



Project Report

for

European Union Agency for Railways

ERA-2017-3-NP

“Tariff data exchange for domestic rail tariffs”

Version 1.02

Document Control Log

Date	Modified by	Comment	Version
2017.01.10	NJSK	Initial Rough Draft	V0.1
2018.04.20	NJSK	Rough draft	V 0.4
2018.05.04	NJSK	Updated Rough draft	V 0.5
2018.05.30	NJSK	Split into two	V 0.6
2018.06.02	NJSK	Revised draft	V 0.7
2018.06.14	NJSK	Revised	V 0.8
2018.06.02	NJSK	Revised draft: Split out collection notes. Add first example.	V 0.9
2018.07.08	NJSK	Revised draft add visualisation, more examples and new gap analysis section.	V 0.91
2018.07.18	NJSK	<p>Revised draft.</p> <p>Add sections on prices, Trip Supplements, Fulfilment methods, Product durations and Train categories. Revise types of Travel document. Revise User profiles & Groups. Revise other common factors.</p> <p>Add paragraphs on scope</p> <p>Add additional gap analysis entries. Add summary at beginning. Reclassify some missing gaps as possible optimisations.</p> <p>Revise and add more NETEX implementation bullets.</p> <p>Correct typos and improve formatting.</p> <p>Clarify points arising from SJ's comments.</p>	V 0.92
2018.07.25	NJSK	<p>Revised draft</p> <p>Further amendments following Meeting 2018.07.27 at EURA Lille.</p> <p>Extend supplements definitions. Add context of validation & Control to introduction.</p> <p>Move some gaps that have workarounds to optimisations section.</p> <p>Correct & extend notes on UK train example.</p> <p>Add infographic icons to tables. Add Annexes with references</p>	V 0.94

2018.08.08	NJSK	Minor corrections	V 0.95
2018.08.30	NJSK	Address EURA feedback comments, update some diagrams	V 1.00
2018.09.25	NJSK	Address EURA feedback comments	V 1.01
2018.09.27	NJSK	Accept all changes	V 1.02

ERA-2017-3-NP – Tariff Data Exchange Report

Contact Details - Contractor

Primary Contact	Nicholas Knowles  s		Steam Intellect 45 Thornhill Road London N11JS
-----------------	---	--	---

Contact Details - Customer

	 EUROPEAN UNION AGENCY FOR RAILWAYS		European Union Agency for Railways 120 rue Marc Lefrancq BP 20392 FR-59307 Valenciennes
--	---	--	---



Table of Contents

Table of Contents	5
1 Introduction	9
1.1 Project Objectives	9
1.1.1 Project Scope	9
1.1.2 Approach	9
1.2 Overview of NeTEx	11
1.2.1 Purpose of NeTEx	11
1.2.2 Use of NeTEx for Fare & Tariff data	11
1.2.3 Access rights and the wider context of Fare Management	12
1.2.4 Relationship to Transmodel	14
1.2.5 Evolving NeTEx	15
1.2.6 Handling large date sets	16
2 Data Collection	18
2.1 Methodology	18
2.1.1 Observations	18
2.2 Translation	19
2.3 Currency of web data	19
2.4 Scope of fares and tariffs	20
2.5 Organisation of filed online data	20
3 The Fare Product Data Set	22
3.1 Organisation of the Fare Product Spreadsheet	22
3.1.1 Spreadsheet Tab1: List of Railway Undertakings	22
3.1.2 Spreadsheet Tab2: List of Products & Profiles	22
3.1.3 Spreadsheet Tab3: Summary Statistics	23
3.2 Collecting data for the Fare Product Data Set	23
3.3 Populating the Fare Product Data Set spreadsheet	24
4 Analysis	25
4.1 Summary of Common Rail Product Features	25
4.1.1 Commonly found Fare Products on Domestic Rail	25
4.1.2 Commonly found Tariff structures in EU domestic rail	27
4.1.3 Commonly found Product Durations	42
4.1.4 Commonly found Product Charging moments	44
4.1.5 Commonly found Time Demand	45
4.1.6 Commonly found Passenger Types in Domestic Rail	47
4.1.7 Commonly found Group Tickets in Domestic Rail	50
4.1.8 Commonly found Conditions of Use in domestic rail	51
4.1.9 Commonly found Supplement Products on Domestic Rail	52
4.2 Overview of product features	53
4.2.1 Summary of the features of rail tariffs	53
4.2.2 Classifying the features of rail tariffs	55
4.2.3 Commonly found Accommodation categories in EU domestic rail	55
4.2.4 Facilities and Fare Products on Domestic Rail	57
4.2.5 Commonly found Types of Travel Document in domestic rail	57
4.2.6 Commonly found Fulfilment Methods for domestic rail	58
4.2.7 Commonly found Payment Methods for domestic rail	60
4.2.8 Commonly found Distribution Channels for domestic rail	61



