Data content requirements, existing gaps, data dictionaries and supporting material (Part a)

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☐ For review/ approval by the Core Alignment Team

☒ For approval by the NAPCORE Steering Committee

Abstract

Concerning the challenges that the transportation sector is facing, valid data flows of increased spatial and mode coverage are essential for the development of Intelligent Transport System (ITS) services and applications capable of ameliorating safety, efficiency, reliability, resiliency, and environmental performance across and within transportation modes and networks. In line with this concept, the European Commission (EC) has proposed and legislated the deployment of dedicated platforms, termed National Access Points (NAPs), to facilitate the discoverability, exchange, and distribution of critical ITS-related data at a national (or even cross-border) level/scale. This proposal was first made within the context of the Delegated Regulations (DR) No. 885/2013, 886/2013, 2015/962, and 2017/1926 supplementing the ITS Directive (2010/40/EU) and is maintained in newer Delegated Regulations repealing current ones (e.g., Delegated Regulation 2022/670). Building upon the descriptions included in these legislative documents, a NAP can be addressed as a single digital platform providing a national-level centralized or decentralized access to properly formatted, machine readable ITS-related data accompanied by the appropriate metadata.

The aim of the first part of this report (M3.1a) is to create a list of all data categories mentioned in the Annexes of the DRs supplementing the ITS Directive and to provide for each of them an initial, yet inclusive, definition and description of critical aspects with the aim of clarifying, to the extent possible, each data category. This set of definitions and descriptions is addressed and referred to as a simplified NAP data dictionary/glossary. Moreover, said definitions and descriptions are provided by collecting evidence from documents published by standardization communities (e.g., DATEXII, TN-ITS, TRANSMODEL), the documentation of data specifications adopted by EC (e.g., INSPIRE data specifications), and in certain cases the content of existing NAP publications. It is highlighted that the current version of this report includes a draft version of the data dictionary that will be updated in the near future. Therefore, it provides a description of the process that will be followed until the development of a stable version and guidelines about its future maintenance. This process is based on a series of workshops organized by the leading team of NAPCORE WG3. These workshops are attended by several NAPCORE participants and experts of ITS data standardization communities. They enable fruitful discussions, reflection, and review of provided definitions and descriptions. On that basis, the current document provides, apart from the data dictionary per se, an outline of the adopted process behind its development and an overview of how this asset can be maintained in the future. It is highly believed that this endeavor constitutes a significant step for encouraging and supporting the harmonization of (the content of) NAPs across Europe.

Abbreviations

Abbreviation	Meaning
CAT	Core Alignment Team
DR	Delegated Regulation
EC	European Commission
EU	European Union
ITS	Intelligent Transport Systems
MMTIS	Multimodal Travel Information Services
MS	Member State
NAP	National Access Point
NAPCORE	National Access Point Coordination Organisation for Europe
RTTI	Real Time Traffic Information
SRTI	Safety Related Traffic Information
SWG	Sub-working Group
TEN-T	Trans-European Transport Network
UVAR	Urban Vehicle Access Regulation
WG	Working Group
WP	Working Programme

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1. Introduction

The activities of WG3 'NAP content and accessibility' of the NAPCORE project targets the harmonization of the content of European National Access Points (NAPs) considering, apart from the current and upcoming European legislative framework for the Intelligent Transport Systems (ITS), recorded and foreseen progress in the entire ITS domain. Moreover, the activities of WG3 are envisaged to facilitate the fair, trusted, and enhanced accessibility to ITS-related data across Europe through the investigation of aspects related to data availability (technical and procedural), data quality, data reuse and data visualization. The objectives of WG3 can be summarized as follows:

1. Support Member States (MS) towards a common understanding on the current and future content of European NAPs considering existing, planned, and foreseen European legislative and technological developments.
2. Monitor and assess the availability of ITS-related data at both national and Pan-European NAP level.
3. Identify data gaps and provide guidelines to mitigate these gaps.
4. Set a robust framework for and bring into practice the evaluation of European NAP platforms' data quality.
5. Investigate commonly accepted frameworks and technical options to achieve fair, trusted, and enhanced accessibility to ITS-related data through European NAPs.
6. Create added value visualization tools to be used by NAP operators, data providers, and data consumers.
7. Support the enhanced use of NAPs in key application areas of priority and added value for EU MS.
8. Align the achievements on the NAP content and accessibility level with the remaining activities and needs of the project, including training.

The scope of the first part of the current report involves and supports the realization of the first objective of WG3. Specifically, it aims to support a common understanding of the data categories mentioned within the DRs supplementing the ITS Directive by providing for each of them a definition and description of critical elements. On that basis, it aims to pave the ground for the development of a reference document that can be consulted by any actor interested in taking part in the NAP ecosystem in a harmonized manner. Therefore, its current objective can be summarized as follows:

The scope of the first part of current report (M3.1a) involves and supports the realization of the first objective of WG3. It does so by analysing the functional scope of the data categories included in the annexes of the Delegated Regulations supplementing the ITS Directive. For each data category, the goal is to provide a definition, reflecting what information should be exchanged in its context, and a description of critical encompassed aspects (i.e., aspects that play key role in the understanding and clarification of each data category). Therefore, the specific objective of the first part of the current report can be summarised as follows:

- To suggest a simplified data dictionary (glossary) for current data categories as a first, yet important, step towards the harmonization of the content of NAPs across Europe through:
    - the analysis of existing standardization endeavours,
    - the analysis of adopted data specifications, and
    - the content of European NAPs.

2. Methodology and structure

The adopted methodological approach for fulfilling the above objective is based on a targeted desktop research involving the systematic analysis of official legislative documents published by the European Commission (EC), documents published by standardization communities (e.g., DATEX II, TRANSMODEL, TN-ITS), specification of data models adopted by the EC (e.g., INSPIRE model on spatial data), other useful electronic sources, and, in certain cases, existing publications of European NAPs. This desktop research has enabled the development of a first version of the NAP-related data dictionary. This version is included in Section 3.

Afterwards, having developed a first version of the data dictionary, the adopted approach involves a reflection and review stage that is supported by a series of workshops organized by the leading team of NAPCORE WG3. These workshops are attended by several NAPCORE participants and experts of experts of ITS data standardization communities. By that means, the aforementioned parties are provided with the floor for making comments and providing feedback for each definition and suggesting additional elements that should be investigated. The provided feedback is then collected by the leading team of NAPCORE WG3 with the aim of adapting the provided definitions. The chain of reflection and review steps are planned to take place until a consensus is reached as regards the provided definitions. The final outcome of WG3 will be the so-called "NAPCORE stable version" that will be held for long-term maintenance. The adopted methodological approach is schematically summarized in Figure 1.
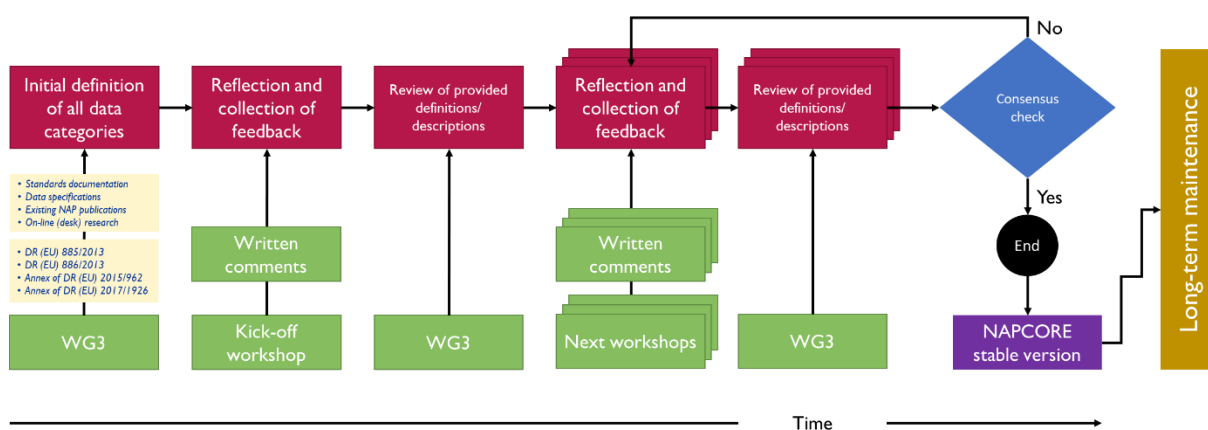

Figure 1: Adopted methodological approach for developing the NAP-related data dictionary.

The structure of the first part of the current report (M3.1a) is pretty straightforward. The third chapter titled "Definition of NAP data categories" includes the first version of the above-mentioned data dictionary. The fourth chapter titled "Data dictionary maintenance" provides suggestions on how the data dictionary can be maintained in future after the completion of NAPCORE project. The last chapter sums up and concludes.

