eMaPS

eSafety Digital Maps
Public Private Partnership
Support Action

D2.32	Report on standardisation activities of ROSATTE framework

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Author(s)	Trond Hovland, Kees Wevers		
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Abstract	In order to be accepted, the ROSATTE specifications will need to go through standardization. This task will first issue a plan for the standardization of the ROSATTE specifications and a monitoring of the activities. The standardization activities are not directly funded in this support action as other funding mechanisms exist. This task is led by NPRA, with support of Tele Atlas. The deliverables are D2.3a planning and D2.3b reporting of the standardization activities.

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Coordinator	Trond Hovland, Norwegian Public Roads Administration Tel.: +47 907 60 831, E-mail: trond.hovland@its-norway.no

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1 Introduction

This deliverable is a result of task WP2.3 "Monitoring of standardisation activities". It is one of the tasks under WP2 "eSafety Digital Maps Working Group". The name of this WP relates to the chosen structure to "reconstitute the *eSafety Digital Map Working Group* activities under the eSafety Forum which will act as Steering Committee for the implementation platform" (eMaPS Description of Work [1], S&T objective 1). Under the umbrella and with the guidance of the Digital Maps Working Group (DMWG, eventually under the iMobility Forum, the new name of the eSafety Forum) various activities were to be carried out by the eMaPS partners in preparation of the ROSATTE Implementation Platform. One of these activities was the initiation of standardisation activities, related to the ROSATTE exchange framework, as described in S&T objective 4 in [1]: "Initiate and monitor standardisation procedures of the ROSATTE framework".

The background for this work is mentioned in Section 1.1.1 of [1], as follows: "In order to be accepted, the ROSATTE specifications will need to go through standardisation. This task will first issue a plan for the standardisation of the ROSATTE specifications and a monitoring of the activities. The standardisation activities are not directly funded in this support action as other funding mechanisms exist. This task will be led by NPRA with the support of TA. The output will be D23a and D23b." In [1], deliverable D23a is named "Plan for standardisation activities of ROSATTE framework", and deliverable D23b is named "Report on standardisation activities of ROSATTE framework". The final version 1.1 of D23a was published on 15 January 2012 [2].

This deliverable is written at a stage at which the "ROSATTE Implementation Platform", under its new name "Transport Network ITS Spatial Data Deployment Platform" (TN-ITS for short) was already established, and is in the process of starting up its activities. The deliverable describes the current status of the (initiation) of the standardisation activities. These activities were prepared during the eMaPS project, and are currently being further progressed under TN-ITS.

It seems that the original plan was that the standardisation activities would already start during the eMaPS project, although these would not be carried out within, and funded by the project (see above, no funding for standardisation activities was foreseen in the project budget). The remit of task WP2.3 was to initiate and then monitor and report on the standardisation activities. The reality is that these activities were somehow prepared, but did not really take off before the start of TN-ITS.

2 Background

2.1 Exchange of ITS spatial data

The concept of the ROSATTE data chain evolved from work in the EU-funded project PReVENT/MAPS&ADAS (February 2004 - January 2007) on safety-related road attributes for ADAS applications, and work in the EU-funded SpeedAlert project (May 2004 - June 2005) on speed limit information in digital maps. ITS applications for enhancing safety, efficiency and comfort of road transport require a highly up-to-date road network database. It was realised that for keeping their map databases up to date, map providers need to cooperate closely with road authorities. Once a road authority stores and maintains its road network data in a digital system, retrieval of any changes entered would be straightforward, and the map providers (and other road data users) could receive immediate updates. See Figure 1 for the data chain as it was envisaged at that time. The concept of a data chain from public road authorities to providers of digital maps for ITS applications was further elaborated in the EU-funded ROSATTE project (January 2008 - June 2010).

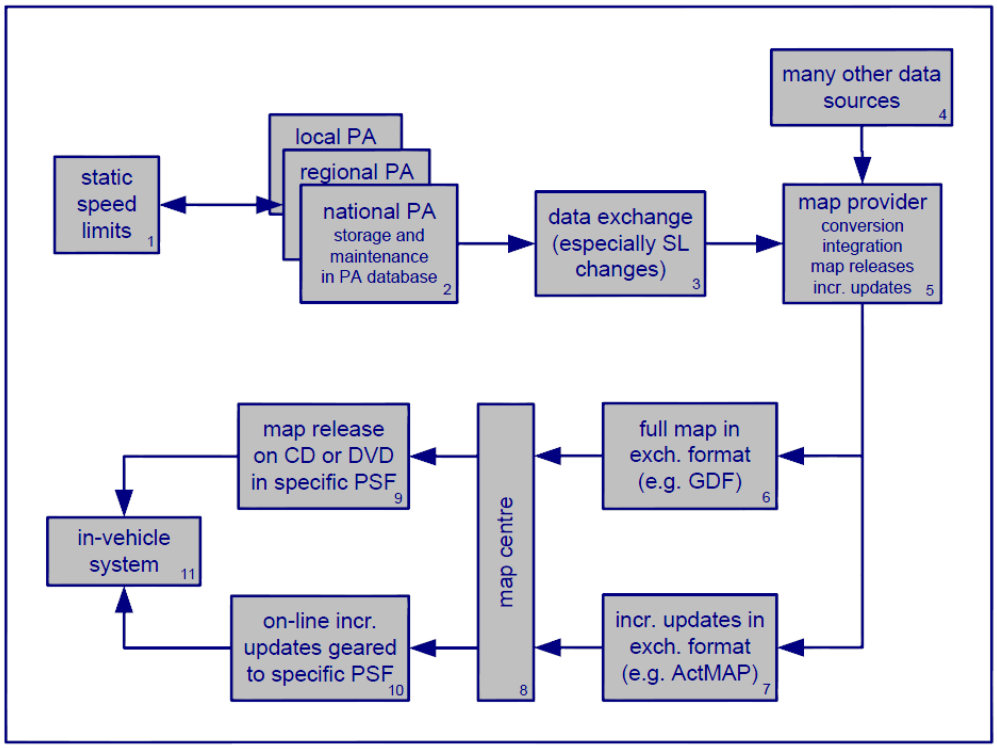

Figure 1 - The data chain for static speed limits as envisaged in the SpeedAlert project. Source: [3].

The ROSATTE project aimed at establishing an efficient and quality-ensured supply chain for information on safety-related road attributes, from public authorities to commercial map providers and other road data users, with a focus on changes in the concerned attributes rather than full data sets. This concerns explicitly static road side information, i.e. road attributes that are of a more or less permanent nature, and not dynamic information, for which other

channels are being used. The basic thought behind ROSATTE was that for information on changes in static road attributes, the public authorities, who create the changes, are the most efficient and immediate source.

Prerequisites for setting up such a data chain are adequate systems and databases (ICT/GIS), and procedures for data maintenance and quality at road authorities, and an adequate common data exchange infrastructure for extracting and publishing the information on changes (updates), able to cope with the multitude of systems and data models that are and will be in use on the side of public authorities across Europe. ROSATTE worked on both topics, and especially developed, specified and tested an exchange infrastructure.

