INTELLIGENT TRANSPORT SYSTEMS IN SOUTH EAST EUROPE

FINAL PUBLICATION OF THE SEE-ITS PROJECT

2014

EDITORIAL TEAM

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EDITORIAL NOTE

“Intelligent Transport Systems in South-East Europe” is the final publication of “SEE-ITS: Intelligent Transport Systems in South-East Europe”, a 2-year project financed by the South-East Europe Transnational Cooperation Programme of the European Union, under the coordination of the Hellenic Institute of Transport of the Centre for Research and Technology Hellas.

SEE-ITS activities were carried out during 2012 - 2014, a period of significant developments throughout Europe as regards the increased deployment of ITS, the next advances of ITS, as well as the framework conditions set by the 2010/40/EU Directive. SEE-ITS focused on the analysis of the current deployment status of Intelligent Transport Systems (ITS) in South-East Europe, on the provision of recommendations for enhanced deployment both from the technical and the policy perspective as well as on suggestions for concrete actions in the form of deployment roadmaps for the future, utilizing also results from targeted ITS demonstration activities.

This publication provides interested readers with up-to-date information on:
- The current status of ITS in South-East Europe, as of 2014, with references to the Priority Areas set by the 2010/40/EC Directive for ITS
- Best practices of ITS deployment in South-East Europe as well as across Europe
- Organizational, operational and technical requirements for interoperable ITS deployment
- Roadmaps for ITS deployment in South-East Europe countries, including proposals for national ITS architectures
- ITS demonstration activities executed within the SEE-ITS project

“Intelligent Transport Systems in South-East Europe” is targeted to the variety of multi-sector stakeholders, which are involved in the complex ITS domain, well beyond the boundaries of the South-East Europe area.

Further details and the complete technical reports of the SEE-ITS project, beyond the contents of this publication, are freely available on www.seeits.eu.

Enjoy the reading!

THE EDITORIAL TEAM
# CONTENTS

## INTRODUCTIONS

- Georgia Aifadopoulou
- Roberta Calcina
- Claire Depré
- Rodanthi Sfakianaki
- Roman Srp

## 1. CURRENT STATUS OF ITS IN SEE

1.1 General information

1.2 Implementation status of ITS in Austria
   - Stakeholders involved
   - SWOT Analysis for Austria

1.3 Implementation status of ITS in Greece
   - Stakeholders involved
   - SWOT Analysis for Greece

1.4 Implementation status of ITS in Bulgaria
   - Stakeholders involved
   - SWOT Analysis for Bulgaria

1.5 Implementation status of ITS in Hungary
   - Stakeholders involved
   - SWOT Analysis for Hungary

1.6 Implementation status of ITS in Italy
   - Stakeholders involved
   - SWOT Analysis for Italy

1.7 Implementation status of ITS in Romania
   - Stakeholders involved
   - SWOT Analysis for Romania

1.8 Implementation status of ITS in Slovenia
   - Stakeholders involved
   - SWOT Analysis for Slovenia

1.9 Implementation status of ITS in Croatia
   - Stakeholders involved
   - SWOT Analysis

1.10 Implementation status of ITS in Albania

## 2. BEST PRACTICES OF ITS DEPLOYMENT IN SEE AREA AND ACROSS EUROPE

2.1 Results of best practice collection
   - Austria
   - Belgium
   - Czech Republic
   - Denmark
   - Finland
   - France
   - Germany
   - Greece
   - Hungary
   - Italy
   - Netherlands
   - Norway
   - Romania
   - Slovenia
   - Spain
   - Sweden
   - United Kingdom
   - European Union level

2.2 Conclusions on Best Practices

## 3. REQUIREMENTS FOR ITS DEPLOYMENT

3.1 Regulatory Instruments for interoperable ITS

3.2 Systems developed by regional and national authorities

3.3 Issues identified for the existing systems
   - Organisational and operational requirements
   - Technical requirements

3.4 Conclusions for Interoperability

3.5 General conclusions

3.6 Proposals for future measures to support and increase interoperability

## 4. ROADMAPS FOR ITS IN SEE

4.1 National ITS Roadmaps

4.2 Comments on ITS roadmaps
4.3 Common Revision Plan for an ITS Architecture
  4.3.1 The European Architecture for ITS
  4.3.2 Review of ITS Architectures in the SEE countries – Current status
  4.3.3 Overview and general proposals
  4.3.4 Guidelines and proposals for the revision of ITS architecture in Austria
  4.3.5 Guidelines and proposals for the revision of ITS architecture in Greece
  4.3.6 Guidelines and proposals for the revision of ITS architecture in Hungary
  4.3.7 Guidelines and proposals for the revision of ITS architecture in Bulgaria
  4.3.8 Guidelines and proposals for the revision of ITS architecture in Romania
  4.3.9 Guidelines and proposals for the revision of ITS architecture in Slovenia
  4.3.10 Guidelines and proposals for the revision of ITS architecture in Italy
  4.3.11 Guidelines and proposals for the revision of ITS architecture in Croatia

5. SEE-ITS DEMONSTRATION ACTIVITIES
  5.1 Thessaloniki ITS pilot site
  5.2 Patras ITS pilot site
  5.3 Vienna ITS pilot site
  5.4 Hungarian ITS pilot site
  5.5 Sofia ITS pilot site
  5.6 Romanian ITS pilot site
  5.7 Emilia-Romagna ITS Pilot Site
Georgia Aifadopoulou

SEE-ITS project idea was conceived by CERTH-HIT research team(*) as a cooperation opportunity of competent in Intelligent Transport Systems stakeholders for promoting deployment and stimulating harmonization and operational interfacing between isolated Intelligent Transport Systems (ITS) in South East Europe. Emphasizing on alleviating digital divide caused by lack of interoperability of these systems and achieving information exchange among existing ITS in the field of road transport and their efficient interfaces with other modes, the project attempted to set the framework for ITS deployment in accordance to the European Union’s Directive (2010/40/EU) dealing with ITS deployment and create direct impact for the benefit of the users of transport infrastructure.

In the SEE region major transport infrastructure developments are currently undertaken and important Trans European Corridors are challenged regarding their integrated operation and seamless accessibility by the users. Technology adoption for transport management is advancing in different rhythms.

In this context intelligent transportation systems can radically contribute in substantiating the vision of a future in the region that integrates existing transportation infrastructure with communication networks in an effort to reduce congestion and travel time. The creation of an integrated network linking cars and trucks with roadway infrastructure and users/passengers with seamless intermodal modal mobility services is a priority need for SEE regions and its development. In doing so on a mass scale, the larger effect of intelligent transportation systems is to limit the release of carbon emissions into the atmosphere, cut back on fuel consumption and improve road safety.

Benefit from a multiple competent, balanced and representative consortium from all the SEE area countries, the SEE-ITS project constitutes the first regional cooperation platform for defining common priorities, implementing actions, harmonizing standards and evaluating the impact of ITS in SEE region. The experience and the knowledge accumulated during the whole project life cycle from the operation of this cooperation platform is constructively stored in the SEE-ITS tool of “Knowledge base for ITS in SEE”. Following a bottom up approach, the project concluded proposals for revisions and guidelines for the National ITS architecture of all participating countries (Greece, Austria, Hungary, Italy, Bulgaria, Romania, and Slovenia) for enhancing interoperability of ITS and supporting the implementation of EU ITS directive in these countries. The preparation and consultation with extended outside the consortium stakeholders’ forum of the “Common Revision Plan for the Interoperability of ITS in SEE” is a major project milestone which will be used as reference after the project end and will multiple the project work impact in the field inside and outside the SEE region area.

Finally, 5 demonstration sites in SEE were used as test beds of the project proposals proving technical implementations of ITS interoperability in the fields of:

- optimal use of road, traffic and travel data,
- continuity of traffic and freight management ITS services,
- ITS road safety and security applications
- linking the vehicle with the transport infrastructure.

SEE-ITS set the scene and detailed the strategy for the ITS deployment in SEE. This document capitalizes the main project outcomes and demonstrates the feasible road maps for achieving the objectives while detailing technical recommendations on ITS interoperability that can be used by different stakeholders inside and outside SEE area. The project operations proved that in the near future we need to maintain the permanent cooperation of the competent actors in the field of ITS in the SEE and implement institutional framework (at the level of the region or of TEN corridors) for further capitalizing the project outcomes.

Georgia Aifadopoulou
Research Director, Head of Sector B
Centre for Research and Technology Hellas - Hellenic Institute of Transport
The South East Europe Programme is a unique instrument which, in the framework of the Regional Policy’s Territorial Cooperation Objective, has supported the development of projects with transnational relevance in the South East European region in the programming period 2007-2013.

Aim of the SEE Programme has been to improve integration and competitiveness as well as to reduce the disparities and foster coordinated development among the 16 countries involved – out of which 8 were originally non-EU members, becoming 7 with the later EU accession of Croatia - on 4 main priorities identified through a SWOT analysis relevant for the region: Innovation, Environment, Accessibility and Sustainable Growth Areas.

In relation to the improvement of accessibility, which is the relevant priority for the topic tackled by the project SEE-ITS, the SEE Programme has since the beginning pursued the aim to support the development of solutions of common interest that could offer concrete results and benefit to the population of the SEE Programme area, within the short time of implementation and limited budget.

Thus, it has concentrated on transnational activities with low initial investment that, taking into account the poor conditions of the transport network and the potential for development of traffic flows in the region, have allowed the achievements of most tangible results and increase efficiency of transport and mobility in the short term.

For improving passengers’ mobility and freight transportation, rail, road, maritime and inland navigation, mono and multi-modality solutions have been put in place by 24 projects awarded with a budget exceeding 58 million euro. The focus on results that could go in the direction of reducing the environmental and territorial impact of transport has additionally been kept in focus.

The SEE Programme has supported fully the introduction of innovative ICT and ITS, as these represent smart solutions to improve mobility efficiently and in a fast way, with limited financial resources.

The awarded projects represent a step forward not only for the solutions developed and deployed, or for having started processes towards seamless mobility for the people and greening freight traffic, but also for representing a kick off of a stronger cooperation among the competent bodies and decision makers of the 16 countries to allow improving the quality of life of the people sharing the SEE space.

Roberta Calcina
Project Officer
South-East Europe Transnational Cooperation Programme

Claire Depré

Intelligent Transport Systems (ITS) rely on the application of information and communication technologies to transport. In times of growing congestion, increasing fuel dependency, and high pressure on the public budgets, constructing new infrastructure is no longer an option for coping with an increased demand for mobility from citizens and freight operators. There is a growing need of optimizing the use of existing infrastructure, making it safer, and promoting smart mobility solutions. To this aim, ITS prove instrumental.

ITS rely on computers, electronics, sensors and even satellites, in order to foster a cleaner, safer and more efficient transport system. They can be applied in every transport mode (road, rail, air, water), including their respective interfaces, therefore enabling and fostering multimodality. As a result ITS can help to reduce congestion and emissions, while smoothing door-to-door mobility and contributing to the efficiency of the internal market.

Smart transport solutions have been deployed across the EU, although still in a fragmented manner or for limited niche markets, what undermines their cost effectiveness and the extent of the benefits achieved. For this reason, the European Commission progressively established a coherent, yet flexible, legal framework fostering a continuous and harmonized ITS deployment across all EU Member States. In 2008 the Commission adopted an Action plan for the deployment of Intelligent Transport Systems in Europe1, which was followed two years later by the adoption of the Directive 2010/40/EU on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport.2

This policy framework focuses in priority on a number of topics, such as: the optimal use of road, traffic and travel data; the continuity of traffic and freight management on corridors and in conurbations; road safety and security; or the integration of the vehicle into the transport infrastructure. The policy focus is increasingly user-oriented, connected, and multimodal. The examples of specific ITS applications in which the Commission fosters harmonized deployment include real-time traffic information, multimodal travel information, emergency call system in case of accident, electronic tolling, dynamic traffic management and many others.

Yet, for a successful achievement of the European transport policy on the whole, and the ITS part, in particular, there is a need of strong cooperation between different stakeholders, both public and private. In order to enhance the exchange of best practices, contribute to constructing knowledge and innovation, and foster further deployment projects, the value of projects such as SEE-ITS is invaluable. SEE-ITS project, co-funded by the European Regional
Development Fund (ERDF) under European Territorial Cooperation Objective, Operational Programme 'South East Europe (SEE)' reinforced regional cooperation in the domain of ITS, and innovation. The members of the ITS unit of the European Commission, Directorate-General for Mobility and Transport have been following the work of the project since its very beginning and value strongly the contributions that have been prepared by different stakeholders throughout the project duration. Apart from useful and enriching workshops, the commitment of project members resulted in drafting very useful reports, related to the state of play, and future developments of ITS deployment in South-Eastern European countries. This knowledge should be put to good use, and for this reason, I invite you all to reading the present publication and all the project reports, to keep the good work going.

Claire Depré
Head of Unit C.3 - Intelligent Transport Systems
Directorate-General for Mobility and Transport
European Commission

It is safe to say that, with an endless list of applications, ITS are making our everyday travel safer & more environmentally friendly. On the other hand, integration of ITS requires compatibility and interoperability of systems, so that effectiveness is not compromised. In Greece, there are a lot of ITS applications already in place, yet highly fragmented due to the lack of a coordinated framework for their deployment. As a result, ITS applications are generally not designed to interoperate, failing to yield maximum benefits. The lack of integrating vision and coordinated approach in terms of definition of thematic priorities, are identified as major setbacks in this process.

With users voluntarily becoming providers of information on their own mobility patterns, the use of traffic control devices and communications equipment, have brought new challenges, like integrating information from disparate and proprietary systems that were not designed to interoperate. From now on, “closed” transport technologies are to be opened to web-based technologies. This will require an ITS architecture that permits interaction between existing systems and newly emerging services. To address these challenges, the development of a national ITS Strategy and ITS Architecture and the use of interface standards between modules are required.

Realizing the above and with the aim to enhance the economy and provide seamless connections, in April 2014, the Hellenic Ministry of Infrastructure, Transport & Networks, designated two working groups with the participation of experts from several sectors in order to establish the ITS Strategy & ITS Architecture for Greece, for the period 2015-2025. National ITS Strategy and Architecture are considered to be fundamental at national & regional level, as they will provide guidance for the development of ITS solutions and will designate a national interoperable ITS structure. Moreover, with the development of coherent positions on national priority projects, ITS investments will reflect the actual priorities.

The Strategy & Architecture drafted by the WGs will be launched to public consultation, so as to ensure transparency and broad participation and reflect the needs of all stakeholders. Both ITS Strategy and Architecture will be based on Systems Engineering Principles so that the final outcome will address user needs and service requirements.

The National ITS Architecture is aimed to support transportation planning, mainly by ensuring interoperability of systems and processes. Through the deployment of ITS applications, the overall transport planning is optimized. National ITS Architecture will draw upon the global experience in ITS, the European E-frame Architecture and best practices of other countries and projects. It will also take into consideration the results of the SEE-ITS
project, especially in what concerns the harmonization of ITS specifications, which is one of the main concerns that EU addresses through the ITS Directive.

Since the National ITS Architecture is also the foundation for much of the ongoing work in the field of ITS standardization and research, consideration of the outputs established by the Architecture today will likely facilitate the transition to harmonized standards and the promotion of research initiatives in the future.

Rodanthi Sfakianaki

Civil Engineer and ITS Expert,
Hellenic Ministry of Infrastructure, Transport and Networks
Coordinator of the National ITS Strategy and Architecture

Roman Srp

ITS: the past or our future?

The field of Intelligent Transport Systems got through the first 20 years of existence under its own unique name ITS alias transport telematics, depending on from which part of the developed world you come from. Therefore it is possible to balance, evaluate and propose further directions of the development in this field. By the way – recently I have heard from one regional policy maker that: “ITS has no more perspective, the future are the Smart Cities, that is obvious!” So what is the current situation? Do we stand at the dawn or the dusk of the transport telematics?

In the Czech Republic during the nineties of last century, when the colleagues – visionaries – came back from foreign meetings and talked about the telematics and ITS as a wholly new field, a heated discussion emerged. Why to talk about the wholly new field? After all, it is only the electronic industry, IT and telecommunications applied in transportation. Even I was a bit sceptical of the ITS phenomenon. However, rather quickly we understood the fact that specificity of this field does not lie in the use of unique technologies, but in how to properly apply information technology and telecommunications in the transportation.