3. Definition of NAP data categories

This chapter outlines the effort to provide definitions for all data categories included in the Delegated Regulations supplementing the ITS Directive as well as indicate the minimum information that needs to be exchanged behind each data category. That endeavour originated from the lack of a solid reference document explaining and clarifying all data categories in one place. By clearly defining each data category, there is less room for confusion, ambiguity, and misinterpretation among different MSs. Additionally, having well-defined data categories can also facilitate the development of interoperable

NAP platforms as well as the harmonization of data across different NAP platforms, which can lead to greater efficiency.

It is highlighted that this chapter constitutes a draft text, paving the ground for further investigation and revision in the upcoming months. It is also highlighted that beyond the organization of workshops, which are addressed as the core methodological basis for developing the so-called "NAPCORE stable version", two additional actions are foreseen:

- Monitoring of policy documents (ITS Directive and DR related documents published by the EC)
  - Same process as today (initial definition of new data categories, reflection, and review)
- Response to comments received on a case-by-case basis from interested organizations, associations, and stakeholders.
  - The exact approach will be discussed at WG3 and CAT level.

3.1. Safe and secure truck parking areas (SSTPA)

DELEGATED REGULATION (EU) 885/2013

Static data

Identification information of the parking area: *the minimum information required for identifying a truck parking area, such as its name and address.*
Based on existing DATEX II publications, this information may extend to: a) the country into which the parking area is located, b) national alphanumerical identifiers of the parking area, and c) the name of the parking area. Considering that safe and secure truck parking areas are typically located alongside national motorways, their address is commonly denoted by the name of the motorway that they are located on.
Source/further reading: https://data.europa.eu/data/datasets/etpa?locale=en

Location information of the entry point in the parking area: *the coordinates (latitude/longitude) of the entry point of a truck parking area.*
Various coordinate systems can be used. However, the commonly utilized coordinate system for encoding point locations in DATEX II publications appears to be the European Terrestrial Reference System 1989 (ETRS89).

Primary road identifier1/direction and Primary road identifier2/direction: *the minimum information required for identifying the road(s) (one or more – as applies) through which a truck parking area is accessible.*
Based on existing DATEX II publications, this information includes alphanumerical values indicating: a) the name of the road, b) its national identifier, and c) the destination of the applicable direction (i.e., destination city).
Source/further reading: https://data.europa.eu/data/datasets/etpa?locale=en

Indication of the Exit to be taken: *the minimum information required for identifying the exit (typically along a motorway) to be taken by a truck driver to approach a truck parking area.*
Based on existing DATEXII publications, this information mainly encompasses the exit number as well as the name and coordinates of the junction to be taken.
Source/further reading: https://data.europa.eu/data/datasets/etpa?locale=en

Distance from primary road: *the distance (typically in meters) between the exit to be taken and the entry point of a truck parking area.*

Total number of free parking places for trucks: *the total number of parking spots (capacity) of a truck parking area.*

Price and currency of parking places: *the minimum information required for disseminating the cost (possibly time dependent) of parking and the applicable currency.*
Based on existing DATEX II publications, the exchanged information is practically limited to a boolean variable indicating whether (or not) parking is free of charge. The provision of information about parking cost and the applicable currency appears not to be included. In this respect, in the case that the above-mentioned variable receives a "False" value, additional information could be provided, indicating the parking cost in the applicable currency for different parking durations (e.g., first hour, every next hour, every next day) and/or its adjustment for different day types (e.g., workdays, weekends). Another relative type of information that is mentioned in the

Truck Parking Europe portal and could be added in the context of the current data category revolves around the possibility to book a parking spot immediately.

Source/further reading: https://data.europa.eu/data/datasets/etpa?locale=en;

https://app.truckparkingeurope.com

Description of security, safety, and service equipment: *the minimum information required for disseminating the multi-type amenities offered by a truck parking area.*

An interesting classification of the above-mentioned amenities used in the Truck Parking Europe portal, which is also to a certain extent the case in existing DATEX II publications, constitutes: a) security amenities, b) comfort amenities, and c) infrastructural (service) amenities. Typical examples include fences and barriers (security), shower, medical care, and hotel (comfort), as well as truck wash, fuel station, truck repair, and power supply (service). Information type that could be added in the context of the current data category involves the assessment of the security level of a parking area (following a five-start ranking) and the conformance to certain standards and requirements (e.g., TAPA or ESPORG certified parking area).

Source/further reading: https://app.truckparkingeurope.com;

https://data.europa.eu/data/datasets/etpa?locale=en

Number of parking places for refrigerated goods vehicles: *the number of parking spots of a truck parking area that satisfy the requirements of refrigerated goods vehicles.*

Information on specific equipment or services for specific goods vehicles: *the minimum information required for disseminating special amenities offered by a truck parking area for specific goods vehicles.*

Specific goods vehicles require different kind of amenities to ensure steady ambient conditions (in case of refrigerated goods vehicles) or the safety and security of their surroundings (in case of dangerous goods vehicles).

Contact information of the parking operator: *the minimum information required for enabling truck parking users reach out to parking operators, including the name and surname, telephone number, and e-mail address of their contact point.*

Based on existing DATEX II publications, this information may extend to: a) the name of the organization that operates a parking area, b) the telephone number and e-mail address that can be used by truck parking users, c) the country and city into which the organization operating a parking area is located (typically the same with parking area), d) the address of the company operating the truck parking area, and e) the postcode of the truck parking area.

Source/further reading: https://data.europa.eu/data/datasets/etpa?locale=en

Consent of parking operators to make their contact information public: *an appropriate value reflecting whether a parking operator agrees (or not) to make his/her contact information visible to the public.*

In the case that a parking operator does not agree, the value of fields corresponding to contact information becomes null.

Dynamic data

Dynamic data on the availability of parking places: dynamic information reflecting the state and status of a truck parking area.

State: whether a parking area is open, closed, or full.

Status: the number of free/available parking spots (total spots or spots satisfying the requirements of specific goods vehicles).

3.2.   Safety related traffic information (SRTI)

DELEGATED REGULATION (EU) 886/2013
Dynamic data

Location of the event/condition: *the minimum information required for disseminating the location of an event/condition that is on-going.*

The location of an event/condition can correspond to a single geospatial point on a road (point), a part of a road network defined between two points on the same road including an indication of the applicable direction (linear), or a geographic or geometric two-dimensional feature (area). Several methods exist for encoding point, linear, or area locations.

The encoding of point locations can be achieved through the following methods:
- Point by coordinates (ETRS89)
- Point along linear element
- TPEG Point Location
- ALERT-C Point
- OpenLR Point

The encoding of linear locations can be achieved through the following methods:
- Linear within linear element location
- ALERT-C linear
- TPEG Linear Location
- OpenLR Linear
- GmlLineString

The encoding of area locations can be achieved through the following methods:
- ALERT-C area
- TPEG Area Location
- named Area
- GmlMultiPolygon
- OpenLR Area

Source/further reading: https://docs.datex2.eu/location/index.html#datatypes

Category of the event/condition: *the minimum information required for disseminating the type of an event/condition that is on-going.*

The events/conditions that are mentioned in the Delegated Regulation (EU) 886/2013 are the following:
- **Temporary slippery road** (unforeseen condition of the road surface which makes it slippery for a certain amount of time, causing low adherence of the vehicle to the road)
- **Animal, people, obstacles, debris on the road** (situation where animals, debris, obstacles or people are positioned on the road where one would not expect to find them so that an emergency manoeuvre might be required to avoid them)
- **Unprotected accident area** (area where an accident has occurred, and which has not yet been secured by the competent authority)
- **Short-term road works** (temporary road works that are carried out on the road or on the side of the road and which are indicated only by minimum signing because of the short-term nature of these works)
- **Reduced visibility** (visibility affected by any condition that reduces the sight range of drivers and which might affect safe driving)
- **Wrong-way driver** (vehicle travelling on the wrong side of a divided carriageway against the oncoming traffic)
- **Unmanaged blockage of a road** (any blockage of a road, partial or total, which has not been adequately secured and signposted)
- **Exceptional weather conditions** (unusual, severe, or unseasonal weather conditions which might affect safe driving)

The above event types could be addressed as high-level ones. Based on a joint effort of Data for Road Safety Collaboration, DATEX II, TISA, and CAR2CAR Communication Consortium, these types can be broken down into lower-level ones presented in the table below. Included elements do not only reflect different facets of each high-level event type but in certain cases its escalation (e.g., "unprotected accident" vs. "accident" that has been to some extent secured by a competent authority but may still present a hazard to road users).

