



TN-ITS c/o ERTICO - ITS Europe
Avenue Louise/Louizalaan 326
B-1050 Brussels, Belgium
Tel. +32 2 400 07 00
info@tn-its.eu/www.tn-its.eu

Transport Network ITS Spatial Data Deployment Platform

TN-ITS Implementation Support

Report prepared by

TN-ITS Working Group 3 - Implementation Support

Version 08 / 5 December 2014

Document control

Version	Date	Main Author(s)	Notes/inputs/changes
07	26-11-2014	Anna Johansson Jacques (TRV ¹), Per Isaksson (TRV), Lars Wik- ström (Triona)	Initial draft document.
08	05-12-2014	Anna Johansson Jacques (TRV)	Comments from Johanna Borup (Nokia/HERE) and Kees Wevers (TN-ITS) to initial draft incorpo- rated.

Note on acronym used:

1. TRV Trafikverket (Swedish Transport Administration)

Note on references

Figures between square brackets refer to the list of references in Section 6.

Table of contents

1 Summary.....	4
2 Purpose	5
3 Generic Process flow	5
4 Support per process step	6
4.1 Maintain road database	6
4.2 Identify change in road data	7
4.3 Transform changes to ROSATTE specification	8
4.4 Export ROSATTE data sets	10
4.5 Publish service with changes	11
4.6 Consume service with changes	12
4.7 Transform ROSATTE changes to receiving data store	13
4.8 Publish map updates.....	14
4.9 Quality assurance.....	15
5 Summary of implementation support	16
5.1 Next step	16
5.2 Providing expert support.....	16
6 References	17
7 Web references.....	18

1 Summary

This document outlines the different kinds of support may be applicable for a data provider to successfully produce a ROSATTE change data set, and for a data receiver to use this data set and include the data updates in its' data products.

2 Purpose

The main purpose of this document is to:

- Give an overview of the steps necessary in order to implement a TN-ITS compliant data exchange
- For each of these steps, indicate support that might be needed in the form of
- Implementation guidelines
- Tools and demo kits
- Expert support including options for its financing

3 Generic process flow

This is a generic process flow that can be used to understand, at a high level, the steps required to achieve a TN-ITS compliant data exchange.

The role of the Data sender is normally held by an enacting authority (i.e. the entity responsible for supervising the establishment of laws and regulations for transport and traffic).

The role of the Data receiver can be held by any party using road data in applications (e.g. providing maps and data sets for use in ADAS and ITS applications).

