



Technical mapping of multimodal data standards and recommendations

NeTEx parking national profiles and APDS

Status: final
Version: 1.0
Date: 22 April 2025

Legal disclaimer

The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the European Union. The European Commission is not responsible for any use that may be made of the information contained therein. All images are provided by the respective partners (unless otherwise noted) and are approved for reproduction in this publication.

Document information

Project acronym	NAPCORE
Full project title	National Access Point Coordination Organisation for Europe
Grant Agreement No.	MOVE/B4/SUB/2020-123/SI2.852232
Activity no. and title	4.3.3 Mapping of different standards for multimodal data and standard update recommendations
Author(s)	David Ariño Montoya, ITxPT
Co-author(s)	-
Related to Milestone no.	M4.3.5 Mapping of multimodal data standards and recommendations
External Milestone	yes

Document history

Version	Date	created/ modified by	Comments
0.1	28.11.2024	David Ariño Montoya, ITxPT	Initial draft
0.2	28.01.2025	David Ariño Montoya, ITxPT	Revision of draft and comments merged
	07.02.2025	Jorge Gonzalez Suitt, Ministère des transports	Revision and comments in mapping table
	06.03.2025	Giandomenico Gagliardi, 5T	Revision and comments in mapping table
	31.03.2025	Yves Amsler, UITP	SWG4.3 internal revision and comments
0.3	07.04.2025	David Ariño Montoya, ITxPT	Changes and comments merged
	10.04.2025	Jon Harrod-Booth, EPA	Revision and comments in mapping table
0.4	15.04.2025	David Ariño Montoya, ITxPT	Changes and comments merged
1.0	22.04.2025	David Ariño Montoya, ITxPT	Comments from peer-review accepted and merged to final version

Document status:

☐	To be revised by partners involved in the preparation of the document
☐	For review/ approval by the Core Alignment Team and Peer Reviewers
☐	For approval by the NAPCORE Steering Committee
☒	Final
☐	Updated/revised final version (e.g. when a second version of Milestone is published)

Abstract

This milestone focuses on the technical mapping of parking data standards. To achieve this, the existing NeTex parking national profiles currently used in European countries (France and Italy) were analysed.

Additionally, the report provides a technical mapping of the elements from various standards used in the parking domain, specifically the NeTex national parking profiles and APDS.

The document concludes with a series of recommendations and next steps to enrich the parking standards.



Abbreviations

Abbreviation	Meaning
APDS	Alliance for Parking Data Standards
CEN	European Committee for Standardization (Comité Européen de Normalisation)
EC	European Commission
EPA	European Parking Association
EPIAP	European Passenger Information Accessibility Profile
EPIP	European Passenger Information Profile
HARP initiative	HARmonisation of Parking data standards
ITS	Intelligent Transport System
ISO	International Organization for Standardization
MMTIS	Multimodal Travel Information Services
NAP	National Access Point
NAPCORE	National Access Point Coordination Organisation for Europe
NeTEx	Network Timetable Exchange
RTTI	Real-Time Traffic Information
SC, SCOM	Steering Committee
SCS	Steering Committee Support
SWG	Sub-working Group
WG	Working Group
WP	Working Programme
XML	Extensible Markup Language

Table of contents

1. Introduction	6
2. Parking data standards state-of-the-art.....	7
3. National profiles and full NeTEx standard.....	9
4. Comparison of existing NeTEx parking national profiles (France and Italy).....	11
5. Mapping Standards between NeTEx and APDS	21
6. Gaps between standards	31
7. Conclusions and Future Work.....	32



List of tables

Table 1: Comparison of French and Italian national NeTEx parking profile on entities under the Parking Element	14
Table 2: Comparison of French and Italian national NeTEx parking profile on entities under the ParkingProperties Element	14
Table 3: Comparison of French and Italian national NeTEx parking profile on entities under the ParkingCapacity Element	14
Table 4: Comparison of French and Italian national NeTEx parking profile on entities under the ParkingEntranceForVehicle Element	15
Table 5: Comparison of French and Italian national NeTEx parking profile on entities under the ParkingPassengerEntrance Element	15
Table 6: Comparison of French and Italian national NeTEx parking profile on entities under the ParkingTariff Element	16
Table 7: Comparison of French and Italian national NeTEx parking profile on entities under the ParkingChargeBand Element	16
Table 8: Comparison of parkingLayout enumeration between French and Italian NeTEx parking profiles	17
Table 9: Comparison parkingVehicleTypes enumeration between French and Italian parking profiles	18
Table 10: Comparison of parkingUserType enumeration between French and Italian NeTEx parking profiles	19
Table 11: Mapping between NeTEx and APDS elements under Parking Element.....	23
Table 12: Mapping between NeTEx and APDS elements under ParkingArea Element	24
Table 13: Mapping between NeTEx and APDS elements under ParkingComponent Element.....	24
Table 14: Mapping between NeTEx and APDS elements under ParkingBay Element.....	25
Table 15: Mapping between NeTEx and APDS elements under ParkingProperties Element.....	26
Table 16: Mapping between NeTEx and APDS elements under ParkingCapacity Element.....	26
Table 17: Mapping between NeTEx and APDS elements under ParkingEntranceForVehicle Element	27
Table 18: Mapping between NeTEx and APDS elements under ParkingPassengerEntrance Element	28
Table 19: Mapping between NeTEx and APDS elements under ParkingTariff Element	29
Table 20: Mapping between NeTEx and APDS elements under ParkingChargeBand Element.....	30
Table 21: Mapping between NeTEx and APDS elements under RefuellingEquipment Element.....	30
Table 22: Mapping between NeTEx and APDS elements under VehicleChargingEquipment Element	30

List of figures

Figure 1: Connection between NeTEx and national profiles	9
Figure 2: Representation of the potential of different national profiles for a specific use case	9
Figure 3: UML Diagram of the Parking Basic Model	12

1. Introduction

Parking data domain attracts a large interest from a variety of stakeholders from the road and public transport fields. This offers a large and different range of points of view and use cases. In the scope of the NAPCORE SWG 4.3 (multimodal standard) parking is observed as an important tool to support the modal shift by attracting car users to take public transport. This vision was supported by the European Commission in the publication of Regulation (EU) 2024/490 (MMTIS DR) amending Regulation (EU) 2017/1926 as it brings the relevant parking data into the multimodal domain ("To be consistent and avoid overlaps with Commission Delegated Regulation (EU) 2022/670 [RTTI DR], specific data types on parking should be added to the scope of Delegated Regulation (EU) 2017/1926")¹.