Temporary slippery road	Flooding; Danger of aquaplaning; Surface water hazard; Slippery road; Loose chippings; Oil on road; Petrol on road; Ice; Black ice; Snow drifts; Icy patches
Animal, people, obstacles, debris on the road	Objects on the road; Obstructions on the road; Shed loads; Fallen trees; Avalanches; Rockfalls; Landslips; Animals on the road; People on roadway; Children on roadway; Cyclists on roadway; Large animals on roadway; Herds of animals on roadway; People throwing objects onto the road; Broken down vehicles; Vehicle on fire

Unprotected accident area	Unprotected accident area(s); Accident; Accident involving bus; Accident involving lorry
Short-term road works	Clearance work; Maintenance work; Slow moving maintenance vehicle(s); Road marking work; Rescue and recovery work; Snowploughs in action
Reduced visibility	Visibility reduced; Smoke hazard; Dense fog; Patchy fog; Blowing snow; Serious fire; Fog
Wrong-way driver	Vehicle(s) on wrong carriageway
Unmanaged blockage of a road	Blocked; Bridge blocked; Tunnel blocked; Exit blocked; Connecting carriageway blocked; Entry blocked
Exceptional weather conditions	Heavy snowfall; Heavy rain; Storm force winds; Strong winds; Crosswinds; Strong winds affecting high-sided vehicles; Hail; Thunderstorm

Typical conditions (e.g., typical weather conditions or completely secured work zones) are out of the scope of the Delegated Regulation (EU) 886/2013.

Source/further reading: https://datex2.eu/sites/default/files/2021-04/ITSTF20001_SafetyrelatedMessage-Sets-DATEXII_DENM_TPEG-TEC_TMC_%20v1.5_FINAL.pdf

Driving behavior advice (where appropriate): *information broadcast to road users through available means (e.g., Variable Message Signs) that may include suggestions for modifying/adapting their driving behavior in a way that can improve their safety and efficiency, as well as minimizing the accident risk. This advice may also include diversion recommendations for altering routes, maintaining a safe following distance, accelerating or decelerating gradually, or even making lane changes to avoid traffic congestion or other hazards.*

This data category is addressed in the NetworkManagement class of DATEXII RRPs for SRTI, specifically by the GeneralInstructionOrMessageToRoadUsers object. The attributes of this object hold messages broadcasted to road users increasing their awareness, prompting them to adapt their speed/driving behavior, and/or use specific equipment that is deemed required (e.g., winter-driving equipment in case of heavy snowfall). Relevant to this data category attributes of existing DATEX II publications constitute urgency and probabilityOfOccurrence. The former provides insight into the severity of an event/condition, while the latter provides insight into whether an event is forecasted or occurred. Both provide useful input to the warning levels included in the TPEG2-TEC and RDS-TMC protocols that govern the semantics of a warning message broadcasted to road users.

3.3. Real-time traffic information (RTTI)

DELEGATED REGULATION (EU) 2015/962

Static data

Road network[1] links and their physical attributes – geometry: *a centerline precise representation of the physical characteristics of road network links, which are connecting two positions and therefore forming a continuous path (without branches), including their curvature, slope, and alignment.*

Considering that road links constitute curvilinear elements, their geometry, according to INSPIRE data specifications, can be represented through the GM_Curve object included in the GM_Object hierarchy (ISO 19107). An abstract straight line would not be sufficient to accurately represent the geometry of a road network link. Even though geometry is in principle a different concept from that of topology, the complete definition of each road link requires the indication of its start and end node.

Source/further reading: https://inspire.ec.europa.eu/id/document/tg/tn

Road network links and their physical attributes – road width: *the width of each element (road link) of a road network, measured as an average value.*

Road network links and their physical attributes – number of lanes: *the number of lanes of each element (road link) of a road network.*
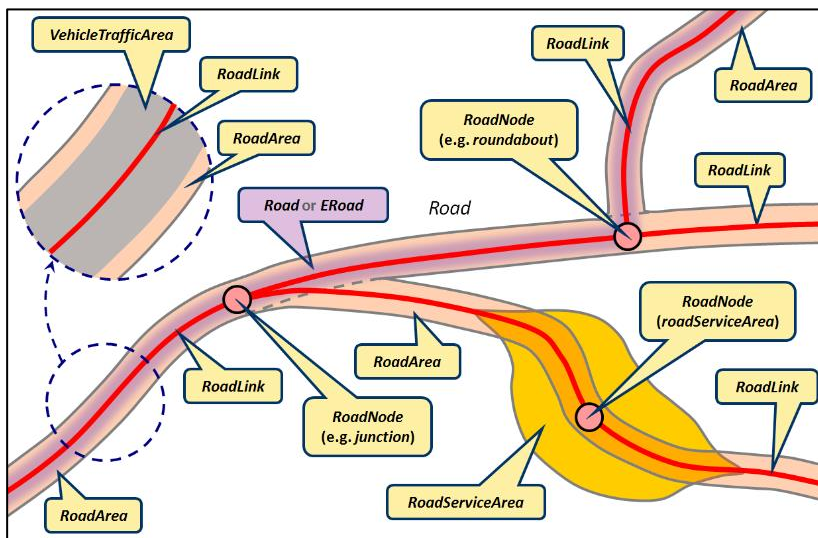
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[1] Road network constitutes a link and node structure representing a road system used for the transportation of vehicles.

Road network links and their physical attributes – gradients: *the degree of inclination (or the rate of ascent or descent) of each element (road link) of a road network, measured as an average value.*

Road network links and their physical attributes – junctions: *a significant position (node) in the road network that always occur at the beginning or the end of a road link.*

Considering that road nodes may be used for technical reasons, such as defining an additional/separate road link between two positions that has different physical attributes (e.g., substantially different road width or higher/lower number of lanes), the definition of junctions as start/end points of road links is not enough. In this respect, junctions should be preferably addressed as decision/choice nodes through which traffic can be diverted to another route.

Source/further reading: https://inspire.ec.europa.eu/id/document/tg/tn; https://ceur-ws.org/Vol-1875/paper8.pdf

Road classification: *distinction of the links of a road network encompassing form of way, functional, or other concerns.*

According to INSPIRE data specification, 'form of way classification' considers the physical properties of each road link, whereas 'functional classification' considers the importance of the role that each road link performs. The figures below indicate various classes of road network links.

Source/further reading: https://inspire.ec.europa.eu/id/document/tg/tn

Traffic signs reflecting traffic regulations and identifying dangers: *the minimum information required for disseminating the location and type of traffic signs reflecting traffic regulations and identifying dangers.*

The following conditions/restrictions are mentioned in the Delegated Regulation (EU) 2015/962:

- Access conditions for tunnels (legal or physical restrictions/limitations on vehicles to access a specific tunnel)
- Access conditions for bridges (legal or physical restrictions/limitations on vehicles to access a specific bridge)
- Permanent access restrictions (permanent legal or physical restrictions/limitations on vehicles to access a specific road segment of any type)
- Other traffic regulations (other traffic regulations that apply along specific road segments of any type)

Considering that traffic signs correspond to specific points on a road segment and may apply to specific directions, their location can be encoded through either the point or linear location referencing methods mentioned in the description of the data categories falling into the scope of the Delegated Regulation (EU) 886/2013.

Access restrictions/limitations can on a case-by-case basis be weight-, vehicle type-, or propulsion technology-related.

According to CEN/TS 17268 TN-ITS model, other traffic regulations may involve mandatory turns to be taken, prohibited turns, prohibited stopping, prohibited use of audible devices, mandatory use of snow chains.

CEN/TS 17268 TN-ITS model supports the provision of any traffic sign defined in the ISO 14826 graphic data dictionary (GDD).

Source/further reading: https://inspire.ec.europa.eu/id/document/tg/tn

Speed limits: *the minimum information required for identifying a limit for the speed of vehicles on a road link.*

Considering INSPIRE data specifications, information that should be provided for identifying a speed limit may involve: a) an indication of whether it corresponds to a maximum or minimum speed, b) the value of the maximum or minimum speed (as applies), c) an indication of the direction that the speed limit is applicable, d) an indication of the lanes including the start lane (counted from the right hand) for which the speed limit applies, e) an indication of the applicable vehicle type, e) an indication of the period during which the speed limit is valid, and f) an indication of the weather conditions the speed limit is dependent on.

Source/further reading: https://inspire.ec.europa.eu/id/document/tg/tn

Traffic circulation plans: *the minimum information required for disseminating permanent traffic management measures that are developed by traffic managers/local authorities to control and guide traffic flows in response to permanent or recurring traffic disturbances. These plans may include a variety of measures to help optimize traffic flow by adjusting inflow and outflow rates, suggesting alternative routes, implementing dedicated turn lanes, or even providing information about traffic conditions and road status (including lane/road closures).*

Traffic circulation plans can also include measures to encourage alternative modes of transportation, such as biking, or walking. For example, a plan might trigger the dedication of specific lanes to bikes. Moreover, traffic circulation plans may indicate specific road segments to be avoided by road users or specific vehicle classes.

Freight delivery regulations: *the minimum information required for disseminating regulations for delivering freight, such as prohibition of certain road segments and restrictions on delivery times (and/or duration).*

Freight delivery regulations are typically developed by local authorities to help manage traffic flow and reduce the impact of freight vehicles on the road network. Their ultimate goal is to balance the needs of freight and passenger transportation.

Location of tolling stations: *the location of tollbooths collecting automatically or manually tolls from passing traffic.*

Identification of tolled roads, applicable fixed road user charges and available payment methods: *the minimum information required for identifying a tolled road and disseminating information about the applicable road user charges and available payment methods.*

Fixed road user charges are typically vehicle class dependent.