2.2 The ROSATTE exchange framework

As the digital systems used on the side of road authorities will be diverse in nature (in terms of GIS and data model), a harmonised approach is needed. Such approach was developed and tested in the ROSATTE project. The resulting ROSATTE exchange framework is described in the project deliverable D 31 "Specification of data exchange methods" [4], one of the main results of the project. The core part of this document provides the specification of a mechanism for data exchange of road safety information, which consists of the following components (see also Figure 1):

- A conceptual specification of the data content (the information model), using UML (pack-ages, class diagrams, attributes, associations and OCL constraints); the data content specification is organised in a number of packages where each package corresponds to a separate subset of the ROSATTE domain.
- A physical exchange format (structure and coding using GML schema) to specify a coding for the various types of data listed under the conceptual model.
- A service specification, using UML class diagrams, in order to facilitate the actual data flow between the various actors within ROSATTE; this service specification is inspired by the INSPIRE network services architecture.

Figure 2 depicts the conceptual and concrete levels of the ROSATTE data exchange framework, as part of the whole data chain.

The exchange has two major elements, similar as in any traffic information messages: content and location, or, more colloquial, what and where. The content concerns the updated value and parameters of an existing road attribute (e.g. a traffic sign), or the value of a newly installed attribute. The location relates to the position in the road network of the attribute. For conveying position, a method of location referencing is used.

The specification were extensively tested in the ROSATTE project for the intended data exchange of map updates for safety attributes from public road authority map databases in several test sites across Europe to the two commercial providers of digital map databases for ITS applications. The validation of the ROSATTE results showed that the developed exchange format and infrastructure work properly and that road safety features can be exchanged almost real-time. However, it also showed that the location referencing methods that were tested are not sufficiently adequate for the ROSATTE purpose. As location referencing methods are not defined by the specification, but only used by the specification, the result concerning location referencing does not hamper standardisation of the specification.

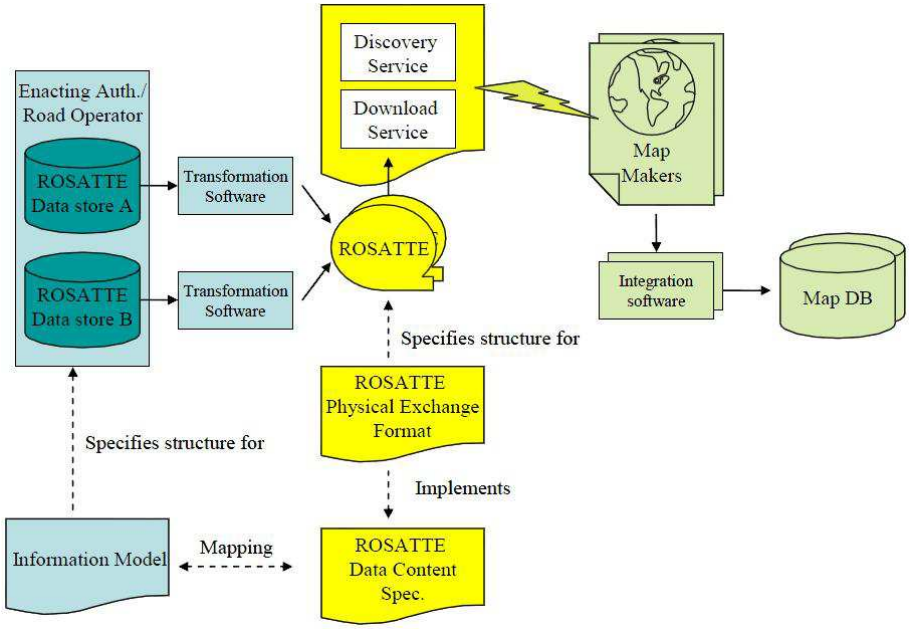

Figure 2 - Conceptual and concrete levels of the ROSATTE data exchange framework. Source: [4].

Another outcome of the ROSATTE project was the proposal to establish a ROSATTE Implementation Platform in order to facilitate Europe-wide roll-out and implementation of the proposed data chain using the technology developed in the project.

2.3 ITS Action Plan and ITS Directive

The proposed data chain for updates of road attributes directly relates to priority actions 1.2 and 1.3 of the ITS Action Plan, published December 2008 [5]. These actions are as follows:

Action 1.2
Optimisation of the collection and provision of road data and traffic circulation plans, traffic regulations and recommended routes (in particular for heavy goods vehicles).

Action 1.3
Definition of procedures for ensuring the availability of accurate public data for digital maps and their timely updating through cooperation between the relevant public bodies and digital map providers, taking into account the results and recommendations of the eSafety Digital Maps Working Group.

The ITS Action Plan is an important driver for the implementation of the results of the ROSATTE project. The ITS Directive [6] provides the legal basis for the implementation of the ITS Action Plan.

2.4 The INSPIRE Directive

Another important pillar for the implementation of the proposed data chain is INSPIRE, the "Infrastructure for Spatial Information in the European Community". The basis for this infra-

structure is the INSPIRE Directive [7]. The main purpose of INSPIRE is to support Community environmental policies, and policies or activities which may have an impact on the environment. The infrastructure will be based on the infrastructures for spatial information established and operated by the 28 Member States of the European Union. The Directive addresses 34 spatial data themes needed for environmental applications, with key components specified through technical implementing rules. INSPIRE is jointly coordinated by the EC Directorate General (DG) Environment (acting as the overall legislative and policy co-ordinator of INSPIRE) and the EC Joint Research Centre (JRC; also having the status of a DG; acting as the overall technical co-ordinator of INSPIRE). (*source: INSPIRE web site*)

The technical implementing rules are the INSPIRE specifications. The theme Transport Networks (TN) is relevant for TN-ITS. There is an interest from the side of the JRC for (exemplary) implementations of INSPIRE in other areas, not directly related to environmental issues, and for that reason JRC intends to actively support the TN-ITS standardisation activities.

2.5 Recommendation to align ROSATTE with INSPIRE

In December 2011 a study on Action 1.3 of the ITS Action Plan was published, commissioned by the Directorate-General Mobility and Transport (DG MOVE) of the European Commission, with the aim "specifying the minimum road data requirements and possible procedures for the publication of public road data". [8] Several of the recommendations of the report concerned alignment of the proposed data exchange with INSPIRE. In view of the complexity and diversity of the road data value chains across Europe with respect to collection, aggregation and publication, the organisational approach of INSPIRE is recommended. On a technical level it is recommended to adopt the ROSATTE specification for coding road data as an extension to the INSPIRE Transport Network Specification, to be referred to as the TN-ITS specification.