In order to prove compatibility and interoperability between standards, a technical mapping is needed. It is under the scope of the NAPCORE multimodal standardisation subworking group to analyse the existing data standards under parking scope and deliver a technical mapping to support interoperability and recommendations. The possible use of converters and/or validators in the scope of DR (EU) 2024/490 is collected in several of its articles which can be summarised as: "Regarding the exchange of static, historic, observed and dynamic travel and traffic data, data holders should make that data accessible via the national access point as specified in Article 3 by using the standards and technical specifications referred to in Articles 4 and 5. This can also be done under any digital machine-readable format where data holders can prove that it is fully compatible with the reference standards, including for example through automatic converters or validators. Hence a technical mapping is necessary to prove the compatibility and interoperability of such convertors.

¹European Commission, Directorate-General for Mobility and Transport. (2023, November 29). EUR-Lex. Delegated regulation - EU - 2024/490 - EN - EUR-Lex. https://eur-lex.europa.eu/eli/reg_del/2024/490/oj/eng

2. Parking data standards state-of-the-art

Parking data is an important element that facilitates the transition between transport modes (either personal and/or public transport) and supports the modal shift from private means of transport towards public transport. The fourth recital of the amended version of the MMTIS Delegated Regulation (DR [EU 2024/490](#)²) concludes: “specific data types on parking should be added to the scope of Delegated Regulation (EU) 2017/1926 [...]. Data on parking, such as location and availability of parking places, where and how to pay for parking, and information on parking tariffs, are considered important for the further development of reliable travel information services, and should be made accessible by data holders, such as transport authorities, transport operators, infrastructure managers, transport on demand service providers or parking operators”.

In the European landscape, parking data can be found under different standards, the most common being:

- Transmodel (EN 12896):
 - NeTEx (CEN TS 16614) for static data
 - SIRI (CEN TS 15531) for dynamic data
- APDS (ISO TS 5206-1:2022); which is linked to DATEX II (CEN TS 16157-6:2022).

Different initiatives aiming to bridge the gap between the different standards took place in the last years. The most relevant of them being the HARP initiative (2018-2020) which included a first mapping between NeTEx, DATEX II and APDS supported by the Transmodel ecosystem, DATEX II and the European Parking Association. The work was initiated but it was not concluded due to the rejection of the road counterparts during the DATEX II part 6 revision.

A few months after (end of 2021) a national NeTEx parking profile³ was finalised by the French public transport standardisation committee which involved the participation of French parking stakeholders. As a result, parking datasets are available in the French NAP in NeTEx format since November 2024: <https://transport.data.gouv.fr/datasets/indigo-open-data>

More recently, during the celebration of the Mobility Data Days 2024 in Turin, Italian NAPCORE partners reported that static parking data is being collected and published through the Italian NAP following the Italian NeTEx parking profile⁴. Moreover, dynamic parking data in SIRI format is published nowadays in the regional access point of South Tyrol⁵.

A recent mapping between APDS and NeTEx can be found in <https://github.com/parking-data-standards/apds2netex/tree/main?tab=readme-ov-file#mapping-from-apds-to-netex>. This mapping

²European Commission, Directorate-General for Mobility and Transport. (2023, November 29). EUR-Lex. Delegated regulation - EU - 2024/490 - EN - EUR-Lex. https://eur-lex.europa.eu/eli/reg_del/2024/490/oj/eng

³Ministère des Transports. (2024, November 21). transport.data.gouv.fr. NeTEx - Profil France v2.3 - Parkings. <https://normes.transport.data.gouv.fr/normes/netex/parkings/>

⁴ST SRL. (2024, October 17). GitHub. Linee guida compilazione NeTEx IT v.4.1.0. <https://github.com/5Tsrl/netex-italian-profile/blob/main/Linee%20guida/Linee%20guida%20compilazione%20NeTEx%20IT%20v.4.1.0.pdf>

⁵NOI Techpark. Open Data Hub. API SIRI Parking facility monitoring. <https://transmodel.api.opendatahub.com/siri-lite/facility-monitoring/parking>

was used in the EPA apds2netex converter: <https://github.com/parking-data-standards/apds2netex/tree/main>

Lastly, a European Regulated Parking Data Profile was developed independently by EPA, which aims to map data categories and data types relevant to parking and targeted by the four Delegated Regulations relevant to ITS, including DR (EU) 2024/490 to the relevant NeTEx elements with the minimum content to cover just the delegated regulations, but leaving outside a complete technical mapping. Such exercise can be found in the document EPA Parking Data Essentials – Part 2B⁶ (the version 1.0 was released in October 2024).

⁶European Parking Association. (2024, October 26). European Parking Association. EPA Parking Data Essentials – Part 2B. European Regulated Parking Data Profile. https://europeanparking.eu/wp-content/uploads/2025/01/Parking-Data-Essentials_Part-2B_European-Regulated-Parking-Data-Profile-general.pdf



3. National profiles and full NeTEx standard

A national profile can be understood as a subset of entities taken from the full standard. This subset is identified as a way to help stakeholders implementing parts of the standard (NeTEx in this case) avoiding work with the complete list of entities.

Figure 1 shows a draft of how the NeTEx profiles are part of the full NeTEx standard but taking parts of it.