A commonly used classification of vehicles for determining the applicable charges along European highways/motorways is the following:

- Class 1: Motorcycles, tricycle vehicles
- Class 2: Light vehicles (with or without trailer and height less than a threshold value)

- Class 3: Trucks, busses, and other vehicles with less than 4 axes (including vehicles with or without trailer with 2 or 3 axes and height greater than a threshold value)
- Class 4: Trucks and other vehicles with 4 or more axes

Fixed road user charges may also be time condition dependent.

Time conditions can be discerned into rush and regular periods. One rush period typically exists in the mornings and another one in the evenings. Given that this distinction is not homogeneous during a week, additional information should be provided for indicating the validity of a road user charge depending on the day type (i.e., workdays versus weekends).

Available payment methods in tolled roads may include a) on cash, b) by credit/debit card, c) electronic payment, and d) via toll stickers. Electronic payment can be contextually associated with a free flow tolling system.

Location of parking places and service areas: *the location of a) places where vehicles are allowed to park and b) places (typically along motorways) where drivers can stop, rest, and get access to available service facilities (alternatively expressed as rest areas).*

Location of charging points for electric vehicles and the conditions for their use: *the minimum information required for disseminating the location of areas where electric vehicle charging units are placed as well as the conditions for their use.*

WARNING: "the location of places where vehicles are allowed to park" is present in Transmodel/NeTEx and thus an overlap with EU 2017/1926 exists.

Based on the functional mapping of IDACS data requirements to DATEX II RSPs as well as the service profile of the DATEX II data model for energy infrastructure, the conditions for the use of charging points for electric vehicles may encompass the following aspects: a) opening hours (i.e., the period in which a charging point is accessible to the public), b) supported payment methods (e.g., active RFID chip, via an app, via calypso, on cash, by credit card, by debit card, etc.), c) available charging modes considering IEC 61851-1 specifications, d) available connectors (e.g., plugs, sockets, induction plates, etc.), e) whether it is possible, not possible, or mandatory for users to make a reservation, f) the types of vehicles that can be charged (e.g., electric cars, electric motorcycles, electric bikes, electric boats, motorhomes, others), g) the maximum and minimum delivery amount, h) the available voltage and charging power, and i) information on the applied pricing policy (e.g., charging time based, delivery unit based, contract, flat rate, other).

Source/further reading: https://docs.datex2.eu/reference_profiles/rsp/alternativefuel/function2rsp.html; https://docs.datex2.eu/energy/index.html

Location of compressed natural gas, liquefied natural gas, liquefied petroleum gas stations: *the location of compressed natural gas, liquefied natural gas, and liquefied petroleum gas refueling stations.*

Location of public transport stops and interchange points: *the location of a) designated places at which public transport vehicles can stop with the aim of allowing passengers to embark and disembark and b) places (transfer points) allowing passengers to transfer between different modes of public transport (such as from bus to train, or from tram to bus).*

WARNING: the "Location of public transport stops and interchange points" is a data category which exists in Transmodel/NeTEx and in INSPIRE. This represents an overlap with DR (EU) 2017/1926, namely: the location may be represented as a Postal Address, as a Road Address or as coordinates in a specific location referencing system.

INSPIRE is the reference for the Postal Address format, whereas NeTEx is a reference for the Road Address format (see conclusions of the project "Inspire support to MMTIS").

So: the term "location" should be clarified, i.e., whether coordinates or address is meant (in the latter case an overlap with DR (EU) 2017/1926 should be avoided).

Location of delivery areas: *the physical location of designated places along a road network or road link reserved for loading/unloading operations.*

Source/further reading: https://www.sciencedirect.com/science/article/pii/S2210539520301073

Dynamic data

Dynamic road status – road closures: *the minimum information required for disseminating the closure of a road segment of any type.*

Dynamic road status – lane closures: *the minimum information required for disseminating the closure of a lane of a road segment of any type.*

Dynamic road status – bridge closures: *the minimum information required for disseminating the closure of a road segment corresponding to a bridge.*

Dynamic road status – overtaking bans on heavy goods vehicles: *the minimum information required for disseminating the prohibition of overtaking by heavy goods vehicles on a road segment.*

Dynamic road status – roadworks: *the minimum information required for disseminating that roadworks take place on a road segment.*

Dynamic road status – accidents and incidents: *the minimum information required for disseminating the occurrence of an accident/incident on a road segment.*

Dynamic road status – dynamic speed limits: *the minimum information required for disseminating changes in the speed limit applying on a road segment.*

Dynamic road status – direction of travel on reversible lanes: *the minimum information required for disseminating the active direction of travel on a reversible lane of a road segment.*

Dynamic road status – poor road conditions: *the minimum information required for disseminating the prevalence of poor conditions on a road segment.*

In line with the descriptions provided in relation to Delegated Regulation (EU) 886/2013, poor road conditions may include: a) flooding, b) danger of aquaplaning, c) surface water hazard, d) slippery road, e) loose chippings, f) oil on road, g) petrol on road, h) ice, i) black ice, j) snow drifts, and k) icy patches.

Dynamic road status – temporary traffic management measures: *the minimum information required for disseminating temporary traffic management measures reflecting the current state or condition of a particular section of a road network, which can change over time dynamically due to several factors (e.g., road works, weather conditions, special events). These temporary/dynamic traffic management measures that are usually developed by traffic managers aim to control and guide traffic flows in response to unexpected/non-recurring traffic disturbances, but also to increase road safety.*

Dynamic road status – variable road user charges and available payment methods: *the minimum information required for disseminating variable road user charges responding to a congestion pricing policy scheme and the available payment methods.*

The conditions mentioned in fixed road user charges are assumed to be dynamically adapted in the context of non-fixed road user charges to reflect the prevailing traffic/air quality conditions in line with applied access control, congestion pricing, or low emission mobility policies. Further insights can be found on the outcomes/deliverables of the UVAR Box & UVAR Exchange project.

In line with the description of the static data category related to tolled roads, available payment methods may include a) on cash, b) by credit card, c) electronic payment, and d) via toll stickers. Electronic payment can be contextually associated with a variable free flow tolling system.

Dynamic road status – availability of parking places: *dynamic information reflecting the state and/or status of on-street and off-street parking infrastructure.*

Based on the documentation of DATEX II parking publications, parking infrastructure encompasses urban or interurban parking sites and on-street parking places. Therefore, the provided dynamic information about parking sites should encompass both their state (e.g., open, full, closed) and status (i.e., number of available parking spots). Status information can be provided for individual parking spots within a site or groups of parking spots.

Source/further reading: https://datex2.eu/sites/default/files/ParkingPublications_v1.0a.pdf

Dynamic road status – availability of delivery areas: *dynamic information reflecting the availability of designated places along a road network reserved for loading/unloading operations.*

Dynamic road status – cost of parking: *dynamic information reflecting the applicable cost of parking on charged parking infrastructure.*

Dynamic road status – <mark>availability of charging points for electric vehicles</mark>: *dynamic information reflecting the state and status of charging points for electric vehicles.*

Dynamic road status – <mark>weather conditions affecting road surface and visibility</mark>: *the minimum information required for disseminating weather conditions affecting road surface and visibility and, thus, implying accident hazards for road users.*

Traffic data – <mark>traffic volume</mark>: *the total number of vehicles passing through a specific point within a specified time period.*

Traffic volume is usually expressed as vehicles/hour. When the observation period is less than an hour, the equivalent hourly volume may be preferably termed as traffic flow rate.

Traffic data – <mark>speed</mark>: *the arithmetic mean of the travel speed of vehicles passing from a specific point during a given time interval.*

Traffic data – <mark>location and length of queues</mark>: *the point of a traffic queue dissipation and its total length.*

Vehicles are said to be in queue when their arrival rate in a road section exceeds their departure rate.

The point of traffic queues dissipation typically coincides with junctions/intersections in congested urban road networks. However, in sparse road networks queueing can happen upstream a junction/intersection for various reasons, such as road accidents.

The length of a queue may be simply defined as the distance between the point of queue dissipation and the last vehicle in queue.

Traffic data – <mark>travel times</mark>: *the arithmetic mean of the total time required for observed vehicles to travel from a given point to another over a specified route under prevailing traffic conditions.*
Source/further reading:

Traffic data – <mark>waiting times at border crossings to non-EU Member States</mark>: *the arithmetic mean of the total time required for observed vehicles to wait between their arrival at and departure from a border crossing.*

The scope of this data category is limited to border crossings from EU Member States to non-EU Member States.

3.4. Multimodal traveller information services (MMTIS)

DELEGATED REGULATION (EU) 2017/1926
Static data

<mark>Location search (origin/destination) - address identifiers</mark>: *the minimum information required for matching specific locations (mainly properties) as trip origins and trip destinations based on their address.*

Based on INSPIRE data specification, the postal address constitutes a hierarchy consisting of components with an increasing level of detail, e.g., town, street name, and house number or house name. It may also include a post code or other postal descriptors.