Furthermore it is recommended that the proposed ROSATTE Implementation Platform "should serve as a forum to discuss, plan and support the implementation of the TN-ITS specifications by Member States and the Digital Map providers. It should also serve as a forum where future road data needs of the users of digital maps - private and public - can be discussed and anticipated, and where the development of coding methods and quality levels for new data types are initiated. The ROSATTE Implementation Platform will act as Spatial Data Interest Community on ITS (SDIC-ITS) within INSPIRE." [8] It should be noted that to some extent the ROSATTE specification was already in alignment with INSPIRE, as the proposed service specification is based on the INSPIRE Directive.

2.6 Progress after the ROSATTE project

After the project the concept for the ROSATTE data exchange infrastructure was further progressed in the revived Digital Maps Working Group (DMWG) of the eSafety Forum, now named iMobility Forum, and the EU-funded eMaPS project (an EU-funded Support Action) [1], both running September 2011- May 2013. Important tasks were the creation of the ROSATTE Implementation Platform, and preparation of the standardisation activities. In view of the above-mentioned recommendation it was decided to align the intended data exchange with the existing INSPIRE spatial data infrastructure and services for data publishing and data discovery, and therefore to embed the ROSATTE exchange specification in INSPIRE as an extension for ITS spatial data of the theme Transport Networks (TN), while

adding elements that are essential for ITS spatial data but not currently offered by INSPIRE, such as maintenance of the data, quality control and location referencing. This lead to the new name TN-ITS for the ROSATTE data exchange infrastructure.

In the framework of the eMaPS project, four studies were carried out. Two of the studies concerned the alignment with INSPIRE, respectively from an organisational and legal perspective [9], and from a technical perspective [10]. The other two studies concerned, respectively, quality requirements for the data exchange [11], and georeferencing methods (location referencing) [12]. All of these four studies are somehow relevant for the standardisation process.

2.7 TN-ITS

In line with and support of Actions 1.2 and 1.3 of the ITS Action Plan of the European Commission [5], and to enable the Europe-wide roll-out of the TN-ITS data exchange infrastructure, the "Transport Network ITS Spatial Data Deployment Platform", or "TN-ITS" for short, was created, gathering all parties constituting the data chain, especially ITS spatial data providers (public road authorities and other road operators) and ITS spatial data users (providers of ITS digital map databases and other parties bringing these data by means of applications to the end users). TN-ITS is an association under ERTICO - ITS Europe, and was formally established on 5 June 2013 at its inaugural General Assembly held in Dublin, Ireland [13]. Current members include the road authorities of Norway, Sweden, Finland, Flanders, Ireland and the United Kingdom, and the map providers TomTom and HERE (former Nokia/NAVTEQ).

The objective of TN-ITS is described in its Terms of Reference [14]: "The objective of the Association is to give support, on a permanent basis, for the implementation of priority actions 1.2 and 1.3 of the "Action Plan for the Deployment of Intelligent Transport Systems in Europe" of the European Commission (for short "ITS Action Plan") of 16 December 2008, as published in document COM(2008) 886 final/2 of 20 March 2009 (corrigendum to the original document)." In more general terms it can be said that the mission of TN-ITS is to foster a harmonised pan-European approach for the exchange of road network ITS spatial data by providing a standardised exchange infrastructure for such data, and by providing road authorities and road data users with a platform to join forces and exchange ideas on the topic of the exchange of such data.

Most of the activities of TN-ITS will take place within its working groups. TN-ITS currently has five working groups. The working groups most relevant for standardisation are WG 1 - Location referencing, and WG 2 - Specifications and standardisation.

3 The TN-ITS standardisation approach

3.1 Introduction

As mentioned before, most of the activities of TN-ITS will take place in and through its working groups. For standardisation this is WG 2 - Specifications and standardisation. Standardisation concerns especially the transformation of the deliverable D3.1 of the ROSATTE project, the so-called ROSATTE specification [4], into a formal standards document. For a short description of this specification see Section 2.2. The standardisation approach that was chosen in TN-ITS is like a road with two parallel lanes, that is to say, it actually consists of two approaches that will be developed in conjunction, and that are expected in essence to lead to the same or a highly similar result, but from slightly different perspectives. For the normative part, the result should be identical.

The standardisation process as it is foreseen within TN-ITS is depicted in Figure 2.

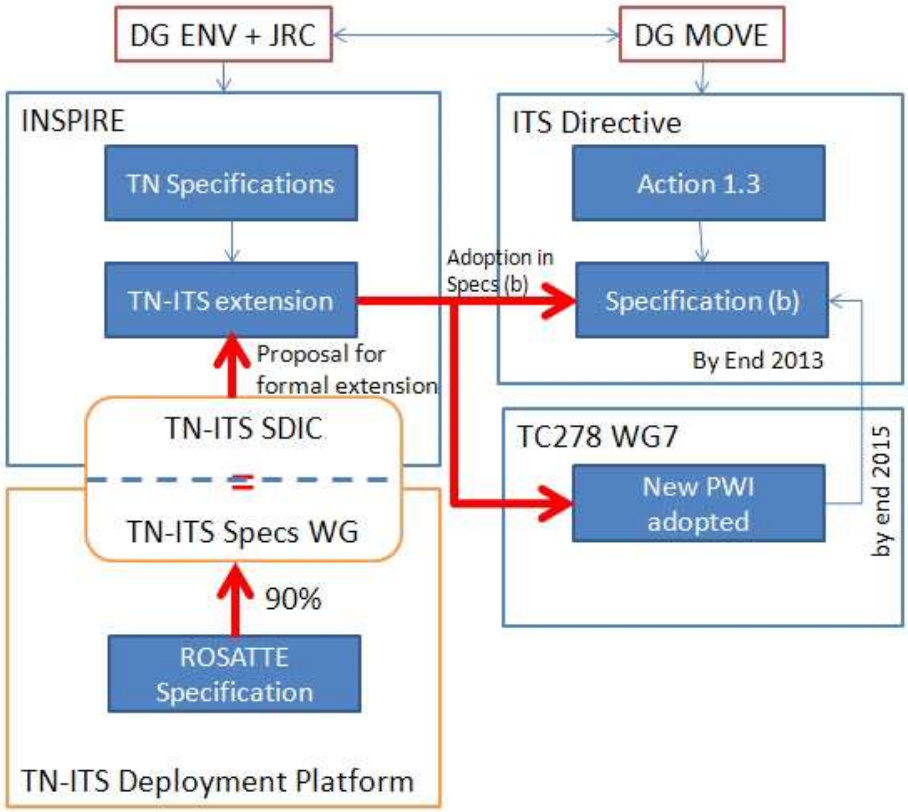

Figure 2 - The standardisation process in TN-ITS. Source: Maxime Flament, ERTICO; adapted version of 17-10-2013. For an explanation, see the text.