4.2.9	Commonly found After Sales conditions in domestic rail	63
4.2.10	Common Combinations of conditions	63
4.2.11	Other factors used in Tariff Structures	64
4.2.12	Other conditions of carriage that relate to fares	66
4.2.13	Frequent traveller products	67
4.3	Summary of rail price features	67
4.3.1	Absolute and derived prices	68
4.3.2	Indirection -Use of Price groups	68
4.3.3	Organisation of rail prices	69
4.3.4	Presentation of fares and fares prices	71
5	XML Examples	72
5.1	Summary	72
5.1.1	General comments	73
5.2	Example 1: Kilometre Distance Tariffs: TFC	75
5.2.1	Key features	75
5.2.2	Network	75
5.2.3	Kilometre distance-based fares	76
5.3	Example 2: Multi Operator Tariffs: Greater Anglia	77
5.3.1	Key Features	77
5.3.2	Network Map	78
5.3.3	Business segments	78
5.3.4	Common National Trip products	79
5.3.5	Time restrictions	80
5.3.6	Types of Travel Document	81
5.3.7	Specifying Interoperable products	83
5.3.8	Railcards	84
5.3.9	Season Passes	86
5.3.10	Additional products	89
5.4	Example 3: Cross border Tariffs: Trilex, DE/CZ/PL	91
5.4.1	Key Features	91
5.4.2	Network Map	91
5.4.3	Saxony Tariff Zones	92
5.4.4	Tariff Sections	92
6	Gap Analysis	94
6.1	Summary Conclusions	94
6.2	What counts as a gap?	94
6.3	Missing feature context	95
6.4	Minor issues – Mainly Interpretation	96
6.4.1	Different prices for different advance booking periods for the same product	96
6.4.2	Different purchase windows and prices for renewal versus initial sale ...	96
6.4.3	Different purchase windows & after sales for different channels	96
6.4.4	Time to Pay vs Time to Book	97
6.4.5	Purchase Window vs Minimum period	97
6.4.6	Commercial conditions may be subject to time limits	97
6.4.7	Point to Zone? Tariff structures.	97
6.4.8	Complex group discounts	98
6.4.9	On board surcharge varies by channel/user profile	98
6.4.10	Assignment of logical operators	98
6.4.11	Fulfilment time.	99



ERA-2017-3-NP – Tariff Data Exchange Report

6.4.12	Ticket Release dates.	99
6.4.13	Personal Tariff zones.	99
6.4.14	Cross border profile differences.	99
6.4.15	Obsolete products.	100
6.4.16	Companion Discounts on specific day types.	100
6.4.17	Relative time for access rights.	100
6.4.18	Staggered expiry dates for a carnet.	100
6.4.19	Personal product allocations.	100
6.4.20	Conditional product elements.	100
6.4.21	Minimum age for purchasing online tickets?	101
6.4.22	Maximum group size for purchasing online tickets?	101
6.5	Minor issues – Mainly Optimisation.	102
6.5.1	Reusing groups of O/D elements.	102
6.5.2	Direction of O/D elements.	102
6.5.3	Type of Product.	102
6.5.4	End of Fare day.	102
6.5.5	Distribution Channel group of points.	103
6.5.6	Multiple fulfilment methods per Distribution Channel.	103
6.5.7	Multiple types of travel document per Sales Offer Package.	103
6.5.8	Additional Documentation attributes.	103
6.5.9	Characterising Fare Quality Factors.	103
6.5.10	Improve Parameter Assignments.	103
6.5.11	Improve Properties of Day.	104
6.5.12	Sales offer Packages in Multiple groups.	104
6.5.13	Improve Reservation.	104
6.5.14	Paying with Usage points.	104
6.5.15	Easements.	104
6.5.16	Multiple Machine reading methods per Type of Travel document.	105
6.5.17	Fare table cells for Fare Section.	105
6.5.18	Relationship between Tariff and product.	105
6.5.19	Lines allowing onboard payment.	106
6.5.20	Activation process.	106
6.5.21	Add Train number etc to Travel Specification.	106
6.1	Minor issues – Optimisations relevant for tariff structure?	106
6.1.1	Multiple operators for Tariff Zone.	107
6.1.2	Rules for Choosing from Multiple Tariffs.	107
6.2	Minor issues – Additional features relevant for passenger Information.	109
6.2.1	Subscriptions – Auto-renewal / Top up.	109
6.2.2	Partial Refunds of Season Passes.	109
6.2.3	Products that have a minimum or maximum distance allowed.	110
6.2.4	Social media Tariffs.	110
6.2.5	Flexible Reservations.	110
6.2.6	Proof of eligibility.	110
6.2.7	Native born.	111
6.2.8	Annual Season pass allows breaks for holiday /sickness.	111
6.2.9	Preferred order of use of products on Smartcard.	111
6.2.10	Retail Consortium – Need to be linked to Country.	111
6.2.11	Extending a journey.	111
6.2.12	Calendar day on Capping Products.	111
6.2.13	Floating or Fixed start for Passes etc.	112