The reference for road address format is provided by NeTEx.

Both types of addresses may be used: the reference for postal address format the reference is INSPIRE, for road address, the reference format is NeTEx.

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744

<mark>Location search (origin/destination) - topographic places</mark>: *the minimum information required for matching wider locations (areas, regions, localities, cities, suburbs, towns, or settlements) as trip origins and trip destinations based on their name.*

Definition by Transmodel/NeTEx-Topographic Place: A type of PLACE providing the topographical context when searching for or presenting travel information, for example as the origin or destination of a trip.

Based on Transmodel/NeTEx data specification, topographic places may be located within one single country, may be intersecting one or more countries, or may be contained inside other topographic places.

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744

<mark>Location search (origin/destination) - points of interest</mark>: *the minimum information required for matching locations of special interest as trip origins and destinations based on their type.*

Based on INSPIRE data specification, points of interest encompass point-based locations of special interest corresponding to a variety of categories of municipal and governmental services and social infrastructure. Source/further reading:

https://inspire.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_US_v3.0.pdf

This report clarifies that INSPIRE can be considered as reference standard only for a limited set of POIs categories (Utilities and Governmental Services (US), Buildings (BU), and Protected Sites (PS)), each of which has its own specific data model.

Trip plans – operational calendar: *a coherent set of assignments of operating days to day types. It may also include information on service hours and days of operation.*

Correspondence with Transmodel/NeTEx

SERVICE CALENDAR: a collection of assignments of operational characteristics (expressed by DAY TYPES) to particular OPERATING DAYs

Reference: EN12896-3 and www.transmodel-cen.eu

Location search (access nodes) – identified access nodes: *the minimum information required for identifying the location of specific places from which travelers can access scheduled transport modes.*

From a topological point of view, access nodes are zero-dimensional nodes of the road network, that may be located by coordinates in a particular Coordinate Reference System, used for the spatial description of the network, where passengers can board or alight from vehicles.

Correspondence with Transmodel/NeTEx

SCHEDULED STOP POINT

From a geographical point of view, they are places comprising of one or more locations where vehicles may stop, and passengers may board or leave vehicles or even prepare their trip.

Correspondence with Transmodel/NeTEx

STOP PLACE

Reference: EN12896 and www.transmodel-cen.eu

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744

Location search (access nodes) – geometry/map layout structure of access nodes: *the minimum information required for identifying the location of specific facilities within access nodes considering the topographical structure of access nodes.*

The topographical structure of access node can be described through digital schematic maps providing insight into their layout.

Correspondence with Transmodel/NeTEx

SCHEMATIC MAP: A map representing schematically the layout of the topographic structure of PLACEs (e.g., a set of SITEs) or the public transport network (a set of LINEs), or other entity with a geometric projection (e.g., DECK PLAN for a train, vessel, or aircraft).

It can include a pixel projection of a set of ENTITies onto a bitmap image so as to support hyperlinked interactions. Reference: EN12896 and www.transmodel-cen.eu

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744

Trip plan computation (scheduled modes transport) – connection links where interchanges may be made: *the attributes of connection links, enabling the transfer of travelers from one mode to another or from one vehicle to another, that are required for trip plan computation purposes.*

From a topological perspective, connection links serve as a means of connecting two or more places that are located sufficiently near to each other. They allow passengers to travel from one place to another within a reasonable timeframe.

Correspondence with Transmodel/NeTEx

TRANSFER and its specializations CONNECTION, SITE CONNECTION, DEFAULT CONNECTION.

From a geographical perspective, connection links can be addressed as designated paths between two places, which may include an ordered sequence of links within a place or between two places that represent(s) a step in a possible route for pedestrians, cyclists, or other out-of-vehicle passengers.

Correspondence with Transmodel/NeTEx

NAVIGATION PATH

A common point in both perspectives is that a passenger transfer shall be time- or distance-feasible to be addressed as valid. In this respect, the attributes of connection links encompassed by this data category should

at least include the distance and time-distance of each connection link. Moreover, considering in a dedicated manner the geographical perspective, connection links should be mode-specific including at least (and as applies) walking and cycling modes.

Reference EN12896 and www.transmodel-cen.eu

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744

Trip plan computation (scheduled modes transport) – default transfer times at interchanges

Correspondence with Transmodel/NeTEx

DEFAULT INTERCHANGE: A quality parameter fixing the acceptable duration (standard and maximum) for an INTERCHANGE to be planned between two SCHEDULED STOP POINTs. This parameter will be used to control whether any two VEHICLE JOURNEYs serving those points may be in connection.

Reference: EN12896 & www.transmodel-cen.eu

Trip plan computation (scheduled modes transport) – network topology and routes/lines: *the minimum topological information about routes and lines of scheduled transport modes that is required for trip plan computation purposes.*

Service topology is determined by routes, lines, and service patterns.

Correspondence with Transmodel/NeTEx

ROUTE: An ordered list of located POINTs defining one single path through the road (or rail) network. A ROUTE may pass through the same POINT more than once.

LINE: A group of ROUTEs which is generally known to the public by a similar name or number.

SERVICE PATTERN: an ordered list of SCHEDULED STOP POINTs on a single ROUTE, describing the pattern of working for public transport vehicles.

Reference: EN12896 and www.transmodel-cen.eu

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744; https://inspire.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_TN_v3.2.pdf

Trip plan computation (scheduled modes transport) – transport operators: *the minimum information about the operators providing scheduled transport services that is required for trip plan computation purposes.*

Such information may encompass the name and identification code of transport operators.

Correspondence with Transmodel/NeTEx

OPERATOR: A company providing public transport services.

Reference: EN1 12896 & www.transmodel-cen.eu

Trip plan computation (scheduled modes transport) – timetables: *a set of data providing information about passing times of public transport vehicles that is required for trip plan computation purposes.*

In the context of this data category, vehicles are assumed to execute specified vehicle journeys conforming to the schedule of particular operating day types[2], including modifications possibly decided by the control staff of a transport operator. Based on the public transport reference data model of Transmodel, passing time information encompasses expected departure times, expected waiting times, earliest departure time, and latest arrival times.

Correspondence with Transmodel/NeTEx

TIMETABLED PASSING TIME: Long-term planned time data concerning public transport vehicles passing a particular POINT IN JOURNEY PATTERN on a specified VEHICLE JOURNEY for a certain DAY TYPE.

DATED PASSING TIME: Time data concerning public transport vehicles passing a particular POINT, e.g., arrival time, departure time, waiting time on a particular OPERATING DAY and for a DATED VEHICLE JOURNEY

Reference: EN 12896 & www.transmodel-cen.eu

Source/further reading: http://www.normes-donnees-tc.org/wp-content/uploads/2014/05/TC_278_WI_00278387_E-informativedocumentation-v9-final.pdf

Trip plan computation (scheduled modes transport) – Planned interchanges between guaranteed scheduled services: *the minimum information on the optimal itinerary/route for a particular trip taking into account reliable scheduled transportation services as well as planned interchanges between them.*

Correspondence with Transmodel/NeTEx

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[2] A type of operating day is characterized by one or more properties which affect public transport operation. For example: weekday in school holidays.

INTERCHANGE: The scheduled possibility for transfer of passengers between two SERVICE JOURNEYs at the same or different STOP POINTs. This can be:

- ➤ SERVICE JOURNEY INTERCHANGE: the scheduled possibility for transfer of passengers between two SERVICE JOURNEYs at the same or different SCHEDULED STOP POINTs or

- ➤ SERVICE JOURNEY PATTERN INTERCHANGE: a recognised/organised possibility for passengers to change public transport vehicles using two SCHEDULED STOP POINTs (which may be identical) on two particular SERVICE JOURNEY PATTERNs, including the maximum wait duration allowed and the standard to be aimed at.or provided by an

- ➤ INTERCHANGE RULE: Conditions for considering JOURNEYs to meet or not to meet, specified indirectly: by a particular MODE, DIRECTION or LINE.

Reference: EN12896 and www.transmodel-cen.eu

Source/further reading:

http://naptan.dft.gov.uk/transmodel/schema/doc/GoogleTransit/TransmodelForGoogle-07.pdf

Trip plan computation (scheduled modes transport) – <u>Hours of operation:</u> *the minimum required information about the time validity of scheduled services required for trip plan computation purposes.*

Trip plan computation (scheduled modes transport) – <u>Stop facilities access nodes (including platform information, help desks/information points, ticket booths, lifts/stairs, entrances and exit locations):</u> *the minimum information about fixed equipment or facilities related to access nodes of scheduled modes that is required for trip plan computation purposes.*

Stop facilities may include platform information, help desks/information points, ticket booths, lifts/stairs, entrances and exit locations.

The above information may be used for providing guidance to travelers for as long as they are at an access node or where to request for information, where to validate tickets, from where to access a service journey, and/or from where to exit the access node.

<u>Correspondence with Transmodel/NeTEx</u>

FACILITY: A named amenity available to the public at a SITE or on a SERVICE.