3.2 The INSPIRE route

On one side the plan exists to define the specification as an extension of the INSPIRE theme Transport Networks, by adding elements that are essential for ITS spatial data but not currently offered by INSPIRE, such as maintenance of the data, quality control and (the use of) loca-

tion referencing. The INSPIRE document that describes the theme Transport Networks, the "INSPIRE Data Specification on Transport Networks" [15] is qualified as a guideline, which "contains detailed technical documentation of the data specification highlighting the mandatory and the recommended elements related to the implementation of INSPIRE. The technical provisions and the underlying concepts are often illustrated by examples. Smaller examples are within the text of the specification, while longer explanatory examples are attached in the annexes. The technical details are expected to be of prime interest to those organisations that are/will be responsible for implementing INSPIRE within the field of Transport Networks." [15] As a specification it seems less formal than for instance a CEN Standard or Technical Specification, and, as stated in the document, it "does not represent an official position of the European Commission, and as such can not be invoked in the context of legal procedures."

For the INSPIRE related work on the ROSATTE specification, an INSPIRE Spatial Data Interest Community (SDIC) "Transport Network ITS Spatial Data" was created early 2013. The SDIC has not yet become active. Note that the intention is to use the SDIC as the INSPIRE standardisation group, and not in the way as proposed in [8]: "The ROSATTE Implementation Platform will act as Spatial Data Interest Community on ITS (SDIC-ITS) within INSPIRE." (see Section 2.5, second paragraph).

To strengthen ties with INSPIRE and the JRC, the custodian of INSPIRE, a meeting was held on 10 September 2013 between representatives of the JRC and TN-ITS. The JRC repeated its intention, already expressed at the ITS Committee meeting held in Brussels on 20 June 2013 in Brussels, to actively support TN-ITS by playing a role in TN-ITS WGs 1, 2 and 5.

3.3 The CEN/TC 278 route

Besides alignment with INSPIRE, formal standardisation of the ROSATTE specification is sought through the CEN standardisation process. For this already several steps have been taken. A proposal for a new preliminary work item (PWI) was submitted to CEN [16]. The scope of the PWIP is as follows:

> "Specification of a framework for an efficient and quality-ensured supply chain for information on safety-related static road attributes, from public authorities to commercial map providers and other road data users, with a focus on changes in the concerned attributes rather than full data sets. Preliminary work was carried out in the EU-funded ROSATTE project. The intended framework will consist of the following parts: (1) a conceptual specification of the data content (the information model); (2) a physical exchange format to specify a coding for the various types of data listed under the conceptual model; (3) a service specification to facilitate the actual data flow between the various actors. The specification will be aligned with INSPIRE as an extension for ITS spatial data of the theme Transport Networks, while adding elements that are essential for ITS spatial data but not currently offered by INSPIRE, such as maintenance of the data, quality control and location referencing."

The PWI was adopted by ballot [17], with 15 votes Yes, and two votes No casted. The following comments were provided:

> *France* (voted Yes) - France noted down the proposal which can be linked with the 2010/40 directive. However it seems to create a link between this initiative and the ongoing work on the priority action b whereas this link does seem neither obvious nor desira-

> ble. The focus should be more set on exchange between actors and not on provision by the road authorities. Moreover by only taking static elements into consideration and then ignoring real-time data (through mechanisms like DATEX II), France considers this proposal as not in the current trend but rather outmoded.
>
> *Germany* (voted Yes) - The proposed CEN work must ensure that the final standard will generate no obligation for road administrations to supply any information. The basis of the CEN work should solely be the INSPIRE directive, but not the deviating results of the ROSATTE Project.
>
> *Switzerland* (voted No) - Abstains due to no reply from national experts. How we can vote with abstain if we get no response from the national experts. But there is no way to do this?
>
> *United Kingdom* (voted No) - No UK interest.

For hosting the new PWI, two options were identified: the dormant WG 7 "Geographic Data Files" or the active WG 8 "Road Data". Although the name of WG 8 seems to indicate that this would be an appropriate place for the PWI, the disadvantage is that WG 8 mainly deals with dynamic ITS data related to the road network, while the TN-ITS work and the ROSATTE specification are only concerned with static data as present in the digital map database representing the road network. A disadvantage of a choice for WG 7 was clearly that it was dormant.

To avoid confusion, and after a discussion between representatives of CEN/TC 278 (TC Chair and WG 8 Convener) and TN-ITS (President), the choice was made to re-activate WG 7. A proposal for this was submitted to CEN/TC 278 [18], and adopted at its Plenary meeting held on 12 September in London [19]. At the Plenary also the name of WG 7 was changed to "ITS spatial data" [19]. During this agenda item at the Plenary, the following comments were made from different delegations [19]:

> "The Norwegian delegation recognizes that there is a need for this work. However, they wonder if the topic should be globally harmonized and involve TC 204 as well. Kees Wevers recognizes that the work is also relevant outside Europe and mentioned that the topic and this initiative was discussed with experts from TC 204, but there was no strong request for harmonizing TN-ITS on a global level at this time."
>
> "Mr. Dominique Descolas, WG 3 convenor, mentioned that the topic 'spatial data' is also used in the NETEX standards developed by WG 3. Crosscutting with WG 3 is therefore recommended."
>
> "The UK delegations requested working group 7 to expands its scope and not limit it to the scope of the adopted preliminary work item."

In addition, in answer to the first comment, especially the European specifics of the ROSATTE/INSPIRE approach make standardisation via CEN at this stage much more adequate.

The proposed standardisation action is made in relation to the "2010-2013 ICT Standardisation Work Programme for industrial innovation" of the European Commission, second update of 2012 [20], especially Section 4 on priority domain "Intelligent Transport", sub-section "Required standardisation actions", item "Digital Maps":

> "The ESOs are invited to consider the need of producing standards and specifications for to the definition of procedures for ensuring the availability of accurate public data for digital maps and their timely updating. The ESO's are invited to follow-up the progress in this ar-

ea, including the necessary cooperation between the relevant public bodies and digital map providers, and to address any standardisation requirements stemming from this action, taking into account the results of previous activities (e.g., the research projects ACTMAP, FEEDMAP and ROSATTE) . The ESOs are also invited to take into account accessibility issues as mentioned at the e-Inclusion domain."

3.4 Static versus dynamic data

It should be well noted that there is a marked difference between static and dynamic data in this context. Static data concern all the content in a digital map, which has a more or less permanent character. But even static content may sometimes change. The TN-ITS exchange framework will provide information on such changes, which will then be incorporated in digital maps as (updated) static content. It will become part of the map database. Dynamic content on the other hand is highly volatile (temporary), will be distributed via different communication channels and protocols, and will generally not be integrated into a map database, but stored op top of and in relation to a map database, and will be discarded after use (after the validity time has ended or when superseded by newer dynamic data). Examples of dynamic data are traffic information, weather information. For the use of dynamic data in relation to a map database it is highly important that the (static information of the) digital map is up to date.