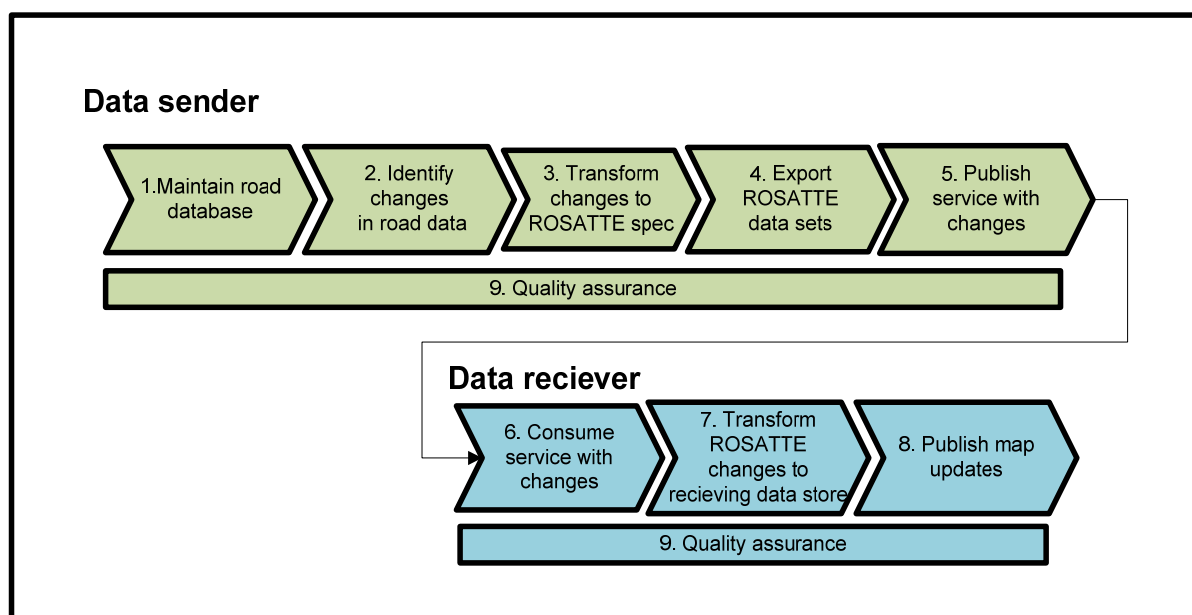


Figure 1: Generic Process Flow

The different types of implementation support is structured according to the high level process depicted above.

For an overview of the requirements and architecture regarding TN-ITS compliant data exchange, please see the ROSATTE deliverable D1.2 - *Requirements and Overall Architecture* [1].

4 Support per process step

Each of the tables below describes the types of support that might be needed in order to perform the specific process step. It also notes which role is performing the process step.

4.1 Maintain road database

Process step 1 - Maintain road database Role: Data sender		Status
Impl. guidelines	Motivation/purpose	
Road data maintenance	ROSATTE deliverable D1.2 - <i>Requirements and Overall Architecture</i> [1].	Existing
Tools and demo kit	Motivation/purpose	
High level presentation material of the data maintenance process	Mainly for decision makers. Needed to highlight the important aspects of road data maintenance requirements for TN-ITS such as update management, location referencing encoding and data quality aspects.	To be developed
Web demo	For decision makers and developers. Demo the simplest way of maintaining a road data repository with all the required components, e.g. the ASFA implementation from ROSATTE project.	To be developed
Expert support	Motivation/Requirements for experts	
Road Authority Road Operator	Experience of maintaining road databases as enacting authority, including: <ul style="list-style-type: none"> - Deep knowledge of the update management process - their own and in general. - Knowledge of different reference systems connected to road databases, such as linear, geographical, geodetic, absolute, relative - their own and in general. - Knowledge of issues regarding topics such as data quality, need for metadata - their own and in general. 	To be staffed

4.2 Identify change in road data

Process step 2 - Identify change in road data Role: Data sender		Status
Impl. guidelines	Motivation/purpose	
Methods for tracking data base changes	Different methods for keeping history of changes in road data. To ensure that a TN-ITS compliant data exchange containing only updates can be provided, the road database needs to log updates or continuously run database version comparisons. ROSATTE deliverable D3.2 - <i>Software modules for data exchange</i> [2].	Existing
Tools and demo kit	Motivation/purpose	
High level presentation material of process	Mainly for developers/architects. A presentation of different methods to identify changes in road data. Including transaction logging and methods for dataset comparison. Also elaborate on how updates are represented according to the ROSATTE specification (persistent id on object/feature level).	To be developed
A process that runs regularly and extracts changes in road data	Mainly for developers/architects. Architectural description of a component included in an overall architectural description of a possible solution at an enacting authority.	To be developed
Expert support	Motivation/Requirements for experts	
Road Authority Road Operator	Experience of needs and methods for keeping track of changes in road databases.	To be staffed
IT development	Long practical experience in assignments related to road databases. Deep knowledge of methods for keeping track of changes in road databases (temporal dimension, history of changes).	To be staffed