ERA-2017-3-NP – Tariff Data Exchange Report

6.2.14	Extend built in fare demand types.....	112
6.2.15	Improve fare demand types	112
6.2.16	Maximum number of fail-to-checkout events allowed before suspension.	112
6.2.17	Additional Fulfilment methods.....	112
6.2.18	Transferability relative to time of travel.	112
6.2.19	Distinguishing between single and return outbound legs	113
6.2.20	Distinguishing between one-at-a-time and transferability.....	113
6.2.21	Eligible for frequent traveller points.....	113
6.2.22	Family members	113
6.2.23	Break of Journey Validation	113
6.2.24	Changing the number of travellers on a group ticket	113
6.2.25	Billing frequency	114
6.3	Additional models - Missing Features	115
6.3.1	Seating Plan Model	115
6.3.2	Eligibility Model.....	116
Annex A	Transmodel & NeTEx specifications	117
Annex B	TAP TSI annexes B1, B2 and B3 mapping.....	118
B.1	Summary of mapping of B1 (NRT) fares	118
B.2	Summary of mapping of B2 (IRT) fares	118
B.3	Summary of mapping of B3 (Special) fares.....	118



1 Introduction

This document is a report for the ERA-2017-3-NP project that analyses European domestic rail fares based on data collected from the websites of operators.

The report accompanies the other project deliverables.

- 1) A *Fare Product Data Set* spreadsheet that gives a systematic listing of products and user types for the countries covered by the study.
- 2) Web pages and documents from operator websites saved to a set of structured directories.
- 3) XML Examples of using NeTEx for rail fares, accompanied by some explanatory material.

An additional ‘Data Collection Notes’ document is provided in rough form, containing extracts of raw data brief notes on specific operators & countries and also picking out practices and examples of interest.

1.1 Project Objectives

1.1.1 Project Scope

The formal objective of the project as stated in the ITT was:

“The proof of concept that the standard NeTEx (CEN/TS 16614-3:2014) may accommodate the domestic tariffs for rail in use in the member states of the European Union as well as for multi-country passes.

The geographic scope of the study is:

- the Trans-European rail system as defined in Article 1 of Directive EC 2016/797.

Scope of the domestic rail tariffs:

- Multi-country passes or cross-border regional tariffs (e.g. Sachsen-Böhmen Ticket, SaarLorLux-Ticket), except of Interrail/EURail (already included in TAP TSI)
- domestic rail tariffs applicable in the specific member state, within a given region or for a specific railway undertaking
- Tariffs of tariff co-operations covering rail services as well urban metro, tram or bus networks are excluded”

1.1.2 Approach

The project examined European domestic rail tariffs (as presented to the travelling customer) in order to ascertain if they can be represented using the NeTEx Exchange format. There were two main aspects to the work;

- (1) Examining a large number of price information tariffs and fare conditions to look for fare types, conditions, and practices that might not be covered by the current NeTEx standard.



ERA-2017-3-NP – Tariff Data Exchange Report

- (2) Preparing a number of examples that demonstrate the use of NeTEx to encode typical rail tariffs.

The project thus comprised four main tasks, needing an iterative approach to advance each task in parallel.

- **Data Collection** – The gathering of data from websites and documents.
- **Data Analysis** – The creation of a categorisation system with which to interpret the many different fares.
- **Creation of Examples** – The encoding of some typical fare data as XML examples.
- **Reporting** – Producing reports and presentation materials to explain the findings, including a **Gap Analysis** of missing capabilities.

These tasks are described below each in a separate chapter.

The main conclusions can be found at the beginning of the Gap Analysis (see Section 6).



1.2 Overview of NeTEx

1.2.1 Purpose of NeTEx

The NeTEx Exchange format is a CEN Technical Standard for exchanging passenger information between computer systems. It covers many types of multimodal data, including stops and lines, timetables and also fare products and prices (Figure 1).

