

Advancing Mobility Data Interoperability: TN-ITS's Breakthroughs in Standards Alignment, Quality Frameworks, and opportunities for AI Driven tools development

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Abstract. Within the NAPCORE project, the TN-ITS platform delivered key innovations for European road data exchange. A major achievement was the strategic alignment of DATEX II and TN-ITS standards, formalized in a cooperation agreement and an upcoming CEN Technical Specification (CEN/TS 16157-14). Concurrently, TN-ITS specifications were updated for full compliance with the EU RTTI Delegated Regulation. We also advanced data quality by harmonizing frameworks from TISA, EU-EIP, and TN-ITS GO into a unified methodology. Looking ahead, we identify AI-driven data conversion as a transformative opportunity to overcome implementation barriers. These advances establish a robust foundation for a seamless European Mobility Data Space.

Keywords: Road data exchange, TN-ITS, DATEXII.

1 Introduction

Digital maps are foundational to Intelligent Transportation Systems (ITS), underpinning applications from navigation to automated mobility, all reliant on high-quality, up-to-date data [1,2]. Leading map providers address this need by integrating diverse sources, including authoritative public sector data [3, 4].

Improving access to this data has been a long-standing European objective. ERTICO-coordinated initiatives under the TN-ITS umbrella have united public agencies, private map providers, and industry [5]. The TN-ITS GO project (2018-2021) operationalized these efforts, deploying services across 13 European road organizations [6]. The evolving regulatory landscape, including EU Delegated Regulations on RTTI and ISA, provided the policy mandate for the NAPCORE project [7]. With a €7 million grant and over 40 partners, NAPCORE aims to harmonize National Access Points (NAPs). TN-ITS was formalized as a dedicated working group (SWG4.2). This paper presents its major outcomes: (1) strategic alignment of TN-ITS with DATEX II [8], (2) refinement of TN-ITS specifications, and (3) development of a holistic data quality framework.

2 Methodologies

2.1 Alignment TN-ITS with DATEXII

A dedicated task force was established within the NAPCORE project from its inception to address the alignment and harmonisation of key mobility data standards. These standards—TN-ITS, DATEX II, and the multimodal SIRI/NeTEx [9]—govern the modelling and exchange of static road attributes, dynamic traffic data, and multimodal information, respectively. As an initial step, the TN-ITS management team conducted a SWOT analysis to evaluate the merits of alignment with DATEX II on both governance and technical levels (Table 1).

The insights derived from this analysis served as the foundational rationale for initiating a formal collaboration between the two standard oriented organisations. The assessment criteria included anticipated industry recognition, the necessary effort for technical integration, the feasibility of establishing a harmonised governance model, and the potential benefits for joint communication and dissemination. These points were systematically addressed through a series of joint workshops held between 2023 and 2025, which fostered open and constructive dialogue among stakeholders from both communities.

Table 1. SWOT analysis of the for the alignment of TN-ITS with DATEX II.

	Advantages		Hindrance
	Strengths		Weaknesses
Internal	- streamlined data exchange - improve accuracy and timeliness - enhanced reliability - support greater interoperability		- addressing technical complexities - addressing compatibility - addressing governance matters (technical and non-technical) - implementation costs
	Opportunities		Threats
External	- driving innovation - promote collaboration between public and private sectors - consistent quality - greater flexibility for future adaptations (AI-based) - increase adoption and trust - simplified regulation - global leadership positioning of the alignment		- ensuring compliance with legal challenges (national and European level) - the challenge in engaging stakeholders - the lack of unawareness or expertise among stakeholders - cybersecurity risks - the slow pace of adaptation

2.2 Update of the TN-ITS technical specifications

A dedicated taskforce was established to advance the technical alignment of TN-ITS (CEN/TS 17268) with the DATEX II suite (Fig. 2). The primary focus was a comparative analysis of synergies and discrepancies between TN-ITS and CEN/TS 16157 - Part 11: Traffic Regulations. Concurrently, implications for Common elements and Location Referencing were investigated. TN-ITS uses a geospatial modelling foundation (GML/OGC/INSPIRE [10]) to represent road geometry, while DATEX II, developed under the CEN/ITS tradition, focuses on dynamic information using UML-based modelling.