4.3 Transform changes to ROSATTE specification

Process step 3 - Transform changes to ROSATTE specification Role: Data sender		Status
Impl. guidelines	Motivation/purpose	
Schema mapping and data transformation guidelines	How to create a mapping schema from a road database schema to the ROSATTE specification, in order to prepare data for location referencing encoding.	To be developed
Location referencing methods fact sheet	Reuse material from the ROSATTE project, combined with the OpenLR [3] and AGORA-C specifications [4] (both methods map-based dynamic referencing), and the ISO standard for linear referencing [5]. Content should cover challenges using open source LR methods.	To be developed
Location Referencing Encoding guidelines	OpenLR [3] and AGORA-C [4] specifications.	Existing
Tools and demo kit	Motivation/purpose	
High level presentation material of process	Mainly for developers/architects. A presentation of the steps needed to transform changes to TN-ITS. Includes schema mapping, data transformation and location referencing encoding.	To be developed
Encoding tools	Mainly for developers/architects. For OpenLR encoding tools are available, see Section 7 - <i>Web references</i> for details.	To be developed
Schema mapping and data transformation tools	Mainly for developers/architects. Architectural description of a component included in an overall architectural description of a possible solution at an enacting authority. Includes listing of available tools.	To be developed
Web demo	For decision makers and developers. Demo the simplest way of transforming road data updates in compliance with TN-ITS, e.g. the ASFA implementation from the ROSATTE project.	To be developed
Expert support	Motivation/Requirements for experts	
Road Authority Road Operator	Experience of participating in the ROSATTE project, with the following elements: <ul style="list-style-type: none"> - Good knowledge of data modelling concerning road data (road network and attributes) - Knowledge of the ROSATTE specifications. - Experience of mapping authority data to ROSATTE specifications. - Good knowledge of issues regarding topics such as data quality, the need for metadata. - Good knowledge on methods for map-based dynamic location referencing such as AGORA-C [4], OpenLR [3]. 	To be staffed
IT development	Experience of participating in the ROSATTE project. Knowledge of the ROSATTE specifications. Deep knowledge on methods for map-based dynamic location referencing such as AGORA-C [4], OpenLR	To be staffed

	[3].	
Map provider	Assist in testing as a data receiver in the TN-ITS data exchange.	To be staffed
Research organizations	Expert knowledge on methods for map-based dynamic location referencing such as AGORA-C [4], OpenLR [3], TPEG-ULR [6].	To be staffed

4.4 Export ROSATTE data sets

Process step 4 - Export ROSATTE data sets Role: Data sender		Status
Impl. guidelines	Motivation/purpose	
Specification of structure and content of ROSATTE data sets	ROSATTE deliverable D3.1 - <i>Specification of data exchange methods</i> [7].	Existing
GML file handling guidelines	How to create a GML file based on a ROSATTE data set and the xsd-schema. Reuse material from the ROSATTE project, the OGC web site on GML-standard [8], and other web based information sources.	To be developed
Tools and demo kit	Motivation/purpose	
High level presentation material of process	Mainly for developers/architects. A presentation of the steps needed to export changes to GML according to the ROSATTE specification [7].	To be developed
XML-tools	For developers/architects. A list of tools for handling xml schema and data (both SAX and DOM). Elaboration on pros and cons including pros and cons between SAX and DOM.	To be developed
Expert support	Motivation/Requirements for experts	
IT development	Experience of participating in the ROSATTE project. Knowledge of the ROSATTE specifications. Deep knowledge on methods for map-based dynamic location referencing such as AGORA-C, OpenLR.	To be staffed
Map provider	Assist in testing as a data receiver in the TN-ITS data exchange.	To be staffed

4.5 Publish service with changes

Process step 5 - Publish service with changes Role: Data sender		Status
Impl. guidelines	Motivation/purpose	
REST service specification	ROSATTE deliverable D3.1 - Specification of data exchange methods [7].	Existing
REST service guidelines	<ul style="list-style-type: none"> - How to create and publish Discovery and Query REST services. - How to use retrieve access methods as a result of a Query service. - Reuse material from ROSATTE deliverable D3.2 - Software modules for data exchange [2]. 	To be developed
Tools and demo kit	Motivation/purpose	
High level presentation material of process	Mainly for developers/architects. A presentation of the steps needed to publish a service.	To be developed
REST- and web-development tools	For developers/architects. A list of tools for developing and publishing REST services.	To be developed
Web demo	For decision makers and developers. Demo the simplest possible REST data provision service in compliance with TN-ITS, e.g. ASFA implementation from the ROSATTE project	
Expert support	Motivation/Requirements for experts	
IT development	Experience of participating in the ROSATTE project. <ul style="list-style-type: none"> - Knowledge of the ROSATTE specifications. - Knowledge of implementation of REST services 	To be staffed
Map provider	Assist in testing as a data receiver in the TN-ITS data exchange.	To be staffed