Using NeTEx with a Profile

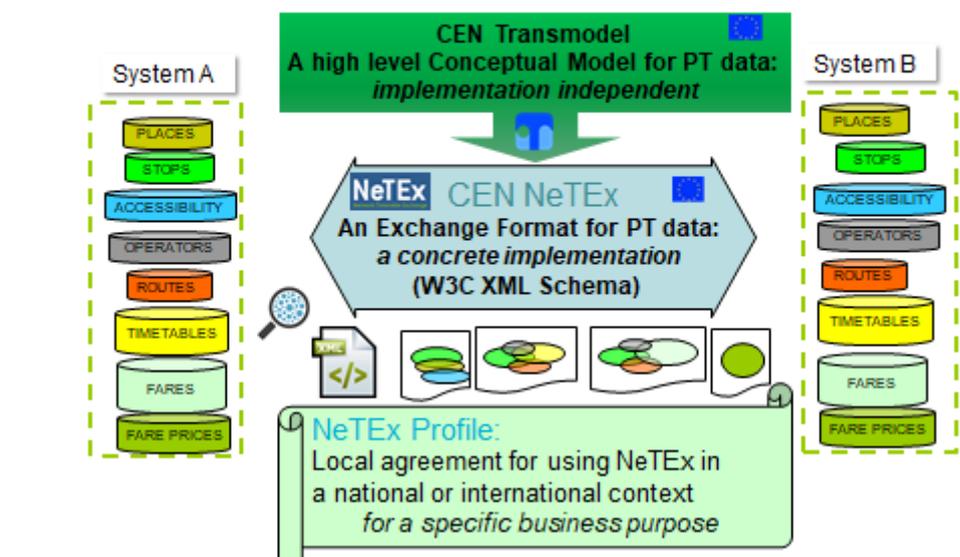


Figure 1 – Use of NeTEx to transfer data between Systems

Data is exchanged as XML documents that conform to a precise schema that can be used to check that the contents have the right data types and values and are self-consistent.

1.2.2 Use of NeTEx for Fare & Tariff data

NeTEx provides a rich representational model for describing both simple and complex fare products and their prices. Products are assembled from a set of low level reusable components, building on other common data sets used to describe the stops, lines and timetabled services of a transport network or networks.

Tariffs and Fare products are described in several steps (Figure 2), summarised as follows;

- The relevant elements of the transport network (stops, tariff zones, etc.) and timetabled services (e.g. specific journeys with fare restrictions, etc). which may be accessed are identified.
- A tariff structure for the transport services is defined in terms of the spatial and temporal elements that are available to access, along with any other features that are subject to differentiated pricing as part of the tariff (e.g. class of use).
- Sets of access rights (e.g. rights to use services in a zone, or travel between specific stops) are defined.

- d) Fare Products are defined that combine access rights with additional conditions such as eligible user types, commercial conditions for purchase and refund, etc.
- e) Products are combined into Sales Offer packages that described the ticket media on which the products are available, along with any additional commercial conditions and the permitted sales channels.
- f) Prices for the allowed combinations of package and product options are defined. The above steps define the offerings that may be purchased and constitute the data needed by fare engines and trip planners to price journeys. In addition, NeTEx has basic capabilities to record sales transactions to purchase tickets.
- g) Purchases of the products can be recorded as sales transactions, each recording a set of product choices.

There are uniform common mechanisms for organizing and versioning sets of data, and for describing common such as validity conditions, etc.

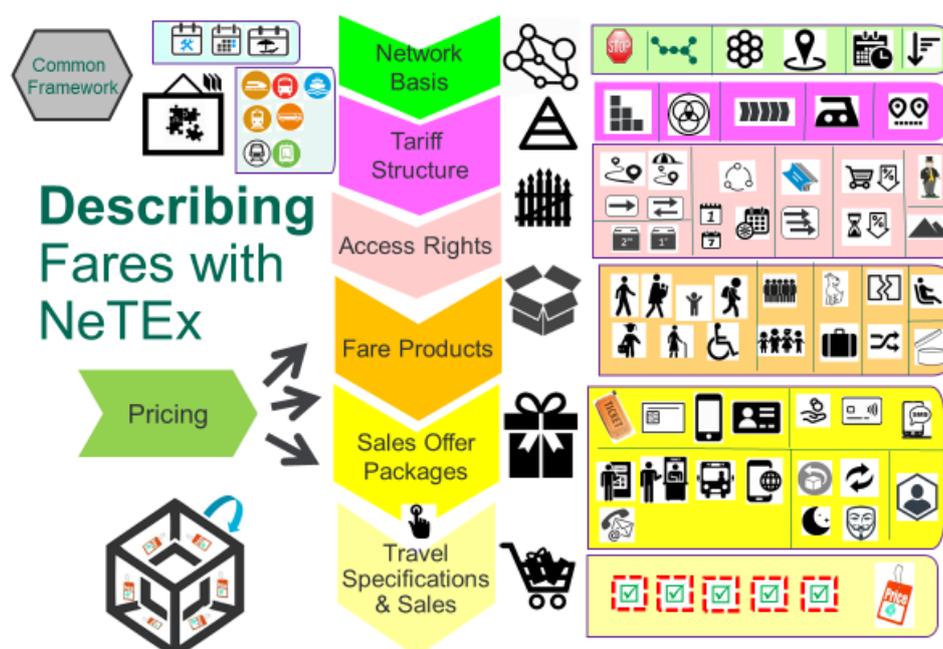


Figure 2 – NeTEx Fare Specification modules

1.2.2.1 Notation - Use of Infographics

Figure 2 above summarises the components of a NeTEx fare specification. The figure, as elsewhere in presentations for the project, makes use of “infographics”; that is, a consistent icon is assigned to each concept to aid the understanding of complex material by users. (Another example of the use of this technique can be seen in the advice to organisations on cybersecurity given on the UK government’s GCHQ site).