3.5 Three pillars, one and the same group

Both the INSPIRE route and the CEN/TC 278 route will be hosted by TN-ITS WG 2 "Specifications and standardisation". The idea is that the three pillars for the standardisation process, TN-ITS WG 2, the INSPIRE SDIC and CEN/TC 278/WG 7, will constitute one and the same group, in the sense that they will have combined meetings, although not necessarily all participants will be members of all three groups (especially membership of a CEN/TC 278 has formal requirements of being accredited through a National Standards Body). It is thought that in the end the document describing the extension to the INSPIRE theme Transport Networks, and the CEN Technical Specification to be developed, will be largely the same document, meaning that, apart from specifics required by the specific environment for which the document was prepared, the normative content should be largely the same.

3.6 Project team proposal

On 28 August 2013 a proposal for setting up a CEN/TC 278 Project Team for preparation of the ROSATTE/TN-ITS Technical Specification, which had been prepared and discussed with the CEN/TC 278 Secretariat (in a few iterations), and which had been extended by the Secretariat with the formal part, was submitted to the CEN-CENELEC Management Centre (CCMC) for further processing and submission to the EU with a request for funding. [21]

3.7 Liaisons

For its standardisation activities, TN-ITS intends to establish liaisons with relevant standards organisations. These concern especially ISO/TC 204/WG3 - ITS database technology, and ISO/TC 211 - Geographic Information/Geomatics. Formal liaisons will be established through CEN/TC 278/WG 7, which will be one of the pillars of the TN-ITS standardisation process.

On an informal basis, liaison with ISO/TC 204/WG3 has already been made. TN-ITS representatives (President and Secretary) met on 7 June 2013, during the ITS European Congress with four representatives of WG 3, including the WG3 Convener. Topics (of presentation and discussion) were the WG 3 PWI (preliminary work item) 19297 "Shareable Geospatial Databases for ITS Applications" (see the next section for a short description), and the plans concerning standardisation of TN-ITS. On 11 July 2013 the TN-ITS President attended a meeting of ISO/TC 204/WG 3, held at the Czech Office for Standards, Metrology and Testing (UNMZ) in Prague, and gave a presentation on TN-ITS, and its planned route to standardisation. Main topic of the meeting was the WG 3 PWI 19297.

3.8 ISO PWI Shareable Geospatial Databases

This section provides some background on the PWI 19297 "Shareable Geospatial Databases for ITS Applications" of ISO/TC 204/WG 3 [22]. The PWI was prepared and approved at the Plenary meeting of TC 204 held in Seattle, USA, 19 April 2013 [23]. The scope of the PWI is to "provide a new framework for accessing various geospatial databases in order to support ITS applications." The justification that is included in the PWI document provides some background information:

> "The advancement of telecommunication and database technologies has helped the introduction of new types of services such as indoor navigation and multimodal navigation deployed on rapidly proliferating mobile devices such as smartphones. These newly emerging services require geospatial databases that contain diverse and detailed content beyond the map databases used in current car navigations systems. A new database service framework that enables the usage and sharing, as needed, of geospatial databases can facilitate emerging ITS applications and services.
>
> The main objective of this standard is to provide a geospatial database service framework for facilitating new ITS applications that satisfy market needs. This framework aims to enable the development of reliable and efficient geospatial database services. Additionally, the standard will be designed to promote the interoperability of databases for both supplier and user environments.
>
> Adopting the standard can produce several benefits. New kinds of applications can be developed and launched in a shorter period of time, thanks to greatly enhanced interoperability of geospatial databases. ITS services can be enhanced as well by enabling access to additional content. The standard will enable data content providers and/or service centers to more easily share geospatial databases."

Some more background, and a figure are provided in an earlier document, where yet a different title was used: "Scalable Geospatial Databases for New and Emerging Applications". [24]

Based on the understanding so far, gathered from presentations and discussions (see the previous section) it can be concluded that although the ISO/TC 204/WG 3 PWI and the CEN/TC 278/WG 7 PWI seem to have some common ground, their scopes and purposes are also largely different. Both relate to geospatial data services, but where the WG 3 PWI is focusing on a framework for providing ITS applications access to different map databases, with, as it seems, on-the-fly integration and thereby enhancement of data from various sources, the focus of the TN-ITS/ROSATTE approach is on providing updates to map databases for ITS applications based on accurate recording of changes in the infrastructure, and immediate delivery to digital map providers fro inclusion in their map databases. In addition, the TN-ITS approach has a

strong Europe-specific component in view of its intended alignment with the INSPIRE infrastructure.

4 Location referencing

The geospatial information to be exchanged in the context of TN-ITS is related to real world locations on the road network, and needs to be referenced to this network. For this a robust location referencing method is needed, which permits encoding, transfer and decoding of the location information with a high degree of certainty. As any part of the network should be addressable, the location referencing method to be used should be flexible and dynamic. For this reason, map-based dynamic location referencing is the preferred approach.

From the results of ROSATTE it became clear that current methods for map-based location referencing, especially AGORA-C and OpenLR, which were mainly developed for traffic information, are sometimes insufficient for the intended data exchange, which requires high precision of location information. Initially in ROSATTE the AGORA-C method was used for location referencing. At a later stage also the OpenLR method was implemented and used in the tests.

The status of location referencing, in general, and more in particular with respect to the specific requirements of the intended data exchange framework, are well described in [12] and [25].

In Section 5 - *Final conclusions and prospects*, of ROSATTE deliverable D5.4 - *Aggregated test report including detailed test reports* [26], the following relevant description of this issue is provided:

> "Within ROSATTE both AGORA and OpenLR location referencing algorithms were used. In both cases satisfactory results could be obtained. The validation of non-functional requirements seems to confirm this conclusion but also makes clear that for superior requirements these methods might be not effective enough. Surely a field which might be of further interest to pursue at the proper time.
>
> Within the validation, the two non-functional parameters “geometrical accuracy” and “topological correctness” played a central role. From the success criteria in Section 2.6 can be seen, that the relocation of the road safety features in the receiving (map provider) map should achieve a geometrical accuracy of less than 50m. From the validation results can be seen that this requirement cannot finally be demonstrated in all test sites.
>
> The second important parameter, topological correctness, was firstly introduced in ROSATTE. It was important to assess not only whether the road safety objects follow the same route as their original, but also whether they are on the right side of the road or whether they were correctly integrated in the context of intersections (nodes) in the receiving map. It could be shown that also here, some problems remain.
>
> However, as can be seen from the test sites’ validation result analysis, the level of implementation of the available algorithms still can be improved. Secondly, the location referencing algorithms themselves need to be further assessed and improved using the results and experiences gained with their extensive use in ROSATTE as well as the defined validation methodology and parameters."

In TN-ITS, WG 1 will deal with the issue of location referencing. It will not necessarily develop something new from scratch, but it will study if the existing methods can be extended or enhanced. One of the options foreseen is to use elements from linear referencing. In any case

the band-width constraint that exists for location referencing for traffic information, is not relevant for the exchange in the ROSATTE (or TN-ITS) framework.

As mentioned before, the fact that location referencing is still an issue does not constitute a problem for the standardisation of the ROSATTE specification. The specification is transparent for the location referencing method that is being used.