EQUIPMENT: An item of equipment installed either fixed (PLACE EQUIPMENT) or on-board vehicles (VEHICLE EQUIPMENT). A service (LOCAL SERVICE such as LEFT LUGGAGE, TICKETING SERVICE) is considered as immaterial equipment as well.

Reference: EN 12896 & www.transmodel-cen.eu

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744

Trip plan computation (scheduled modes transport) – <u>Vehicles (such as low floor, wheelchair accessible) and accessibility of on-board services (such as toilets):</u> *the minimum information about the accessibility conditions of the vehicles and on-board services of scheduled modes that is required for trip plan computation purposes.*

The above information may be used for providing guidance to travelers (including impaired ones) on whether and how they can access a vehicle.

<u>Correspondence with Transmodel/NeTEx</u>

ACCESSIBILITY LIMITATION: a categorization of the accessibility characteristics <u>of a SITE</u> to indicate its usability by passengers with specific needs, for example, those needing wheelchair access, step-free access or wanting to avoid confined spaces such as lifts.

ACCESSIBILITY LIMITATION provides the following characteristics (some of them may be used to characterize accessibility of a vehicle as well):

- • Wheelchair access
- • Step-free access
- • Escalator-free access
- • Lift-free access
- • Audible signs available
- • Virtual signs available

Reference: TR12896-9 & www.transmodel-cen.eu

Trip plan computation (scheduled modes transport) – <u>Accessibility of access nodes, and paths within an interchange (such as existence of lifts, escalators):</u> *the minimum information about the*

accessibility conditions of access nodes and the conditions for transferring from one mode to another or one vehicle to another that is required for trip plan computation purposes.

The above conditions may encompass access through lifts, escalators, or navigation stairs.

Correspondence with Transmodel/NeTEx

ACCESS EQUIPMENT: an item of equipment of a particular type actually available at a location within a PLACE and dedicated to access (e.g., lifts, entrances, stairs, ramps, etc.).

Reference: EN12896 and www.tranmodel-cen.eu

Trip plan computation (scheduled modes transport) – Existence of assistance services (such as existence of on-site assistance): *the minimum information about assistance services that is required for trip plan computation purposes.*

Correspondence with Transmodel/NeTEx:

LOCAL SERVICE: a named service relating to the use of the SITE or transport services at a particular location, for example porterage, assistance for disabled users, booking offices, etc.

It includes several subtypes, such as Assistance service, Left Luggage service, Meeting Point service, Complaints Service, Lost property service, and Ticketing service.

Trip plan computation (road transport for personal modes) – road network: *the minimum information required for describing the link and node structure of a (linear) road network used for the transportation of vehicles.*

The primary dimensions modelled for road network elements include:

> ➤ Spatial dimension: Geometric (point, line, and area (topographic)) representation of various elements that are parts of a road network. Typically, the road network is handled as a network of connected linear elements (links) with points (nodes) at the ends of the lines (at junctions, road ends, etc.). Real objects with a function in a network may also be represented in a dataset. Network connectivity within the roads network is essential but between elements in the other networks is an optional spatial aspect.

> ➤ Temporal dimension: All elements in a network may have a temporal validity (i.e., description of when a network element exists in the real world). Optional information on when an information about a network element was entered, modified, or deleted may also be included in a dataset.

> ➤ Thematic dimension: The road schema can be thematically displayed via several of the attributes defined within the specification.

The three dimensions mentioned above are relevant to the physical infrastructure representing the road network.

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744

Trip plan computation (road transport for personal modes) – cycle network: *the minimum topological and attribute information about the cycle network that is required for trip plan computation purposes.*

There is no dedicated-reference data standard for this data category. The classes/attributes of the INSPIRE data specification can to a certain extent be used for segregated cycle streets that are parts of/adjacent to road networks, i.e., road segments the FormOfWayValue of which is bicycleRoad.

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744;

https://inspire.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_US_v3.0.pdf

Trip plan computation (road transport for personal modes) – pedestrian network and accessibility facilities: *the minimum information about the topology of a pedestrian network (physical and logical arrangement of nodes and links) required for trip plan computation purposes.*

In line with the previous data category, the scope of the current one is limited to personal modes. There is a gap in INSPIRE, namely the classes/attributes of the INSPIRE data specification can to a certain extent be used for walkways and pedestrian zones that are adjacent to/interface with the remaining road network, i.e., road segments the FormOfWayValue of which is walkway or pedestrianZone. Pedestrian zones represent segments of road networks reserved for pedestrian use and closed for regular vehicular use by means of physical barriers.

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744;

https://inspire.ec.europa.eu/documents/Data_Specifications/INSPIRE_DataSpecification_US_v3.0.pdf

Location search (demand-responsive transport and personal transport) – location of parking places (on and off-street)

Correspondence with Transmodel/NeTEx

PARKING: Designated locations for leaving vehicles such as cars, motorcycles and bicycles.
Reference: EN 12896 and www.transmodel-cen.eu

Location search (demand-responsive modes) – park & ride stops: *the minimum information required for identifying the location of park & ride stops.*

Park & ride stops constitute facilities located nearby public transport access nodes that hold an appropriate capacity for motorized and non-motorized vehicle parking, thus enabling travelers to leave/pick up their vehicles before/after a public transport trip.
Correspondence with Transmodel/NeTEx
STOP PLACE as a one CONNECTION END of a CONNECTION where the other CONNECTION END is a PARKING.
Reference: EN 12896-10

Location search (demand-responsive transport and personal transport) – park & drive stops
Requires further clarification.

Location search (demand-responsive modes) – bike sharing stations: *the minimum information required for identifying the location of bike sharing stations.*

Bike sharing stations constitute facilities wherein travelers can catch or drop a short-term cycle rental.
Correspondence with Transmodel/NeTEx
VEHICLE SHARING PARKING AREA (for cycle sharing): A dedicated part of the PARKING AREA for cycle sharing which is composed of one or more VEHICLE SHARING PARKING BAYs.
Reference: EN 12896-10

Location search (demand-responsive modes) – car sharing stations: *the minimum information required for identifying the location of car sharing stations.*

Car sharing stations constitute facilities wherein travelers can catch or drop a short-term car rental.
Correspondence with Transmodel/NeTEx
VEHICLE SHARING PARKING AREA (for car sharing): A dedicated part of the PARKING AREA for car sharing which is composed of one or more VEHICLE SHARING PARKING BAYs.
Reference: EN 12896-10

Location search (demand-responsive modes) – publicly accessible refueling stations for petrol, diesel, CNG/LNG, hydrogen powered vehicles, charging stations for electric vehicles: *the minimum information required for identifying the location of publicly accessible refueling stations for petrol, diesel, CNG/LNG, hydrogen powered vehicles, charging stations for electric vehicles.*

Refueling stations in scope of this data category encompass the OrganicGasRefillPoint, DieselRefillPoint, PetrolRefillPoint, HydrogenRefillPoint, and ChargingPoint classes of the Energy Infrastructure data model made available by DATEX II.
Source/further reading: https://docs.datex2.eu/energy/

Location search (demand-responsive modes) – secure bike parking (such as locked bike garages): *the minimum information required for identifying the location of secure bike parking facilities.*

A bike parking facility can be addressed as secure when it provides the necessary equipment for locking a bicycle on the available bike racks and protecting it from prevailing climatic conditions. An increased level of security may be associated with the existence of the required means for assisting the discovery of stolen bicycles.
Correspondence with Transmodel/NeTEx
The location of CYCLE STORAGE EQUIPMENT the latter defined as (a specialisation of) an item of EQUIPMENT actually available on a location describing cycle parking equipment., classified by TYPE OF CYCLE STORAGE EQUIPMENT providing a classification of CYCLE STORAGE EQUIPMENT (e.g. racks, bars, railings, etc.).
Reference: EN12896 & www.transmodel-cen.eu.

Information service – where and how to buy tickets for scheduled modes, demand responsive modes and car parking (all scheduled modes and demand-responsive incl. retail channels, fulfilment methods, payment methods): *the minimum set of information required for describing the way of purchasing a ticket for scheduled transport modes, demand responsive modes, or car parking, including the location as well as the supported payment and fulfilment methods.*

This data category includes information about different retail channels where tickets can be purchased (e.g., online, ticket desks), different fulfilment methods (e.g., pick up from a designated location) and accepted payment methods for purchasing a ticket (e.g., credit/debit cards, cash).

Correspondence with Transmodel/NeTEx (retail channels)

RETAIL DEVICE: A retail device used to sell fare products. Its identity can be used to record fulfilment and support security processes.

This device may be either fixed or on-board vehicles. Fixed equipment is located (cf. EQUIPMENT PLACE, EQUIPMENT POSITION (e.g., by coordinates).

DISTRIBUTION CHANNEL: A type of outlet for selling of a FARE PRODUCT.

This may be managing/providing an ONLINE SERVICE (any remotely accessible service providing access to any mode of transportation and/or information related to transportation services.).

