish national infrastructures build upon new technical and organisational approaches. Therefore, EuroRoadS will not only support countries with a well-developed road data infrastructure, but also those starting to look upon future solutions. For countries, where a road data infrastructure is not yet developed, the EuroRoadS framework of specifications and data exchange can be very helpful as a basis.

By demonstrating how the public sector road information can be harmonised and accessed on a pan-European level, EuroRoadS will open up information that to a great extent already exists in digital form. It would maximise the use and knowledge of public road data and will provide a foundation for the production of both commercial and public value added services.

## 3.2 What to implement?

There are a number of building blocks, based on the EuroRoadS results, supporting the implementation of a consistent European road data infrastructure. These building blocks consist of:

- EuroRoadS specification framework
  - Road network information model
  - Core European road data
  - Exchange model and format
  - Quality model
  - Metadata catalogue
  - Terminology catalogue
- A technical solution (prototype) for search, view and dissemination of metadata
- Experiences from tests and demonstrations during the project
- Facts and experiences concerning the current situation concerning the handling of road data (from technical, organisational and business views)

### 3.2.1 Specification framework

To enable many suppliers to deliver data in the EuroRoadS format, the format has been designed open and flexible. There is only a minimum set of mandatory attributes. Most attributes are optional or user defined. Together with the fact that there are many optional attributes, the EuroRoadS format makes it possible for many suppliers to provide data and does not discourage suppliers to transform their data into a new format.

Some of the fundamental issues in the specification framework are the road network in form of geometry and centrelines and the definition of core road data.

EuroRoadS defines core European road data in three groups:

1. Mandatory – data that must be supplied by the EuroRoadS exchange format regardless of the application to be supported. The mandatory attributes are:
  - Geometry
  - UUID
  - Functional road class
  - Form of way
  - Road link/node level
2. Optional – data that can be supplied by the EuroRoadS exchange format regardless of the application to be supported
3. Conditional – data needed for a specific application area.

Existing road data in local standards and specifications can be converted or transformed into the EuroRoadS exchange format. As a starting point suppliers are required to supply mandatory data.

The EuroRoadS quality model provides strategies for improving and measuring data quality. The measured quality values are published in the metadata server. The quality descriptions of data supplied in the metadata server allow users to determine, if the data has sufficient quality for the user's needs. To be able to determine quality there are three evaluation methods in the EuroRoadS quality management concept:

1. indirect: based on external knowledge,
2. internal direct: inspection of items within a dataset using only data from the dataset itself,
3. external direct: inspection of items within a dataset using external reference data.

### 3.2.2 Metadata service

On an organisational level, potential suppliers and data users need to exchange information on what data and how data are available through EuroRoadS. This is usually done through the exchange of metadata i.e. a formalised data description of the data sets available for exchange.

A metadata server and services enables potential data users to search and inquire available data using a central access and marketing point.

In EuroRoadS the metadata server:

- provides information on all data available through the EuroRoadS suppliers network,

- uses the EuroRoadS conform metadata description

The EuroRoadS metadata description has about 120 different attributes. Typically, a comprehensive metadata description is supposed to be bundled with the actual data set.

On the metadata server a subset of metadata from the full EuroRoadS metadata description is used. This subset can be split into two parts:

1. general metadata such as name, description, data, provider, country, language etc,
2. quality related metadata such as the update regime, the rate of completeness, correctness etc.

Especially for the latter part, a more detailed understanding of the EuroRoadS Quality framework is required.

With a growing EuroRoadS network, it will be of interest to extend the metadata server functionalities. This could include:

- Implementing a low level interface to make the EuroRoadS metadata base content accessible to external metadata search engines,
- Functionalities to order data,
- Functionalities to assist in the data exchange transactions.

By contributing to the metadata catalogue and make metadata accessible to others through a metadata server (the one developed by the project or other metadata services able to present the required information) the application of EuroRoadS specified data will increase.

### 3.2.3 Experiences from tests and demonstrations

The EuroRoadS project and its demonstrator have put emphasis on solving problems related to the feasibility of data conversion and use between data suppliers and data providers. The demonstrator focuses on building the information chain, allowing the testing and evaluation of the data processing steps involved. The task has not been to develop and implement an integrated IT architecture for this purpose, rather to put together existing solutions into a common information chain, without deep technical integration.