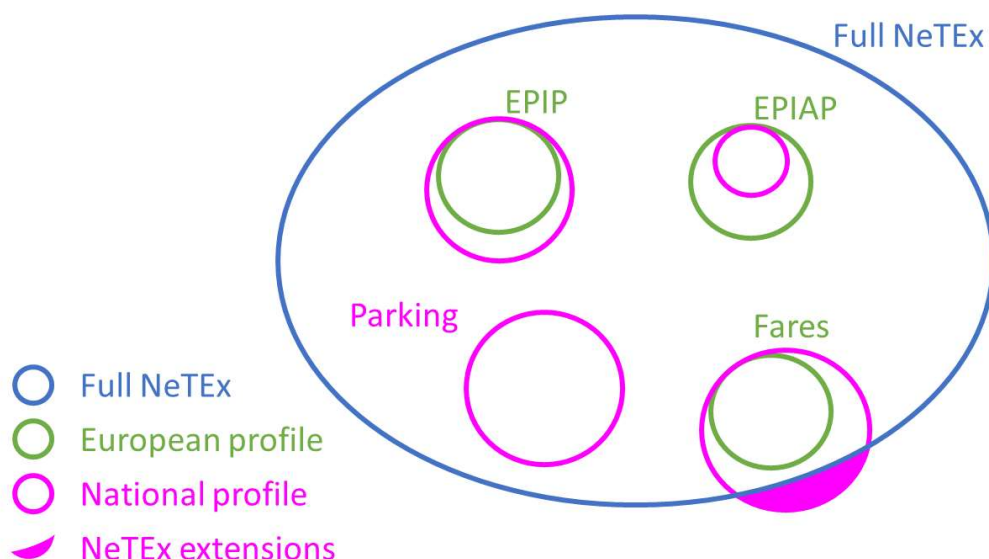


Figure 1: Connection between NeTEx and national profiles

In the figure 2 it is visualised the relation between national profiles and the minimum European profile. Each country can choose to extend or limit its national profile as considered to cover the national needs. As long as the minimum European profile is respected by the national profiles a degree of interoperability should be guaranteed between the different datasets.

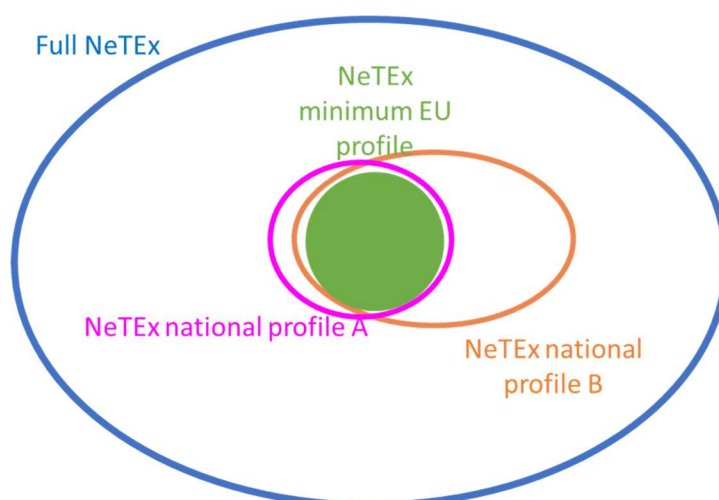


Figure 2: Representation of the potential of different national profiles for a specific use case

More information on the relation between the full standard and a national profile can be found in the NAPCORE milestone 2.7 – An updated list of requirements concerning the use of data standards, profiles and metadata⁷.

It must be observed regarding the preparation of national parking profiles in particular that DR (EU) 2024/490 highlights their importance as it is expected from member states to represent static and dynamic data types described under Annex I through minimum EU profiles or national profiles. At the moment this report is completed (April 2025), there are two NeTEx national profiles on static parking data (French and Italian) that aim to provide a functional answer to the requirements of the MMTIS DR as well as the functional needs of parking in the frame of Transmodel (e.g. location, space availability, fares, etc.).

⁷NAPCORE. (2025, March). Milestone 2.7 – An updated list of requirements concerning the use of data standards, profiles and metadata. <https://napcore.eu/activity-wg2-interoperability-and-level-of-service-of-naps/>

4. Comparison of existing NeTEx parking national profiles (France and Italy)

A comparison of the available NeTEx national profiles (French and Italian) was done in order to understand better their similarities and differences. A complete version of this comparison can be found in the annex 1.

In the scope of NeTEx standard (TS-16614-1: Public transport network topology exchange format): “NeTEx includes a model to describe parking elements. A PARKING is a type of SITE that describes the availability of parking for different types of vehicles and its relation to other SITES such as stations.”.

The French NeTEx parking profile was downloaded from the French National Access Point. For this mapping it was used the version 2.3⁸ published on the 21st of November 2024:

<https://normes.transport.data.gouv.fr/normes/netex/parkings/>

The UML of NeTEx parking (as appears on §8.4.12 in TS-16614-1) is presented in the Figure 3.

⁸Ministère des Transports. (2024, November 21). transport.data.gouv.fr. NeTEx - Profil France v2.3 - Parkings. <https://normes.transport.data.gouv.fr/normes/netex/parkings/>