Correspondence with Transmodel/NeTEx (ticketing/fulfilment)

TICKETING EQUIPMENT is characterized by:

➢ TYPE OF TICKETING: A classification for ticketing services available at a TICKETING EQUIPMENT (e.g., purchase, collection, card top up, reservations).

➢ TYPE OF PAYMENT METHOD: A classification for payment method (e.g., cash, credit card, debit card, travel card, contactless travel card, mobile phone, token, etc.).

➢ VEHICLE MODE: A characterization of the public transport operation according to the means of transport (bus, tram, metro, train, ferry, ship).

➢ TICKET SCOPE: whether the equipment is for long distance, urban, regional, etc.

Such equipment can be placed either in a fixed location or on-board. When it is fixed, information about its location (cf. EQUIPMENT PLACE, EQUIPMENT POSITION) should be provided (e.g., by using coordinates).

Trip plans, auxiliary information, availability check – fare network data (fare zones/stops and fare stages) (all scheduled modes): *the minimum information required for describing the layout of a fare network, such as the zones of which it is comprised.*

Fare or tariff zones are used to group different sections of a public transport journey for which a set charge is made. They constitute two-dimensional elements within the service area of a public transport operator. The individual one-dimensional sections of a fare network are defined as the consecutive fare or border points of a public transport journey that fall within the same fare or tariff zone.

Correspondence with Transmodel/NeTEx

FARE ZONE: a specialization of TARIFF ZONE (a ZONE used to define a zonal fare structure in a zone-counting or zone-matrix system) composed of FARE SECTIONS.

Trip plans, auxiliary information, availability check – standard fare structures (point to point including daily and weekly fares, zonal fares, flat fares) (all scheduled modes): *the minimum information required to describe how users of public transport services are charged (i.e., data objects and elements needed to support the definition of fare products and their parameters).*

Fare structures can be broadly discerned into:

• Space-based structures: flat or progressive, zonal- or interval-based, point-to-point, etc. Interval-based fares may be based on simple distances, numbers of zones, border points, etc.

• Time-based structures: flat or progressive depending upon time intervals.

• Combination of the two (e.g., fare products based on both zones and time intervals)

Source/further reading: https://www.transmodel-cen.eu/wp-content/uploads/2019/10/TUTORIAL_Part5_v2.3-1.pdf

Trip plans, auxiliary information, availability check – vehicle facilities such as classes of carriage, on-board Wi-Fi: *the minimum information required to describe the available facilities/amenities offered by a public transport mode.*

The above-mentioned facilities/amenities may involve an indication of whether a) on-board Wi-Fi, b) equipment supporting bicycle or scooter boarding, c) monitors providing vehicle tracking or declaring the next stop is/are available. They may also involve information about the available classes of carriage and the included facilities/amenities. For instance, in rail transport services there are various types of wagons, such as luxury class, first class, second class, third class, economy class. Each of these classes offer different amenities/facilities ranging from private compartments, including private beds, showers, and toilets, to shared compartments, including their own backs, lights, tables, and luggage spaces.

Detailed common standard and special fare query (all scheduled modes) – passenger classes (such as adult, child, senior, student, military/veteran, passenger with reduced mobility and qualifying

conditions, and classes of travel): *the minimum information about passenger classes required for supporting fare queries.*

Provided information may be classified based on fare classes (e.g., first class, second class, business class, etc.) and/or based on user profiles (e.g., adults, children, students, veterans, impaired people). Provided information may also encompass the qualification conditions applying in each user class.

Correspondence with Transmodel/NeTEx

USER PROFILE: Eligibility requirements to be met by the social profile of a passenger, based on age group, residence, employment status, sex, mobility requirements etc., used for allowing discounts: 18-40 years old, graduates, preferences, unemployed, women, etc.

FARE CLASS with attributes: first class, second class, third class, economy class, business class.

Source: EN12896 & www.transmodel-ce.eu

Detailed common standard and special fare query (all scheduled modes) – common fare products (access rights such as zone/point-to-point including daily and weekly tickets/single/return, eligibility of access, basic usage conditions such as validity period/operator/time of travel/interchanging, standard point-to-point fares prices for different point-to-point pairs including daily and weekly fares/zonal fare prices/flat fare prices): *the minimum set information about common fare products required for supporting fare queries.*

Provided information may be classified based on tariff offers and access rights (e.g., zone/point-to-point weekly/single/roundtrip tickets) as well as the eligibility of access and basic usage conditions (e.g., valid period/operator/time of travel/interchanging, standard point-to-point fare prices for different point-to-point pairs including daily and weekly fares/zonal fare prices/flat fare prices).

Source/further reading: *European Commission JRC.B.6. Overlaps in standards related to the Delegated Regulation (EU) 2017/1926. Final joint report with recommendations to Member States and the Commission. Appendix 1. Project Team INSPIRE-MMTIS*

Detailed common standard and special fare query (all scheduled modes) – special fare products: *the minimum set of information about special fare products required for supporting fare queries.*

Special fare products are based on offers with additional special conditions, such as promotional fares, group fares, season passes, aggregated products combining different products and add on products (e.g., parking and travel, minimum stay).

Detailed common standard and special fare query (all scheduled modes) – basic commercial conditions: *the minimum set of information about basic commercial conditions required for supporting fare queries.*

This information may refer to the principles of refunding, replacing, exchanging, and transferring a ticket and/or the basic booking conditions, such as purchase windows, validity periods, fare limitations, and minimum duration.

Information service (all modes) – how to book car sharing, taxis, cycle hire etc.: *the minimum information required to describe the way of booking car-sharing, taxi, and cycle-hiring services.*

Correspondence with Transmodel/NeTEx

SERVICE BOOKING ARRANGEMENTS: information on booking rules and additional data allowing the user to take the decision to book a service and to undertake the booking (of a MOBILITY SERVICE such as car sharing, taxis, cycle rental, etc.).

Included attributes may indicatively refer to a) booking access, b) booking methods, c) booking URL, d) latest booking time, e) booking procedure, f) deposit required, g) cancellation allowed, etc.

See (Transmodel) EN12896-10 and NeTEx-5

Information service (all modes) – where and how to pay for car parking, public charging stations for electric vehicles and refueling points for CNG/LNG, hydrogen, petrol- and diesel-powered vehicles: *the minimum set of information required to describe the location (physical or online) and way of paying for car parking, vehicle charging, or vehicle refueling (including CNG/LNG, hydrogen, petrol, and diesel refueling).*

This information may refer to retail channels, fulfillment methods, and payment methods.

Trip plans – detailed cycle network attributes (surface quality, side-by-side cycling, shared surface, on/off road, scenic route, 'walk only', turn or access restrictions (e.g., against flow of traffic): *the*

minimum set of information required for describing the attributes of a cycle network (physical and logical arrangement of nodes and links).

These attributes encompass surface quality, type of surface (e.g., side-by-side cycling, shared surface, on/off road, scenic route, walk only indication), and turn or access restrictions (e.g., against flow of traffic).

There is no reference standard for this data category.

Source/further reading: https://publications.jrc.ec.europa.eu/repository/handle/JRC118744

Trip plans – parameters needed to calculate an environmental factor such as carbon per vehicle type or passenger mile or per distance walked: t*he minimum set of information required for enabling the estimation of the environmental footprint of a trip.*

As mentioned within the Delegated Regulation (EU) 1926/2017, this information encompasses parameters, such as carbon dioxide emissions per vehicle type (i.e., average rate per vehicle type per mile traveled), passenger mile (i.e., average rate per vehicle type per mile traveled per passenger), and distance walked (i.e., average rate per mile of walking).

Trip plans –parameters needed to calculate fuel consumption of conventional and alternative fuels: *the minimum set of information required for estimating costs related to fuel consumption.*

Trip plan computation – estimated travel times by day type and time-band by transport mode/combination of transport modes: *the minimum set of information required for calculating the estimated travel times by transport mode or even combination of transport modes considering recurring conditions at/in specific time bands and day types.*

ADDITIONAL DATA CATEGORIES IN THE REVISED MMTIS

Level of service 4

- ➢ **Historic travel and traffic data on delays – scheduled transport and demand-responsive transport where relevant**
- ➢ **Observed data on delays:**
    - o **Length of and the reason for delays of more than 60 minutes for rail passenger services (according to Article 19 of Regulation (EU) No 2021/782)**
    - o **Length of and the reason for delays in departure of more than 90 minutes for sea and inland waterways passenger services (according to Article 18 of Regulation No (EU) 1177/2010)**
    - o **Length of and the reason for delays of more than 120 minutes for regular bus and coach passenger services with a scheduled distance of 250 km or more (according to Article 19 of Regulation No (EU) 181/2011)**
    - o **Length of and the reason for flight delays at departure of more than 120 minutes; and flight delays at arrival of more than 180 minutes (according to Articles 5 and 6 of Regulation (EC) No 261/2004)**
- ➢ **Observed data on cancellations:**
    - o **Cancellations of rail passenger services**
    - o **Cancellations of sea and inland waterways passenger services**
    - o **Cancellations of regular bus and coach services with a scheduled distance of 250 km of more**
    - o **Cancellations of flights**
- ➢ **Information on parking tariffs**

Dynamic data

Passing times, trip plans and auxiliary information – disruptions (all modes): *dynamic information disseminating the existence of changes in the normal operation of transport services.*

Correspondence with Transmodel

OPERATIONAL EVENT: any event affecting the public transport operation occurring on an OPERATING DAY and recorded in the system. An OPERATIONAL EVENT is generally causing a CONTROL ACTION.