Transport, transport infrastructures, vehicles and services represent a very complex, large-scale and geographically distributed system that most of all reminds human society with all its good and bad qualities. Moreover, it is a critical government infrastructure, which construction and operation is co-financed in the all-society interest. Hence, the most important character in which ITS differs from the related field of ICT is the deep understanding of the specific needs of transportation in a broad sense.

Development of ITS in European regions has been for a long time based on the natural “bottom-up” innovation and led to the creation of hundreds of perfectly functional systems, which – in the territory for which they were designed – perfectly fulfil their function, based on corporate or regional specifications. Along with the creation of a single European area – coincidentally the European Union is almost the same age as transport telematics – the new requirements for ITS were established. Their carriers are European and national strategic documents, directives such as the well-known 2010/40/EU, specifications and technical ISO and CEN standards. The primary aim is to ensure the interoperability of data, data structures, ITS systems and services across the European area. It seems that interoperable telematics can in the future satisfy the requirements of the European economy better than isolated solutions, and moreover such an approach allows taking responsibility for driving.

Building the intelligent and interoperable transport systems, unlike the proprietary
solutions, however, requires a highly skilled public sector, it cannot dispense with the consent of key industry players – competitors on the market – and it needs the ability to seek consensus. The art of reaching consensus is currently the greatest risk of further successful development of the field of ITS. Therefore, the national and international networks of key players in the field, the transport telematics associations, are more and more important. Cooperation of key players on the basis of these non-profit industry initiatives, and promotion of their activities to the international level will be, in addition to the application of the European regulatory framework, a key tool for the further development of interoperable ITS in Europe.

Successful completion of the implementation process of interoperable telematics solutions will enable to the field of ITS successful enforcement even in areas known under the new and attractive concept of Smart Cities. From my point of view, the Smart Cities represent transport telematics applied to micro-dimension of cities, extended to other municipal sectors i.e. energy, urban planning, building and governance. In the beginning I put a rhetorical question whether in 2014 we stand at the dawn or the dusk of ITS. Personally, I believe that we are at the very end of one stage of the ITS evolution and, on the other hand, in the beginning of the new era. How exactly will the new era of ITS look like and when does it come, is an open issue, and it will depend on our next steps as well.

Roman Srp
Chairman ITS Nationals

1. CURRENT STATUS OF ITS IN SEE
1.1 General information

The 2010/40/EC Directive sets the framework for the deployment of ITS in Europe. The Directive defines four Priority Areas:

I. Optimal use of road, traffic and travel data
II. Continuity of traffic and freight management ITS services
III. ITS road safety and security applications
IV. Linking the vehicle with the transport infrastructure

Accounting for the policy setting as well as the guidelines for increased deployment of ITS, the main priority of the SEE-ITS project is the identification of the Intelligent Transport Systems (ITS) deployment status in South East Europe (SEE) countries. This recording is the first and necessary step in an effort to achieve the further operational objectives of the project, as it provides all the essential information regarding the development, the architecture, the technological framework and the operation of ITS in SEE countries. The identification also addresses the main actors involved in ITS development, deployment and operations, along with the major obstacles towards ITS implementation, funding schemes, key strengths, and a short outline of the legislative framework in the SEE area. According to their thematic framework, ITS applications are linked with the EU ITS Action Plan and the Priority Areas of the 2010/40/EC ITS Directive.

This Handbook is built on data collected from 9 European countries, representing a diverse pool of information and backgrounds. On one hand, there is a non-EU country – Albania and 8 EU member states (Croatia was EU candidate country at the beginning of the project, entering the EU during 2013). On the other hand, among the member states, the picture is also diverse: Greece and Italy are founding states, while Austria was the earliest to join in the first expansion, followed by Hungary and Slovenia; finally, Romania and Bulgaria are the youngest EU members.

Based on the collected information, it can be purported that the overall picture regarding ITS in the SEE area is quite mixed. In terms of implementation, it ranges from only a few initiatives (for instance in Albania or Bulgaria) to numerous systems and services (for instance in Austria, Italy, Greece and Hungary).

In terms of policy, countries such as Austria and Greece have already developed National ITS Plans, while others do not have any national strategies related to ITS, nor to the transport field in general as of yet. In addition, there are certain EU member states that have not yet transposed the EU ITS Directive in their national legislation.

Despite the differences, it is clear that all countries share a common interest and motivation to implement ITS in line with the EU ITS Directive and the ITS Action Plan. This holds true also for Albania, which is not an EU member states.

In the following sections, an overview of the implementation status as well as the results of SWOT analyses for the countries of SEE are presented.
1.2 Implementation status of ITS in Austria

Travel information services based on ITS have so far been deployed only by limited transport services, infrastructure operators and private companies within and for their respective field. Consequently there are sectorial supplies, which concentrate on single areas and means of transport and are not interconnected. Examples include Scotty by the Austrian Federal Railway company ÖBB, ASFINAG Roadpilot, qando by the Viennese Public Transport provider Wiener Linien and VOR (East Austrian Public Transport Association), the traffic information centre of the Austrian broadcaster Ö3 and the traffic information service of the Austrian Automobile Association ÖAMTC. In terms of individual transport, private suppliers of navigation tools and services have been established on the market. The quality of road and traffic data represents an important factor for the acceptance of ITS services and thus for the success of taken measures. Consequently, it is necessary to guarantee and continually improve the quality of all existing and newly developed ITS services.

The Austrian ITS law, adopted on 31st March 2013, creates a framework for the support of a coordinated and coherent implementation and utilisation of ITS and sets the necessary conditions. It is applicable for the implementation of ITS in road transport and the interfaces to other modes of transport. With this law, Austria adopts the EU ITS Directive. In addition to the definitions laid down in the EU ITS Directive, the Austrian ITS law defines the “Graph Integration Platform” (Graphenintegrationsplattform, GIP), an intermodal Austria-wide traffic graph. AustriaTech is the institution responsible for monitoring ITS deployment both nationally and internationally and also for reporting to the Austrian Minister for Transport, Innovation and Technology. The Austrian ITS Action Plan was presented in 2011 and is regarded as a constantly evolving document. Furthermore, there is an Austrian comprehensive traffic plan, a dedicated implementation plan for electromobility and an Austrian Traffic Safety Programme 2011 - 2020.

1.2.1 Stakeholders involved

The most important stakeholders involved in the ITS implementation process are:

- **AustriaTech:**
  - Supporting technological strengthening of the Austrian traffic industry and domestic technology providers
  - Research on strategic level (future studies) with respect to technologically relevant topics (Think Tank)
  - Developing innovation strategies to implement ITS in Austria
  - Realisation of technologies
  - Contributing to the realisation of EU directives and international standards in Austria

- **Austrian Ministry for Transport, Innovation and Technology (BMVIT):**
  - Transport policies
  - Road, rail, shipping, aviation
  - Traffic accident research
  - Commercial passenger and freight transport
  - Setting of priorities in national research programmes with a council for research and technological development

- **ASFINAG**
  ASFINAG operates, maintains and monitors the motorways and expressways. This includes route management, winter services, pruning and clipping as well as the cleaning of tunnels, roads and rest areas. The second pillar is the planning and building of primary sections of road. Within the scope of a coordinate building programme with the owner, ASFINAG annually invests in building new roads and expanding the road network. The third task area of ASFINAG is the collection of tolls: car toll (toll sticker), HGV toll (GO-Box) and the special tolls.

- **Ö3**
  The Austrian radio station Ö3 provides traffic information via traffic announcements and TMCPlus.

The Austrian graph integration platform GIP.at and GIP.gv.at shall contribute in closing crucial gaps in the acquisition of traffic data, especially for the lower level road network. Real-time data shall increasingly be used for public transport and consequently another important step towards intermodal real-time traffic information shall be taken. Central element for the provision of traffic information will be the fusion of information and traffic
data from different sources (including user generated content). In this matter, the Austrian motorway operator ASFINAG is developing the so-called “Verkehrsdatenplattform” (traffic data platform) right now. For the next five years, the focus will be on adding data of lower level and urban infrastructures of all means of transport to the existing traffic information system. By separating the processing from the presentation of the data, future investments and further development of the content platform (Verkehrsdatenplattform) will keep the service platform (“PVIS”) up to date.

There is a strong commitment of all stakeholders in Austria regarding the implementation of ITS applications and services. According to an extrapolation within a study conducted by Brimatech, the Austrian ITS industry generates an annual turnover of 2.2 Billion Euros. In Austria there are well-established funding and research programmes, internationally acknowledged companies with a high level of technological know-how, a well-developed transport system, as well as a powerful energy system featuring 70% of renewable energy sources in the electricity mix. The Austrian federation works together with the states to harmonise and simplify the current fare system, in order to shape public transport in Austria in an even more attractive, transparent and simple way. Yet, there are differentiated political interests. Depending on their electorate and regional presence, each party variably sympathises with each mode of transport. Additionally, up to now, ITS have been regarded primarily as a synonym for industry-driven technological innovation of telematics components (vehicles, infrastructure, devices) in the field of transport. It has been omitted to deal with political and administrative issues, coequally to technological development on national and European level.

A basic requirement towards an Intelligent Transport System is a harmonised data exchange between Austrian infrastructure operators. To facilitate this exchange, measures to create a consistent organisational and legal framework are taken on national level. In this way, the necessary premises for Austrian infrastructure operators to ensure a harmonised and comprehensive exchange of ITS-relevant data shall be created. In this perspective, it is important to sufficiently define and analyse quality requirements for the data exchanged as well as rights and duties of all stakeholders involved.

The most important basis for the successful interoperability and compatibility between cities and regions is a cooperative organisational and management structure that covers states, countries and operators and is initiated by public authorities. In this way, it is possible to integrate a maximum number of partners from administration, transport services and infrastructure operators and the data they have to offer.

The objective is to provide all traffic participants with real-time traffic information services. In the next five years there will be improvements all over the information chain (incident detection, processing and customer information) by quality assurance measures, which are expected to increase the overall efficiency. Thus, processing times will be shortened and users will receive information faster. This will not only improve infrastructural utilisation, but will also contribute to increased efficiency, safety and environmental friendliness.

1.2.2 SWOT Analysis for Austria

• Strengths
  - According to an extrapolation within a study conducted by Brimatech, the Austrian ITS industry generates an annual turnover of 2.2 Billion Euros.
  - Many companies already provide various ITS services on a partnership basis. Yet, these partners are often in a state of competition, so a trusted third party is needed in order to ensure equal conditions. This task is undertaken by AustriaTech.
  - There are well-established funding and research programmes, internationally acknowledged companies with a high level of technological know-how, a well-developed transport system as well as a powerful energy system featuring 70% of renewable energy sources in the electricity mix.
  - Many activities and initiatives have already been set by research and development, demonstrations and pilot schemes as well as funding initiatives.
  - The Austrian federation works together with the states to harmonise and simplify the current ticketing fare system, in order to enhance the attractiveness, transparency and simplicity of public transport in Austria.
  - The 2012 Austrian comprehensive traffic plan calls for a 40% shift of freight traffic from road to rail until 2025. In 2011, the share of rail freight transport already amounted to 32% in Austria, while the European average only amounted to 15%.
  - The Austrian traffic policy commits itself to regulation through targeted support as well as through acts, prohibitions, fees and fiscal measures. The accessibility of the transport system has to be ensured on a broad basis and barriers shall be diminished. Another focus is on cost transparency. In these central areas, the Austrian transport policy is consistent with the European one and vice versa.
  - In comparison with other European capitals, the objective of Public Transport being affordable has already been achieved. The annual ticket in Vienna is priced at 365 Euros, while it is 657 Euros in Paris, at least 710 Euros in Berlin and even 1456 Euros in London.

• Weaknesses
  - There are various political interests. Depending on their electorate and regional presence, each party variably sympathises with each mode of transport.
  - Up to now, ITS have been regarded primarily as a synonym for industry-driven technological innovation of telematics components (vehicles, infrastructure, devices) in the field of transport. Yet, it has been omitted to deal with political and administrative issues coequally to technological development at national and European level.
In Austria, there are 522 cars per 1000 inhabitants, which is clearly above the EU-27 average of 473 per 1000 inhabitants. Especially on the main traffic arteries this large number of vehicles leads to lower average speeds and congestion. This results in decreasing productivity and consequently economic loss.

**Opportunities**
- Electromobility in Austria can demonstrate Austrian competence for innovation and technology, improve the competitiveness of Austria as a business location and create new jobs.
- Both the Austrian highway network density (20.2 km per 1000 km²) and rail network density (69.3 km per 1000 km²) are higher than the EU-average (15.1 km respectively 49.1 km per 1000 km²).
- New technologies are generally very attractive to potential users. This fact is a powerful opportunity for e-mobility.
- There is a potential for an increased use of public transport in suburban areas. For this potential to be used it is necessary to increasingly synchronise spatial and transport structures, in order to prevent an increase of individual transport and its negative impacts.
- Multimodality can significantly contribute to raising the efficiency of the Austrian transport system.

**Threats**
- Especially Vienna and Lower Austria will experience a demographic growth in the long run.
- Positive aspects of a high-performance traffic system are generally taken for granted, while negative impacts tend to cause a negative atmosphere very quickly.
- With the number of electric vehicles increasing, there will be heavily varying loads in the low-voltage electricity network.
- According to forecast values the demand of individual motorised mobility will exceed the infrastructural capacities in conurbations within the next 20 to 40 years.

There are several factors that drive the ITS policy making and implementation in Greece. The geographical position and morphology, the current transport network (a relative sparse road and railway network, more than 140 passenger and freight ports, 45 airports), but also the economic recession that the country faces over the last years, create a rather complex context that influences ITS deployment.

Greece has already implemented a number of large ITS projects, mainly in the field of road transport and in large cities of Greece (Athens and Thessaloniki). Greece’s main strengths regarding the ITS deployment rest upon its scientific human potential, its scientific experience and know-how coming from ITS related European projects (i.e. Intelligent Urban Mobility Management System of Thessaloniki, EASYTRIP, VIAJEO, etc.), but also from private initiatives in the ITS research and development, as well as the active involvement of representatives of Greek ITS related bodies in European ITS organizations (e.g. ERTICO, ITS Nationals).

Nonetheless, the current ITS deployment in Greece is generally hindered by:
- restrictions on the financing;
- high investment costs that are demanded in combination with the uncertainty when the depreciation timeframe and the return on investment is concerned;
- existing weaknesses in the public administration structures;
- long time period from tendering to implementation;
- lack of a structured policy and national ITS priority framework that causes a fragmented
and limited, geographically, ITS deployment

As already mentioned, Greece presents a number of large ITS projects that, nonetheless, mainly focus on major urban areas of Athens and Thessaloniki or major motorways, while a lack of such projects in other urban and rural areas is observed.

Despite the legislative actions in pro of ITS systems, it is a general remark that Greece stands in a rather early stage of adopting a national regulatory framework for the deployment of ITS. Only in mid-2014 the Ministry of Infrastructures, Transport and Networks has established expert working groups for defining the National ITS Strategy and the National ITS Architecture, both currently ongoing. This can be explained by the fact that the EC only recently has set an ITS legislative framework that should be adopted by all member states in due time. The transposition of the EC ITS Directive into national law took place in 2012. Nonetheless, the rapid growth of the ITS technology, along with the role of the ITS systems in enabling a more intelligent use of infrastructures and vehicles and in enhancing the management of traffic and mobility, necessitates the creation of a robust and extended legislative framework that will support an effective and holistic deployment of ITS in Greece.

Therefore, as also highlighted in the ITS Action Plan for Intelligent Transport in Greece (Ministry of Development, ITS Action Plan for Intelligent Transport in Greece, 2012), the specific issues that need to be addressed for the deployment of ITS at national level include the following aspects:
- The need to support rural ITS deployment, since the majority of ITS applications and projects are concentrated on the two large urban agglomerations Athens and Thessaloniki
- The need to promote interoperability and coordination among implemented ITS systems
- Promote collaboration between public (central and regional authorities) and private bodies and clearly define roles and responsibilities among the involved players
- Improve administrative structures and personnel in order to raise bureaucratic obstacles
- Provide incentives to the private sector aiming to invest more on ITS innovation
- Better cooperation between research community and private initiatives

1.3.1 Stakeholders involved

The following organisations and authorities are involved in planning, financing and implementing ITS in Greece.