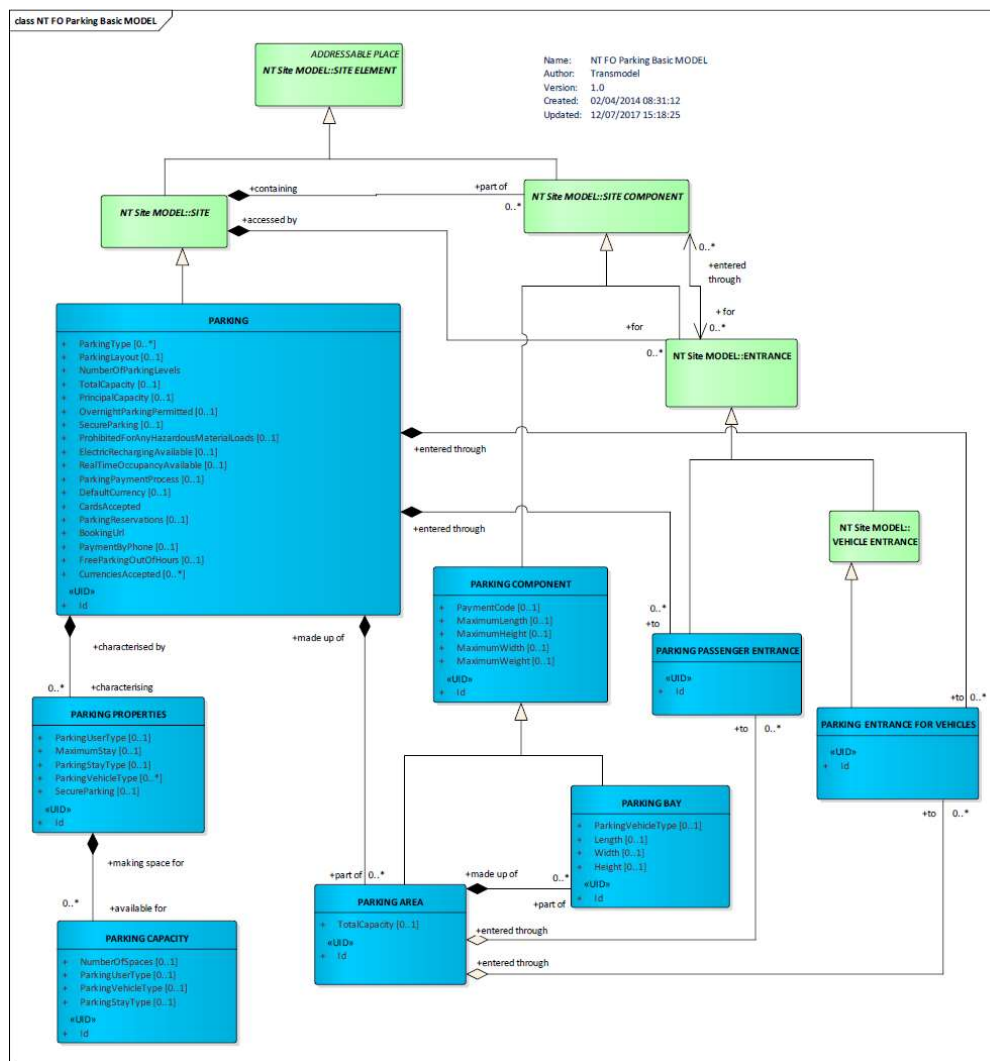


Figure 3: UML Diagram of the Parking Basic Model

The Italian NeTex parking profile was taken from the document “Linee guida per la compilazione del profilo italiano del NeTex (Network Timetable Exchange)” version 4.1.0⁹ which was published on the 17th of October 2024: <https://github.com/5TsrI/netex-italian-profile/blob/main/Linee%20guida/Linee%20guida%20compilazione%20NeTex%20IT%20v.4.1.0.pdf>.

A comparison of the document structure of both profiles shows a few differences between them. The Italian profile has an XML, while the French profile is presenting the XML and the UML. While the XML provides examples of parking data sets, the UML aims to remind the main concepts which are manipulated. Moreover, it can be observed that in both profiles NeTex parking data can be grouped under the domain of “description of the parking place” and “description of the parking fares”.

⁹ST SRL. (2024, October 17). GitHub. Linee guida compilazione NeTex IT v.4.1.0.

<https://github.com/5TsrI/netex-italian-profile/blob/main/Linee%20guida/Linee%20guida%20compilazione%20NeTex%20IT%20v.4.1.0.pdf>

After completing the comparison step between the two NeTEx national parking profiles, the respective French and Italian experts involved in the preparation of their national profiles were consulted and their input incorporated to the document.

In the following pages (Table 1 – 7), it is presented a detailed list of entities that were found in the NeTEx national parking profiles (French and Italian) and marked with an x under which profile they appeared. It is important to remember that the occurrence of entities under the profiles is based in implementation choices of the countries depending on their needs.

NeTEx Entity	FR NeTEx parking profile	IT NeTEx parking profile
Parking - Element		
::>		
id	x	x
(SiteAccessGroup)	x	
PublicCode	x	
Label	x	
ParkingType	x	x
TypeOfParkingRef	x	
ParkingVehicleTypes	x	x
vehicleTypes	x	
ParkingLayout	x	x
NumberOfParkingLevels	x	
TotalCapacity	x	x
OvernightParkingPermitted	x	
ProhibitedForHazardousMaterials	x	x
RechargingAvailable	x	x
Secure	x	x
RealTimeOccupancyAvailable	x	
OperatorRef		x
PrincipalCapacity		x
Generic pricing elements		
ParkingPaymentProcess	x	
PaymentMethods	x	
typesOfPaymentMethod	x	
DefaultCurrency	x	
CurrenciesAccepted	x	
CardsAccepted	x	
ParkingReservations	x	x
BookingUrl	x	
PaymentByMobile	x	
FreeParkingOutOfHours	x	
Components		
parkingProperties	x	x
parkingAreas	x	
entrances	x	x

Table 1: Comparison of French and Italian national NeTex parking profile on entities under the Parking Element

NeTex Entity	FR NeTex parking profile	IT NeTex parking profile
ParkingProperties - Elements		
::>		
id	x	
Name	x	x
ParkingUserType	x	x
ParkingVehicleTypes	x	x
vehicleTypes	x	
ParkingStayList	x	
MaximumStay	x	
BayGeometry	x	
ParkingVisibility	x	
spaces	x	x
version		x

Table 2: Comparison of French and Italian national NeTex parking profile on entities under the ParkingProperties Element