OPERATIONAL EVENTs may concern a SITE, a FACILITY, or may be related to a DRIVER or a VEHICLE.

Source/further reading: https://www.transmodel-cen.eu/wp-content/uploads/2015/01/TUTORIAL_Part4_v2.1-1.pdf

Passing times, trip plans and auxiliary information – <u>real-time status information (delays, cancellations, guaranteed connections monitoring) (all modes):</u> *dynamic information providing further details about the operational status of transport services.*

Provided information may provide further details about delays, cancellations, and guaranteed connections among different modes (e.g., foreseen delay duration, cancellation timeframe). It shall be dynamically updated as soon as it becomes available to reflect the latest operational status of transport services.

Correspondence with Transmodel

PT SITUATION CONSEQUENCE: A description of the consequences of the PT SITUATION generally or in relation to involved or indirectly impacted public transport elements.

May provide information such as:

- ➢ DELAYs: description of deviations from the public transport timetable.
- ➢ PT SITUATION GENERAL CONSEQUENCE: A parameter describing a general consequence of a PT SITUATION.
- ➢ EASEMENT: A description of temporary (fare) exceptions allowed because of disruptions.

Passing times, trip plans and auxiliary information – <u>status of access node features (including dynamic platform information, operational lifts/escalators, closed entrances and exit locations — all scheduled modes):</u> *dynamic information providing insight into the operational status of access nodes features.*

The operational status of access nodes features (e.g., platform information systems, lift/escalators, entrances, and exits) may be affected by technical issues and malfunctions.

Correspondence with Transmodel

MONITORED PLACE EQUIPMENT FACILITY: A monitored named amenity or capability related to a PLACE EQUIPMENT.

MONITORED FACILITY CONDITION: describes a changed state of availability for a MONITORED FACILITY

FACILITY STATUS: categorizes the change to availability of the facility, such as being removed, unavailable or only partially available.

ADDITIONAL DATA CATEGORIES (definitions / correspondence to Transmodel to be completed)

Level of service 2

- o **Information service on parking tariffs – demand-responsive transport and personal transport**
- o **Availability check and location – demand responsive transport and personal transport**
- o **Car-sharing availability and location, bike-sharing availability and location, scooter-sharing availability and location, and other vehicle-sharing availability and location**
- o **Car parking spaces available (on and off-street)**

Level of service 3

- o **Occupancy information of the vehicle – scheduled transport and demand-responsive transport where relevant**

WARNING: the below data categories seem to be removed from the revised MMTIS.

Passing times, trip plans and auxiliary information – <u>estimated departure and arrival times of services:</u> *dynamic information reflecting the estimated time that a public transport vehicle passes from a particular point (e.g., arrival time, departure time, waiting time).*

Correspondence with Transmodel

ESTIMATED PASSING TIME: A time data, calculated from the latest available input, about when a public transport vehicle will pass a particular POINT IN JOURNEY PATTERN on a specified DATED VEHICLE JOURNEY. These are mainly used to inform passengers about expected times of arrival and/or departure but may also be used for monitoring and re-planning.

Reference: Transmodel EN12896-4

Passing times, trip plans and auxiliary information – <u>current road link travel times:</u> *dynamic information reflecting the time required for traversing a specific road link considering prevailing traffic conditions.*

Provided information should be updated as soon as it becomes available to reflect the latest operational status of the road network.

It should probably be specified what type of run time is considered. In PT there are different types of RUN TIMES, including:

➢ MEAN RUN TIME: An estimated value of the mean run time on a TIMING LINK, used to inform passengers on the mean duration of trips.

➢ JOURNEY PATTERN RUN TIME: The time taken to traverse a TIMING LINK in a particular JOURNEY PATTERN, for a specified TIME DEMAND TYPE.

➢ VEHICLE JOURNEY RUN TIME: The time taken to traverse a specified TIMING LINK IN JOURNEY PATTERN on a specified VEHICLE JOURNEY. This gives the most detailed control over times.

However, it should be noted that there are additional RUN TIME types in Transmodel.

Reference: Transmodel Part 2 (EN12896-2)

Passing times, trip plans and auxiliary information – <u>cycling network closures/diversions</u>: *dynamic information providing insight into the operational state of a cycling network.*

Provided information may refer to closures and/or diversions of cycling network links/routes. It may also provide further details regarding:

• the exact location of the diversion/closure
• the direction that is temporarily influenced
• the duration of this modification (i.e., diversion/closure)
• alternative options (rerouting) in case of diversions

Information service – <u>availability of publicly accessible charging stations for electric vehicles and refueling points for CNG/LNG, hydrogen, petrol- and diesel-powered vehicles</u>: *dynamic information reflecting the number of available charging spots for electric vehicles and refueling points for CNG/LNG, hydrogen, and petrol- or diesel-powered vehicles in a specific location.*

Availability check – <u>car sharing availability, bike sharing availability</u>: *dynamic information reflecting the number of available vehicles of a car-sharing or bike-sharing service.*

Depending on the type of service (i.e., free-floating versus station-based) the number of available vehicles may be given for specific stations or polygons indicating a specific area.

Reference: SIRI (providing MonitoredCounting)

Availability check – <u>car parking spaces available (on and off-street), parking tariffs, road toll tariffs</u>: *dynamic information reflecting the number of available on- or off-street parking spaces and the applicable parking and road toll tariffs.*

In the case of off-street parking, availability information may be given for individual parking spaces within a site or groups of parking spaces. On the other hand, parking and road toll tariffs may be subject to variable charging, considering various parameters, such as demand, type of the day, and day hour.

Trip plans – <u>future predicted road link travel times</u>: *dynamic information required for supporting the estimation of the travel time on specific links of the road network.*

4. Documentation maintenance

The maintenance of a documentation derived from a project plays crucial role in assuring its long-lasting impact and compatibility with the current and future state of the art. To this extent, it is important to provide some guidelines for maintaining the data dictionary included in the current deliverable so as all valuable information/definitions can be preserved for future reference and knowledge retention. This chapter is dedicated to the actions that should be taken to achieve the aforementioned goal. The foreseen actions are summarized and described in Table 1.

Table 1: Foreseen actions and measures for maintaining the data dictionary document.

Actions	Description/ explanation
Establish a document management system	Implement a structured system for organizing and storing the data dictionary document and its versions.
Define document ownership	Assign responsibility for the document to an organization or a project team/ team group. This party will control the access rights of the document and be responsible for modifying/updating its content.
Review and update	Regularly review the document to ensure that its content is accurate and up to date. Reviewing frequency should be discussed and decided among involved stakeholders. It ought not to be less than once per year. The reviewing process could be executed by using a working version of the document, while the updating process can be done only on a master version of the document. Updates should be discussed and decided by all involved stakeholders.
Track document versions	Version control should be implemented in order to record the changes made to the document over time. Maintaining a clear record of different versions can ensure a comprehensive history of the document's evolution.
Document permissions	Access rights should be set in order to protect the document from unsolicited editing.
Maintenance plan	Set a comprehensive maintenance plan that highlights the timeliness, ownership, and responsibilities. This plan can be reviewed and modified based on the current needs and foreseen developments.
State of the art monitoring	Monitor the state of the art in ITS and mobility domain. Track the outputs of the important on-going projects, paying increased attention to projects (a) in which several MSs participate and (b) providing new insights into technical aspects of great relevance to NAPs and NAPs' operations (e.g., data and metadata standards).
EC policy developments monitoring	Monitor developments in ITS-related EC policy. Include in the data dictionary any new suggested data categories and data perspectives. Consider policy domains with impacts on ITS data exchange (e.g., spatial data).

5. Conclusions

The activities of WG3 of the NAPCORE project aim, among others, to bring consistency to the content of European National Access Points (NAPs) based on the current European legislative framework for Intelligent Transport Systems (ITS). These activities consider both recorded and anticipated progress in the entire ITS domain.

The current report, building upon the observation that several data categories enlisted in the DRs supplementing the ITS Directive are not harmoniously defined across all MSs, presents the initial version of the effort to develop a NAP-related data dictionary. This artifact is considered as a significant step for encouraging and supporting the harmonization of (the content of) NAPs across Europe. In this respect, the current report provides, apart from the initial version of the data dictionary per se, a description of the process followed for its development. Based on this process, newer and more stable versions of the data dictionary will trigger an update of the current document. Finally, the current document provides guidelines for the maintenance of the data dictionary after the completion of the NAPCORE project.