4.6 Consume service with changes

Process step 6 - Consume service with changes Role: Data receiver		Status
Impl. guidelines	Motivation/purpose	
REST service specification	ROSATTE deliverable D3.1 - Specification of data exchange methods [7].	Existing
REST service guidelines	<ul style="list-style-type: none"> - How to use Discovery and Query REST services. - Reuse material from ROSATTE deliverable D4.1 - <i>Description of applicable and viable data integration methods</i> [9] and D4.2 - <i>Software components for data integration in digital databases</i> [10] 	To be developed
Tools and demo kit	Motivation/purpose	
High level presentation material of process	Mainly for developers/architects. A presentation of the steps needed to consume a TN-ITS compliant REST service.	To be developed
REST- and web-development tools	For developers/architects. A list of tools for developing REST consumer services.	To be developed
Web demo	For decision makers and developers. Demo the simplest possible REST data consumer service in compliance with TN-ITS, e.g. TomTom implementation from ROSATTE project.	
Expert support	Motivation/Requirements for experts	
Road Authority Road Operator	Assist in testing as a data sender in the TN-ITS data exchange.	To be staffed
Map provider	<p>Experience of participating in the ROSATTE project.</p> <ul style="list-style-type: none"> - Knowledge of the ROSATTE specifications. - Deep experience of the road databases within the own organisation. - General knowledge of common solutions for road databases with other organizations - Deep knowledge and understanding of different reference systems connected to road databases, such as linear, geographical, geodetic, absolute, relative. - Knowledge and understanding of issues regarding topics such as data quality, need for metadata. - Deep knowledge on methods for map-based dynamic location referencing such as AGORA-C, OpenLR. 	To be staffed

4.7 Transform ROSATTE changes to receiving data store

Process step 7 - Transform ROSATTE changes to receiving data store Role: Data receiver		Status
Impl. guidelines	Motivation/purpose	
Schema mapping and data transformation guidelines	How to create a mapping schema from ROSATTE specifications to receiving data store, in order to prepare data for location referencing decoding.	To be developed
Location referencing methods fact sheet	Reuse material from the ROSATTE project, combined with the OpenLR [3] and AGORA-C specifications [4] (both methods map-based dynamic referencing), and the ISO standard for linear referencing [5]. Content should cover challenges using open source LR methods.	To be developed
Location Referencing Decoding guidelines	OpenLR [3] and AGORA-C [4] specifications.	Existing
Tools and demo kit	Motivation/purpose	
High level presentation material of process	Mainly for developers/architects. A presentation of the steps needed to transform the changes to receiving data store. A condensation of ROSATTE deliverable D4.2 - <i>Software components for data integration in digital databases</i> [10]	To be developed
Decoding tools	Mainly for developers/architects. See tools available at www.openlr.org for OpenLR decoding.	To be developed
XML-tools	For developers/architects. A list of tools for handling xml schema and data (both SAX and DOM). Elaboration on pros and cons including pros and cons between SAX and DOM.	To be developed
Web demo	For decision makers and developers. Demo the simplest possible data integration mechanism in compliance with TN-ITS, e.g. TomTom implementation from ROSATTE project.	To be developed
Expert support	Motivation/Requirements for experts	
Road Authority Road Operator	Assist in testing as a data sender in the TN-ITS data exchange.	To be staffed
Map provider	Experience of participating in the ROSATTE project. <ul style="list-style-type: none"> - Knowledge of the ROSATTE specifications. - Deep experience of the road databases within the own organisation. - General knowledge of common solutions for road databases with other organizations - Deep knowledge and understanding of different reference systems connected to road databases, such as linear, geographical, geodetic, absolute, relative. - Knowledge and understanding of issues regarding topics such as data quality, need for metadata. - Deep knowledge on methods for map-based dynamic location referencing such as AGORA-C, OpenLR. 	To be staffed

4.8 Publish map updates

The data chain envisaged by TN-ITS has two main parts. The first part concerns provision of map updates by public authorities to ITS map providers (and other users of these data), and implementation of these updates by the ITS map providers. This represents the core of what TN-ITS is working on. The second part of the data chain concerns the flow of map updates, containing the updates provided by the public authorities, from the ITS map providers to the map databases that are present and in use in in-vehicle devices and other end-user equipment. The second part of the chain is as important as the first part, as without the second part being in place it makes no sense to have the first part.