NeTex Entity	FR NeTex parking profile	IT NeTex parking profile
ParkingCapacity - Element		
::>		
id	x	
ParkingUserType	x	x
ParkingVehicleType	x	x
TransportTypeRef	x	
ParkingStayType	x	x
NumberOfSpaces	x	x
NumberOfSpacesWithRechargePoint	x	x

Table 3: Comparison of French and Italian national NeTex parking profile on entities under the ParkingCapacity Element

NeTex Entity	FR NeTex parking profile	IT NeTex parking profile
ParkingEntranceForVehicle - Element		
::>	x	
id	x	x
ModeOfOperationRef	x	
areas	x	
version		x
Centroid	under Zone - Element (abstrait)	x

PostalAddress	under AddressablePlace - Element (abstrait) under PostalAddress - Element (objet inclus)	x
IsEntry	under Entrance - Element	x
IsExit	under Entrance - Element	x

Table 4: Comparison of French and Italian national NeTex parking profile on entities under the ParkingEntranceForVehicle Element

NeTex Entity	FR NeTex parking profile	IT NeTex parking profile
ParkingPassengerEntrance - Element		
::>	x	x
id	x	x
areas	x	
version		x
Centroid	under Zone - Element (abstrait)	x
PostalAddress	under AddressablePlace - Element (abstrait) under PostalAddress - Element (objet inclus)	x

Table 5: Comparison of French and Italian national NeTex parking profile on entities under the ParkingPassengerEntrance Element

NeTex Entity	FR NeTex parking profile	IT NeTex parking profile
ParkingTariff - Element		
::>		
id	x	x
TariffDescriptionGroup	x	
TariffOrganisationGroup	x	
TariffTimeGroup	x	
TariffQualityGroup	x	
ParkingUserType	x	x
ParkingStayType	x	x
ParkingVehicleType	x	x
vehicleTypes	x	
appliesTo	x	
AdditionalTax	x	
parkingChargeBands	x	x
version		x
ValidBetween	under ValidBetween - Element (objet inclus)	x

FromDate	under AvailabilityCondition - Element (objet inclus) under ValidBetween - Element (objet inclus)	x
ToDate	under AvailabilityCondition - Element (objet inclus) under ValidBetween - Element (objet inclus)	x
OperatorRef-ref		x
OperatorRef-version		x
TimeIntervalRef-ref	under TimeStructureFactor - Element	x
TimeIntervalRef-version		x
ParkingRef-ref		x
ParkingRef-version		x

Table 6: Comparison of French and Italian national NeTex parking profile on entities under the ParkingTariff Element

NeTex Entity	FR NeTex parking profile	IT NeTex parking profile
ParkingChargeBand - Element		
::>		
id	x	x
ParkingVehicleType	x	x
MaximumStay	x	
prices	x	
version		x
TimeIntervalRef	TimeStructureFactor - Element	x
ParkingVehicleType	x	x

Table 7: Comparison of French and Italian national NeTex parking profile on entities under the ParkingChargeBand Element

A noticeable difference between these two profiles is the configuration of the parking space. The French parking profile allows the subdivision of parking in differentiated sections with the element ParkingArea. This element is not present in the Italian NeTex parking profile, which shows that in this case, parkings are modelled as a whole unit.

In the following lines we will continue the discussion on some relevant NeTex enumerations for parking data. Table 8 shows a comparison of the parkingLayout enumeration between the French and Italian NeTex national parking profile which is used to define the nature of the parking. As it can be observed, they share almost the same elements, except for onPavement which only appears in the Italian profile.

French NeTEx parking profile	Italian NeTEx parking profile
covered	covered
cycleHire	cycleHire
multistorey	multistorey
-	onPavement
openSpace	openSpace
other	other
roadside	roadside
undefined	undefined
underground	underground

Table 8: Comparison of parkingLayout enumeration between French and Italian NeTEx parking profiles

Following the previous analysis the different types of vehicles authorised in the parking (ParkingVehicleType enumeration) were compared. This enumeration is of importance as it establishes which types of vehicles can access the parking. Table 9 shows the comparison between French and Italian profile and the existing gaps between them. It can be seen that some modes of transport appear with different wording under French and Italian profile. This is the case for a motorcycle; that in the Italian profile is motorcycle, but under the French profile appears as motorbike. Similarly, a bicycle can be defined in the French profile as pedalCycle, while in the Italian profile we find pedalCycle, cycle and eCycle. It has to be noted, that the French national parking profile has undefined as one of the options to be selected. In that case, further determination of the vehicle can be done with the vehicleTypes attribute.

For interoperability purposes, it should be considered that future versions of the existing NeTEx national parking profiles and new national profiles take into consideration the existing enumerations and use the same wording.

French NeTEx parking profile	Italian NeTEx parking profile
agriculturalVehicle	agriculturalVehicle
all	All
allPassengerVehicles	allPassengerVehicles
articulatedVehicle	articulatedVehicle
bus	Bus
camperCar	camperCar
car	Car
carWithCaravan	carWithCaravan
carWithTrailer	carWithTrailer
-	cycle
-	eCycle
fourWheelDrive	fourWheelDrive
heavyGoodsVehicle	heavyGoodsVehicle
heavyGoodsVehicleWithTrailer	heavyGoodsVehicleWithTrailer
highSidedVehicle	highSidedVehicle
largeCar	largecar
largeVan	largeVan
lightGoodsVehicle	lightGoodVehicle
lightGoodsVehicleWithTrailer	-
-	microCar
minibus	minibus
-	miniCar
-	minivan
moped	moped
motorbike	-
-	motorcycle
motorcycleWithSidecar	motorcycleWithSidecar
motorScooter	motorScooter
other	other
passengerCar	passengerCar
pedalCycle	pedalCycle
smallCar	smallCar
-	snowmobile
tanker	tanker
taxi	taxi
threeWheeledVehicle	threeWheeledVehicle
tram	tram
-	transporter
truck	-
twoWheeledVehicle	-
undefined	-
van	-
vehicleWithTrailer	-

Table 9: Comparison parkingVehicleTypes enumeration between French and Italian parking profiles

Finally, Table 10 shows the parkingUserType enumeration. This is the list of users allowed in the parking. Once more, most of the elements is the same for both national parking profiles. It can be

seen a different wording for the parking staff. In the French profile appears as “car park staff” while in the Italian profile it is shown as “staff”.