- Greek Government, which is responsible for:
  - the creation of a national ITS strategy and a general ITS development framework
  - the creation of a national ITS implementation platform
- The Ministry of Infrastructure, Transport and Networks (the Ministry has elaborated

the national ITS action plan in cooperation with stakeholders involved in ITS activities) is responsible for:
- creating legislative texts (when and if necessary), namely for adopting the legislation relating to the Directive of ITS
- taking the necessary measures in order to be compliant with the adopted specifications
- making the strategic plan for the deployment of ITS applications, in cooperation with the relevant stakeholders
- setting measures that address the national research institutes, authorities and private companies
- promoting and signing of a Memorandum of Understanding (MoU) between public and private entities that shall specify the actions under the national strategy for comprehensive ITS deployment; ensuring the compliance to the MoU
- General Secretariat for Research and Technology (GSRT) of the Ministry of Education, Life Long Learning and Religious Affairs, which is responsible for the promotion of ITS related actions involving research institutes, authorities and private companies.
- ITS Hellas, the national ITS Association.

1.3.2 SWOT Analysis for Greece

- Strengths
  - At legislative level, Greece has already adopted the Directive 2010/40/EU by a transposition into national law with the Presidential Decree PD50/2012 (GG 100A/27-4-12).
  - Although Greece has no large-scale industry, it has implemented intelligent system applications (some of which are large ITS projects, mainly in the country's large cities) and has ample scope for the adoption and implementation of innovative solutions, expertise, research institutions and private enterprises highly engaged in technology and innovation initiatives.
  - The highly-skilled scientific resources of the country have the potential to develop and support innovative technological applications and to make efficient use of the expected benefits with the cooperation of institutions and the state.
  - Greece has also experience from pilot projects and programmes already from the beginning of 90’s in the area of ITS, such as the COMPASS4D, EASYTRIP, VIAJEO and others, which are underway.

- Weaknesses
  - There is no single unit within the public sector that deals with ITS planning, development and operational issues.
- There is a lack of defined roles and responsibilities in public administration, institutional inertia, issues related to allocation of power and generally incomplete structures in public administration as well as a gap in the coordination of the ITS development.
- The national deployment of ITS is largely fragmented and limited in geographical scope so far (most of the large ITS projects have been implemented in large cities of Greece), due to the lack of a structured policy and national ITS priority framework.
- Given the country’s topology, Greek transport networks face significant gaps in infrastructural connections.
- There are shortcomings in terms of user safety in the national transport networks.
- Transport operators are not informed properly on what ITS are and how they can be successfully implemented, in order to produce benefits for both users and operators.
- There are too little incentives for the private sector in order for them to invest more in ITS innovation.
- Only a limited number of public authorities are involved in the ITS Hellas organisation so far.

**Opportunities**
- The historical and dynamic traffic data of the Athens Traffic Management Centre are available to third parties.
- The Greek ITS Action Plan sets the national strategic planning regarding ITS, general strategic targets in certain thematic areas and national priority sectors for ITS development.
- The construction of four large national road axes is being restarted. These roads will be equipped with ITS from the beginning.
- Despite the current political and economic instability Greece has the opportunity to develop entrepreneurship in the field of ITS.

**Threats**
- The deep economic recession that Greece has been facing over the last four to five years has caused a rather complex context for ITS deployment.
- The required investment costs, financing restrictions, uncertainty as to the payback period, planning failure as a result of economic instability and uncertainty about demand, cause serious limitations and pose a threat to the development of ITS applications.

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1.4 Implementation status of ITS in Bulgaria

The transposition of the Directive 2010/40/EU was performed in the end of January 2013. The Law on Road Transport is defining the responsibility for coordinated and coherent deployment and use of Intelligent Transport Systems in the Republic of Bulgaria. It obliges the Minister of Transport, Information Technology and Communications to coordinate activities in the deployment and use of Intelligent Transport Systems in the field of road transport and for interfaces with other transport modes. To support the performance of the Minister of Transport and Communications, a Council on Intelligent Transport Systems is to be constituted in an advisory capacity. This Council has not been constituted yet and does not function so far.

In 2010, a Strategy for development of the transport system of the Republic of Bulgaria 2020 was accepted. Another important document was the adoption of the National Strategy for the improvement of road safety in the Republic of Bulgaria 2011 – 2020; however there is no separate strategy for ITS deployment yet. The major issues regarding ITS implementation in Bulgaria are the following:

- Lack of ITS infrastructure on all National roads and highways
  One of the major problems in regard to the deployment of ITS systems in Bulgaria is the lack of supporting infrastructure on most non-urban roads. The majority of the infrastructure has been planned and built 20 years ago. ITS, being a new technology, has not yet been taken into account at all. A considerable portion of the road construction in
the past 20 years has been the refurbishment of already existing roads. There are significant construction projects for new roads only in the last 7-8 years and the majority of them are also based on older projects. From the technical point of view, there is no main power supply and no wire based communication options. For the communication part, there are some available substitutions; using the 3G GSM of the mobile operators is the main available option. It is worth mentioning that Bulgaria is a country with a mountain terrain and 3G is not always available, especially in the high mountain passes as 2G (GPRS) has to be used there. This constraint significantly limits the number of ITS applications that can be supported over these communication channels. The transfer speed might be appropriate for some low bandwidth applications like sensors for weather conditions or traffic, but insufficient for high demanding applications like video surveillance, live traffic monitoring etc. Supplying the equipment with power is a more complex issue; the lack of main power supply leaves solar panels as the only available option. This might be enough for some low power sensors, but will not be sufficient for more power demanding technology like cameras, radars, etc. The infrastructural problems are directly inherited from the administrative and legal level. ITS infrastructure is not planned as a part of the construction project, even when it comes to future roads segments.

- Lack of information systems for road users and maintainers

Traffic data collection in Bulgaria can be divided in two major categories: urban and non-urban roads. In the cities, there is some data regarding the travel time from one destination to another and the average speed of the traffic flow. The vehicles of public transport are equipped with GPS for positioning and communication modules for transmitting their current location to the central management of the public transport. Based on this data, conclusions for the traffic situation can be drawn. On non-urban roads, there are about 117 measurement locations of the Road Infrastructure Agency. Very few of them have old and non-functioning counting equipment. Counting is conducted manually on an annual basis. This produces a small volume of traffic data, which is unreliable most of the times. The value of this data and whether it is suitable for developing models and planning infrastructure is questionable. The Road Infrastructure Agency is aware of this problem and currently there are several tenders planned for installing traffic counting systems. In contrast to road planners and maintainers, road end users have practically no information about the traffic conditions, except occasional radio reports. This reduces their ability to avoid congestions by using different routes. This situation is the same when it comes to informing the public about hazardous events, incidents and obstacles on the road.

- Lack of integrated traffic management systems

There are no automated or even partially automated telematics systems for traffic management. Management of everyday regular traffic and of specific traffic incidents is conducted via traditional methods and mainly by human presence and intervention on the network (traffic and police officers). Usually, police officers manually manage the traffic in intersections during peak hours (e.g. lane switching to balance commuter traffic in different directions, and manually reroute traffic due to an accident. There are no systems with VMS (Variable Message Signs) and no live traffic monitoring, which significantly increase the reaction time to traffic events, accidents inclusive.

- Lack of integrated electronic GIS systems for analysis

Currently, there is no operational electronic GIS system for analysis of road accidents and locations with high accident rates and potentially dangerous locations. The accident protocols are delivered in electronic form with very low level of automation. All these conditions hinder the further statistical processing and analysis of the collected data into an information system. In September 2011, the Ministry of Regional Development and Public Works has ratified EC 2008/96 regarding road safety audit. It should not be carried only on new roads, prior to acceptance for use, but also on already existing roads and it should be done proactively, when there is indication of higher accident rates. In this case the existence of a good system for analysis is imperative.

- Poor institutional data exchange

The available data is not shared and used optimally between different authorities. Quite often, different state institutions – e.g. road maintainers, infrastructure planners and enforcement authorities collect their own data, sometimes duplicating each other and do not share it. When they do, the procedure is complicated, not automated and requires administrative work. In many cases, traffic data is available, but it is viewed as “internal information” for the particular institution and thus it is not circulated or made accessible to road users.

- Low level of automation in traffic law enforcement and violation processing systems

Currently, a large part of the violation processing done by the Ministry of Interior is manually intensive. This includes also the data transfer part from the enforcement devices on the road to the office. The consequence is very low collection (payment) rate for traffic offences, which leads to minimising the preventive effect of enforcement and increasing the accident rates. The traffic police are aware of this problem and a new back-office system is being developed currently, which will significantly increase the level of automation and ticket collection rate. It will support the processing of a wide variety of offences, originating from different sources like enforcement cameras, radars, police officers, parking violations etc.
Lack of coordination between the institutions responsible for ITS
The ITS deployment in Bulgaria is a responsibility of the Ministry of Transport, Information Technology and Communication. The responsible Ministry for highway administration is the Ministry of Regional Development and Public Works with the Road Infrastructure Agency, which is responsible only for the non-urban roads. In the cities, the responsibility lies on the municipalities and there are also centres for traffic mobility. Traffic police is separately dealing with the enforcement part of it.

1.4.1 Stakeholders involved

• Ministry of Transport Information Technology and Communication.
  - It is the institution that prepares the guidelines and policies in the transport sector, following European trends in the development of Intelligent Transport Systems (ITS) and aims to contribute to the implementation of short and long term objectives of promoting the implementation of ITS in Bulgaria. Its responsibility is the coordination of activities in the deployment and use of Intelligent Transport Systems in the field of road transport and for interfaces with other transport modes.

• Ministry of Regional Development and Public Works.
  - This is the national managing authority and contact unit for the operational programme "Regional Development" and territorial cooperation programs.

• Road Infrastructure Agency.

• TS Bulgaria.

• Others.
  - The Ministry of the Interior is responsible for road safety and security. The Municipalities are responsible for ITS deployment on local level.

1.4.2 SWOT Analysis for Bulgaria

• Strengths
  - Bulgaria has well-developed 3G GSM communication infrastructures, enabling the increased deployment of ITS.
  - There is a number of local IT system integrators and developers, whose expertise can be beneficial for ITS implementations.
  - There are local manufacturers and integrators of both IVS (In Vehicle Systems) hardware and software for fleet management.
  - A Public Private Partnership act has been adopted in the beginning of 2013. It provides the opportunity for the involvement of private partners in areas that public authorities are traditionally responsible.
  - Currently, there is a massive road construction program. The government is covering the crisis gap using the free resources in the construction sector for road building.

• Weaknesses
  - There are no dedicated national ITS funding programmes in Bulgaria, so financing ITS deployment is highly dependent on EU funding.
  - Bulgarian public institutions responsible for ITS implementation are not coordinated properly.
  - The predominant part of the infrastructure has been built in the past and is at least 20 years old. Consequently, many roads are in a bad condition.

• Opportunities
  - As an EU member, the national transport policy should comply with the principles of the European transport policy and coordinate the national priorities with the European principles for integration and interoperability, providing sustainable mobility.
  - Currently, there are large-scale investments in road infrastructure in Bulgaria.
  - ITS deployment in Bulgaria is in its initial stage and can therefore be structured properly from the ground up.
  - ITS deployment is still a comparatively free niche market for developers and manufacturers in this area.
  - Bulgaria has a strategic geographical location at the crossroad of major European transport corridors.

• Threats
  - There is no clear vision for a governmental policy concerning ITS deployment.
  - Due to the economic crisis there are less opportunities for national funding.
  - The unstable economic situation is not favourable for private domestic manufacturers of ITS solutions.
  - There is too little experience in the area of ITS project implementation.
The most characteristic examples of ITS applications in Hungary today are the traffic management and control systems of motorways, the electronic fee collection (road toll) and the route guidance and navigation systems. Intelligent Transport Systems and services in the road sector are diverse and several stakeholders are involved, such as network operators, network providers, content providers and the road users (drivers, public transport users, pedestrians etc.).

It will be extremely important in the future for local authorities – mainly in larger cities – to address the field of Intelligent Transport Systems and services, defining deployments that support the implementation of their objectives, in order to ensure more efficient local mobility.

In 2007, the “Coherent Strategy for Transport Development (EKFS)” was published, dealing with the field of Intelligent Transport Systems and services as a horizontal topic, besides the improvement of road safety, the reduction of environmental impacts and the improvement of energy efficiency of transport. In 2009, the “Strategy for national development of Intelligent Transport Systems and services” was completed as a draft paper, focusing mainly on systems and services related to road transport.

On the national road network, taking into account the current situation, analysing European and national trends in accordance with strategic EU and national documents in the field of Intelligent Transport Systems and services, the following significant areas and priorities can be set out:

- Deployment of ITS in modern road operation – traffic management
- Traffic control and information systems of the motorway network
- Traffic control centres
- Multimodal traffic information: real-time information systems
- Electronic fee collection
- Coherent electronic payment system of passenger transport (e-ticketing)
- ITS deployment for freight and logistics
- E-Safety systems supporting road safety
- Integrated EU-wide e-Call service

Overall, it is urgently needed to develop the national “ITS strategy”; not only for the road sector but also for other sectors. The “Action Plan” should relate to the recorded priorities of the strategy in accordance with the strategic main objectives and goals, indicating the priorities.

A number of other tasks are linked to the Intelligent Transport Systems that have important roles at planning, implementation and operation of Intelligent Transport Systems and services. These are horizontal issues, which are summarized as follows:

- Establishment of a system architecture: coherent framework to link and identify the way of cooperation of certain independent systems and services
- Evaluation of Intelligent Transport Systems and services
- Standardisation issues of Intelligent Transport Systems and services

The Ministry of National Development fulfils its reporting notification in accordance with the paragraph 17 (deadline: 27 August 2011) of the EC ITS Directive as in the structure below:

- Implemented ITS elements on the TEN-T network and related to the TEN-T network (related to the priority areas of the ITS Directive) from governmental and/or EU sources;
- Planned implementation of ITS elements on the TEN-T network and related to the TEN-T network (related to the priority areas) from governmental and/or EU sources;
- Implemented ITS projects of cities/capital (related importance to the national TEN-T network);
- Interfaces with other modes of transport/sub-sections (related importance to the national TEN-T network);
- Private investments with significant effects on ITS deployment (implementation of TMC place-codes, TMC services)

1.5.1 Stakeholders involved

The following organisations and authorities are involved in planning, financing and...
implementing ITS in Hungary.

• Ministry of National Development.
  - This authority provides the legal background for the planning, financing and implementation of ITS services and applications. In the past 8 years it was a beneficiary of the “Euro-regional” project CONNECT and the European project EasyWay (TEN-T projects).

• Hungarian Transport Administration (KKK).
  - This institution is responsible for the reporting activity in accordance with the “ITS” ministerial decree, in the EasyWay project implementing body.

• Hungarian Public Roads.
  - Apart from operating the national public road network this non-profit organisation is also present in the CONNECT and EasyWay project implementing body.

• State Motorway Management Company.
  - This is the operator of the Hungarian motorway network and is also present in the CONNECT and EasyWay project implementing body.

• BKK Public Road.
  - This is the operator of the road network of the City of Budapest and is also present in the CONNECT and EasyWay project implementing body.

• ITS Hungary.
  - This is a non-profit “PPP” organisation to support and promote the national consensus as well as national cooperation for Hungarian ITS applications in all transport sectors. Furthermore it promotes dissemination and exchange of experiences.

1.5.2 SWOT Analysis for Hungary

• Strengths
  - The national ITS strategy will form an integral part of the multi-transport approach of the ‘National Transport Strategy’ currently being prepared, which provides the framework of the future development.
  - Hungary is actively involved in European organisations (ERTICO, etc.) in the field of ITS.
  - There are ITS systems, which already operate well and effectively in the fields of traffic control and information systems and their results can be adopted.
  - Basic ICT are known and available in the fields of both traffic control and traffic information systems as well as travel information systems.
  - There is an institutional and organisational framework existing in the field of road transport related to ITS.

• Weaknesses
  - When it comes to deploying ITS, there are obscurities regarding institutional responsibilities. It is not clear how far governmental control should go and where the sector of commercial providers starts.
  - The institutional and regulative background of cooperation between different stakeholders is still not defined clearly.
  - There are several systems operating in Hungary which are not compatible with each other.
  - The lack of a proper institutional background, as well as legal and technical regulations hampers the dissemination of already existing services and applications.