The demonstration activities have had the objective to gain hands-on experience with the specification framework itself and to understand related issues along the whole information refinement chain. It has thereby provided input to the project validation. At the same time the demonstration work have yielded practical insights and tangible showcases useful for implementation and exploitation of the outputs by third parties beyond the project.

With regards to the interface between data supplier and data user the demonstration have generated experiences with:

- transfer and usability of similar data from different (public) sources,
- metadata and related services

The EuroRoadS framework has been experienced by the data users and data suppliers as well conceived and well documented. It offers a number of concepts e.g. for the network description or the linking of borders which appear well formed. In general and typical circumstances, the barrier to provide data in conformance with the EuroRoadS framework of specifications should be relatively low to a data supplier.

### 3.2.4 Other experiences

The project has also gathered other facts and experiences concerning the current situation concerning the handling of road data (from technical, organisational and business view) of importance for the implementation. The studies on requirements and market development give good understanding of the user needs and the market outlook. A study of the state of the art gives a good understanding on the actual situation concerning the handling of road data in Europe. Furthermore, the project has gathered information on best practices on how to develop a road data infrastructure.

The implementation involves organisational issues, both internal and external cooperation with other national road data providers.

EuroRoadS offers mechanisms to establish a road data infrastructure by taking advantages of partnerships and using the common specification framework. This will make the integration of different data sources easier, give better data quality and lower the costs.

## 3.3 How to implement?

### 3.3.1 Implementing the specification framework

There are two sides to the EuroRoadS implementation process. On one hand, individual actors need to evaluate and implement the EuroRoadS specification framework, so that their data can be supplied accordingly. On the other hand, the approach needs to be introduced as a de-facto standard for data exchange in the 'data market'. This requires a gradual approach involving decisions and actions of individual market actors, coordination between different actors as well as other drivers.

The implementation process can be conceived as a step-wise approach and is a long-term endeavour. Every national or regional supplier can contribute with existing road data – whether they can provide mandatory data only or a more exhaustive road dataset with additional features and attributes.

The diversity of the road data situation among countries in Europe is substantial and each regional or national organisation has to take its own decisions on how to start. EuroRoadS specifies harmonized ways to represent road data.

The organisations with no existing digital road data infrastructure can profitably use the EuroRoadS specification framework when starting building up a road database on a local, regional or national level.

Organisations with existing digital road databases need to analyse the compatibility of their own data and data-handling with the EuroRoadS specification framework. When providing data in EuroRoadS format, each content provider will need to transform their data according to the EuroRoadS representation. Data users may also need to transform data received, in the EuroRoadS format, according to their own data model.

The data exchange specification defines how the real world objects, represented by concepts in the information model, are expressed in a data format. The same data format should apply regardless of the data source of the conversion tools used. There should be a clear connection between the objects and attributes being described in the information model used by the data provider and the EuroRoadS information model.

Beyond what can be done by individual suppliers for a region, coordination between suppliers in one region or between different regions in one country could be helpful to increase the usefulness of the EuroRoadS data supply. If harmonised data sets for specific topics or application areas become available for larger areas, countries (and finally the whole of Europe), the value of the data to data users is greatly increased, compared to a patchwork of regional, un-harmonised data.

Useful tools for making data availability and harmonisation apparent are metadata services. Road metadata can be described according to the EuroRoadS metadata catalogue. This will give potential users a possibility to understand the content of the actual road database and its conformance with EuroRoadS specifications.

By using the EuroRoadS terminology catalogue as a basis the actual organisation holding road data can describe their data content more precisely in relation to the EuroRoadS terminology.

EuroRoadS model for evaluation and quality control supports organisations holding road data in assessing and describing the quality of the data. The availability, up-to-dateness, completeness, consistency, correctness and accuracy can be described in a structured way. The potential users can be informed about the quality – on a general level – by the metadata.

The EuroRoadS transformation or conversion can take place at the local level, and subsequently be unified at the national level from where data and metadata can be entered to the EuroRoadS metadata server.