1.2.3 Access rights and the wider context of Fare Management

The describing and pricing of Tariffs and Fare products is only one aspect of the functions involved in managing public Transport fares. The products must be marketed and sold to the user, with purchasing and payment processes; then the users’ travel must be validated and controlled to ensure that they have an



appropriate ticket for the trips that they make. Back office processes must also handle settlement and clearing of fare revenues. Although the scope of NeTEx model is currently just the specification and pricing of fare products (the blue boxes and the box labelled ‘Access rights’ in Figure 3), the model is designed so that it has the necessary elements to interface and provide the necessary information to downstream systems for sales and for control and validation. See the Transmodel Specification for further details.

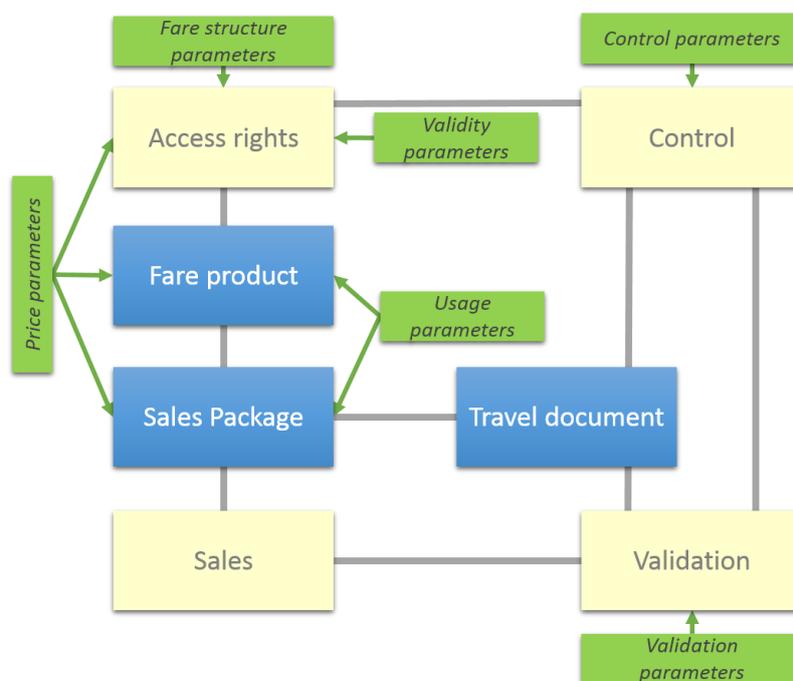


Figure 3 – Fare collection main processes and concepts (SCHEMATIC)

As indicated in the previous section, the essential characteristic of the NeTEx “fare collection” data model is that it is based on **access rights** (i.e. service consumption rights), rather than on prices.

An access right granted to a customer is a part of a service that a user is entitled to consume, and of which the service provider (or another organisation) is able to control the consumption. A wide variety of prices may be attached to a particular access right, and it may be sold in a wide range of marketable combinations. It is possible to describe a price or a marketable package by starting from the access right description, but the opposite is not true, or at least would result in a great complexity.

- Various access rights may be combined in order to form immaterial “fare products” (for example, a “single ride” granted by a fare product called “simple ticket” or multiple trips during one month” granted by a fare product called “monthly pass”), which are marketable sets of access rights.
- One or several fare products may be associated to a “travel document” and materialised (e.g. a paper single ticket allowing only a “single ride” or an electronic card containing various fare products).

- Combinations of fare products and travel documents are sold to customers as “sales offer packages”. Each sold package is part of an individual “contract” with a particular customer.
- Controls are applied to access rights present on travel documents or in contracts, aimed at validating the consumption. The modelling of data related to control and validation of fare use is out of scope of NeTEx; however, the fact that fare products may represent “compound access rights” and that their elementary “components” have to be validated at a certain point or under some conditions, makes it necessary to be able to determine the elementary components of access rights function (called in Transmodel CONTROLLABLE ELEMENTs, FARE STRUCTURE ELEMENTs, VALIDABLE ELEMENTs). in order for downstream processes to

Pricing parameters are applied to access rights (either in a planning stage or, in the case of yield managed fares, in real time), fare products and sales offer packages, in order to calculate the end price to be paid by the user.