• Opportunities
  - Organizations from Hungary participate in pilot projects that deal with ITS applications and services deployed outside Hungary so far. This can provide the requested expertise for ITS deployment in Hungary in the future.
  - The active involvement in R&D programmes of the European Commission provides new perspectives for research background, active governmental and public support for researchers and business stakeholders.
  - Hungary is a relatively small country with a diversified and busy transport network.
  - Along with the increasing governmental commitment, the growing interest of private service providers and the needs of network operators as well as road users contribute to the acceleration of ITS services and applications.
  - Traffic is managed by a small number of companies.
  - EU sources are available in the field of ITS since Hungary joined the EU.

• Threats
  - Since there is no dedicated ITS funding landscape in Hungary, national ITS deployment is dependent on EU funding. In case of participation of private national partners and stakeholders the addition of equity is difficult to ensure.
  - The available EU sources are either not used at all or not used properly. There is therefore the risk of losing EU support due to improper project preparation, planning and conduction.
1.6. Implementation status of ITS in Italy

ITS in Italy are a sector operating since the 1980s, even if it had a relevant development starting from the 1990s, in parallel with the growth of the industry in other major industrialized countries.

ITS for the management of traffic and mobility are active in many Italian cities under the responsibility and control of public authorities (Rome, Turin, Milan, Genoa, Naples, Florence). Besides that, more than 50% of the Transport Agencies for Local Transport are equipped with fleet localization and monitoring systems, in order to improve the services offered. A survey recently conducted within the project Infocity (Elisa Programme) on local authorities, showed that a high percentage of the local authorities concerned, adopted a mobility plan that includes a section devoted to ITS. Moreover, ITS applications for traffic management and infrastructure, management of local public transport, information to users, road pricing, electronic ticketing, integrated tariffs, transport of goods and road safety, are either completed or planned for the activities within the next three years. In particular, as regards the activities envisaged in a time horizon between the next 5 and 10 years, the areas where the local authorities focus their priority investments will be those of information to users, management and monitoring of traffic, freight management and electronic ticketing.

Concerning the automotive sector, considerable efforts have been placed on the development of tools and solutions to increase safety, mobility efficiency and energy and fuel consumption reduction. For instance, the advanced navigation systems that provide tips for a more eco-friendly driving or reducing consumption, systems of tracking and traffic monitoring that enable fleet management services and insurance services, ADAS (Advanced Driver Assistance Systems) aimed to increase the level of safety of vehicles, including heavy vehicles. There are numerous projects placed on strategic corridors of freight transport, in order to promote the development of intermodal and integrated logistics.

In Italy, the toll motorway network has been representative scenery for testing and applying innovative systems and technologies. For instance, the Telepass system for automatic payment of tolls is an Italian excellence, which is also used in other European countries, to the benefit of the domestic industry.

The critical aspects concerning the implementation of ITS in Italy are the following:
- Lack of general Guidelines for standard development of open and interoperable systems
- Lack of clear and certain rules
- Pilot projects are not always part of large-scale applications
- Lack of a national research program
- Lack of a national fund for financing ITS
- Restrictions on financing

Measures concerning ITS are included in article 8 of the law “Further urgent measures for the growth of the nation” (18 October 2012, n.179). This law has been defined by the Ministry Council, in order to counteract the economic crisis.

In particular, two aspects are considered relevant by the article:
- Interoperable electronic ticketing (technical rules for public transport agencies will be adopted within 90 days after the publication)
- Database of information on infrastructures and services collected by the infrastructure managers, owners of the transport and logistics nodes (freight villages, ports, et.) and parking areas. Design, realise and diffusion requirements will be adopted within 60 days after the publication.

The national ITS action plan (“Piano d’Azione ITS nazionale”) has been issued in December 2012. It identifies the national priorities until 2017.

The plan goes beyond the EU priorities, for which specific actions are defined for each priority, and it defines necessary actions, at general level, to support the coordinated development of ITS in Italy:
- Revision and updating of the national ITS framework
- Promotion of the elaboration and utilization of reference models and technical standards for the design and implementation of ITS
- Promote of the deployment of ITS on the national road network
- Introduction of a classification of the service level for the national road network, considering available ITS for information, management and safety
- Launch of a system for measuring and monitoring of the benefits of using ITS applications (database of benefits)
- Networking transport platforms
- Creation of the conditions for the utilization of services provided by navigation systems
- Increased utilization and deployment of telematics systems on vehicles

The National ITS Action Plan of Italy defines the main actions for some of the priority areas that will be specifically developed in the near future, until 2017.

- **Priority Area 1**
  - AP1 – Implementation of databases for traffic and travel information (2014)
  - AP2 – Development of reliable and certified information services (2015)

Currently, the critical aspects of this sector in Italy are mainly organizational and data related (availability of reliable and timely data sources on the whole territory).

The aim is to ensure that all citizens have access to secure information, localized, real-time conditions of mobility along their journeys using the potential given by the new communication technologies (smart phones, web browsers, nomadic devices).

- **Priority Area 2**
  - AP1 – Development of integrated multimodal ITS services for both passenger and freight transport (2014)
  - AP2 – Development of ITS services for multimodal logistics (2014-2015)
  - AP4 – Nationwide adoption of interoperable electronic ticketing (2014)
  - AP5 – Continuity of services along the borders (2016)
  - AP6 – Adoption of smart mobility policies in urban and metropolitan areas (priority for public transport, bike sharing, car sharing, electric mobility) (2015)

The objective to be met is the ability to provide integrated services for multimodal mobility for people and goods, making it possible to plan and manage the movement in an informed and personalized way, seamless from the point of origin to destination using all the available modes in an efficient and safe manner.

The development of integrated mobility for both people and freight is based, necessarily, on the availability, access and set up of data and information that are, thus, the enablers of these services, management and organization of the data in integrated platforms open, interoperable and integrated payment systems, ticketing and transport services.

- **Priority Area 3**
  - AP1 – Development of the national e-Call service (2015)
  - AP2 – Implementation of safe and secure parking places for trucks and comm. vehicles (2015)

- **Priority Area 4**
  - AP1 – Development of cooperative driving systems (2017)
  - AP2 – Monitoring of road transport infrastructures in adverse weather conditions also for the optimisation of maintenance operations (2015-2016)

The fourth priority area concerns the development of communications of the vehicle and its progressive integration with the transport infrastructure (road, service centres), not only as an operating field in its own right but also as an enabler for the other priority areas.

Vehicle-to-Vehicle, Vehicle-to-Infrastructure and Infrastructure-to-Infrastructure communication technologies are enabling the development of innovative applications, aiming at developing a model of sustainable mobility.

1.6.1 Stakeholders involved

The following organisations and authorities are involved in planning, financing and implementing ITS in Italy.

- **Ministry of Transport and Infrastructure.**
  - This is the department of the Italian Government, which is responsible for funding and national decision making regarding all transport infrastructure networks (road, highway, railway, port, airport) and expressing the general plan of transport and logistics, as well as plans for the transport sector including urban mobility plans.

- **ITS associations – TTS Italia.**
  - The main national association is TTS Italia, the National Association for Telematics for Transport and Safety.
1.6.2 SWOT Analysis for Italy

• **Strengths**
  - Italian private companies are heavily present in the field of ITS.
  - There is a strong commitment of research and development to support the implementation and utilisation of new technologies applied to the transport sector.

• **Weaknesses**
  - The main weakness is the difficult situation of the Italian economy that does not allow consistent financing for projects and applications.
  - For a long time in Italy, an overall view of the ITS development and implementation has been missing. This is now a task of the national ITS Action Plan.

• **Opportunities**
  - Italy is one of the countries with the highest density of traffic, so actions in the field of ITS are even more important than elsewhere.
  - Road transport is still the dominant share, so it is necessary to improve efficiency and safety of the road network.
  - Intelligent Transport Systems are able to facilitate interoperability, in order to encourage private companies to increasingly develop multimodal applications.

• **Threats**
  - Compared to other EU-countries, there already is a technological and organisational backlog in Italy, while ITS development in other countries is progressing.
  - There is a lack of sustainability of ITS innovation without collaboration between public organisations and private companies.
  - Risk for a negative gap compared to European countries, if the national action plans don’t immediately turn into practice through real actions.

1.7 Implementation status of ITS in Romania

In Romania, Intelligent Transport Systems are in an emerging stage of implementation. However, there are already some systems deployed, both at urban level and at national roads and motorways. This is the reason why almost all projects address the priority area of optimal use of road, traffic and travel data.

Another important aspect is that a decision of the National Motorways Company is in force, according to which all new motorways to be built will include intelligent infrastructures. Therefore, the premises for a full-scale deployment of ITS exist.

However, it is important to note that there is no national strategy for the deployment of ITS. On the one hand, this makes it difficult to coordinate the implementation because there are no clear objectives and targets on the medium and long-term. On the other hand, it is also challenging to find and allocate funding sources for project ideas, as there is no framework to nurture and correlate them with a global vision. Still, some steps in this direction have been taken, the most important of which are:

- The “National Strategy for a sustainable transport system for 2007 – 2013 and 2020, 2030” adopted in 2008 mentions the implementation of ITS as a solution for the development of the transport field;
- The “National Strategy for intermodal transport 2020” adopted in 2011 proposes ITS as key technologies for the implementation of intermodal platforms and services for intermodal freight transport services;
- Adoption of the ITS Directive (2010/40/EU) into national law by Governmental
Ordinance no. 7 from January 2012.
The latter not only sets up the framework for the implementation of ITS, but it also creates a National Coordination Board for ITS in charge of monitoring the implementation of ITS and exchange of information and expertise among both public and private stakeholders in the field.

The 2012 Governmental Decision established the National Coordination Board for ITS as a consulting body of the Government. The chair of the Coordination Board is assigned by the Ministry of Transport and the vice-chair by the Ministry of Communications. The Board includes members from various Ministries, from the Special Telecommunications Service, the Romanian Space Agency, the National Authority for Radio communications, the Romanian Standardisation Association as well as various public organisations representing cities and administrative regions. The Board can set up for itself an Inter-institutional Working Group and also a Technical Working Group. While the members of the former are only representatives of the public administration, the latter can also have members from private stakeholders and non-profit organisations.

Finally, regarding sources of financing, the majority come from the state. The main reason is that public administrations are not well trained to comply with the requirements for developing and managing projects involving European Funds. Another reason is bureaucracy, as such projects impose the cooperation and coordination of multiple agencies, in order to be set up and monitored. Now, as the budgetary resources are getting lower, the option of concession contracts is also starting to be explored.

1.7.1 Stakeholders involved

- The Ministry of Transport coordinates ITS deployment in Romania at national level and monitors the implementation of the EU ITS Directive.
  - The General Directorate for Strategy coordinates the elaboration of ITS legislation, the Transport Master Plans and the ITS National Plan.
  - The General Directorate for External Financial Relations ensures the financing of ITS projects by using European funds: cohesion, structural, TEN-T and national budget.
  - The Road Directorate ensures the integration of ITS systems into road networks and relations with transport operators.
- The National Company for Motorways and National Roads of Romania ensures the operation and maintenance of motorways and the national road network.
- At county level, the County Road Administration is responsible for the county road network.
- In cities the Street Administration is responsible for street network, including the Traffic Management Systems

1.7.2 SWOT Analysis for Romania

• Strengths
  - There is strong ITS community in Romania that has a good communication base inside the European Union.
  - The Romanian Ministry of Transport clearly commits to ITS implementation.

• Weaknesses
  - The continuity of ITS implementation is not guaranteed. The level of implementation and funding depends on the experience of decision makers (governmental, state companies and local level).
  - The frequent change of decision makers will probably affect the continuity and quality of ITS implementation.

• Opportunities
  - European ITS suppliers are strongly interested in the Romanian market.

• Threats
  - Until now, the ITS Directive is only a technical framework and not a mandatory document for ITS implementation in the country.
1.8 Implementation status of ITS in Slovenia

After joining the EU, Slovenia has moved into a new era of faster, more accessible road traffic. At the same time, many sophisticated ITS have been installed and upgraded to ensure smooth and safe traffic flow at increasing traffic volumes. The focus of ITS in Slovenia was therefore on motorways, but there were several successful projects also outside this scope.

In these cases, the main strengths of ITS deployment in Slovenia:
- Successful deployment and implementation of ITS in Slovenia made by domestic knowledge, for instance:
  - Electronic toll collecting (ETC) system on motorways for personal vehicles that was in use between 1995 and 2008 when it was replaced with the toll stickers (vignette) for R1 and R2 vehicle classes. The same ETC system is now serving the heavy goods vehicles
  - Traffic surveillance and management systems on several high hazardous motorway sections
  - Cross border traffic data exchange
  - WIM (weigh in motion) systems
  - Advantageous geostrategic position within important transport corridors in Central and South East Europe (nearby important EU countries like Italy, Germany and Austria and access to West Balkan)

With the construction of new infrastructure, the need of defining the role of each party involved in traffic management arises. At the same time, mutual agreements between each party are going to be defined. In the past, the Ministry of Infrastructure and Spatial planning introduced SITSA-C, the Slovenian ITS architecture, which has never been adopted by other ITS stakeholders.

On the other hand, the absence of concrete measures from the Ministry of Transport in last twenty years in the direction to introduce single ticketing systems and coordinated timetables resulted to significantly reduced numbers of public transport passengers, although the legal basis for this was created. Different entities developed a number of systems for e-ticketing for the use of public transport, which, while using a single standard on the local level, but due to differences in data protocols among themselves, are incompatible.

From these experiences, the weaknesses of Slovenia in field of ITS are:
- Weak policy and absence of a strategy regarding ITS implementation on different levels
- Bottom-up instead of top-down development of existing ITS, due to local commercial interests and requirements
- Recent ITS deployment has focused on the low level system application, resulting to lack of interoperability
- Existing knowledge not utilized properly
- Low share of innovative companies and low level of innovation culture
- Low investments by the public and private sectors in research and development of ITS
- Education orientation primarily targeting to scientific results, without a clear contribution to the economy
- Existing educational and research system makes it almost impossible for collaboration with ITS industry
- Inconsistency of subvention measures by the state (inefficiency of the tax system)
- Intolerance to business risk and failure, especially on the public places
- Low level of networking and formation of strategic partnerships with foreign partners
- Lack of management with advanced business knowledge and experience abroad
- Predominantly focusing on traditional markets
- Quantity of local suppliers

To introduce higher level of ITS understanding, Slovenia should:
- Discuss publicly and present the specific intentions in the field of ITS
- Prepare or upgrade strategic documents such as ITS Action plan or ITS Strategy on the National, Regional and Municipal level
- Update, promote and adopt the SITSA, the framework of Slovenian ITS architecture
- Define rules and responsibilities of ITS actors in Slovenia, including tasks such as integrity, liability, etc.
- Implement more cross-border EU ITS
At the time this report was conducted, a national ITS action plan was in preparatory phase. In this document, the vision and strategy for the period 2013 - 2018 is proposed, including rules and responsibilities of different ITS stakeholders, business models and financing sources of ITS in Slovenia.

Moreover, the Slovenian government has approved amendments to the Roads Act (ZCes-1), (Official Gazette of R.S., No. 109/2010, No. 109/2010, 48/2012) that transpose the EU Directive into national legislation and create the framework for the deployment of Intelligent Transport Systems in Slovenia.

In addition, the Roads Act set basic questions regarding the establishment of the National Traffic Management Centre (NCUP). For the implementation of the legislation, the Ministry for Infrastructure and Spatial Planning, the Slovenian Road Agency and DARS d.d. (as national motorway operator and concessioner) are competent. The above law allows operators to perform their duties in the premises of the NCUP and for the implementation of the tasks of the Centre are entitled to use the facilities for free.


The Public Passenger Transport Act is in the preparatory phase. With this act the integrated public transport will be established in Slovenia, including e-ticketing, real-time schedules for all transport modes and management of passenger transport.

1.8.1 Stakeholders involved

The following organisations and authorities are involved in planning, financing and implementing ITS in Slovenia.