French NeTEx parking profile	Italian NeTEx parking profile
-	all
allUsers (no restrictions)	allUsers
car park staff	-
-	customers
doctors (doctors and medical staff)	doctors
emergencyServices	emergencyServices
-	guests
-	impairedMobility
other	other
registered (registered people)	registered
registeredDisabled (registered disabled people)	registeredDisabled
rental (people renting the space)	rental
residentsWithPermits	residentsWithPermits
reservationHolders	reservationHolders
-	staff
taxi (taxi)	taxi
vehicleSharing	vehicleSharing
visitors	visitors

Table 10: Comparison of parkingUserType enumeration between French and Italian NeTEx parking profiles

It should be specifically noted how the payment process is described in the French national NeTEx parking profile, with elements such as parkingPaymentProcess, PaymentMethods, currencies or cardsAccepted. Alternatively, the Italian profile these elements are not present. To fully explain its approach, it has to be considered that in NeTEx a travel or parking ticket is described in several steps, from the “atomic” access rights to the “logical” fare product and to the “physical” ticket materialized on a physical support (paper, card or mobile application). The price can be attached to each level.

For the NeTEx Italian profile an intermediate step (FareTable) was chosen and specifying discounts in the physical level (SalesOfferPackage).

Hence, in the case of parking titles:

- ParkingTariff is used only to connect parking access rights (in terms of TimeIntervals) to the Parking area
- The “logical tariff” (FareProduct) recalls the ParkingTariff
- The first level where prices are introduced is the FareTable
- The “physical level” SalesOfferPackage recalls:
 - The FareProduct (and indirectly the ParkingTariff)
 - The FareTable
 - And applies discounts.

In this case, the final price can be calculated gathering all the information: the ParkingTariff alone is not sufficient and has no price attached directly.

In any case, it should be observed that a non-correspondence between NeTEx profiles is a choice of implementation done by the profile itself to include or not the data elements from NeTEx and not a proper lack of functional coverage. Even if an element is not covered by a specific NeTEx profile, it is still under the umbrella of NeTEx.

5. Mapping Standards between NeTEx and APDS

A mapping of elements from the NeTEx standard with APDS was done and a complete version of the document can be found in the Annex 1. For NeTEx, a selection of the elements that appeared at least once on the Italian or French NeTEx parking profiles was done.

Regarding APDS (Alliance for Parking Data Standards), it is an ISO standard (ISO TS 5206-1:2022) that targets at the parking ecosystem and related, amongst others, to DATEX II. The document from Information Model version 4.0¹⁰ release was used to study APDS (updated on 7th of June 2022).

To the best of our knowledge, there are two mappings prepared by EPA between APDS and NeTEx. The first one can be found in <https://github.com/parking-data-standards/apds2netex/tree/main?tab=readme-ov-file#mapping-from-apds-to-netex> and it is used in the apds2netex converter (<https://github.com/parking-data-standards/apds2netex/tree/main>). The second one from the document EPA data essentials (<https://europeanparking.eu/parking-data-essentials/>).

After completing the mapping step between the NeTEx national parking profiles and APDS, the respective EPA experts were consulted and their input incorporated to this document.

¹⁰European Parking Association. (2022, June 7). Alliance For Parking Data Standards. APDS Releases Version 4.0 of International Data Specification for Parking. <https://www.allianceforparkingdatastandards.org/apds-version-4>

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
Parking - Element			
::>			
id	Place.identifier	Y	Y
(SiteAccessGroup)			
PublicCode			
Label	Assumed to be INSEE code		
ParkingType	Place.OperatingRestrictionEnum		
TypeOfParkingRef	Place.OperatingRestrictionEnum		
ParkingVehicleTypes	Eligibility.Qualification.VehicleType. (ReferencedCodeListEntry)		Y
vehicleTypes	Eligibility.Qualification.VehicleType. (ReferencedCodeListEntry)		
ParkingLayout	Place.CoveredEnum Place.topLevelNotCovered Place.StructureTypeEnum	Y	
NumberOfParkingLevels	not found in APDS Information Model		
TotalCapacity	Place...CommonComponents.Characteristics.spacesTotal	Y	Y
OvernightParkingPermitted	IdentifiedArea.Times.Times.available24hours (if parking access is available 24 hours)		
ProhibitedForHazardousMaterials	VehicleLoad can exclude materials materials if defined by user		
RechargingAvailable	Presence of ElectricChargingPoint class implies that charging is available	Y	
Secure	SafetyStandardClassification class supports user-defined safety and security standards		
RealTimeOccupancyAvailable	Supply and Demand of APDS occurs on real-time basis	Y	

OperatorRef	Place.ResponsibilityRoleAssignment.ContactPoint.ContactDetails.personFirstName Place.ResponsibilityRoleAssignment.ContactPoint.ContactDetails.personName Place.ResponsibilityRoleAssignment.ContactPoint.TelephoneContact.ituCountryCode Place.ResponsibilityRoleAssignment.ContactPoint.TelephoneContact.areaCode Place.ResponsibilityRoleAssignment.ContactPoint.TelephoneContact.localNumber Place.ResponsibilityRoleAssignment.ContactPoint.TelephoneContact.extensionNumber		
PrincipalCapacity	SpecificArea.CommonComponents.Characteristics.spacesNonDedicated SpecificArea.CommonComponents.Characteristics.spacesTotal		
Generic pricing elements			
ParkingPaymentProcess	Eligibility.noFeeToUse		Y
PaymentMethods	PaymentMethod.means. (and then the relevant enumeration)		Y
typesOfPaymentMethod	PaymentMethod.means. (and then the relevant enumeration)		
DefaultCurrency	APDS identifies currencies accepted by parking		
CurrenciesAccepted	APDS identifies currencies accepted by parking		
CardsAccepted	BrandsAcceptedCodeList		
ParkingReservations	Qualification.withReservation		
BookingUrl	RateTable.additionalInformation can be used, but not expressly defined on APDS		
PaymentByMobile	Place.PaymentMethod.MeansOfPaymentEnum.mobileAccount		
FreeParkingOutOfHours	This would be defined by the conditions of RightSpecification, Eligibility and associated RateTables		
Components			
parkingProperties	not found in APDS Information Model		
parkingAreas	See IdentifiedAreas and parking Place hierarchy		
entrances	not found in APDS Information Model		