1.2.4 Relationship to Transmodel

NeTEx itself is based on the European reference model for Public Transport data, Transmodel, which sets out an extensive model of entities and relationships describing many different functional areas of passenger information and transport operation in addition to fares. Transmodel has recently (2016-2018) been revised to create an updated version 6.0 broken down into 8 functional parts. Transmodel as a conceptual model is concerned primarily with entities and relationships and prescribes only a basic set of attributes. NeTEx, as a concrete format, provides a detailed set of attributes.

NeTEx implements only a subset of Transmodel 6.0, including most of Transmodel Part 6 (Fare Management). Transmodel 6.0 includes additional features not yet implemented in NeTEx 1.1 (see discussion under Gap Analysis).

Transmodel defines a generalised, implementation independent model for PT data, using a consistent vocabulary and specified in UML, a standard software modelling language. NeTEx transforms this general model into a design model for a physical implementation, and then into a W3C schema. Among the benefits of this “model driven” approach are a systematic, modular, design with a high level of reuse of components and the ability to evolve the model readily to meet future needs.

See Annex A for a list of standard specifications for NeTEx and Transmodel.



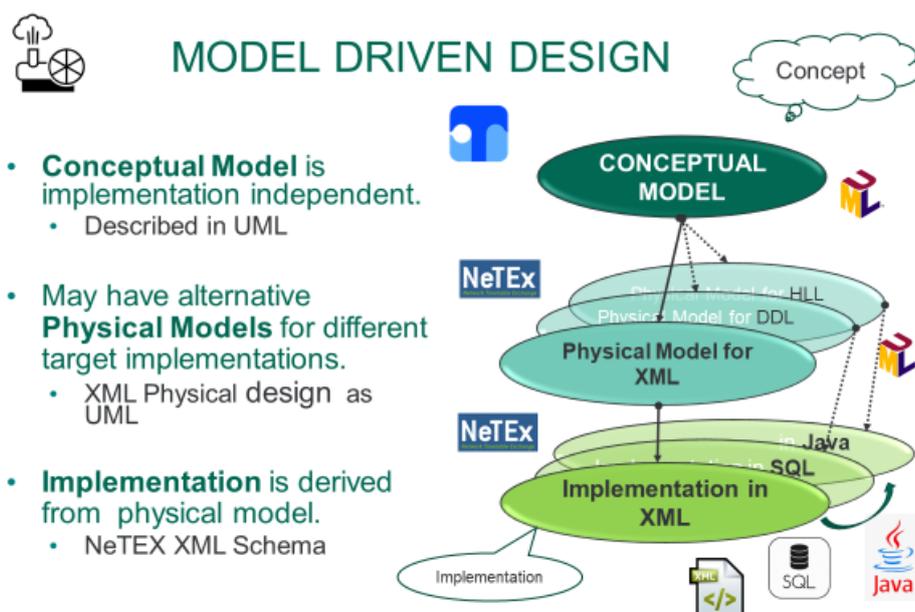


Figure 4 – Model driven design

1.2.5 Evolving NeTeX

NeTeX is designed to be modular and extensible under a uniform framework.

As a CEN standard, NeTeX has a formal process and active working group to maintain the and enhance the standard to meet additional business requirements. CEN has an establish governance process to develop and enhance standards by a consensus process, with formal review and voting procedures.

This study and other projects will identify additional requirements that can be added to NeTeX and Transmodel in future.

Successive releases of NeTeX are identified by a version number; this study is based on NeTeX 1.1, a recently completed revised and enhanced version of NeTeX currently being reviewed and due for ratification by the beginning of 2019.

1.2.5.1 Previous alignment of NeTeX with TAP B1 B2 and B3 specifications

A previous example of the CEN evolution process occurred in developing the NeTeX 1.1 specification; in 2015 a previous ERA sponsored study compared the TAP B1 (NRT), B2 (IRT) and B3 (Special fares) specifications for standard rail tariffs with NeTeX (See Annex B). A number of gaps were identified and addressed by enhancements to the NeTeX 1.1 and Transmodel 6.0 specifications in order to support rail tariffs more completely.

As a proof of concept, examples of actual TAP TSI B1 and B2 data were subsequently encoded in NeTeX, including a large B1 data set comprising many thousands of prices.