5 Conclusion

Standardisation activities were foreseen to be initiated already during the eMaPS project. However, this did not materialise. A major outcome of the eMaPS project was the establishment of the ROSATTE Implementation Platform under its new name "Transport Network ITS Spatial Data Deployment Platform" or TN-ITS for short.

A study that was carried out in parallel to the eMaPS project on behalf of DG MOVE, concerning the implementation of Priority Action 1.3 of the ITS Action Plan. A key recommendation of this report was to align the specification for the ROSATTE framework, as developed in the ROSATTE project, with the INSPIRE framework. This recommendation was adopted. The ROSATTE specification will be developed into an extension of the INSPIRE theme "Transport Networks", while adding elements that are not currently provided by INSPIRE, such as offered by INSPIRE, such as maintenance of the data, quality control and location referencing. An ispire SDIC was created early 2013.

While the standardisation activities did not take of in eMaPS, several useful reports were produced that will provide a solid input for the standardisation process The topics of these reports were INSPIRE alignment, both legal/organisational and technical, quality aspects, and location referencing.

During the preparations for the establishment of TN-ITS, spring 2013, it was decided develop the ROSATTE specification as well to a CEN/TC 278 Technical Specification. A PWI was prepared and adopted, and WG 7 was re-established to host the PWI.

The idea is that the two routes will be complimentary, and that the resulting documents will be largely the same, and identical for the normative content. The standardisation activities of TN-ITS will take place in its WG 2. This will essentially be the same group as the SDIC and CEN WG 7. With all preparations it seems that TN-ITS is now well prepared for the standardisation process.

A separate topic, but highly important for the intended data exchange, is location referencing. This is related to standardisation, and standards and specifications exist. However the ROSATTE project showed that the result while using the current methods were unsatisfactory, and that some improvement is needed. TN-ITS WG has the important task to address this issue. The aim is to try to find solutions that do not require substantial new development.

6 Explanation of acronyms and other terms

AGORA Implementation of global location referencing approach

EU-funded project, duration October 2001-June 2003. The aim of the project was to adapt and further develop the approach taken in the previous EU-funded project on location referencing Evidence and implement the proposed universal location referencing method in real life applications, involving all major actors in the service/application chain. Source: project deliverables as they can be found on the AGORA web site.

AGORA-C Method for map-based location referencing

AGORA-C was developed based on the result of the EU-funded AGORA project, and first published in the AGORA-C specification [27]. The logical model of AGORA was substantially simplified, the number of encoding rules was reduced to 27 for the core part, and an efficient physical format was developed (partly based on the alternative compact format that was defined in the AGORA project, but never implemented). The name AGORA-C was nicknamed after the name ALERT-C used for TMC location referencing (ALERT being an acronym for "Advice and problem Location for European Road Traffic" [28], C indicating the third version). In tests the AGORA-C method demonstrated a hit rate above 98% and average code size below 40 bytes [29]. The specification became eventually part of ISO standard 17572 part 3, "Dynamic location referencing" [30]. The standard was substantially extended with elements that were not present in the core part of the original AGORA-C specification. Source: [25].

CCMC CEN-CENELEC Management Centre

Located in Brussels, the CCMC is in charge of the daily operations, coordination and promotion of all CEN and CENELEC activities. CCMC is responsible for handling the tasks assigned to it by both CEN and CENELEC General Assemblies, the Administrative Boards and the Technical Boards. CCMC is also responsible for correspondence and liaison with the services of the European Commission and the EFTA Secretariat. The CEN-CENELEC Management Centre is headed by the Director General of CEN and CENELEC, with a staff of some 80 people. Source: CEN CENELEC web site.

CEN European Committee for Standardization

CEN is a major provider of European Standards and technical specifications. It is the only recognized European organization according to Directive 98/34/EC for the planning, drafting and adoption of European Standards in all areas of economic activity with the exception of electrotechnology (CENELEC) and telecommunication (ETSI). CEN operates in a decentralised way through is 33 members, the National Standards Bodies of the EU and EFTA countries. Source: CEN web site.

CEN/TC 278 CEN Technical Committee 278 "Intelligent transport systems"

CEN/TC 278 is responsible for managing the preparation of standards within the field of Intelligent Transport Systems. Source: CEN/TC 278 web site.

CENELEC European Committee for Electrotechnical Standardization.

CENELEC is responsible for standardization in the electrotechnical engineering field. It prepares voluntary standards, which help facilitate trade between countries, create new markets, cut compliance costs and support the development of a Single European Market. Source: CENELEC web site.

CSA Coordination and Support Actions

Actions that cover not the research itself, but give support to activities aimed at coordinating or supporting research activities and policies (inter alia networking, exchanges, trans-national access to research infrastructures, studies, conferences).
Source: http://cordis.europa.eu/fp7/ict/fet-proactive/csa_en.html.
See also: http://ec.europa.eu/research/fp7/understanding/fp7inbrief/funding-schemes_en.html.

DG Directorate General

DG Connect The Directorate General for Communication Networks, Content and Technology of the European Commission.

The DG helps to harness information & communications technologies in order to create jobs and generate economic growth; to provide better goods and services for all; and to build on the

greater empowerment which digital technologies can bring in order to create a better world, now and for future generations. Source: DG Connect web site.

DG ENV The Directorate General for the Environment of the European Commission.

One of the more than 40 Directorates-General and services that make up the European Commission. Commonly referred to as DG Environment, the objective of the Directorate-General is to protect, preserve and improve the environment for present and future generations. To achieve this it proposes policies that ensure a high level of environmental protection in the European Union and that preserve the quality of life of EU citizens. Source: DG Environment web site.

DG INFSO The Directorate General Information Society & Media of the European Commission; as of 1 July 2012 renamed to DG Connect.

Source: https://webgate.ec.europa.eu/eipaha/news/index/show/id/50.

DG MOVE The Directorate General for Mobility and Transport of the European Commission.

Transport and mobility play a fundamental role in today's world, and directly affects everyone in Europe. The aim of the Commission is to promote a mobility that is efficient, safe, secure and environmentally friendly, and to create the conditions for a competitive industry generating growth and jobs. The issues and challenges connected to this require action at European or even international level; no national government can address them successfully alone. The European Commission's Directorate-General for Mobility and Transport works in concert with the European Union Member States, European industry, citizens and stakeholders. Source: DG MOVE web site.

DMWG Digital Maps Working Group of the iMobility Forum (iMF)

There was already a DMWG under the predecessor of the iMF, the eSaftey Forum, which was made dormant after it published its Final Report, including recommendations for further actions, in November 2005 [31]. The DMWG was revived September 2011, to prepare the creation of the ROSATTE Forum (now named TN-ITS) in close cooperation with the eMaPS Consortium [1], and made dormant again 23 May 2013, shortly before the establishment of TN-ITS.

eMaPS eSafety Digital Maps Public Private Partnership Support Action

EU-funded project, CSA Support Action, Seventh Framework Programme, Category Cooperation, Theme 3 - ICT, Call FP7-ICT-2009-7. Its objective was to contribute "to the establishment of an independent implementation platform promoting and extending the scope of the validated ROSATTE framework as an enabler for the implementation of priority action 1.2 and 1.3 of the ITS directive." [1]

EC European Commission

ETSI European Telecommunications Standards Institute

ETSI produces globally-applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies. Source: ETSI web site.