- Ministry of Infrastructure and Spatial Planning (Directorates: Infrastructure, Transport).
- This is the central authority for transport policy and implementation, operating through different agencies and operators for roads, rail, maritime and air transport. It is also responsible for coordinating operations between road authorities and the Police. The following bodies are affiliated to the Ministry of Infrastructure and Spatial Planning:
  - Slovenian Roads Agency
  - The Surveying and Mapping Authority of the Republic of Slovenia
- Ministry of the Interior. The following bodies are affiliated to the Ministry of the Interior:
  - Police, Traffic Police Division
- Ministry of Defence. The following bodies are affiliated to the Ministry of Defence:
  - Administration of the Republic of Slovenia for Civil Protection and Disaster Relief

1.8.2 SWOT Analysis for Slovenia

- **Strengths**
  - ITS in Slovenia is deployed successfully by utilisation of domestic knowledge and experience.
  - In Slovenia, there is both tradition and highly educated manpower (internationally certificated) in the field of ITS.
  - There have been investments in research and development previously and also tax reliefs for the R&D sector.
  - Scientific and research activities in the public sector are widely branched, with well-established international cooperation.
  - There is excellent knowledge of foreign languages and ability to adapt the culture of other nations.
  - The Slovenian road infrastructure, especially motorways, is of high quality.
  - The Slovenian automotive (supply) industry is well established.

- **Weaknesses**
  - The Slovenian government has a weak policy and no strategy regarding ITS implementation.
  - Existing ITS are being developed bottom-up instead of top-down.
  - Recent ITS deployment has been focussing on low-level system applications, resulting in a lack of interoperability.
  - Available knowledge is used poorly.
  - There is a low share of innovative companies and low level of innovation culture.
  - Both public authorities and the private sector do not invest much in R&D of ITS.
  - Education is primarily oriented towards scientific results without a clear contribution to the competitiveness of Slovenia. The existing educational and research system almost renders any collaboration with the ITS industry impossible.
  - Subvention measures by the government are inconsistent for the reason of the inefficiency of the Slovenian tax system.
- There is too much intolerance towards business risk and failure. Consequently, it is very difficult to develop completely new solutions.
- The networking in the home environment is quite poor and the formation of strategic partnership with foreign partners is insufficient.
- There is a lack of management personnel with advanced business knowledge and experience abroad.
- The general focus lies predominantly on traditional markets.
- There is a lack of financial resources to achieve goals of existing programmes.

**Opportunities**
- Slovenia has an advantageous geostrategic position within important transport corridors in Central and South East Europe.
- The Slovenian economy is export-oriented.

**Threats**
- With the continuation of the global financial crisis and the problems in the domestic economy the progress of ITS development could be slowed down.
- Due to the anti-competitive business environment foreign investors might withdraw.

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1.9 Implementation status of ITS in Croatia

There has been no systematic approach to ITS implementation financing in road networks in Croatia thus far. A significant highway network has been built (1300 km) during the last decade and modern information and communication technologies have been implemented, to mark the beginning of Croatian ITS development. Unfortunately, due to the non-existent national ITS architecture, the systems were not integrated at higher instances. Therefore, there was no unitary national scheme for funding ITS as a special system. ITS funding was a part of the total funding for highway development. The main investor was the Republic of Croatia using Word Bank and European Bank for Reconstruction and Development loans. Particular ITS projects were integrated with the development of particular highway sections. Also, there are multiple highway concessioners in Croatia, a fact that leads to differences between implemented systems and adjacent technologies.

It can be generally said that the applied ITS solutions on certain highway sections are on a high technological level. For example, the systems for incident management on highways (especially in tunnels) have received excellent grades in the existing project on tunnel safety (European Tunnel Assessment Programme). 51 tunnels were tested in 2007 and one of the tunnels on the A1 highway (“Brinje”) was determined to be the best in Europe. Application of VMS in highways is high, which reveals a significant improvement in regard to the information provision to users (drivers, passengers, etc.).

The basic obstacle of ITS implementation lies currently in the lack of integration at higher levels (regional, national, EU). This leads to low levels of interoperability. Current data
exchange methods are manual (e.g. protocols on exchange of information on traffic and incidents with Slovenia and Austria based on fax machines). The use of the DATEX standard (information exchange between traffic management centres, traffic information centres and service providers) is not even planned for implementation.

ITS does not have a regulated status in the current Croatian legislation. In accordance with the remaining legislative obligations for Croatian accession to the EU, a supplement to the existing Highway Act is currently underway in the sense of the Directive 2010/40/EU.

1.9.1 Stakeholders involved

Up to now there are no organisations in Croatia that are involved in planning, financing and implementing ITS. The reason for this is the lack of a legislative framework. The new supplement to the Highway Act has begun to address this issue. In the future, key stakeholders for the development and deployment of ITS will be:

- Ministry of Maritime Affairs, Transport and Infrastructure
- Ministry of Regional Development and EU founds
- Ministry of Science, Education and Sport
- ITS Croatia
- Business Innovation Agency of the Republic of Croatia – BICRO
- Croatian Institute of Technology – CIT
- The Croatian Association of Toll Motorways Concessionaires
- Croatian Motorways Ltd.
- Croatian Roads Ltd.
- The Croatian Standards Institute, Technical committee HZN/TO 524
- Faculty of Traffic and Transport Sciences

1.9.2 SWOT Analysis

**Strengths**
- Private companies in Croatia working in the transport telematics sector are capable of developing ITS technology and equipment.
- There is a high level of education in Croatia in the area of ITS that has been certified internationally.

**Weaknesses**
- The governmental strategy in Croatia regarding ITS deployment and financing is unstructured and inconclusive.

- Private companies regard it neither necessary nor attractive to invest in ITS deployment.
- Recent ITS deployment was focused on low-level system applications. This resulted in a lack of integration and consequently obstructed synergies.
- Croatian road operators, as well as other stakeholders (Ministry of Maritime Affairs, Transport and Infrastructure, Road Authorities) responsible for ITS implementation have limited capability and not enough expertise in the field of ITS deployment.
- There is only a small number of Croatian R&D projects in the field of ITS.
- There are no dedicated ITS funding initiatives in Croatia.

**Opportunities**
- Croatia is part of important transport corridors in South East Europe.
- ITS bear potentials for small tourist towns located at the Adriatic coast with big traffic problems during tourist seasons.

**Threats**
- A continuation of the global financial crisis would result in problems for the Croatian economy. There are major financial problems to be expected within the next two to five regarding the development and implementation of ITS in Croatia, as a consequence of the recent global crisis and the current economic situation in the Republic of Croatia.
- ITS development in Europe progresses too fast for Croatia to go along with.
- Most of the technologies used in recently deployed applications are accompanied by high maintenance costs.
One of the most important changes after 1990s in Albania was the migration of population from rural to urban areas. Tirana, the capital of Albania, has undergone new settlements. The population of Tirana in 1990 was 270,000 inhabitants, while today the Tirana Municipality Area accommodates 880,000 inhabitants. This urban development overloads the transport and utility networks of Tirana. The lack of roads with adequate traffic capacity hinders the operation of public transport and the accessibility to many areas of the city. The occupation of the road sides is one of the major causes of traffic overload with reduced level of service and slowing traffic flows. The majority of new constructions made in Tirana during the last decade do not account for car parking areas, and as a result the cars are mostly parked on the streets, resulting to increased traffic congestion. Pedestrians are also affected by the current conditions, in terms of not sufficient road crossing facilities.

Tirana is currently facing a deep restructuring process in its urban transport system. Over the recent years, neither the transport infrastructure nor the transport services have kept pace with the population growth and the boost in the number of private cars. These changes have increasingly fostered the demand for more efficient transport infrastructures, as well as integrated plans for urban development and traffic management in the city.

Albania has invested significant resources in the last twenty years for the reconstruction of the existing road network and the construction of new roads and highways throughout the country.

As result of the investments in road transport, the interurban transport is improved. On the contrary, in urban areas (especially in Tirana), the traffic congestion creates unfavourable conditions for the movement of cars, vehicles and people.

The reconstruction and building of new roads and highways in Albania was a priority. The ITS deployment and implementation is left rather behind, because the priorities were placed on the construction of the road network. Factors that caused delays in ITS deployment in Albania include:
- Lack of strategy and policy approach regarding the implementation of ITS
- Lack of appropriate ITS legislation
- Unavailability of funds

The European Commission has set up the ITS legislative framework in 2010. Under this perspective, Albania has the opportunity to build up strategies based on EU legislative frameworks for the deployment of ITS.

The strengths for the current status toward increased deployment of ITS in Albania are listed below:
- Albania can establish adequate framework conditions for accelerating and coordinating deployment of ITS
- Prepare an up to date legislation for the deployment of ITS
- Plan and integrate the generic ITS components on a realistic timetable
- Use the “best practices” for the design of up to date technologies to support the ITS deployment

In order to start the deployment of ITS in Albania at national level, the following issues need to be addressed on behalf of responsible stakeholders:
- Provision of an adequate legislation framework for deployment of ITS, laws and Government decisions for this purpose, in coherence with EU legislation and ITS Action Plan and ITS Directive Priority Areas
- Establishment of a strategy for the deployment of ITS in conformity with the EU Directive 2010/40/EU of the European Parliament and of the Council of 7 July 2010, EC Action Plan and other EU documents on this subject
- Creation of an administrative structure/department at national level, which will promote, support, develop and follow up the ITS deployment
- Initiation of projects for the deployment of ITS in cities, especially for Tirana at first place
- Promotion of collaboration between central and regional authorities and between public and private organizations with defined roles and responsibilities
- Financial support for projects aiming the ITS deployment
- Promotion of public-private partnership for the research and deployment of ITS
2. BEST PRACTICES OF ITS DEPLOYMENT IN SEE AREA AND ACROSS EUROPE
2. BEST PRACTICES OF ITS DEPLOYMENT IN SEE AREA AND ACROSS EUROPE

The objectives of this section are to critically compare the applied (in SEE) practice for ITS deployment with the European best practices and policy initiatives for achieving interoperable ITS implementation. The gap of regional/national ITS architectures with the EU ITS framework is documented, with the main emphasis on the added value of the integrated traffic management. This section provides an overview of the information collected during the course of SEE-ITS on best practices.

2.1 Results of best practice collection

<table>
<thead>
<tr>
<th>Country</th>
<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tbody>
<tr>
<td>Austria</td>
<td></td>
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<tr>
<td>Interaction and Conflicts between Cyclists and Public Transport in narrow Urban Space</td>
<td>Public transport Bicycles</td>
<td>Road transport related personal safety</td>
</tr>
<tr>
<td>ITS Vienna Region / AnachB.at</td>
<td>Public transport Rail Road Pedestrians</td>
<td>Traveller Information Services</td>
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<tr>
<td>TMC plus service implementation in Austria</td>
<td>Road</td>
<td>Traffic Management and Operations Services, Traveller Information Services</td>
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</tbody>
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<tr>
<th>Belgium</th>
<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tbody>
<tr>
<td>Average speed calculation and display on the A602 (E25) in Liège</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Météoroutes</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Reyers Tunnel, Brussels</td>
<td>Road</td>
<td>Traffic Management and Operations Services, Traveller and Information Services</td>
</tr>
<tr>
<td>The European PROSPER-project: Final results of the trial on Intelligent Speed Adaption (ISA) in Belgium</td>
<td>Road</td>
<td>Intelligent Vehicle Services</td>
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<tr>
<td>Traffic Management Plan Brussels-Beaune</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
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The majority of the projects address Traffic Management and Operations Services and Traveller Information Services, while road transport is mostly addressed.
### Czech Republic

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<tr>
<th>Title</th>
<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tbody>
<tr>
<td>Ex-post evaluation of ITS applications implemented on highway D8 in Czech Republic</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
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### Denmark

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<th>Title</th>
<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tbody>
<tr>
<td>Evaluation of Bilejseplanen.dk</td>
<td>Public transport Rail Road Bicycles Pedestrians Waterway Park &amp; Ride Information</td>
<td>Traveller Information Services</td>
</tr>
<tr>
<td>Evaluation of variable speed limits at Holbaekmotorvejen</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Multi-modal Traveller Information Service Trafikken.dk/Hovedstaden, Denmark</td>
<td>Public Transport Rail Road Bicycles</td>
<td>Public Transport Services Traveller Information Services</td>
</tr>
<tr>
<td>The road pricing Experiment in Denmark – User Reactions</td>
<td>Road</td>
<td>Transport-related Electronic payment Services</td>
</tr>
<tr>
<td>Traffic management applications on the Koge Bugt Motorway</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>TRIM Queue, Vejle N</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>TRIM Travel Time Funen, Denmark</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
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### Finland

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<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tbody>
<tr>
<td>Evaluation of regional traffic information service</td>
<td>Public Transport Rail Road</td>
<td>Traveller and Information Services</td>
</tr>
<tr>
<td>Evaluation of Renewal of Road Weather Information System and Finnish Road ITS Action Plan</td>
<td>Road</td>
<td>Traffic Management and Operations Services Traveller and Information Services</td>
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### France

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<th>Title</th>
<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tr>
<td>Alert in tunnels</td>
<td>Road</td>
<td>Disaster response management and coordination</td>
</tr>
<tr>
<td>Automatic Incident Detection and Fast Alert Evaluation</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Ban on truck overtaking</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Dedicated Lane for taxis and buses</td>
<td>Road, Public Transport</td>
<td>Traffic Management and Operations Services Traveller Information Services</td>
</tr>
<tr>
<td>Dynamic motorway lane management in France</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>ERATO traffic management system – Real time information services through VMS on urban fast lanes of Toulouse</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>French-Spanish Cross Border Traffic Management and Information Interoperability of Services</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Geolocation of service vehicles</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Grand Lyon Urban Traffic Management System</td>
<td>Public Transport Rail Road Car-sharing Bicycles</td>
<td>Traffic Management and Operations Services Traveller Information Services</td>
</tr>
<tr>
<td>Gutemberg traffic management system – Real time information on VMS on urban fast lane</td>
<td>Road</td>
<td>Traffic Management and Operations Services Traveller Information Services</td>
</tr>
<tr>
<td>Secure parking places for trucks</td>
<td>Road</td>
<td>Freight Transport Management</td>
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### Germany

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<th>Title</th>
<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tr>
<td>Analysis of the red light driving on ramp metering systems on the motorway A40</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
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<td>Design, setting up and installation of ramp metering on motorways intersections</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Dynamic HGV Information at A5 in Baden Wuerttemberg</td>
<td>Road</td>
<td>Freight Transport Management</td>
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<tr>
<td>Evaluation of the cross-border Re-routing System Mosel-Saar Network</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Hazardous Goods in the Alpine Region – Preparatory Activity</td>
<td>Road</td>
<td>Freight Transport Management</td>
</tr>
<tr>
<td>HGV On-site Parking Information at the Motorway A61 Service and Rest Area “Brohltal-Ost”</td>
<td>Road</td>
<td>Freight Transport Management</td>
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### Greece

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<th>Mode of Transport</th>
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<tr>
<td>e-Trikala ITS system</td>
<td>Public Transport</td>
<td>Public Transport Services</td>
</tr>
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<td>Road</td>
<td>Traffic Management and Operations Services</td>
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<td>Parking</td>
<td>Transport-related</td>
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<td>Electronic Payment Services</td>
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<td>Traveller Information Services</td>
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<tr>
<td><strong>H.I.T. PORTAL – An Online Portal for Integrated Transportation Data Management and Processing</strong></td>
<td>Public Transport</td>
<td>Freight Transport Management&lt;br&gt;Public Transport Services&lt;br&gt;Traffic Management and Operations Services&lt;br&gt;Traveller Information Service</td>
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<td>Air</td>
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<tr>
<td><strong>Intelligent Urban Mobility Management System of Thessaloniki</strong></td>
<td>Public Transport</td>
<td>Traffic Management and Operations Services&lt;br&gt;Traveller Information Services</td>
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<td>Car-sharing</td>
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<td>Pedestrians</td>
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<tr>
<td><strong>ITS services in Egnatia National Motorway</strong></td>
<td>Road</td>
<td>Traffic Management and Operations Services&lt;br&gt;Traveller Information Services</td>
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<td><strong>MOBINET – Mobility Centre of the Kalamaria Municipality and development of electronic traveller information services through the Internet</strong></td>
<td>Public Transport</td>
<td>Public Transport Services&lt;br&gt;Traveller Information Services</td>
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<td><strong>Myroute Portal Road</strong></td>
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<tr>
<td><strong>Telematics services for the Organization of Urban Transportation of Thessaloniki (OASTH)</strong></td>
<td>Public Transport</td>
<td>Public Transport Services&lt;br&gt;Traveller Information Services</td>
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<td><strong>Traffic Management System (TMS) of the Athens Traffic Management Centre (ATMC)</strong></td>
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| **Hungary** | **Mode of Transport** | **ITS-Services addressed** |
| **Title** | **Mode of Transport** | **ITS-Services addressed** |
| TEMPO Evaluation of a traffic monitoring pilot project on Hungarian motorway M7 | Road | Traffic Management and Operations Services |

| **Netherlands** | **Mode of Transport** | **ITS-Services addressed** |
| **Title** | **Mode of Transport** | **ITS-Services addressed** |
| Additional Lanes Program – 10 Projects in The Netherlands | Road | Freight Transport Management<br>Traffic Management and Operations Services<br>Traveller Information Services |
| Evaluation Field Trials with Dynamic Speed Limits | Road | Freight Transport Management<br>Traffic Management and Operations Services<br>Traveller Information Services |
| Evaluation of Ramp Metering on the A10 Amsterdam Ring road | Road | Freight Transport Management<br>Traffic Management and Operations Services<br>Traveller Information Services |
| Travel Time Information on Dynamic Route Information Panels | Road | Freight Transport Management<br>Traffic Management and Operations Services<br>Traveller Information Services |

| **Norway** | **Mode of Transport** | **ITS-Services addressed** |
| **Title** | **Mode of Transport** | **ITS-Services addressed** |
| Fully automated free flow road toll stations in Tønsberg and Bergen, Norway | Road | Transport-related<br>Electronic payment Services |

| **Italy** | **Mode of Transport** | **ITS-Services addressed** |
| **Title** | **Mode of Transport** | **ITS-Services addressed** |
| Evaluation of the dynamic speed control system on the Mestre beltway | Road | Traffic Management and Operations Services |
### Romania