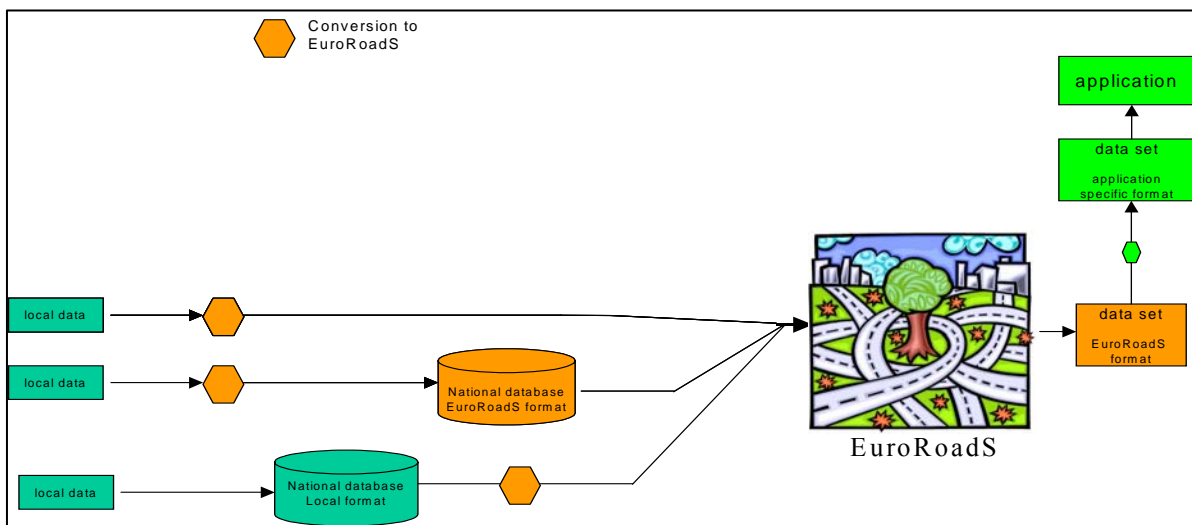


Figure 3.1 Different ways and stages in the process to implement EuroRoadS

If a country already has a national road database and a good cooperation with other organisations in the country, the conversion to EuroRoadS specifications can be done directly from the local/regional/national road data and described from there in the EuroRoadS metadata server.

In practise, different countries and regions might follow different models. Different players at local, regional or national level can start using the specification framework for their specific data exchange purposes, customers and use cases.

### 3.3.2 Metadata service

EuroRoadS has developed a technical solution for a metadata server, which has been used and tested within the project demonstrations. A possible solution for the future is to develop and maintain this server and giving all interested road data providers a possibility to inform about their road data as well as giving potential users access to search and inquire available data.

Also other technical solutions are already available or in the process of being created. Therefore, metadata can be described in accordance with the EuroRoadS metadata catalogue using existing national metadata services. Furthermore, steps are taken to establish a European metadata portal (as part of the preparations for the implementation of INSPIRE).

Despite technical and organisational solutions for handling metadata it is recommended that data providers introduce processes for metadata description in direct relation to the processes for production and maintenance of databases.

### 3.3.3 Experiences from the tests

Experiences from the demonstration and test activities, of specific interest for the recommendations concerning how to implement, are the following:

EuroRoadS exchange format (GML) for complete data sets covering large areas leads to very large data volumes. This requires special techniques to handle when delivering complete datasets, as the GML format primarily is developed to handle transfer of data change.

The EuroRoadS information model for network description offers a lot of flexibility and liberty for usage/interpretation by suppliers. This implies a low entry barrier for suppliers as they rather easy can transform their data model to the EuroRoadS data model, at the same time the users have to interpret the data according to the model used. It might be necessary to build a profile on the EuroRoadS specifications giving more strict definitions, which also will be of help for countries/regions developing road data bases.

Border linking is required for routing applications covering several countries/regions. The EuroRoadS information model provides a good basis to resolve topological linking.

### 3.3.4 Organisational recommendations

The implementation of EuroRoadS involves not only technical issues but also organisational.

An effective cooperation, especially between national mapping agencies and national road administrations, is an important pre-requisite for the development and implementation of EuroRoadS results.

One of the first actions should be the internal organisation on how to organise the implementation of EuroRoadS in the organisation and to define the distinct responsibilities for each part of the process.

Next step is the co-operation with other national/regional/local organisations dealing with road data, to agree on a common understanding of the aims for the national road data infrastructure and its relation to the European, including the implementation of the INSPIRE directive.

The success of EuroRoadS requires a widespread adoption of EuroRoadS implementation.

### 3.3.5 Implementation steps for road data suppliers

In the following some recommendations are given to road data suppliers on how to initiate the implementation of the EuroRoadS results.