1.2.6 Handling large date sets

Public transport data sets can be technically challenging to standardise not only because they cover a complex domain, but also because they can be large. The NeTEx framework includes mechanisms to assist with the management of large datasets including:

- ❖ **Frames:** A container mechanism that allows data to be modularised into coherent subsets. For example, “all the Season ticket products for a specific operator”, or “all the Network elements describing a line and its stops”. There are different types of version frame for exchanging different types of data (Figure 5).
- ❖ **Groups:** Groups of elements may be grouped in named lists, allowing their repeated reuse as sets, and the assignment of common properties. For example, groups of sales offerings may be given shared properties so that many similar products can be defined efficiently just by the properties that are additional to the common set.
- ❖ **Versioning and Validity conditions.** Fare management especially for multi-operator products will typically involve the exchange and aggregation of data from multiple stakeholders. There will be successive versions of data over time with updates having a specific validity period.
- ❖ **Systematic global identifiers.** In order to integrate diverse data sets a globally unique way of identifying elements of any types is needed. NeTEx employs a powerful uniform system of codespaces based on W3C namespaces.
- ❖ **Referential integrity checks:** Typically, a given data set will require a coherent set of elements all to be present in order to be usable. NeTEx makes extensive use of XML’s built in validity checking mechanisms to validate cross references within a document to ensure completeness. For external references to entities in other documents a uniform approach (including versioned references) is used that facilitates programmatic checking.

XML Examples of using the above mechanisms can be found in the XML examples that accompany this report.

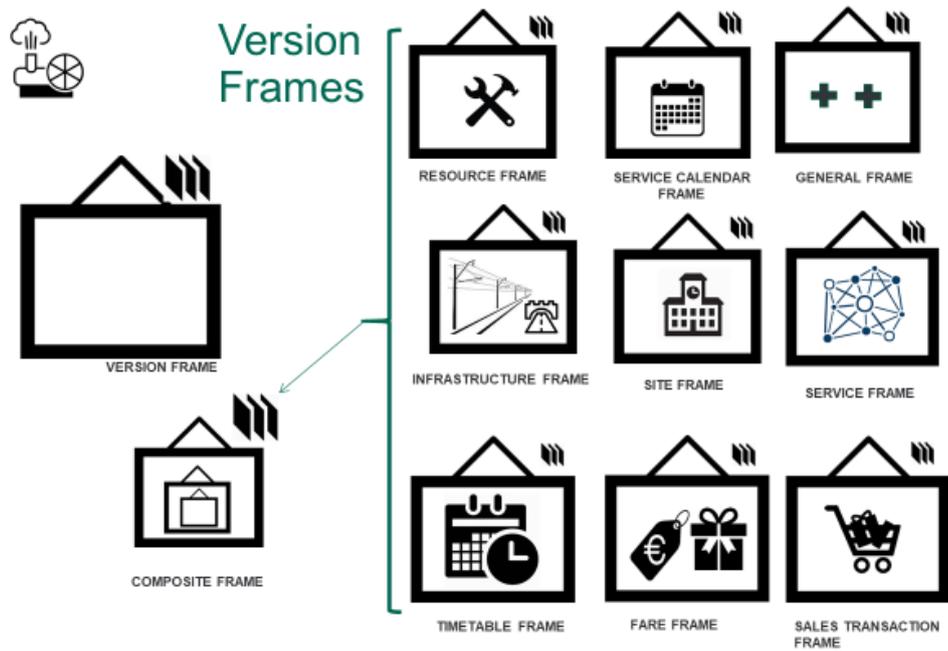


Figure 5 – Types of Version frame

2 Data Collection

The goal of the data collection exercise was to examine available domestic rail tariffs for a specified list of operators in 27 European countries in order to find representative examples and in particular to make a gap analysis - to identify detailed conditions, edge cases, and practices that might not be covered by the current NeTEx standard.

The original list of operators was compiled by the ERA team.

2.1 Methodology

Data was collected by visiting online web data available in each country from the operator, and other source. This included both static pages of fare types and prices, interactive trip planning services, and published documents on conditions of carriage and other terms.

The collection of data was recorded in three ways;

- 1) Entries were created in a **Fare Product Data Set** spreadsheet for each product noted and each type of user to which the products were targeted.
- 2) The **web pages** and **documents** visited were saved to a set of directories.
- 3) Rough notes were made on particular points with small extracts from various operators.

2.1.1 Observations

We note:

- ⇒ There are a large number of operators (200+) providing altogether a very large number of products, using different fare structures (zonal, point-to-point, distance, etc., etc.) and packaged in different combinations for different categories of user (adult, child, student, disable, veteran etc., etc.).
- ⇒ Presentation for tariffs varies widely between different countries and different operators, reflecting differences in different countries as to business practices and markets; in statutory requirements; in the sophistication of ticketing and fare collection technology; in the degree of network integration, etc.
- ⇒ In many cases, especially for Western Europe, there is a close integration of domestic rail and multimodal transport systems and it is impossible to draw a clean line between domestic rail and non-rail products. This is especially the case for commuter products for in metropolitan areas which typically allow use of both rail and other modes under the same ticket or pass.
- ⇒ Within each country, there tends to be similarity in the product sets offered by all the operators. This arises for several reasons:
 - Because of statutory restrictions in the country (e.g. as to the publishing of tariffs, the conditions of carriage and the awarding of concessionary fares to certain types of user, such as the disabled, veterans, pensioners, etc.).