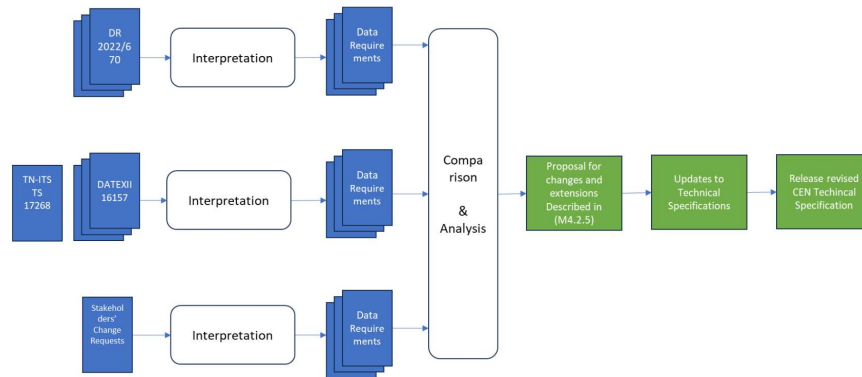


Fig 2. Methodology adopted by NAPCORE Task 4.2.3

2.3 TN-ITS enhancements of the data sharing supply chain

The creation of deliverable M4.2.6 "TN-ITS Inventory on requirements related to trust, quality, integrity, security and sovereignty of data" [11] followed a structured, two-phase methodology to scientifically address the complexities of the multi-actor data chain.

- **Foundational Research and Vulnerability Mapping:** This phase established a common knowledge base through desktop research on trust, quality, integrity, security, and data sovereignty. Building on EU EIP [12] and TN-ITS GO, the team mapped the TN-ITS data chain, highlighting potential vulnerabilities.
- **Expert Assessment and Framework Development:** The second phase focused on analysing vulnerabilities and evaluating mitigation measures, incorporating inputs from external initiatives. Conducted through expert meetings and focus groups (late 2023-mid 2024), the findings were validated in broader workshops. The objectives were to identify improvements and propose a TN-ITS quality assessment framework (Fig. 3).

2.4 AI Developments in the TN-ITS ecosystem

To analyse AI proliferation in the transport data ecosystem, a structured approach was employed, consisting of two components:

- Desktop Research: Landscape scanning to identify and categorize emerging AI technologies.
- Expert Elicitation: Primary data was gathered through "Quarterly Partner Meetings" organized by NAPCORE SWG 4.2 throughout 2024-2025. These sessions facilitated knowledge exchange on AI's potential to enhance data availability, quality, and trust. The expert pool included new members Insight Warehouse, AI Infr solutions, and MOVIAS.

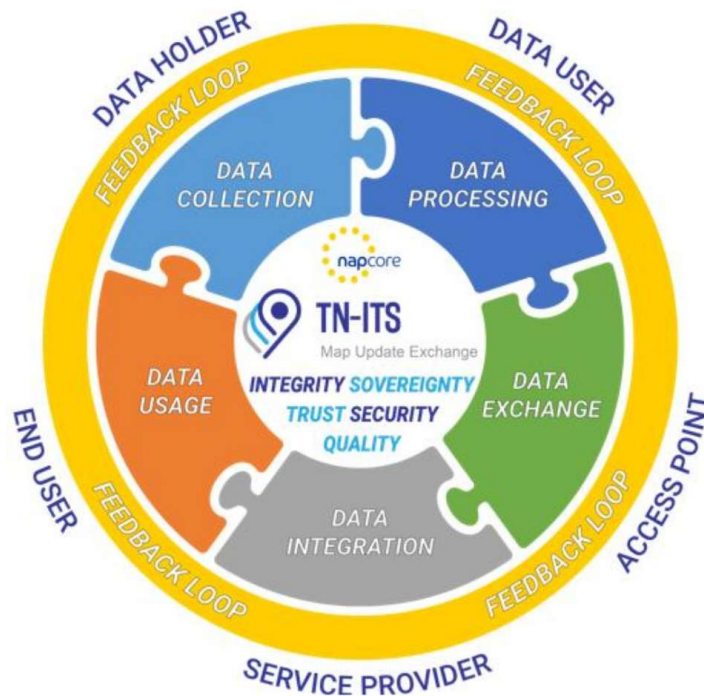


Fig. 3. Circular TN-ITS data chain (Milestone 4.2.7) illustrating the key stages of data collection, processing, exchange, integration, and usage.

3 Results

3.1 Alignment TN-ITS with DATEXII

The main outcomes of the alignment of TN-ITS with DATEX were first formalized in a declaration statement and were presented at the 2023 ITS congress in Lisbon. The essential conclusions demonstrated a firm commitment to strengthened collaboration, standardization, and a user-centric approach for moving towards a seamless European mobility data space. Key commitments included enhanced cooperation to avoid duplication and ensure complementary, interoperable standards, interoperability by design to enable smooth data flow between systems, and a focus on concrete user needs to ensure shared data's applicability and value. The declaration also positioned both standards as fundamental pillars for the European Mobility Data Space and included agreement to develop a joint strategic roadmap outlining technical and organizational steps for implementation.

The Declaration of Lisbon recognized that no single standard serves all needs, requiring TN-ITS (static road data) and DATEX II (dynamic traffic information) to work in concert. This commitment was operationalized in May 2025 at the ITS European Congress in Seville through the signing of a formal cooperation agreement that established a concrete framework for joint action. The pact solidified collaboration on technical interoperability, user-driven standards development, and a shared strategic roadmap, marking significant step toward a seamless road transport data ecosystem.