Table 11: Mapping between NeTEx and APDS elements under Parking Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
ParkingArea - Element			
::>			
id	Place.identifier		
TotalCapacity	Place...CommonComponents.Characteristics.spacesTotal		
NumberOfBaysWithWithRecharging	No direct equivalent - RefillPoint/Electric Charge Point / Connector shows the number of available connectors		
ParkingPropertiesproperties	not found in APDS Information Model		
bays	Space (class)		
entrances	IdentifiedArea.VehicularAccess IdentifiedArea.PedestrianAccess		

Table 12: Mapping between NeTEx and APDS elements under ParkingArea Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
ParkingComponent - Element			
::>			
id			
ParkingPaymentCode			
Label			
MaximumLength	Space.VehicularAccess.MaximumDimensions.maximumLength		
MaximumWidth	Space.VehicularAccess.MaximumDimensions.maximumWidth		
MaximumHeight	Space.VehicularAccess.MaximumDimensions.maximumHeight		Y
MaximumWeight	See Eligibility Qualification GrossWeightCharacteristic		

Table 13: Mapping between NeTEx and APDS elements under ParkingComponent Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
ParkingBay - Element			
::>			
id			
ParkingVehicleType	Eligibility.Qualification.VehicleType. (ReferencedCodeListEntry)		
Length	Space.Dimensions.length		
Width	Space.Dimensions.width		
Height	Space.Dimensions.height		
Weight	Space.Dimensions.weigth		
RechargingAvailable	RefillPoint		

Table 14: Mapping between NeTEx and APDS elements under ParkingBay Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
ParkingProperties - Elements			
::>			
id	Place.identifier		
Name	Place.name		
ParkingUserType	Place.Facilities.xxx (UserTypeEnum)		Y
ParkingVehicleTypes	Eligibility.Qualification.VehicleType. (ReferencedCodeListEntry)		Y
vehicleTypes	not found in APDS Information Model		
ParkingStayList	not found in APDS Information Model		
MaximumStay	RateLineCollection.maxTime		
BayGeometry	not found in APDS Information Model		
ParkingVisibility	not found in APDS Information Model		
spaces	SpecificArea.CommonComponents.Characteristics.spacesNonDedicated SpecificArea.CommonComponents.Characteristics.spacesTotal		
version			

Table 15: Mapping between NeTEx and APDS elements under ParkingProperties Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
ParkingCapacity - Element			
::>			
id			
ParkingUserType	Place.Facilities.xxx (UserTypeEnum)		
ParkingVehicleType	Eligibility.Qualification.VehicleType. (ReferencedCodeListEntry)		
TransportTypeRef	Eligibility.Qualification.VehicleType. (ReferencedCodeListEntry)		
ParkingStayType	not found in APDS Information Model		
NumberOfSpaces	SpecificArea.CommonComponents.Characteristics.spacesNonDedicated SpecificArea.CommonComponents.Characteristics.spacesTotal		
NumberOfSpacesWithRechargePoint	RefillPoint		

Table 16: Mapping between NeTEx and APDS elements under ParkingCapacity Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
ParkingEntranceForVehicle - Element			
::>			
id			
ModeOfOperationRef			
areas			
version			
Centroid	VehicularAccess.PointLocation.PointByCoordinates.PointCoordinates.epsgCode VehicularAccess.PointLocation.PointByCoordinates.PointCoordinates.x VehicularAccess.PointLocation.PointByCoordinates.PointCoordinates.y	Y	Y
PostalAddress	Place.Address.city Place.Address.postcode Place.Address.countyCode	Y	
IsEntry	IdentifiedArea.VehicularAccess.AccessLaneSpecificl.AccessLaneTypeEnum (entryOnly or reversibleLane)		
IsExit	IdentifiedArea.VehicularAccess.AccessLaneSpecificl.AccessLaneTypeEnum (exitOnly or reversibleLane)		

Table 17: Mapping between NeTEx and APDS elements under ParkingEntranceForVehicle Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
ParkingPassengerEntrance - Element			
::>			
id			
areas			
version			

Centroid	VehicularAccess.PointLocation.PointByCoordinates.PointCoordinates.epsgCode VehicularAccess.PointLocation.PointByCoordinates.PointCoordinates.x VehicularAccess.PointLocation.PointByCoordinates.PointCoordinates.y		
PostalAddress	Place.Address.postcode		

Table 18: Mapping between NeTEx and APDS elements under ParkingPassengerEntrance Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
ParkingTariff - Element			
::>			
id		Y	
TariffDescriptionGroup	not found in APDS Information Model		
TariffOrganisationGroup	not found in APDS Information Model		
TariffTimeGroup	not found in APDS Information Model		
TariffQualityGroup	not found in APDS Information Model		
ParkingUserType	Place.Facilities.xxx (UserTypeEnum)	Y	
ParkingStayType	not found in APDS Information Model		
ParkingVehicleType	Eligibility.Qualification.VehicleType. (ReferencedCodeListEntry)		
vehicleTypes	Eligibility.Qualification.VehicleType. (ReferencedCodeListEntry)		
appliesTo	Eligibility / Qualifications	Y	
AdditionalTax	Rates.RightSpecification.Eligibility.RateTable.RateLineCollection.t axIncluded Rates.RightSpecification.Eligibility.RateTable.RateLineCollection.t axRate Rates.RightSpecification.Eligibility.RateTable.RateLineCollection.t axValue		
parkingChargeBands	RateTables / RateLineCollection	Y	
version	rateTable.version	Y	
ValidBetween	OverallPeriod		
FromDate	Place.RightSpecification.OverallPeriod.start		
ToDate	Place.RightSpecification.OverallPeriod.end		

