Transport Networks – Executive Summary

Purpose
INSPIRE Directive (2007/2/EC, 14.03.2007) defines the spatial data theme ("theme") Transport Networks as: "Road, rail, air and water transport networks and related infrastructure. Includes links between different networks. Also includes the trans-European transport network as defined in Decision 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport network ([1]) and future revisions of that Decision."

This version (3.2) of the data specification on Transport networks provides:

- the basis for the development of the part of the Implementing Rules, defined in the Article 7(1) of the INSPIRE Directive, related to the spatial data theme Transport networks and
- the implementation guidelines that will accompany the Implementing Rule on the Interoperability of Spatial Data Sets and Services according to Article 7(1) of the INSPIRE Directive.

The data specification has been prepared by the INSPIRE Thematic Working Group Transport Networks (TWG-TN), a multinational team of experts in the field drawn from different parts of the European Union ([2]), in the frame of the common and transparent development process.

This version of the INSPIRE data specification for Transport networks has been compiled from reference material submitted by the Spatial Data Interest Communities (SDICs) and Legally Mandated Organisation (LMOs) of INSPIRE, plus the responses to the User Requirements Survey and a set of agreed use cases - some of which have been specifically prepared by the TWG-TN based on their knowledge and experience, like environmental impact assessment, noise mapping, speed limits (related to the in-car information systems) and journey planning.

A large amount of submitted reference material was available for the road networks, largely from the mapping agencies and less input from road authorities. For the other sub-themes Rail, Water and Air transport networks the TWG-TN has had to undertake additional research, building on existing material and documentation. Research has included supporting material regarding trans-European networks and the objects required to support them, such as TEN-T, as well as other initiatives for example: specific documentation from Eurocontrol for air documentation.

Scope and description
The transport component should comprise of an integrated transport network, and related features, that are seamless within each national border. In accordance with Article 10(2) of the INSPIRE Directive, national transport networks may also be seamless at European level, i.e. connected at national borders. Transportation data includes topographic features that are related to transport by road, rail, water, and air. It is important that the features form networks where appropriate, and that links between different networks are established, i.e. multi-modal nodes, especially at the local level, in order to satisfy the requirements for intelligent transport systems such as location based services (LBS) and telematics. The transport network should also support the referencing of transport flows to enable the navigation services.

The data specification is extensive, covering major transport networks types that are defined in the five distinct transport themes (sub-themes): Road, Rail, Water, Air transport and Cableways[3], including the connections between those types. The sub-themes are defined in a way that they can be used together to support an integrated approach to transport and they may be used with other spatial data themes. It is evident that there are a very large number of applications that can potentially use the Transport networks.

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[1] OJ L 228, 9.9.1996, p.1. Decision as last amended by Council Regulation (EC) No 1791/2006 (OJ L 363, 20.12.2006, p.1).
[2] The Thematic Working Group Transport Networks (TWG-TN) is composed of the experts from Belgium, France, Spain, Sweden and the United Kingdom.
[3] Included in the data specification as a separate sub-theme based on the comments received in the consultation process.

Taking into account the variety of responsibilities in collecting, managing and using the data and different approaches in the data base management practice, from simple models to complex data arrangements, this data specification is provided as basic framework and with the purpose to maximize the reuse and sharing of the data about a network. It is mainly focused on the "widely reused – widely referenced" segments of spatial objects, supporting the loose linkage between the diverse organizational data with these spatial objects and allowing the extensibility to fit into diverse applications and users needs.

This approach provides a framework for users to configure and associate their own information (from surface condition surveys, to journey planning, to trans-European transport policy making etc.) using existing transport networks information in each Member State.

The datasets in scope are used extensively at the "local level" and extended to regional, national and European levels. This data specification provides a coherent approach to the forms of the representation (physical topographic area objects or centreline representations) and consistency between data sets, the latest as different types of coherence (between spatial objects of the same theme at different levels of detail, between different spatial objects within a same area or coherence at state boundaries).

All the spatial data sub-themes are based on the INSPIRE Generic Conceptual Model (GCM)([4]) that relies on several ISO 19100([5]) series of geographic information standards to provide the foundations for specific aspects of interoperability.

Within the GCM, the Generic Network Model (GNM)([6]) is defined to be shared by any network spatial data theme (e.g. Hydrography) to ensure a consistent approach across all network themes.
Specific mechanisms, used in the data specification and defined in the GNM, include:

- Network connection mechanism to establish the cross-border connectivity (a simple cross-referencing system to establish cross-border connections between the transport networks) or to establish intermodal connectivity (by linking two transport network elements from different transport networks which use a different mode of transport);
- Object referencing to support the reuse of information (for example to avoid the duplication of the geometry and to link complementary feature types from different organistaions);
- Linear referencing([7]) to support and link the different transport properties to the transport elements – it is used to position phenomena along a linear object, using a distance from the beginning of the linear object and
- The mechanism to combine the network elements into high-level semantic meanings.

The elements in the network are handled as nodes, links, aggregated links, areas and points. In addition, the individual transport links can be combined to form transport link sequences or further – the combination of both can be used to form the transport link sets.

The data specification includes three types of geometry: (a) (topographic) area objects, (b) centreline objects and (c) point objects. The types (a) and (b) may be alternative representations of the same real world phenomena about which the user can associate their own information (objects). The type (c) is, apart from network nodes, only included in the specification for marker posts. The basic spatial representation type is 2D vector.

Topology is handled in the data specification implicitly rather than explicitly, with the main reason to keep the model simple as possible but expecting that most applications will use the network data

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4 Generic Conceptual Model is part of the data specification development framework;
http://inspire.jrc.ec.europa.eu/documents/Data_Specifications/D2.5_v3.4rc3.pdf

5 *http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_tc_browse.htm?commid=54904*

6 Generic Network Model (GNM) is described in the Generic Conceptual Model (v3.4rc3). The GNM provides the basic structure for network nodes, links, aggregated links and areas and basic mechanisms for: grade separating crossings between network elements, cross-referencing, adding properties to a network (including the use of linear referencing) and adding inter-network connections.

7 Linear referencing is included in the GNM based on ISO 19148.

within a topological environment.There is therefore a prerequisite for “implicit topology”, where the data provided must be sufficiently clean and capable of automated topological construction within a user’s application. This concept is framed with the specific requirements, including the data quality information.

There are relationships with other spatial data themes, in particular with:

- Hydrography, where the water transport sub-theme reuses the INSPIRE river network model for inland transportation purposes and
- Addresses, where the majority of addresses can be linked to the transport links (roads, rivers, etc.).

Next steps in the development
It is intended that this data specification will be maintained in accordance with the future development of the INSPIRE data specification framework documents, new identified user requirements or policy requirements, development of the standards (used as a basis for data specification) and based on the best practices and on the input from the implementation of the INSPIRE Implementing Rules.

The data specification – guidelines will be are published on INSPIRE web site([8]).

[8] http://inspire.jrc.ec.europa.eu/