3.2 Update of the TN-ITS technical specifications

The TN-ITS CEN 17268 specifications underwent a comprehensive revision driven by multiple inputs. The primary driver was addressing gaps between the specification and the EU RTTI regulation, as detailed in M4.2.4 [13], yielding modifications to incorporate missing datatypes. A second input was strategic alignment with DATEX II (CEN 16157 - Part 11), resulting in refinements to the data model. The update also incorporated requests from European road authorities (e.g., Sweden, Flanders) for cycling networks and new traffic signs [14].

During alignment, it was decided to formally integrate TN-ITS into the CEN 16157 series as Part 14, with the title: *CEN/TS 16157-14: "Intelligent transport systems - DATEX II data exchange specifications for road and traffic information - Part 14: TN-ITS road attribute update exchanges". Publication is expected by early 2026. Technical files will be available on the ERTICO Open TN-ITS Github repository [15].

3.3 TN-ITS enhancements of the data sharing supply chain

Research on the TN-ITS enhancements of the data chain developed and proposed an integrated framework for enhancing data quality within intelligent transport systems. NAPCORE milestone M4.2.7, developed under Task 4.2.4 of the TN-ITS framework, provides updated guidance and recommendations for strengthening the RTTI data chain

[16]. Building upon prior work in Deliverable 4.2.6, the report focuses on ensuring data trustworthiness, quality, integrity, security, and sovereignty while proposing practical tools and methodologies for continuous improvement.

The report introduces a refined TN-ITS data chain framework that delineates stakeholder roles, data flows, and critical points for maintaining trust and quality. It emphasizes alignment with existing standards and policies, including ISO norms, the EU ITS Directive, the NIS 2 Directive (Directive (EU) 2022/2555 of the European Parliament and of the Council, 2022), and complementary initiatives such as EU-EIP, Traffic Management 2.0 (TM2.0) [17,12,18], and the Traveller Information Services Association TISA quality rating [19]. Vulnerabilities within the data chain are systematically identified, and responsibilities for mitigation are assigned to relevant stakeholders.

To enhance evaluation and monitoring, guidelines are provided for deploying tools that assess data quality and trustworthiness, alongside mechanisms for feedback loops to address inaccuracies and improve overall reliability. A practical use case on speed limit data demonstrates the applicability of these recommendations, validating the proposed framework. In addition, the report offers proposals for cooperative trust models, drawing on TM2.0 principles, and provides analytical guidance for aligning TN-ITS with the DATEX II standard, highlighting the implications for data integrity, security, and interoperability, see fig. 3.

Key recommendations include the adoption of a structured RTTI data chain framework, implementation of quality assessment models based on EU-EIP, TN-ITS GO, and TISA criteria, and deployment of tools to mitigate data vulnerabilities. The report further suggests enhancements to feedback loop mechanisms to ensure continuous improvement and stakeholder collaboration.

The strategic relevance of the work lies in its potential to improve interoperability across National Access Points (NAPs) and harmonize data practices across Member States. While immediate policy changes are not proposed, the recommendations lay the groundwork for future enhancements in data procurement, management, and public-private partnerships, supporting the EU Mobility Data Space. Technical adoption of standardized evaluation tools is expected to increase uniformity and reliability, supporting emerging technologies, including AI-driven transport analytics and connected or autonomous vehicles, thereby reinforcing the EU's technological competitiveness.

3.4 AI developments in the TN-ITS ecosystem

Based on the understanding that many road authorities struggle to publish TN-ITS services because data is not readily available, the TN-ITS management focused on making more data available. Two approaches are in scope: one focusing on AI tools supporting operators on data entry, and one aiming at AI tools to mine and combine data sources to generate TN-ITS changes. AI-driven data conversion can greatly decrease project complexity. By applying an AI agentic approach, data can be converted from any source to TN-ITS without traditional data mapping complexity, allowing rapid deployment of services on top of existing tools.

4 Conclusions and further work

This work successfully advanced European mobility data interoperability through the strategic alignment of TN-ITS and DATEX II standards, formalized in a cooperation agreement and the forthcoming CEN/TS 16157-14 specification. The TN-ITS specification was updated for EU RTTI compliance and to incorporate new operational needs. A significant output is the development of a holistic data quality framework that harmonizes criteria from TN-ITS GO, EU-EIP, and TISA to enhance trust across the data chain.

Looking forward, AI-driven tools for data conversion present a transformative opportunity to overcome implementation barriers and rapidly scale TN-ITS deployment. These collective breakthroughs establish a robust contribution to a seamless European Mobility Data Space and will be further matured within subsequent project phases.

The forthcoming EU CEF project TISGRADE (2025-2028) [20] is essential for enhancing RTTI availability and quality across Europe. It operationalizes TN-ITS standards by developing tools for data digitization, validation, and NAP upgrades, including implementing a semantic feedback loop. For TN-ITS, TISGRADE represents a critical deployment phase, translating technical standards into widespread, policy-compliant implementation.

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