OperatorRef-ref	Place.ResponsibilityRoleAssignment.ContactPoint.ContactDetails. personFirstName Place.ResponsibilityRoleAssignment.ContactPoint.ContactDetails. personName Place.ResponsibilityRoleAssignment.ContactPoint.TelephoneCon tact.ituCountryCode Place.ResponsibilityRoleAssignment.ContactPoint.TelephoneCon tact.areaCode Place.ResponsibilityRoleAssignment.ContactPoint.TelephoneCon tact.localNumber Place.ResponsibilityRoleAssignment.ContactPoint.TelephoneCon tact.extensionNumber		
OperatorRef-version	not found in APDS Information Model		
TimeIntervalRef-ref	not found in APDS Information Model		
TimeIntervalRef-version	not found in APDS Information Model		
ParkingRef-ref	not found in APDS Information Model		
ParkingRef-version	not found in APDS Information Model		

Table 19: Mapping between NeTEx and APDS elements under ParkingTariff Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
ParkingChargeBand - Element			
::>			
id			
ParkingVehicleType	Eligibility.Qualification.VehicleType. (ReferencedCodeListEntry)		
MaximumStay	period.startOfPeriod period.endOfPeriod Tables.RightSpecification.Eligibility.RateTable.RateLineCollectio n.maxTime	Y	
prices	Tables.RightSpecification.Eligibility.RateTable.RateLineCollectio n.maxValueCollection	Y	
version	not found in APDS Information Model		
TimeIntervalRef	not found in APDS Information Model		
ParkingVehicleType	not found in APDS Information Model		

Table 20: Mapping between NeTEx and APDS elements under ParkingChargeBand Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
RefuellingEquipment - Element			
::>			
id			
TypeOfFuelAvailable	Place...SupplementaryFacility.SupplementaryEquipment.RefillPoint Rates.EnergySourceEnum		

Table 21: Mapping between NeTEx and APDS elements under RefuellingEquipment Element

NeTEx	APDS	Covered by APDS-2-NeTEx convertor?	Covered by EPA Data Essentials?
VehicleChargingEquipment - Element			
::>			
id			
FreeRecharging	Not reservability...noFeeToUse		
Reservation	Place...IdentifiedArea.SupplementaryEquipment.RefillPoint.reservability		
ReservationUrl	not found in APDS Information Model		

Table 22: Mapping between NeTEx and APDS elements under VehicleChargingEquipment Element

6. Gaps between standards

This section looks into the gaps found between the studied standards (NeTEx and APDS). Although the scope of APDS and the studied NeTEx national profiles are the same (parking) there are differences in the way data is organised.

Starting for a high level, it seems clear that both standards cover a similar scope (parking) as well as related facets (geometry, distribution, bay availability, fares, payment methods, etc.).

Nonetheless, a deeper analysis and comparison of both standards show that some attributes cannot be directly mapped (there is no correspondence for some entities in the source model towards the target model). For example, the NeTEx entity `ParkingType`, which offers an enumeration list to describe the very nature of the parking (e.g. `parkAndRide`, `roadSideParking`, `airportParking`, etc.). Similar enumerations to this one can be found under `Place.OperatingRestrictionEnum` although it is not exactly the same.

Similarly, `ParkingLayout` (which defines the very nature of the parking and the spatial structure) cannot be traced to one specific attribute in APDS. Instead, similar enumerations were found spread across three different attributes: `Place.CoveredEnum`; `Place.topLevelNotCovered` and `Place.StructureTypeEnum`.

Similarly, there were attributes that could not be mapped to APDS. `BayGeometry`, which stands for the distribution that cars are parked in the parking. `ParkingVisibility`, which determines the marking of the parking is done or `ParkingStayList`, which lists the type of parking duration (e.g., `midterm`, `longTerm`, `dropoff`, etc.).

7. Conclusions and Future Work

The present report showed a comparison between the French and Italian NeTEx parking profile and a mapping between French and Italian NeTEx parking profile and APDS.

As found in during the technical mapping, there is a need for a more harmonised structure of the standard documents is needed for the NeTEx profiles. Possibly, developing a template for profiles will be of help in the future development of new parking profiles to ensure alignment between member states.

Additionally, further alignment between the NeTEx national parking profiles would be useful. For example, enumerations for some vehicles are different in French and Italian profile (e.g. bicycles).

In future iterations of this mapping, it would be useful to compare the enumerations of NeTEx and APDS. For example, ParkingType in NeTEx FR includes certain types that are not covered by APDS and vice versa (e.g., APDS includes 'snow' as one of the enumerations). This would require an even more detailed analysis on the correspondences.

Future work on this technical mapping and conversion between NeTEx and APDS should be continued in future stages. This continuation should take place in the future project NAPCORE-X as it is the natural continuation of the NAPCORE project.

Regarding the future work on the technical mapping and conversion between NeTEx and APDS should consider the following points:

First, the development of an EU NeTEx parking profile would be useful as well to align national profiles.

Also, a deeper understanding of the enumerations and their respective mapping is necessary. A description of the APDS enumerations could not be found in the Information Model document. Without this description, the correct understanding of the enumerations can only be guessed at best.

The continuation of the mapping work. This continuation can be extended to other NeTEx profiles that are related to parking, but not covered by the current work (e.g., inherited elements, etc.).

Finally, gaps found between both standards have to be evaluated and can be filled if necessary to secure alignment.