One of the underlying objectives for EuroRoadS has been to find a good balance between a far-reaching harmonisation and to make use of existing road data. Therefore, the EuroRoadS road data network model and description of core European road data can be regarded as a common denominator to achieve interoperability for the creation of a pan-European road data infrastructure. This means that different organisations benefit from using the EuroRoadS specification framework not only for road data exchange, but also for the development of individual databases. Apparently, additional needs have to be taken into consideration in order to meet the local, regional and national demands.

The spatial data infrastructure concept being used within EuroRoadS promotes the creation of cooperation between different road data producers. However, single organisations do not have to wait for long-term harmonisation across many players but can start using EuroRoadS specification framework when assessing their road data policies, including adoption of exchange format.

It is recommended to take a step-by-step approach and make a gradual implementation with short-term targets. This includes to be informed of best practises and by that benefit from others experiences.

The following steps can be distinguished, when existing data shall be supplied according to the EuroRoadS specification framework:

- First a decision has to be taken on what content to be supplied. Based on the EuroRoadS road network information model and description of core European road data, it has to be considered what features and attributes – besides the mandatory – should be supplied.
- Each content provider need to transform their data according to the EuroRoadS representation. Data users may also need to transform data received, in the EuroRoadS format, according to their own data model.
- The minimum data offer according to the EuroRoadS specification framework is the road network and the mandatory attributes.
- If data is being delivered for use in cross-border applications, a border linking process should be established. EuroRoadS offers different models for border linking. Ideally, the identifiers of the neighbouring data set and the specific node should be included into the supplier's data to enable the user to easily merge the neighbouring datasets.
- Each data supplier has to develop a converter to extract data from the actual database to EuroRoadS exchange format. The EuroRoadS specification framework defines the expected output from this converter.
- It is recommended to evaluate data quality using the methods being developed in the EuroRoadS project. In short this means:
  - Analysing existing processes and development of additional quality assurance measures
  - Testing quality assurance measure by simulation before implementation
  - Determine data quality by indirect methods (based on external knowledge) and

internal methods (based on inspection)  
- Document processes and quality values  
- Extend quality management step-by-step

- To document the quality of the offered data, it is recommended to enter the quality parameter values (e.g. geometric correctness of roads) that have been determined with the help of the quality evaluation methods into the metadata server.
- To realise a uniform quality description, it is recommended to deal with whole set of quality characteristic and quantify each of the quality characteristic with one quality parameter value at least.

### 3.4 Examples of early adoption

In August 2006, some organisations have already implemented the EuroRoadS specification framework in practise. Therefore, to some extent the implementation of EuroRoadS project results have already started. Furthermore, there are a number of projects and initiatives related to the handling of road data, which now are considering establishing their solutions upon results from EuroRoadS. Some of these activities are briefly described in the following.

#### 3.4.1 Cross border applications

##### *Norwegian-Swedish border cooperation*

Public road administrations are increasingly co-operating in different cross border applications, e.g. in traffic planning and in the handling of permissions for transport of heavy or dangerous goods. To facilitate these kinds of official duties there is a need for harmonised data on the road network. One example where the EuroRoadS framework of specifications now is in use for data exchange is the co-operation between the Norwegian and Swedish road administrations.

##### *Barents GIT Project*

There are also a number of other projects considering the establishment of a cross-boarder road data solution on EuroRoadS. Such an example is the Barents GIT project, which includes the establishment of a harmonised road data infrastructure for the Barents region (covering large areas above the Polar circle within Norway, Sweden, Finland and Russia). The idea is to make the national road data available in EuroRoadS exchange format on a server in each country and make easy access to the data from the already developed Barents GI portal, which is an appreciated source for viewing basic geographic information within the region. Road data of better quality than today is needed for transport planning, traffic safety work, and support to the development of tourism in the Barents region.

#### 3.4.2 Exchange of road data

##### *Norwegian Road Administration and municipalities*

The EuroRoadS solution has also proved to be of interest for the exchange of road data between different national organisations. For example, the Norwegian Road Administration considers establishing a deeper co-operation between the national road administration and the municipalities on EuroRoadS exchange model and exchange format as well as quality model.

### 3.4.3 Trans-European road network

#### *Change from RADEF to EuroRoadS*

Based on the Trans-European road network (TERN), the national road administrations report different kinds of statistical information. The RADEF format has been developed by CEDR Subgroup on road data in order to facilitate the data exchange related to TERN. However, CEDR is now considering a change from RADEF to EuroRoadS exchange format in order to facilitate the data exchange. For that reason RADEF attributes have been included in the EuroRoadS information model.