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<tr>
<th>Title</th>
<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tr>
<td>Integrated system for optimizing the cashing and the costs in the Public Transport Company of Timisoara (RATT)</td>
<td>Public Transport</td>
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### Slovenia

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<tr>
<td>Evaluation of Detection of wrong way driving pilot deployment on road split Sermin</td>
<td>Road</td>
<td>Traffic Management and Operations Services&lt;br&gt;Traveller Information Services</td>
</tr>
<tr>
<td>Evaluation of Estimation of cargo traffic flows in Slovenia</td>
<td>Rail, Road, Waterway, Air Traffic</td>
<td>Freight Transport Management&lt;br&gt;Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Evaluation of VMS deployment on Slovenian part of corridor V</td>
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<td>Traffic Management and Operations Services&lt;br&gt;Traveller Information Services</td>
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### Spain

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<th>Title</th>
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<th>ITS-Services addressed</th>
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<tbody>
<tr>
<td>ARENA (Accidentes de Tráfico: Recogida da información y análisis); a system for reporting road accidents</td>
<td>Road</td>
<td>Transport-related&lt;br&gt;Electronic payment Services</td>
</tr>
<tr>
<td>Dynamic speed control in the area of Barcelona</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>eTraffic: Integration of traffic information and Google Maps</td>
<td>Road</td>
<td>Traveller Information Services</td>
</tr>
<tr>
<td>FREILOT Delivery Space Booking scheme, Bilbao, Spain</td>
<td>Road</td>
<td>Freight Transport Management</td>
</tr>
<tr>
<td>Information via VMS. Segment Málaga - Nerja</td>
<td>Road</td>
<td>Traffic Management and Operations Services&lt;br&gt;Traveller Information Services</td>
</tr>
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### Sweden

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<tr>
<th>Title</th>
<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tbody>
<tr>
<td>Assessment of attitudes to variable accident road sign, Sweden</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Bus priority system (project SMILE)</td>
<td>Public Transport</td>
<td>Public Transport Services</td>
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<tr>
<td>Driver Assistance Systems for Quiet Vehicle Operation</td>
<td>Road</td>
<td>Intelligent Vehicle Services</td>
</tr>
<tr>
<td>Environmentally adjusted speed on E18 Sweden</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Evaluation of Enhanced Information at pedestrian crossings Sweden</td>
<td>Road</td>
<td>Road Transport Related Personal Safety&lt;br&gt;Traveller Information Services</td>
</tr>
<tr>
<td>New Dynamic Road Sign Activated together with Speed Limits at Poor Air Conditions</td>
<td>Road</td>
<td>Traffic Management and Operations Services&lt;br&gt;Traveller Information Services</td>
</tr>
<tr>
<td>New Travel Time VMS in Gothenburg, Sweden</td>
<td>Road</td>
<td>Traffic Management and Operations Services&lt;br&gt;Traveller Information Services</td>
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<tr>
<td>Optis – Optimised traffic in Sweden</td>
<td>Road</td>
<td>Traveller Information Services</td>
</tr>
<tr>
<td>Quiet City Transport</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Road weather controlled variable speed limits, Sweden</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Time Controlled Variable Speed Signs in Gothenburg, Sweden</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
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<tr>
<td>Traffic controlled Variable Speed Limits; Sweden</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
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<tr>
<td>Variable Speed Limits at intersections, Sweden</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
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### United Kingdom

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<tr>
<th>Title</th>
<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tbody>
<tr>
<td>A55 North Wales Tunnels Area Video Automatic Incident Detection</td>
<td>Road</td>
<td>Disaster Response Management and Coordination Traffic Management and Operations Services Traveller Information Services</td>
</tr>
<tr>
<td>ATM Monitoring and Evaluation</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Congestion Charging in London</td>
<td>Road</td>
<td>Traffic Management and Operations Services Transport-related Electronic Payment Services</td>
</tr>
<tr>
<td>CURACAO Coordination of Urban Road User Charging Organisational Issues</td>
<td>Road</td>
<td>Transport-related Electronic Payment Services</td>
</tr>
<tr>
<td>Datex II Evaluation Results</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Integrated Traffic Management at Junction 33 of the M1</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Intelligent Road Studs Evaluation</td>
<td>Road</td>
<td>Traffic Management and Operations Services Road Transport Related Personal Safety</td>
</tr>
<tr>
<td>Local Journey Time System Evaluation</td>
<td>Road</td>
<td>Traffic Management and Operations Services Traveller Information Services</td>
</tr>
<tr>
<td>M90 COMPANION Hazard Warning System (Tabasco project &amp; subsequent Scottish Executive research)</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
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<tr>
<td>Mobile Journey Time System</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
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<tr>
<td>NADICS Journey Time Planner</td>
<td>Public Transport</td>
<td>Traveller Information Services</td>
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<tr>
<td>Own Language Information System</td>
<td>Road</td>
<td>Traveller Information Services</td>
</tr>
<tr>
<td>Parking Guidance and Information</td>
<td>Road</td>
<td>Traffic Management and Operations Services Traveller Information Services</td>
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### European Union level

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<tr>
<th>Title</th>
<th>Mode of Transport</th>
<th>ITS-Services addressed</th>
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<tbody>
<tr>
<td>Call-a-bus-Services</td>
<td>Public Transport</td>
<td>Public Transport Services</td>
</tr>
<tr>
<td>CityMobil Towards advanced transport for the urban environment</td>
<td>Rail</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Long-Distance Corridor Demonstration Project</td>
<td>Road</td>
<td>Traffic Management and Operations Services</td>
</tr>
<tr>
<td>Public Bicycles</td>
<td>Bicycles</td>
<td>Public Transport Services</td>
</tr>
</tbody>
</table>
2.2 Conclusions on Best Practices

122 best practices across Europe were identified, which reflect ITS related activities of the past few years. The majority of the projects/ implementations identified as best practices come from UK, France and Germany. The majority concerns measures for the road (80%).

The collected best practices can provide assistance to decision makers in the SEE-countries, and beyond, in order to gain an overview of which projects are reasonable to implement. Furthermore, the best practice collection should represent a support function and demonstrate the benefits of ITS projects and implementations. Figure 3 gives an overview of the ITS services collected.

**ITS Services addressed**

![Figure 3: ITS services best practices](image-url)
3.1 Regulatory Instruments for interoperable ITS

According to the 2010/40/EU Directive, interoperability stands for “the capacity of systems and the underlying business processes to exchange data and to share information and knowledge”. Under the European digital agenda, the European Commission has been implementing the European Interoperability Strategy (EIS) and the European Interoperability Framework (EIF). These two documents aim at promoting the cooperation between public administrations of the EU members and the interoperability issue, while creating the foundations in the organisational – standardisation dimension of interoperability.

Article 8 of the 2010/40/EU Directive highlights that interoperability should be strongly supported by the provision of standards by the relevant standardisation bodies. Standards are needed, in order to address interoperability at different layers in the ITS architecture and issues of data compatibility across ITS applications and services. They also ensure that local and regional systems coalesce into a coherent national system and allow integration of its components into European and international systems.

At European level, there are three European Standardisation Organisations (ESOs), namely:
- CEN (European Committee for Standardization). The European Committee for Standardization, which is the EU body that provides the platform for the development of European standards and other technical specifications.
- CENELEC (European Committee for Electro-technical Standardisation), which creates standards in the electro-technical engineering field on European level. Cenelec also cooperates with the International Electro-technical Commission (IEC) for the adoption of international standards.
- ETSI (European Telecommunications Standards Institute), which is an industry member based standardisation organisation responsible for the production of standards in the Information and Communications Technologies (ICT) field (including fixed, mobile, radio, converged, broadcast and internet technologies).

The CEN/TC 278 (Road Transport and Traffic Telematics) and the Technical Committee (TC) ITS for the ETSI (5 working groups) are responsible for managing the preparation of standards within the field of Intelligent Transport Systems. These committees also collaborate closely with various CENELEC Technical Bodies that are associated with ITS (i.e. CLC/BTTF 69-3 “Road traffic signal systems” CLC/TCSX “Electrical and electronic applications for railway”), but also with ISO (International Organization for Standardization) in developing standards that may be applied globally. The Technical Committee of ISO that deals with ITS is ISO/TC 204 “Intelligent Transport Systems”. Collaboration is also promoted with SAE International, IEEE (developer of industry standards) and IETF (Internet Engineering Task Force, which is responsible for the production of internet standards).

3.2 Systems developed by regional and national authorities

A catalogue of operational systems for interoperable Intelligent Transport Systems in Europe is given below:
- Austrian Graphic Integration Platform (GIP)
- Traffic Information Austria (VAO)
- H.I.T. PORTAL (Greece)
- Greek EFC tollways
- e-Call in several SEE and EU countries
- Road Safety Information Coordination Centre (CCISS)
- GIM - Gestione Informata della Mobilità
- Dutch National Data Warehouse for Traffic Information
- Hungarian KIRA

Standards are designed and created through a transparent, open, technically coherent and consensual process. Proposals for the introduction of a new standard can be submitted by any interested party (i.e. as part of European projects, through trade federations, etc.) to the relevant ESO. Usually, most standardisation work is proposed through the National Standards Bodies (NSBs). It should be stated here, though, that within the European Union, only standards ratified by CEN, CENELEC and ETSI are recognised as “European standards”. Nonetheless, after the publication of a European Standard by an ESO, all member countries of the ESO should transpose this European standard into a national one.

Apart from the ESOs, other organisations in Europe deal with the design and creation of standards as part of their overall activities, as well. As such, some are mentioned below:
- TISA (Traveller Information Services Association). TISA is a non-profit, market-driven membership association focusing on traffic and travel information services and products. TISA has developed the TPEG traffic and travel information (TTI) data protocol, which is described in the following sections.
- OMG (Object Management Group), which is an international, open membership, not-for-profit computer industry standards consortium. OMG closely collaborates with ISO for publication of its standards. OMG has created and manages the CORBA architecture (Common Object Request Broker Architecture), which is an open, vendor-independent architecture and infrastructure that computer applications use to work together over networks (for description see also sections below).
3.3 Issues identified for the existing systems

This section presents an overview of existing systems that provide interoperable ITS services. They are maintained by private companies and operate in various countries. Their interoperability analysis revealed the following issues:

- Only few of them integrate real-time traffic and timetable information regarding the modes of transport they use
- They concern mainly trip planning using public transport without information about road network traffic
- The services are available only at national level

The majority of the systems are focused on trip planning and combine information from different urban public transport modes with rail transport travel information. Although some of them have the option to be fed with real-time timetable information, for most this information is static.

Looking at the presented systems, it seems that they are divided in trip planners and road traffic data collection. Therefore, there is no interoperability between public transport operators and road network administrators.

Finally, one of the most important issues regarding the interoperability of the existing systems is that their services are limited to national level with no cross-border information exchange.

3.3.1 Organisational and operational requirements

In order to ensure the interoperability between different ITS services and applications, their organisational structure needs to be clearly defined in terms of responsibilities of each party and their influence level; strategic or technical. Another important aspect is to have the mechanisms to involve all the stakeholders and administrations that can provide or receive data. In terms of operation, the systems should provide for information reliability and accuracy. This is quite significant as each system has to trust the information received from other systems.

3.3.2 Technical requirements

In order to be interoperable, from a technical point of view, ITS services and applications have to use the same international, existing standards. This applies firstly to the services provided. In this way the user experience will be the same when passing through different systems. This can be achieved if the system is designed according to the approved standards in the field of ITS. Secondly, the interfaces of the systems have to be standardised so they can easily connect and exchange information. When proprietary protocols are used, it is very difficult and often not desired for other parties to adapt their systems in order to make them interoperable.

3.4 Conclusions for Interoperability

There are several aspects to be considered before a comprehensive and integrated ITS deployment can actually be achieved. Along with an appropriate political and organisational framework, it is equally important to identify the requirements for the technical interoperability of ITS and align them from small-scale to a transnational level.

3.5 General conclusions

Standards are necessary, in order to address interoperability at various levels of the whole ITS architecture, as well as dealing with issues of data compatibility across ITS applications and services. They also facilitate the joining of local and regional systems into a coherent national application and enable the integration of its components at European and international level.

There are indeed several standards that were developed by European Standardising Bodies, which are being refined on a regular basis. It becomes visible that common standards like DATEX II, XML, or TPEG are being preferred to proprietary solutions. Still the use of open standards seems to be an important feature as it is emphasised in most cases, even if the standards used are not described in detail.

It can be observed that all SEE-ITS countries (apart from Croatia) defined their status quo regarding interoperability as “National”. Up to now Austria and Hungary are the only countries in the SEE area that implement actually national solutions, namely the Austrian GIP and the Hungarian KIRA, covering the whole national territory. Other countries’ solutions rather emphasise single aspects of their national transport like the high-level road network, certain conurbations or single modes of transport. Against the backdrop of geographical conditions differing from country to country, this is comprehensible. In countries like Greece and Croatia that are comprised of a large number of islands, the premises are different to comparatively “compact” countries like Slovenia or Austria.

All SEE-ITS countries have however started or are at least planning cross-border activities including international graph integration platforms, interoperability solutions for waterway and rail transport as well as cross-border traveller information services.
3.6 Proposals for future measures to support and increase interoperability

Each European country has its own structure in terms of operators and responsibilities, a fact hindering ITS deployment. For example in Austria there is only one operator of the high-level road network (ASFINAG) and this company is owned by the state. In Croatia there are three private motorway operators and one government-run responsible for the high-level road network. Yet there are also similarities in terms of stakeholders. Additionally to the transport operators, there is often the police involved, as well as national broadcasting agencies.

Another major issue is the national funding landscape for Intelligent Transport Systems that is completely missing in some countries. Consequently, it is very difficult for those countries to independently develop ITS services and applications on a national level, forcing them to participate in European projects and therefore neglecting the national progression, which would again serve as a good basis for a more effective and efficient participation on European level.

It can be observed that ITS services and applications are not only being developed for commercial purposes any more. With increasing governmental and political commitment to ITS, commercially available systems for traffic management were found to be insufficient. Especially when it comes to national or even cross-border solutions, it is important to ensure interoperability from the beginning, in order to guarantee a consistent flow of data and information amongst all stakeholders. But also at regional level, authorities begin to recognise the importance of interfaces being compatible to European standards. Consequently, national and regional authorities start to define their own specifications based on interoperable standards.

Within this process it can be difficult to break out of gradually grown and often inflexible organisational structures. Based on the best practice examples provided for some European countries, this is what would be necessary to comprehensively implement in practice as already recognised on paper. With this way out from outdated bureaucracy, more efficient working will be made possible on all levels, which is necessary in view of the rapid technological progress. Otherwise, due to organisational barriers, technically appropriate solutions could remain trapped in the planning stage until they become outdated and therefore obsolete.