EU European Union

GA General Assembly

GIS Geographic Information Systems(s)

GML Geography Markup Language

XML encoding standard of the OGC for the transport and storage of geographic information modelled in accordance with the conceptual modelling framework used in the ISO 19100 series of International Standards (ISO/TC 211) and including both the spatial and non-spatial properties of geographic features. GML serves as a modelling language for geographic systems as well as an open interchange format for geographic transactions on the Internet. GML is also an ISO standard in the TC 211 series of standards (ISO 19136:2007). Source: OGC web site.

INSPIRE Infrastructure for Spatial Information in the European Community

Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 (the INSPIRE Directive), published 25 April 2007 and entered into force 15 May 2007 [7], aims to

establish an Infrastructure for Spatial Information in the European Community (INSPIRE), to support Community environmental policies, and policies or activities which may have an impact on the environment. INSPIRE is based on the infrastructures for spatial information established and operated by the 28 Member States of the European Union. The Directive addresses 34 spatial data themes needed for environmental applications, with key components specified through technical implementing rules. All this makes INSPIRE a unique example of a legislative "regional" approach. Source: INSPIRE web site.

ISO International Organization for Standardization

ISO is an independent, non-governmental organization made up of members from the national standards bodies of 164 countries. It has a Central Secretariat in Geneva, Switzerland, that coordinates the system. ISO develops International Standards. Since its foundation in 1947, it has published more than 19,500 International Standards covering almost all aspects of technology and business. Source: ISO web site.

ISO/TC 211 ISO Technical Committee 211 "Geographic Information/Geomatics"

The scope of this ISO Technical Committee is standardization in the field of digital geographic information. The work aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth. These standards may specify, for geographic information, methods, tools and services for data management (including definition and description), acquiring, processing, analyzing, accessing, presenting and transferring such data in digital/electronic form between different users, systems and locations. The work shall link to appropriate standards for information technology and data where possible, and provide a framework for the development of sector-specific applications using geographic data. Source: ISO/TC 211 web site.

ICT information and communication technology

ITS Intelligent Transport Systems

JRC Joint Research Centre

As the European Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle. Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners. The JRC coordinates the INSPIRE Initiative. Source: JRC web site.

NPRA Norwegian Public Road Administration; in Norwegian: Statens vegvesen

OCL Object Constraint Language

A formal language used to express constraints. Part of the UML standard. Source: UML specification [32].

OGC The Open Geospatial Consortium

International industry consortium of companies, government agencies and universities participating in a consensus process to develop publicly available interface standards. OGC Standards support interoperable solutions that "geo-enable" the Web, wireless and location-based services and mainstream IT. The standards empower technology developers to make complex spatial information and services accessible and useful with all kinds of applications. The OGC has a class A technical liaison agreement with ISO/TC 211, coordinated by a Joint Advisory Group (JAG). A number of OGC standards have been submitted into ISO and approved as ISO standards. Source: OGC web site.

OpenLR Open Location Referencing

Method for map-based location referencing, made public in 2009 [33,34], developed probably as a reaction to the IPR issues related to AGORA-C and ISO standard 17572 part 3, and trying to circumvent the related IPR. Although new IPR was vested on the method, it has been stated by the owner, TomTom, that the method can be used under licence without any charge. However, also in the case of OpenLR, wide-spread adoption seems to be somehow hampered by the related IPR and the fact that the method is owned and controlled by just one company. OpenLR seems to be building on ILOC and AGORA-C concepts, but to be designed such that it attempts to avoid infringement of the AGORA-C patents (there seems still to be some uncertain-

ty if this is successfull). Especially for the routing point part a new approach was developed. Reported success rates between map databases of different origin are lower than the success rates reported for AGORA-C. Source (in part): [25]

PWI Preliminary Work Item

ROSATTE Road Safety Attributes Exchange Infrastructure in Europe

EU-funded project, running January 2008 – June 2010, funded through DG INFSO, coordinated by ERTICO. The project aimed at establishing an efficient and quality-ensured supply chain for information on safety-related road attributes, from public authorities to commercial map providers and other road data users, with a focus on changes in the concerned attributes rather than full data sets. Source: ROSATTE page at the ERTICO web site.

SDIC Spatial Data Interest Community (INSPIRE)

Spatial Data Interest Communities (SDICs) bundle the human expertise of users, producers and transformers of spatial information, technical competence, financial resources and policies, with an interest to better use these resources for spatial data management and the development and operation of spatial information services. Through their activities they drive the demand for spatial data and spatial information services. Environmental monitoring, reporting and development of applications and services for environmental management are among the main driving forces behind the natural formation of SDICs. SDICs are best placed to know what spatial data is required in implementing different environmental tasks, ranging from local, regional, and national to Pan-European applications. The involvement of stakeholders can be one or more of the following: keep informed, review INSPIRE deliverables, propose experts, submit reference material, and/or test draft specifications. Registration is continuously open. Source: INSPIRE web site.

TA Tele Atlas

Digital map provider, partner in the eMaPS project. Now part of TomTom.

TC Technical Committee (of standardisation organisation)

A Technical Committee (TC) is a technical decision making body with precise title, scope and work programme, established in the CEN System by the Technical Board (BT). A TC essentially manages the preparation of CEN deliverables - in accordance with an agreed business plan. A Technical Committee is composed of a chairperson, a secretary and CEN national members. The national delegations are designated by the CEN members. At meetings CEN national members are represented by a number of delegates, normally not exceeding three, one of whom acts as head of delegation. Other bodies may delegate observers to meetings. Source: CEN web site.

TN-ITS Transport Network ITS Spatial Data Deployment Platform

See Section 2.7 of this document for a short introduction.

UML Unified Modelling Language

A graphical language, defined in ISO/IEC 19501:2005, for visualizing, specifying, constructing and documenting the artifacts of a software-intensive system. The UML offers a standard way to write a system's blueprints, including conceptual things such as business processes and system functions, as well as concrete things such as programming language statements, database schemas, and reusable software components. Source: UML specification [32].