### 3.4.4 Use of EuroRoadS data in a mobile application

#### *The EuroRoadS demonstration application speed advice*

In the demonstration work package, EuroRoadS data on speed limits from the demonstration partners Sweden, Norway, France, Austria and Bavaria has been used for a speed advice application running on a mobile client. All supplying partners have delivered data in EuroRoadS format, that has then been transferred to an application specific format for the use in the client.

### 3.4.5 INSPIRE

The results from EuroRoadS are also of great interest for the implementation of the European Spatial Data Infrastructure and by that for the proposed INSPIRE Directive.

Reports from the EuroRoadS project have been delivered to and carefully investigated by the INSPIRE Drafting teams, who are in the process of developing draft implementing rules for the directive. Therefore, it can be stated that the project will have an impact on the implementation of the European spatial data infrastructure in general and especially concerning the handling of data on road networks.

### 3.4.6 Other effects

Results from the EuroRoadS project – mainly the framework documents and the quality model – have been carefully scrutinized by a number of national organisations, which have started to discuss and plan for the development of national road data infrastructures. For example in Switzerland, Estonia, Croatia and Malta the national road administrations and the national mapping agencies have started to plan for a closer co-operation concerning the future handling of road data and to base the technical concept on the EuroRoadS framework. Even from Australia a great interest has been shown in EuroRoadS as a tool to create interoperability between existing road databases in the different states.

EuroRoadS has also a great potential to support commercial applications, even if, so far, limited results from the test beds are available.

Naturally, EuroRoadS project partners are in the forefront of implementation of results from EuroRoadS.

## 4 Exploitation plan

The aim of the exploitation plan is to propose recommendations on how to promote the future take-up and exploitation of EuroRoadS results as well as to support a wide use of the European road data infrastructure. This will affect the data supplier community, the customer community and others, for example EU (INSPIRE). The basics for the exploitation is to ensure continuity of support services for suppliers and users i.e. provide user support, act as help-desk, take care of eventual errors and updates in specifications, promote standardisation of EuroRoadS results, dissemination of information and development of liaisons etc. It is also important to develop documents like guidelines for suppliers and users, examples of best practice. Also could be included to establish quality certification and compliance testing procedures.

The development of the exploitation plan includes analysis on how to organise the cooperation necessary for the establishment of a European road data infrastructure. Different business models for organising the necessary services have been explored.

### 4.1 Business models

Different organisational set-ups for the handling of information services, data supply and membership services have been analysed and the following two options have been retained as the most interesting: a decentralised and a centralised model. Other options on an organisational level in between could be conceived as well.

The decentralised model is shown in figure 4.1. In this model a “EuroRoadS operator” would provide information services (e.g. operation of metadata services) to potential data users, based on adequate input from data suppliers. Through these information services, data users could get in touch with data suppliers, who then agree on the supply arrangements and handle the data supply and payment of it bilaterally. With regards to commercial aspects (licensing, price model etc.) suppliers would operate independently from each other

In addition to the information services, a “EuroRoadS operator” could operate specific membership services on behalf of the supplier network. For both kinds of services the operator would need to be remunerated by the group of data suppliers commissioning the services.

This model requires only limited collaboration of the data suppliers on commercial issues such as licensing, pricing etc., which will facilitate the organisation of cooperation between data suppliers. However, this model will not give full support to the data users as they still have to deal with many different suppliers.