Step 8 in the Generic Process Flow as depicted in Figure 1 is a major first step of this second part of the data chain. As such it falls without the scope of the TN-ITS focus, and therefore it is not discussed in this document in terms of providing implementation support.

4.9 Quality assurance

Process step 9 - Quality assurance Role: Data sender, Data receiver		Status
Impl. guidelines	Motivation/purpose	
Road data quality guidelines	<ul style="list-style-type: none"> - ROSATTE project deliverable D5.2 - <i>Report on data quality management concept</i> [11]. - eMaPS project deliverable D2.43 - <i>Quality of Service</i> [12]. 	Existing
Tools and demo kit	Motivation/purpose	
High level presentation material of process	A presentation of a condensation of the deliverables D5.1[13], D5.2 [11], D5.3 [14], and D5.4 [15] of the ROSATTE project.	To be developed
Tools for assessment of the data exchange process	For decision makers and developers/architects. Examples of tools (descriptions) to verify a TN-ITS compliant data exchange. Reuse, if applicable, tools used by University of Stuttgart in the ROSATTE project.	To be developed
Expert support	Motivation/Requirements for experts	
Road Authority Road Operator	<ul style="list-style-type: none"> - Knowledge of road data quality management and potential issues - Knowledge of meta data related to road data quality - Knowledge of the TN-ITS data exchange process and its data quality management concept 	To be staffed
IT development	General knowledge of road data quality management and related meta data	To be staffed
Map provider	<ul style="list-style-type: none"> - Knowledge of road data quality management and potential issues - Knowledge of meta data related to road data quality - Knowledge of the TN-ITS data exchange process and its data quality management concept 	To be staffed
Research organizations	Deep knowledge of data quality management principles	To be staffed

5 Summary of implementation support

5.1 Next step

The content of 3. Support per process step above is the identified support that might be needed by a data sender or data receiver in order to implement a TN-ITS compliant data exchange. In order to provide this support the following steps need to be taken:

1. Develop and implement, in a prioritized order, the missing parts according to the tables above.
2. Decide how the support will be provided (e.g. web portal, printed fact sheets).
3. Provide access to the implementation support (i.e. implementation guidelines, tools and demo kit, and expert support).
4. Establish maintenance of the implementation support.

5.2 Providing expert support

The biggest challenge in providing expert support is to staff experts that can contribute over time. The goal is to achieve a sustainable TN-ITS platform with an increasing number of members who can contribute to the pool of experts. However, several issues need to be resolved. The table below describes the most urgent ones.

Investigate legislative issues regarding procurement of experts	<ul style="list-style-type: none"> - Can the TN-ITS membership serve as a contract base? - Is it possible for TN-ITS to hold a framework agreement for the pool of experts? - What kind of contracts are required, and between which parties?
Determine model to finance expert support	<ul style="list-style-type: none"> - Is it a financial transaction through TN-ITS or a bi-lateral transaction between parties (expert and party receiving advice)? - Identify relevant reimbursement levels for parties providing expert support
Determine relevant level of expert support within TN-ITS	<ul style="list-style-type: none"> - Differentiate between expert support and project work (which is not part of TN-ITS) - Identify relevant response time from expert support
Investigate other sources for funding of expert support	<ul style="list-style-type: none"> - EU-funding, e.g. in relation to ITS-directive - Sponsors