WG Working Group

7 References

7.1 Document references

1. eMaPS Consortium, "Description of Work", Annex I to Grant Agreement no 287954 for a Coordination and Support Action under the Seventh Framework Programme, 1 June 2011.
2. Hovland, T., "Plan for standardisation activities of ROSATTE framework", eMaPS Consortium, deliverable D2.31, (final) version 1.1, 15 January 2012.
3. Wevers, K., Lu, M. "Provision of in-vehicle speed limit information", ITS World Congress, San Francisco, November 2005 (with acknowledgement of the EU-funded Speed-Alert project).
4. Wikström, L. (ed.), et al., "Specification of data exchange methods", ROSATTE Consortium, deliverable D3.1, version 16 (final), 31 August 2009.
5. Commission of the European Communities, "Action Plan for the Deployment of Intelligent Transport Systems in Europe", Communication from the Commission, Brussels, 16 December 2008, second corrected version of 20 March 2009, document COM(2008) 886 final/2. *Generally referred to as the "ITS Action Plan"*.
6. European Parliament and the Council of the European Union, "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", Brussels, 7 July 2010. *Generally referred to as the "ITS Directive"*.
7. European Parliament and the Council of the European Community, "Directive 2007/2/EC establishing an Infrastructure for Spatial Information in the European Community (INSPIRE)", Brussels, 14 March 2007. *Generally referred to as the "INSPIRE Directive"*.
8. Ven, T. van de, Long, J., "Final Report on Action 1.3 - Availability of Public Data for Digital Maps", 19 December 2011, Rapp Trans. *Report prepared for The European Commission, Directorate-General Mobility and Transport*.
9. Ven, T. van de, Eisses, S., "Investigation of the organizational and legal issues to align ROSATTE with the INSPIRE Directive", draft version 0.1, 8 May 2013, report prepared for the eMaPS consortium by Rapp Trans NL BV, Amsterdam, The Netherlands.
10. Wikström, L., Svensk, P., "INPIRE Alignment - A study on how to align ROSATTE with INSPIRE on a technical point of view", 15 May 2013, prepared for the eMaPS consortium by Triona AB, Borlänge, Sweden.
11. Beetz, A., Schützle, R., Metzner, M., "Quality of Service", version 2.0 (final), March 2013, prepared for the eMaPS consortium by the Institute of Engineering Geodesy (IIGS), University of Stuttgart, Stuttgart, Germany.
12. Svensk, P, Wikström, L., "Georeferencing methods - A study on how to deal with georeferencing in the ROSATTE Implementation Platform", version 1.2, 21 March 2013, prepared for the eMaPS consortium by Triona AB, Borlänge, Sweden.
13. TN-ITS, "Minutes of the Meeting of the constituting General Assembly of TN-ITS", meeting held on 5 June 2013 in Dublin, Ireland, minutes of 14 June 2013.
14. TN-ITS, "Terms of Reference", draft version of 16 May 2013, approved at the General Assembly of 5 June 2013 held in Dublin, Ireland.

15. INSPIRE Thematic Working Group Transport Networks, "D2.8.I.7 - INSPIRE Data Specification on Transport Networks - Guidelines", 26 April 2010,version 3.1. *Also named: "INSPIRE Data Specification for the spatial data theme Transport Networks"*.
16. CEN/TC 278 Secretariat, "PWI proposal: Intelligent transport systems - Transport network ITS spatial data exchange framework", document CEN/TC 278/N2915, 17 July 2013, NEN (TC 278 Secretariat), Delft, The Netherlands.
17. CEN/TC 278 Secretariat, "Result of voting, ballot title: Intelligent transport systems - Transport network ITS spatial data exchange framework, ballot reference: Proposed Decision 009-2013 PWIP (WG7)", informal document, 9 September 2013.
18. Wevers, K., "Proposal to re-establish CEN/TC 278/WG 7 *Geographic Data Files*", document CEN/TC 278/N 2912, 5 July 2013, NEN (TC 278 Secretariat), Delft, The Netherlands.
19. CEN/TC 278 Secretariat, "Draft minutes of the 51 plenary meeting of CEN/TC 278", held in London 12 September 2013, document CEN/TC 278/N 2959, 18 September 2013, NEN, Delft, The Netherlands.
20. European Commission, DG Enterprise and Industry, "2010-2013 ICT Standardisation Work Programme for industrial innovation", second update, Brussels, 2012.
21. Wevers, K., "Draft proposal for CEN/TC 278 Project Team for preparation of ROSATTE/TN-ITS Technical Specification (TS)"; first version prepared 31 May 2013; submitted by CEN/TC 278 Secretariat to CEN-CENELEC Management Centre 28 August 2013, for further processing.
22. Anonymous, "Shareable Geospatial Databases for ITS Applications", new work item proposal, ISO/TC 204/WG 3, April 2013.
23. Anonymous, "Resolutions ISO/TC204 Plenary - 19 April 2013 - Seattle, U.S.A.", document ISO/TC 204/N3140, undated.
24. Park, S.H., Lee, S.Y., Kakumoto, S., "Proposed Work Item Scalable Geospatial Databases for New and Emerging Applications", 16 June 2012. Wevers, K., "Map-based location referencing: status and prospects", Technical Paper EU00467, 19th ITS World Congress, Vienna, 22-26 October 2012.
25. Schützle, R., Frank, J., "Aggregated test report including detailed test reports", ROSATTE Consortium, version 1.0 (final), 28 Februari 2011.
26. Hendriks, T., Wevers, K., Heßling, M. and Pfeiffer, H.W., "Specification of the AGORA-C on-the-fly location referencing method", version 1.0, 6 April 2005.
27. Laurent Meillaud, "Intelligent Mobility", published by ERTICO and Navigation Technologies, June 1999.
28. Wevers, K., and T. Hendriks, "AGORA-C map-based location referencing", Transportation Research Record, 2006, vol. 1972, pp 115-122.
29. Anonymous, "Intelligent Transport System (ITS) - Location referencing for geographic databases - Part 3: Dynamic location references (dynamic profile)", ISO/FDIS 17572-3:2008, 5 September 2008, International Organization for Standardization (ISO), Geneva, Switzerland.
30. eSafety Forum, Digital Maps Working Group, "Final Report - Recommendation", November 2005, Brussels.
31. Anonymous, "Unified Modeling Language Specification", version 1.4.2, standard ISO/IEC 19501:2005, 1 April 2005, International Organization for Standardization (ISO), Geneva, Switzerland.

32. Anonymous, "OpenLR White Paper", version 1.0, TomTom International B.V., Amsterdam, The Netherlands, 8 September 2009 (version 1.5 2012).
33. Anonymous, "The OpenLR initiative", TomTom International B.V., Amsterdam, The Netherlands, presentation document, 7 September 2009.

7.2 Web site references

AGORA	http://www.ertico.com/agora-website
CEN	http://www.cen.eu
CEN-CENELEC	http://www.cencenelec.eu
CEN/TC 278	http://www.itsstandards.eu
CENELEC	http://www.cenelec.eu
DG Connect	http://ec.europa.eu/dgs/connect
DG MOVE	http://ec.europa.eu/transport
DG ENV	http://ec.europa.eu/dgs/environment
ETSI	http://www.etsi.org
INSPIRE	http://inspire.jrc.ec.europa.eu
ISO	http://www.iso.org/iso
ISO/TC 211	http://www.isotc211.org
OGC	http://www.opengeospatial.org
OpenLR	http://www.openlr.org
ROSATTE	http://www.ertico.com/rosatte