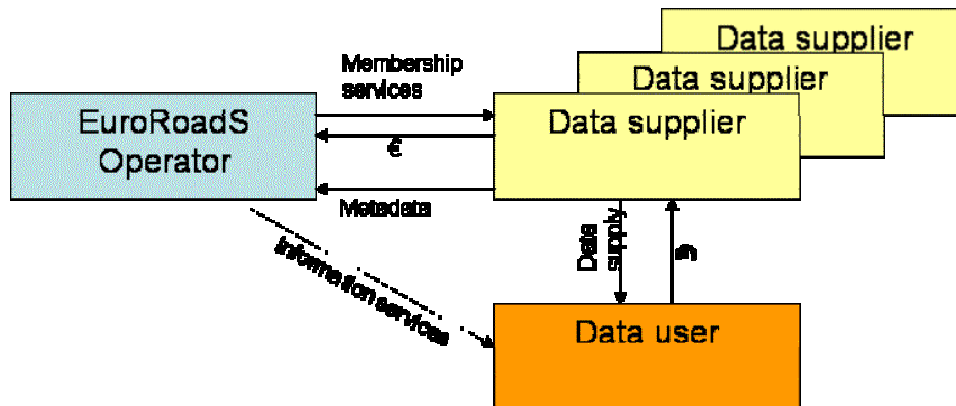


Figure 4.1 EuroRoadS decentralised model

The centralised model is shown in figure 4.2. Here a “EuroRoadS operator” would operate all services of the decentralised model, and, in addition, take on further functions with regards to the data supply. In principle it could become the technical, commercial and organisational interface to the customer. In this model the data users would only have to approach one single agent. This requires a far-reaching harmonisation of the commercial conditions, marketing strategy etc. related to the data supply and use. Such a “EuroRoadS operator” would become a sales agent for the data suppliers on an international level.

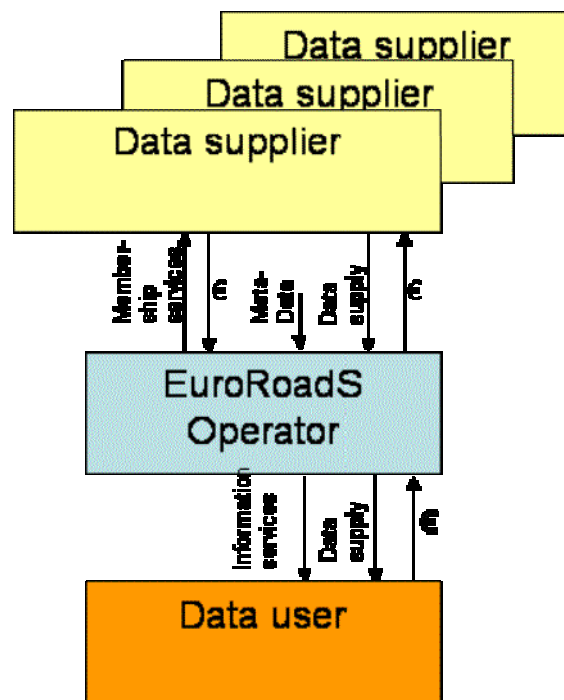


Figure 4.2 EuroRoadS centralised model

For the time being the decentralised model appears a realistic starting point. The current community of potential EuroRoadS suppliers is technically and commercially very heterogeneous. Before any commercial alignment process has been started between data suppliers, the harmonisation of data (or data products) on a technical level is required, as

delivery of data from many suppliers to one user is non-efficient. Therefore, initial steps should focus on fostering technical harmonisation of data supply. In addition information services to potential customers should be developed.

In the future, when the technical harmonisation is further developed, the next step towards a centralised model could be taken. This includes development of a commercial and organisational alignment.

## 5 Towards an organisational set-up for the deployment of EuroRoadS results

Implementation and exploitation of the project results are based on a step-wise approach. The recommendations are based on the actual situation concerning the handling of public road data, user needs and possible business model.

There is an interest amongst road data suppliers and users to address the following needs:

- support, correct and improve the specification framework following the end of the EuroRoadS project,
- support users of the EuroRoadS specifications,
- support the development of national, regional and local spatial data infrastructures with regard to the efficient handling of road data,
- represent the EuroRoadS achievements in the INSPIRE process,
- promote the implementation of EuroRoadS by the widest community of public data suppliers in Europe,
- provide a platform for potential users and data suppliers to collaborate,
- identify needs for further research and development,
- identify projects and activities that should make use of EuroRoadS' results and improve existing achievements,
- develop guidelines and distribute information on best practice,
- develop commercial environment aiming to facilitate a widespread market adoption of EuroRoadS compliant data.

A clear interest to support the deployment of the EuroRoadS results has been shown. Therefore the idea to establish a EuroRoadS Forum to promote and exploit the results has been raised. The idea is to engage both providers and users of public/private-sourced road data.

A draft Memorandum of Understanding (MoU) has been set up as a basis for discussion between potential founders of a EuroRoadS Forum. The final content of the MoU will be decided by stakeholders participating in this process. All providers and users of road data, European organisations working with road information as well as other interested parties are welcome to take part in this process.

### 5.1 A EuroRoadS Forum

The project proposes to establish a EuroRoadS Forum to promote and exploit the results of the project and to support both providers and users of public/private-sourced road data. The main task for a EuroRoadS Forum is to explore and promote the EuroRoadS aims and results.