6 References

1. Vennesland, A., Rennemo, O. (eds), et al., *Requirements and Overall Architecture*, Deliverable D1.2, Version 11, 28-08-2008, ROSATTE Consortium, Brussels, Belgium.
2. Nasr, A., Wevers, K. (eds), et al., *Software modules for data exchange*, Deliverable 3.2, Version 10, 12-11-2010, ROSATTE Consortium, Brussels, Belgium.
3. Anonymous, *OpenLR White Paper*, version 1.5, Revision 2, 19-01-2012, TomTom International B.V., Amsterdam, The Netherlands, and Deutsches Zentrum fuer Luft- und Raumfahrt e.V., (DLR, German Aerospace Center), Berlin, Germany.
4. ISO, *Intelligent Transport System (ITS) - Location referencing for geographic databases - Part 3: Dynamic location references (dynamic profile)*, ISO/FDIS 17572-3:2008, 05-09-2008, International Organization for Standardization (ISO), Geneva, Switzerland. *Note: This standard contains the AGORA-C specification.*
5. ISO, *Geographic information - Linear referencing*, ISO 19148:2012(E), First edition, 15-02-2012, International Organization for Standardization (ISO), Geneva, Switzerland.
6. Ernst, T., Kwella, B., Schramm, A., Schmidt, M., *Direction instructions for Communicating Linear Locations in TPEG2-ULR*, Progress Report, TPEG-LOC2 Study, 07-06-2013, Fraunhofer FOKUS, Berlin, Germany.
7. Wikström, L., et al., *Specification of data exchange methods*, Deliverable 3.1, Version 16, 31-08-2009, ROSATTE Consortium, Brussels, Belgium. Also referred to as *The ROSATTE specification*.
8. Portele, C. (ed.), *OpenGIS Geography Markup Language (GML) Encoding Standard*, Version 3.2.1, document reference OGC 07-036, 27-08-2007, Open Geospatial Consortium Inc., Wayland (MA), USA.
9. T'Siobbel, S. (ed.) et al., *Description of applicable and viable data integration methods*, Deliverable 4.1, Version 13, 01-02-2011, ROSATTE Consortium, Brussels, Belgium.
10. T'Siobbel, S. (ed.) et al., *Software components for data integration in digital databases*, Deliverable 4.2, Version 10, 15-06-2010, ROSATTE Consortium, Brussels, Belgium.
11. Schützle, R. (ed.), et al., *Report on data quality management concept*, Deliverable 5.2, Version 12, 12-11-2010, ROSATTE Consortium, Brussels, Belgium.
12. Beetz, A., Schützle, R., Metzner, M., *Quality of Service*, Deliverable 2.43, Version 20, 05-03-2013, eMaPS Consortium, Brussels, Belgium, report prepared by the University of Stuttgart, Germany.
13. Schützle, R. (ed.), et al., *Test and validation plan*, Deliverable 5.1, Revised version 32, 31-01-2011, ROSATTE Consortium, Brussels, Belgium.
14. Schützle, R. (ed.), et al., *Report on validation of data quality management concept and experiences from test sites*, Deliverable D 5.3, Version 11, 02-03-2011, ROSATTE Consortium, Brussels, Belgium.
15. Schützle, R. (ed.), et al., *Aggregated test report including detailed test reports*, Deliverable D 5.4, Version 10, 04-03-2011, ROSATTE Consortium, Brussels, Belgium.
16. Wikström, L., *Retrospective report ROSATTE implementation*, Version 1.1, 09-08-2013, Triona, Borlänge, Sweden.

For web references of the above documents, see Section 7 - *Web references*.

Note that the documents under references 4 and 5 are ISO standards, and are not publicly available.

7 Web references

The documents of the references 1, 2, 7, 9, 10, 11, 13, 14 and 15 in the previous section concern deliverables of the ROSATTE project. All deliverables of this project are available at the page:

<http://tn-its.eu/rosatte-project>

The document of reference 3, named OpenLR White Paper, concerns the OpenLR specification. This document (as well as an errata document) is available at the page:

<http://www.openlr.org/documents.html>

Tools for OpenLR encoding are available at the page:

<http://www.openlr.org/tools.html>

The document of reference 6 concerns the ULR method for map-based dynamic location referencing. This document is available via the following link:

<http://publica.fraunhofer.de/dokumente/N-243508.html>

The OGC GML standard (reference 8) is available at the page:

<http://www.opengeospatial.org/standards/gml>

The document of reference 12 concerns a deliverable of the eMaPS project. All deliverables of this project are available at the page:

<http://tn-its.eu/emaps-project>

The above web links were active at the time of production of this document. The reader should be aware that web links do sometimes change.