In order to achieve cross-border interoperability, it is crucial to consolidate the country-specific structures on all levels. As a result, it is important both to increasingly initiate transnational projects and to foster the national development of Intelligent Transport Systems.
4.1 National ITS Roadmaps

Herein the identification of the future plans of all countries towards further ITS deployment at a regional, national and transnational level is presented. Within the SEE-ITS project, priority measures in each country of the SEE area have been collected and analyzed. Prioritization of the measures has been carried out with the use of a questionnaire survey, which assisted in evaluating each measure against the following seven criteria:

1. Efficiency (based on traffic-related parameters, e.g. reduction of travel time per person)
2. Financial and social reciprocity (according to cost-benefit principles)
3. Accessibility (in terms of creating improved use of a transport service)
4. Environment (reduction of negative environmental impacts)
5. Safety and security
6. Strengthening of the transport sector (e.g. increased turnover, new jobs)
7. ITS-related innovation and technology (e.g. development of new and innovative products)

The aim is to assess the proposed measures against the background of the four priority areas of the EU ITS Directive 2010/40/EC in each participating country, based on their contribution to the achievement of the above-mentioned criteria. The final objective is to create an implementation roadmap for ITS in nine SEE countries, based on the prioritization of the various measures.

Representatives from institutions, organizations and companies related to ITS, from each country, were contacted and asked to complete the questionnaire. Further to the rating of the criteria that the respondents attributed to each measure, the participants were asked to indicate the level of confidence of their assessment for each specific action/project (1 = very low, 5 = very high). This question was used in order to assign the appropriate weight to each criterion (from 1-for very low confidence up to 5-for very high confidence). Based on this, each measure was attributed a general rank (sum of the ratings that were given for each criterion) and then the top measures for each Priority Area were selected. The optimal period for the measures’ implementation (short term = 1-3 years, medium term = 3-6 years and long term = 7 and more years) was also suggested by the questionnaire survey participants, in order to form the timeline of the roadmap.

The top ranked measures for each country for a period between one to seven years are presented next.
4. ROADMAPS FOR ITS IN SEE

Figure 6: ITS Roadmap for Bulgaria

Figure 7: ITS Roadmap for Hungary

Figure 8: ITS Roadmap for Italy

Figure 9: ITS Roadmap for Romania
Based on the above, it is clear that in most cases projects and measures related to priority area 1 of the ITS Directive are those considered as the most crucial for the enhancement of ITS deployment in the short term. Measures of priority area 3 are considered to be mature enough to become implemented within the next couple of years. Projects of priority area 4 are considered to be at an early stage of development. Therefore, in most cases, their deployment is expected to begin in a few years (after 2016). Finally, measures of priority area 2 are unanimously considered as follow-up to the measures of priority area 1, thus their deployment is expected to begin after that of priority area 1 measures.

4.2 Comments on ITS roadmaps

The deployment of ITS in the SEE area is strongly influenced by the availability of funds and the existence - or not - of an appropriate policy and legislative framework in the SEE countries. In terms of implementation, policy context and future priorities, a mixed picture is revealed both in terms of current status as well as of the priorities themselves. This could be attributed mainly to the different time periods in which each state became a member of the EU and the different levels of experience of the various actors. Lack of
experience would influence their ability to absorb and effectively use EU and other national or regional funds, which are the main sources of financing for all states in the SEE area.

The identification of the current status of ITS deployment in SEE countries demonstrates some major variations among the countries. With the exception of Austria, half of the countries have an average level of ITS deployment strategy and half of them are in the initial steps of organizing such a strategy. Most of the countries have an adequate research background and can already deploy existing and successful ITS applications, thus avoiding initial problems. However, the total absence, in some cases, of previous deployment and the inadequate integration between various levels of administration (national, regional, EU) are major drawbacks for further successful deployment. The existing and forthcoming funding mechanisms should play an important role in achieving optimal ITS implementation and in developing interoperability between different regions. Next steps that need to be followed include the identification of a suitable bundle of measures for each country, the finalization and prioritization of proposed interventions in order to reach a desired level of ITS services deployment and, finally, the harmonization of ITS national strategies with EU ITS policies, in order to achieve an acceptable level of interoperability.

### 4.3 Common Revision Plan for an ITS Architecture

The suggested revision plan aims at providing a sound picture of the current status of interoperability and proposing measures and actions that could foster interoperability and ensure close cooperation among the SEE countries towards increased and harmonized deployment of ITS.

#### 4.3.1 The European Architecture for ITS

FRAME is the European Architecture for ITS, created and published in 2000 by the project KAREN. Since then, Member States and their regions have used it to create ITS Architecture subsets. The E-FRAME project (2008-2011) has further extended the Architecture to include Cooperative Systems and it now covers almost all of ITS areas1, namely:

- Electronic Fee Collection;
- Emergency Notification and Response – Roadside and In-Vehicle Notification;
- Traffic Management – Urban, Inter-Urban, Simulation, Parking, Tunnels and Bridges, Maintenance, together with the Management of Incidents, Road Vehicle Based Pollution and the Demand for Road Use;
- Public Transport Management – Schedules, Fares, On-Demand Services, Fleet and

1 [http://www.frame-online.net/](http://www.frame-online.net/)

### FRAME – Austria

Within Austria there was no need to develop an own national ITS Architecture as the Austrian Ministry of Transport and the ITS stakeholders decided to use the FRAME architecture.

Austria has used the FRAME architecture since 2006 for several development projects

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2 A working group for establishing the National ITS Architecture has been set up by the Ministry of Infrastructures, Transport and Networks during mid-2014. The adopted work plan will utilize the FRAME architecture as the basis for the Greek National ITS Architecture.
under the 6th and 7th framework programme (e.g. COOPERS, IN-TIME) of the European Commission.

**HITS - Hungary**

Following the development of the FRAME Architecture, the Hungarian Public Road Company launched a pilot project in 2002 in order to test the applicability of the FRAME Architecture in Hungary. Functional structures were examined in the fields of traffic control, event management and on-the-route information demand. In the following years, the Hungarian version of the FRAME Architecture was finalized and the description of user requirements, as well as the elaboration of the functional and physical components became available. In 2005, all the versions of the Hungarian ITS Architecture that had been created until then were processed and integrated, and the Hungarian ITS Framework Architecture (HITS) was delivered (http://www.frame-online.hu/hits_tortenete_en.html).

HITS is comprised of:
- User Needs
- Functional Architecture
- Physical Architecture
- Supplementary units

**NARITS and CN ADNR - Romania**

Currently, Romania has two main FRAME implementations: NARITS (a research project, which adapted the FRAME Architecture at a national level) and ITS Architecture's chapter of a strategy of Romanian National Road Administration, CN ADNR.

The NARITS (National Architecture for Road Intelligent Transport Systems) national research project was launched in 2005 (end year: 2008) and it developed a national architecture based on the FRAME architecture. Currently, however, only the ITS architecture contracted by the National Road Administration is used for the development of new ITS projects. The Architecture describes all user needs of FRAME, which are connected with ITS systems for the national road network, but only the user needs related to monitoring are detailed and mentioned in the strategic document as an example of using FRAME in developing new ITS systems (for other categories of user needs the main document presented the FRAME list and methodology). The ITS Architecture of the National Road Administration is a strategic document, which is used as reference for technical specifications of new ITS systems.

**SITSA - C – Slovenia**

SITSA – C, the Slovenian ITS Architecture, module Roads (Ceste), represents a uniform concept for the designing, planning and integration of ITS in the Slovenian road network.

3 (Nemtanu & Dumitrescu)

4 http://www.its-artist.rupa.it/english/
### 4.3.3 Overview and general proposals

Interoperability in the countries of the SEE area has been mainly achieved, so far, within each country’s borders and less on a cross-border level, although some important steps have been undertaken, like the EU-wide projects eCall and EasyWay and bilateral or multilateral cooperation between the SEE countries through SEE-ITS, EDITS or the PROMET projects.

Interoperability has been achieved to different degrees in the SEE countries. Most of the countries (Greece, Romania, Slovenia, Hungary) have achieved a level of national interoperability in specific fields, such as traffic management, data exchange, uniform fare ITS, e-tolling, whereas the ones that have had thus far a relatively limited ITS deployment (Croatia, Bulgaria) have not yet reached that level. It is an issue, however, that even countries like Austria or Italy, which have implemented national or regional interoperable systems to a significant extent, are still reporting “isolation” of ITS applications within their borders.

The reasons for the abovementioned lack of desirable interoperability can be found in each country’s special conditions and their existing ITS environment. Some common grounds can be found on an administrative level (lack of governmental coordination), financial level (lack of funding), technical level (use of international standards mostly for proprietary ITS solutions, obsolete national ITS frameworks, lack of open interfaces) and regulatory level (lack of legislation and standardization documents).

Specific areas and projects could lead the way for cooperation among the SEE countries. These include, first of all, the harmonised EU-wide eCall service. Although most of the countries of the SEE area are already active in that field (participating in the HeERO project), similar steps should also be undertaken by the rest of the countries. A basis for integration of the SEE countries could also be provided through EU initiatives, including the INSPIRE geoportal and the TN-ITS platform.

The field of multimodal travel information could also be a “champion” field for cooperation. A number of multi-modal journey planners have already been implemented in most of the SEE countries on a local, regional or national level. These should be integrated, in order to address cross-border needs (an important initiative towards that goal has been undertaken through the EDITS project).

For the definition and harmonization of services across the EU, the EasyWay program is a key platform and environment in which transport ministries, directorates, road operators and partners from the EU try to achieve effective ITS implementation with the goal of ensuring continuous ITS services within the EU. With the harmonization of European ITS services, the program EasyWay offers access to the set of ITS services, so that each member state does not need its own services development. Based on the aforementioned, the following options for interoperability could be selected:

- One of the options is to use and further develop the common Deployment Guidelines of EasyWay. Following this direction, the development of ITS services will be more certain and organized. EU member states will avoid situations where each member state would have to develop its own framework for the services’ harmonization.
- Focus on service selection is necessary. Projects on corridors and pilot implementations on a multinational level must be stressed, especially in the years after 2015.
- The evolution of cooperative systems will have a strong influence on the development of ITS. The program EasyWay provides an environment for the assessment and determination of the roles and responsibilities of road operators in relation to stakeholders in the private sector.
- More efficient integration of the secondary road network and multi-modal solutions require activation of additional resources and activities’ coordination, to ensure continuity of the services on urban and regional transport networks.

The activation of a multi-year research program on ITS could be a significant tool for putting the domestic industry in a position to meet the challenges posed by the services that the new technologies will make possible in the short to medium term, and by international competition. Nonetheless, it is important that the research plan provides solid monitoring and control of each research result, in order to achieve the objectives and maximisation of the investment.

### 4.3.4 Guidelines and proposals for the revision of ITS architecture in Austria

There are many aspects to be considered before comprehensive integrated ITS deployment can actually be achieved in Austria. Along with an appropriate political and organisational framework it is equally important to identify the requirements for the technical interoperability of ITS and align them, from small-scale to a transnational level. With the juxtaposition of regulatory instruments and real use cases with the detailed description of current national activities this report aims to support the further development of existing national ITS architectures.

One difficulty is that each European country has its own structure in terms of operators and responsibilities. For example, in Austria there is only one operator of the high-level road network (ASFINAG) and this company is owned by the state. Yet, there are also similarities in terms of stakeholders.

Using the FRAME Architecture supports a common approach within the European Union, thus constituting a step towards interoperability and integrated ITS. Due to the principles of subsidiarity, no technological or organisational structures are mandated. FRAME can therefore be used by anyone within the European Union, without preference to any specific
4.3.5 Guidelines and proposals for the revision of ITS architecture in Greece

Indicative actions that would promote interoperability of ITS systems within and across the SEE countries are:

- Establish a solid political framework and perhaps a regulatory framework. The challenge is to convince individual/private ITS developers to adopt technical solutions that are nationally integrated.
- Promote transnational cooperation among SEE countries through established and dedicated to ITS governmental agencies. This cooperation could include exchange of best practices, exchange of skilled in IT personnel, etc.
- Define requirements for technical interoperability (i.e. standards) and investigate actions towards their implementation in each country.
- Adopt FRAME (with participation of all ITS-related stakeholders) that would serve interoperability on both a national and European level.
- Formulate transnational research and development programmes that will promote ITS implementation based on solid architectural frameworks and according to the ITS needs of each country. Strong participation of industrial partners (mainly technology providers) is a decisive factor to the success of ITS deployment.
- Organize workshops, training seminars and campaigns in the SEE countries that will inform the key ITS users about the benefits from the adoption of interoperable ITS applications.

The current project activity in Greece aimed at setting the basis for a national ITS Architecture, by investigating the User Needs for national ITS, through a questionnaire survey dedicated to that purpose. These User Needs were mapped against specific functions of the European Framework Architecture (FRAME), thus resulting in the functional context that is proposed for the national ITS Architecture.

Although this report provides a preliminary analysis that can be used towards the formulation of a Greek national ITS Architecture, further steps are needed for that purpose (mostly initiated from a high level, i.e. from the Ministry of Development). As examples, the following are mentioned: definition of the Data Flows (linking the functions to each other); provision of recommendations for standards and best practices that could be used during implementation, etc.

The FRAME architecture provides a solid ground for the formulation and establishment of a national ITS Architecture, but, most importantly, it well serves the purpose of achieving ITS interoperability between European countries.

4.3.6 Guidelines and proposals for the revision of ITS architecture in Hungary

Like other European countries, Hungary has also had to face the challenges posed by “technological islands”, ITS developments as separated blocks. It was the decision to tackle this problem that gave birth to the national and international framework architectures. However, HITS could fulfil its purpose only after the preconditions listed below (and in the next chapter) were in place:

- national and international financial, technical and/or official support;
- fluent updating of ITS-related content;
- country-level dissemination of the results and methodology;
- integration and cooperation with the national ITS strategy and local ITS Master Plans.

Finally, the HITS architecture could help maintain the network structure of existing TCC and TMC mentioned earlier, and national level applications, for example the KIRA\(^5\) (defined below). The connection between new and planned systems would be planned in the long term. These elements could be the base of the national Physical Architecture (PA) that is the first and most important step to creating interoperability between all ITS of Hungary.

KIRA is a new national database whose fundamental function is to solve connection and communication issues between online data collection roadside units and ITS systems developed in Hungary, and to provide them with a unified digital transportation network map and reference data. KIRA implements a unified spatial data management and metadata serving in the transportation sector, according to the EU INSPIRE directive, with the power of publishing collected information through the web.

Besides national road and highway management companies, the system serves as a platform for Budapest and also other large municipalities to publish transportation

\(^5\) Közlekedési Információs Rendszer és Adatbázis – Information System and Database of Transport
HITS Framework Architecture is a very useful application and a tool that will help solve the problems listed above. Continuous upgrades would be necessary to reach widespread deployment of the architecture and to make it more attractive, user-friendly and familiar for decision makers. To reach this goal, the following are suggested:
1. Upgrade and update of the background databases and elements of HITS;
2. Upgrade of the HITS Selection Tools (e.g. UML diagram making, excel or other output form);
3. Upgrade of the website with new results and developments;
4. Long term financial support for maintenance and dissemination;
5. Support team for every day users;
6. Methodology-handbook to inform more levels of decision makers;
7. Wide dissemination of the HITS results.

4.3.7 Guidelines and proposals for the revision of ITS architecture in Bulgaria

The ability to integrate systems greatly increases their potential. By complying with the European ITS Framework Architecture, not only will applications work together, but they can be made interoperable at a European level, a feature of growing importance.

Interoperability encompasses the technical, operational and organisational aspects, and implies the harmonious and complementary functioning of the overall systems. Thus far, in Bulgaria, there has been no experience regarding the implementation of ITS systems and therefore no development of the National ITS Architecture. Development of ITS National Architecture will become a tool for planned development and deployment of ITS solutions for both governments and businesses.

Using the experience of other EU countries is an important and useful tool for accelerating the time needed to develop ITS architecture (in countries such as Bulgaria and reflect the best practices in EU).

4.3.8 Guidelines and proposals for the revision of ITS architecture in Romania

The following actions have been identified as being the most important:
- Extension of the architecture up to the design level of ITS systems, not only on a strategic level;
- Education and training activities on ITS Architecture;
- An integration of urban and interurban ITS Architecture;
- Common ITS Architecture for all European countries (ex. FRAME) could ensure the interoperability between countries in terms of technical approach and could be an instrument for political and economic understanding of the interconnection of ITS systems between countries;
- Deployment of road corridors, as well as multimodal corridors, among different member states in Europe could provide an opportunity for developing interoperable systems.