A draft Memorandum of Understanding (MoU) has been developed giving the basis for discussion between potential founders of a EuroRoadS Forum. The MoU includes a description of tasks and how to organise a EuroRoadS Forum and to distribute undertakings.

The draft MoU was presented and discussed during EuroRoadS' Closing Workshop. The common feedback at the workshop welcomed the MoU as a good starting point for insuring continuity for future management and development of the EuroRoadS results.

An invitation to participate in the future deployment and setting up the MoU has been sent to the EuroRoadS project partners, workshops participants and all subscribers of the EuroRoadS Newsletter. A first meeting with all interested parties will be held on 30 November 2006. The meeting will focus on the definition of the future EuroRoadS activities and the structure and main goals of a EuroRoadS Forum.

The EuroRoadS vision is in short: to establish a European-wide road data infrastructure delivering access to harmonised and quality assured road information covering EU25+ by end of 2012. The timetable will however depend on the willingness and readiness of the national road data providers to make use of EuroRoadS results and give access to their road data through EuroRoadS exchange format. The EuroRoadS project partners and other stakeholders already using parts of EuroRoadS results will be the frontrunners for introducing the concept by implementing EuroRoadS and by best practise encouraging others to do the same.

Of vital importance is also the timetable of the INSPIRE Directive as well as the level of details in the INSPIRE implementing rules concerning the transportation network.

It is assumed that the EuroRoadS Forum will for the next two years consider how a more sustainable organisation for EuroRoadS can be organised and how each organisation can be engaged in implementing and exploiting EuroRoadS.

## 6 Conclusion

The EuroRoadS project has developed a specification framework with a suitable technical approach for the development of a European road data infrastructure.

The project has aimed to find a good balance between far reaching harmonisation and to make use of existing road data. The specifications offer flexibility which means that data providers fairly easy can make use of them. It is rather easy to transform existing road data to the EuroRoadS data model and to deliver the data in the specified exchange format. The consequence of this approach is that the users have to interpret the data according to the model used. The specification framework is – as far as having been tested and verified until now – proved to work in practice for efficient exchange of road data.

The project results imply an important harmonisation exercise within transport networks. EuroRoadS has a clear potential to contribute to INSPIRE, national SDI's and development of ITS.

The EuroRoadS outcome has a clear potential to meet the needs of harmonised and quality assured road data in Europe. Outcome from workshops demonstrates a strong interest from many stakeholders to implement and exploit EuroRoadS results and to reach the EuroRoadS vision. This is a good starting point for implementation and exploitation of a European road data infrastructure.

The implementation plan gives recommendations on how to start implementing EuroRoadS for data suppliers. A step-by-step approach is recommended, where every organisation by making a small beginning can contribute with existing road data.

The implementation and exploitation plans including the business model gives a good starting point for further deployment of the EuroRoadS results. EuroRoadS has a strong infrastructural approach on public road data which results in a high level description of costs and benefits as well as the business model.

It is important to keep the EuroRoadS vision alive but to concentrate on and set priorities for the coming two years. The specifications must be maintained and, if necessary further developed. Efficient forms for co-operation supporting the deployment of the EuroRoadS results by dissemination of information, best practises, etc must also be established.

On a European level it is important to support the INSPIRE process and represent the road data community e.g. when developing implementation rules for transportation networks. Of importance is also to develop an organisational and business model for pan-European service giving access to national/regional maintained road databases.

The proposed implementation and exploitation activities, including the suggested establishment of a EuroRoadS Forum are supported by a number of organisations willing to bring EuroRoadS forward.

## References

D2.1 Evaluation methodology

D2.2 Report on Quality Frame for Information

D2.3 Probabilistic model for information chain

D2.4 Quality Management Concept

D2.5 Evaluation Scheme

D3.7 Report Closing Workshop

D4.1 Market Analysis Report

D4.2 Cost Benefit Analysis

D4.3 Business Case Report

D5.2 Final Report on User Requirements

D6.3 Final Specification of Road Network Information Model

D6.5 Final Specification of Core European Road data

D6.8 Metadata Catalogue

D6.10 Final Specification of Road Network Exchange Model

D6.11 Final Specification of Road Network Exchange Format

D6.12 Terminology Catalogue

D7.5 Sample Mobility Service Demonstrator

D8.2 State of the Art of Road Data in Europe

D8.3 Workshop Report

Memorandum of Understanding of EuroRoadS