The European ITS Architecture could improve the quality of transport services, generally speaking, and the efficiency of ITS deployment, specifically. The context diagram could provide a first step for interoperability through identification of the links between the ITS system and any other system. A detailed architecture, mainly based on the same European architecture for both interurban and urban roads, could create the proper environment for ensuring the interoperability between systems, organisations and countries to provide, finally, continuity of ITS Services on TERN.

4.3.9 Guidelines and proposals for the revision of ITS architecture in Slovenia

Ensuring the interoperability of national and EU ITS is a lengthy process, especially for systems and services with a long tradition. The basic solution, at this stage, is an all-European communication platform or device in the vehicle, which contains the functionality of the various national systems, while respecting different European directives (2004/52/EC, for example), and the standards and results of various European projects (eCall case). Depending on the vehicles/personal devices used for services in the transport chain, appropriate infrastructure should be adjusted. This will provide the technical aspect of interoperability. To achieve compatibility, interoperability and continuity, it will be necessary to upgrade national ITS architectures and requirements for their acceptance. There is the need for their promotion to stakeholders who were not included in the process of design. In this way, we will achieve a certain level of so-called organizational interoperability.

While the benefits of ITS are relatively well known, the problem tends to be with site financing and business models. Usually, there is no regulation that would be committed to individual operators, infrastructure managers or service providers who implement the service. As a result, the systems are not interregionally integrated and not interoperable at all. Consequently, users do not take advantage of ITS and have an aversion to the use of ITS.

Since SITSA-C is a "growing" process, it would be sensible to continue with its implementation. The methodology or the approach of is described below:
1. To upgrade the list of user needs or to use the list of needs of currently lower priority.
2. To define elements of physical architecture (traffic management centres, on-board systems, road-side infrastructure, etc.) and their precise allocation (unified architectural plan).
3. To evaluate the quality of the types and capacities of communication interfaces (media).
4. To present the technology available on the market (main features and selection criteria) that agrees with the communication requirements.
5. To prepare warnings about possible modality of service operationalization (e.g. tolling can also serve as traffic data collection).
6. To present or bring closer the currently used applicable norms as well as the existing solutions that are normally selected, applied according to the identified communication interfaces.
7. To present or bring closer the applicable legal acts (standards, directives, acts, guidelines, etc.) presenting the legal framework of ITS.
8. To prepare up-to-date web pages for the popularisation of the ITS architecture or to interconnect the prepared web pages with continuity of ITS architecture management by a special (audit) legal body.

Considering the functional, physical and communication ITS architecture, the allocation of physical units shall be prepared: i.e. subsystems and modules shall be allocated to individual organisations (legal bodies) - managers. Unfortunately, ITS is still poorly defined in the Slovenian legislation, which is why the area of organisation needs much more attention.

The purpose of the SITSA-C project was to elaborate a proposal of the Slovenian ITS architecture. And this was achieved. The second main goal, to increase the awareness of the interested public about what ITS has achieved was, however, only partially realised. Accordingly, the work in the area of the national ITS architecture shall continue. At the same time, the public will be informed about the advantages offered by the ITS architecture itself and ITS in general. In other words, a campaign of raising awareness about ITS and ITS architecture shall be launched again in a more sustained fashion. SITSA-C represents the groundwork for the development and introduction of ITS on the level of individual towns (e.g. City of Ljubljana).

4.3.10 Guidelines and proposals for the revision of ITS architecture in Italy

In 2003, the Ministry of Infrastructure and Transport published the Italian Telematics Architecture for the Transport System (ARTIST), providing guidelines to ensure that ITS applications could be compatible, integrated and interoperable with each other and consistent with the European Architecture KAREN, albeit complex practical application.

The lack of common specifications and shared procedures has slowed the market for systems and services and increased a high fragmentation of the applications. The National Architecture ARTIST was a first important step towards amending this situation. Carrying out revisions and updates of the National Architecture to make it more usable is a clear priority, as well as promoting the dissemination and training activities.

A lack of coordination and organization emerges from the Italian situation, and this seems true not only when it comes to ARTIST, but also with reference to the whole sector of ITS in Italy. The ARTIST architecture has not been successfully disseminated and then not all the projects and initiatives are interoperable and based on ARTIST. At the same time, some problems seem to have been identified in the initial version that now has to be revised and updated.

Actions that can be taken in order to overcome these difficulties are:

1. Creating a board of coordination only for ITS

   It would be appropriate to set up a coordination table bringing together the various ministries with expertise in different fields of application of ITS (Ministry of Infrastructure, Ministry of Transport, Ministry of Environment, Ministry of Regional Affairs, Ministry of the Interior, Ministry of Innovation, Ministry of Economy, Ministry of Communications, Ministry of Economic Development and Ministry of Research), and representatives of the associations of local authorities (municipalities, provinces and regions).

   The overall coordination of this common table should be entrusted to the Ministry of Transport, in order to ensure the necessary interaction with the management committees of Architecture National ARTIST.

2. Establishment of a Technical Secretariat to support the Ministry of Transport to promote the use of ARTIST

   The application of ARTIST Architecture to different contexts is crucial in order to achieve a truly integrated transport network with the ITS. To promote the knowledge and application of ARTIST is therefore an urgent necessity so as to promote the full development of ITS in Italy, in order to enhance the market for systems and services in the short term.

   With the aim of accelerating the process of diffusion of the national architecture, the management and dissemination of ARTIST could be delegated to a technical support for the Ministry of Transport.

   This should take the form of a "technical secretariat", which would undertake the following:

   - ARTIST’s dissemination to as wide an audience as possible;
   - communication of the results of national and/or local activities made on the basis of ARTIST (e.g. projects financed with PON funds);
   - maintenance and updating of the ARTIST website with the most recent versions, that will be carried out by an external body through special tender;
   - technical and financial support to local governments and to the managing bodies of the services and infrastructure, for the application of ARTIST in different contexts;
   - training of technicians and experts in the field who will have to implement the ITS
Architecture schemes, in close collaboration with the university.

**Provision of financing instruments**

A central coordination responsible for allocating funds to public administrations plays a fundamental role in ensuring, through the use of tools such as ARTIST, that investments go to the latest ITS technologies and interoperable solutions on a national and European level.

**Stimulate the use of ARTIST**

The Ministry of Transport should consider the possibility of developing some sort of ARTIST certification for ITS applications.

This could act as an incentive for local governments to adopt systems only compatible with ARTIST (for example, in notices compatibility with ARTIST should be identified as a matter of preference).

### 4.3.11 Guidelines and proposals for the revision of ITS architecture in Croatia

As a part of the European Union, Croatia needs ITS architecture to ensure interoperability with the architecture of other countries. In order to achieve the harmonization of the transport system with the European Union (which is one of the most important tasks), the Republic of Croatia should focus on the development of optimal ITS architecture with advanced interoperability. A possible solution is to take into consideration a wider approach – regional Southeast Europe ITS architecture. Such an initiative should propose guidelines for the revision of the existing ITS architectures in SEE countries.

Regardless of reduced organisational barriers to deploying ITS architecture in Croatia there is a problem of commercialisation of ITS services. There are no actions to commercialise ITS services through private or public initiatives. It is expected that these two spheres will have to join in the formation of services that can be presented as a marketable package.

Basic benefits to Croatia as a result of the development of ITS architecture include:

- Creation of national and regional vision for ITS;
- Identification and description of the major components required for planned systems and interfaces between them;
- Establishment of a framework for future development and upgrading;
- Creation of new connections to EU member states;
- Commercialization of ITS services and the creation of new jobs.

Planning ITS architecture does not only involve transport systems. Its implementation brings about economic, political, environmental and other benefits. With this in mind, one must take into consideration the following criteria:
5. SEE-ITS DEMONSTRATION ACTIVITIES
5. SEE-ITS DEMONSTRATION ACTIVITIES

One major objective of the SEE-ITS project is to implement ITS demonstrations through feasibility studies and through the development of interoperable traffic management and intermodal traveller information systems and services in seven areas of the SEE region.

The SEE-ITS demonstration activities aim to provide data for the impact assessment of ITS and for the quantification of their benefits. These results, at the same time, contribute to the cooperation, harmonization and interoperability of the ITS implementations in the SEE area, by allowing all relevant stakeholders to identify potential benefits and deployment prospects of similar and transferable ITS solutions in other cities, regions and countries.

Next, the role of demonstration activities in the development and deployment of ITS solutions are presented, providing a detailed description of the related activities within the SEE-ITS project. The main goal is to provide guidelines for demonstration activities and to describe in detail the seven demonstration implementations of the project.

5.1 Thessaloniki ITS pilot site

The focus of the pilot activities in Thessaloniki is on the provision of real time travel time for the most important routes of the city through internet, mobile-based applications and VMS panels. The travel time is estimated by an algorithm developed by CERTH-HIT for the provision of real time travel time using point-to-point detectors.

The detectors track MAC identities of Bluetooth equipped devices at predefined locations within Thessaloniki’s road network. The travel time estimation on the most significant routes results in the provision of traffic-related information to the drivers, who will make better decisions about their routes, since they will be informed, in real time, about the traffic conditions throughout the city.

A total of 45 Bluetooth detectors perform more than 3.6 million detections and 1000000 trips per week. The network of Bluetooth detectors has been carefully designed to provide reliable information for the most significant routes in Thessaloniki, taking into account the current mobility patterns of the city, in order to provide useful information to the maximum number of drivers.

The selected ITS service, related to the use of novel detection technologies for the provision of real-time advanced traveller information services is integrated into the already existing systems for mobility management in the city. The newly installed devices enrich the quality and quantity of data used, so that the information and routing services provided are more reliable.

5.2 Patras ITS pilot site

The focus of the pilot activities in Patras is similar to that of Thessaloniki, providing real time travel time for central routes of the city through various communication channels. Travel time estimation is performed by the algorithm developed by CERTH-HIT.

As in the pilot of Thessaloniki, the expected impact of the information provision is the reduction of congestion on the most significant routes within the city centre, providing information to the travellers about traffic congestion on alternative routes at the critical decision points of the city.

The selected ITS services are based on Bluetooth technology and they were chosen because they are easy to install, with no need for specific permissions or allowances. It is the first ITS system in the city of Patras that aims to monitor the traffic in several routes in the city center. There are also similar projects that have been planned by the Municipality of Patras. In the near future, there are plans to complement the pilot service of SEE-ITS project with extra Bluetooth devices or communication services.

In a next stage, the Bluetooth devices are going to be integrated with a central system that will monitor their operation but also will collect all the traffic data in a central information system. This system will be able to communicate with other Traffic Management systems of the Municipality of Patras, exchanging traffic data, but also with CERTH-HIT, in order to use its travel estimation algorithms and related features.

5.3 Vienna ITS pilot site

The Vienna pilot site mainly covers the motorway intersection A2/A23-A4-S1, as well as the interface to the urban road network in the Vienna area with a length of about 45 km. These road sections are operated by the Austrian highways agency (ASFINAG). The site was originally created for the Austrian project “Testfeld Telematik” (telematic testing field), also used for the demonstration of cooperative systems at the ITS World Congress 2012. As A23 is the most heavily used motorway in Austria, with 180,000 vehicles per day (VCOE, http://www.vcoe.at/de/presse/aussendungen-archiv/details/items/vcoe-untersuchung-suedosttangente-ist-meist-befahrene-autobahn-oesterreichs-18032013), it is also more likely for users to experience traffic jams and related obstacles.

The cooperative ITS services demonstrated in the Vienna pilot site include in-vehicle
signage, hazardous location notification, traffic jam ahead warning, road works warning, park & ride information and Floating Car Data.

The in-vehicle signage service will inform drivers about dynamic road signs. The shown messages comprise the information displayed on variable message signs in the test area at A2/A23, A4, S1. The hazardous location notification service warns drivers about upcoming hazards, such as broken down vehicles, oil on the road, wrong-way drivers, or lost goods. This service allows warning the user also when there is no VMS or other warning sign deployed on the track. Therefore, the user can be warned in an effective way wherever a traffic jam is detected. The road works warning service informs drivers of road works on the route ahead. The purpose is to inform the driver in advance, so as to increase awareness and to inform them of potential dangerous conditions. The driver is also able to adapt the speed of the vehicle early enough. Additionally, the user is informed about the length of the road works section. When driving near the park & ride facilities in the test area, information on the availability of the park and ride facility as well the name of the exit leading to the park & ride facility is provided. With this information, the driver can, for instance, decide to switch to public transport in case of heavy traffic. The Floating Car Data service uses vehicles as sensors to provide information on the current traffic situation. The application sends periodically information on the current position and speed and transfers it to the SEE-ITS server. This data can be used, at a later stage, to improve the precision of traffic information. The users are also able to deactivate this service.

In previous projects, most of these services have been defined as day one use cases. Most of the selected services have a safety aspect, which is important for the Austrian Ministry and the Austrian motorway operator ASFINAG.

5.4 Hungarian ITS pilot site

The Hungarian pilot is implemented on the eurovelo-6 route, which crosses Pest County, as well as the whole country. Therefore, testing takes place in the area of Pest County and Danube Bend. The pilot service is a free end user smart phone application. The purposes of the application are to assist bikers’ navigation in the pilot area as well as to demonstrate the utility of the existing web services and databases. Eurovel-6 is one of the most popular cross European cycle routes. The Hungarian section is about 470 km long, running along the Danube from Rajka till Mohács.

Existing services and databases are utilized by the Hungarian pilot, such as KIRA, National Transport Information System and Database, KENYI, the National Bicycle Road Database and the Public Transport module of KIRA.

5.5 Sofia ITS pilot site

The Dragichevo Roundabout is located 15 km to the south-west of site candidate two - South Ring of Sofia south-west part and 1 km away from the east part of the neighboring town of Pernik. It is heavily used by commuter traffic and is on the Trans-European network E79, E871, A3 and A6 highways.

Four Bluetooth sensors are installed on each entry/exit of the roundabout mounted on the poles of the street lighting. The Bluetooth channel is used for data transmission for a limited amount of data; the channel is efficient and cost effective. With a significant percentage of the passing vehicles providing a Bluetooth signal the sensors will provide highly accurate traffic information. Based on the Bluetooth technology, travel times and speeds are estimated and stored in the cloud. Subsequently, travel times are displayed on Google Maps.

5.6 Romanian ITS pilot site

The Romanian pilot focuses on Multimodal Traveler Information Services. The actual implementation consists of a web-based journey planning application involving information about the following modes:
- Public transport
- Urban and inter-urban road transport
- Railway transport
- Inland waterway transport

The pilot-implemented services follow a corridor approach starting from a location in Timisoara and ending at a location in Constanța, as depicted in the figure below.

A web-based application allows the user to receive information about travel times on the selected corridor at any time, using different combinations of transport modes. The application provides real-time data. However, if real-time data becomes temporarily unavailable for a certain mode of transport, then static data can be used.

5.7 Emilia-Romagna ITS Pilot Site

The piloted solution in Emilia-Romagna monitors the DG transport flows using the Highway network in correspondence with the ‘Bologna node’ – Emilia Romagna - Italy. Bologna is, in fact, an important crossroads of the north-south and east-west road transport
axes, as it links South and North of Italy but also eastern Adriatic with the Western Tyrrenian seaborne. Specifically, the Bologna node is the point of meeting of the highways A14, linking northwest with southeast Italian territory (Bologna - Taranto), A1, linking north with south of Italy (Bologna – Milano and Bologna - Napoli) and A13, linking Bologna to Padova

The technological solution monitors the flow of trucks transporting dangerous goods passing through the Bologna node. The solution detects and distinguishes between two types of traffic: the DG traffic crossing the node and that which has its origin or destination in the node. The focus of the intervention is based on the individualization of the trucks transporting DG goods, which are recognizable by the orange panels they exhibit as requested by ADR European normative. In fact ADR (formally, the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)) is a 1957 United Nations treaty that governs transnational transport of hazardous materials. In practice, ADR imposes that vehicles carrying dangerous goods have to be fitted with orange signs, where the lower number identifies the transported substance, while the upper number is a key for the threat it may pose. Therefore, specific optical recognition systems (OCRs) can be the solution, as they scan the orange panels’ information. The optical recognition of such codes means knowing (1) the type of substance transported and (2) the risks occurring. At the moment, this information is not known by regional key players, since a dedicated ITS system does not yet exist.

The selection for this ITS solution is indeed to bridge the gap of a complete absence of a regional dangerous goods transport management systems.