- Because of customer expectation and familiarity with local practice (e.g. kilometre distance-based fares versus zone counting, etc).
- Because of levels of technological development in the country (e.g. extent of use of smartphones, contactless credit cards, bank accounts, automated ticketing equipment, etc).

A consequence of this is that even if there are large numbers of regional operators offering products, it is usually sufficient to describe only a few of them to cover the tariff features found in a given country. Furthermore, a single set of user types will generally be applicable for most products in a country regardless of operator.

For the above reasons, neither the Fare Product Data Set, nor the examples are at all exhaustive, but merely a representative sample chosen to achieve a reasonable basic level of coverage and to record the examination of many detailed web pages.

Because of the wide variation found in the presentation of their products and prices by different operators within each country, it is also not realistic to bring all aspects of their fares into a simple uniform structure, unless the products are additionally broken down into several thousand lower level entries. A loose generic classification was created as a first pass. This has been refined, normalised and simplified as additional data sets have been added, but remains an approximation with different levels of detail used in different places. The classification might be evolved further in future.

2.2 Translation

The data collection has involved looking at data in many different European languages. Where data is not in English, online translation tools have been used to translate web pages and documents – this generally gives useful results but on occasion this leads to ungrammatical or stilted translations.

Many operators offer a version of their website in English. While this is of course valuable and helpful for the purposes of this study, it should be noted that the translated pages provide by an operator often represent a carefully chose subset of information. It was found generally advisable to also check with the native language pages as these often include extra products and conditions for the local market – in particular, concessionary products for students, seniors and the disabled often require a local qualification and so are only presented in native tongue descriptions.

2.3 Currency of web data

The web sites of the rail operators are subject to constant update and improvement as they update their services, develop new products and delivery channels, or simply improve their marketing and customer information. New franchises may be established and companies may be acquired, cease trading or change their names. Although many details taken from web pages are stored in the data set along with the detailed urls from which they came, these will become less accurate over time – and in some cases obsolete. (Changes were observed even during the relatively short span of the study).



2.4 Scope of fares and tariffs

The project geographic scope was given as follows: “The passenger railway undertakings and their tariff data shall be collected. ERA will provide an initial list of undertakings. Railway undertakings only offering services for historic and touristic use are excluded.... The data should be collected exclusively from the internet. Only the currently available tariffs have to be taken into account.” The countries included in the ERA list are shown in Table 1

Austria	Denmark	Greece	Italy	Norway	Slovenia
Belgium	Estonia	Croatia	Lithuania	Poland	Slovakia
Bulgaria	Spain	Hungary	Luxembourg	Portugal	UK
Czech Republic	Finland		Latvia	Romania	
Germany	France	Ireland	Netherlands	Sweden	

Table 1 – Countries included in study

The main focus of the study is standard domestic rail fares in the countries specified in the RU spreadsheet.

- The scope includes in particular standard single and return trip fares, together with day and season passes (any of which may be based on distance, point-to-point or zonal tariff structures). It distinguishes products targeted at different user types (adult, child, student, senior, disabled, etc., etc.).
 - In order to cover the above, it is also necessary to consider additional products such as Rail Cards and usage discounts, which can be used to get reduced fares on the standard offerings.
 - It is also necessary to consider different distribution channels (at station, online, etc) and different ticket media (Print paper, smartcard, mobile app, etc) as different fares may be offered for different combinations of these.
- The project scope formally excludes special offers (excursions, transport for events, temporary reductions, combined offers), though a few of these are included in the data set to indicate how they might readily be included too.
- The scope excludes international products, though some regional cross border fares are included (e.g. see Example 3).
- The scope formally excludes urban multimodal products, though in actually many are included since they are not always easy to distinguish from zonal and commuter rail products.

2.5 Organisation of filed online data

The pages that have visited have been saved to a directory for each operator. This provides a historic snapshot of data examined. The urls recorded in the fare product data set can be used to revisit the actual pages – providing the Url or page contents have not changed in the meantime.



ERA-2017-3-NP – Tariff Data Exchange Report

The top directory structure creates a directory for every operator within every country. The two letter W3C domain code is used for each country, de, fr, ro, uk etc. For example;

de/DB
de/Abelio/
dk/DSB
Ro/Softrtrans/

Within operator, addition levels may be used for operators with separate regional operations. For example;

de/Abelio/MDV

In some cases, where there are a large number of pages, additional folders are used to group similar files.

The URL's of key pages have been included in the Fare Product Data Set spreadsheet.



3 The Fare Product Data Set

The fare product data set is presented as an accompanying MS Excel spreadsheet, with three main tabs:

- (1) List of **Railway Undertakings** RUs This is a slightly augmented version of the original list supplied by the ERA, with some annotations. There are separate entries for each operator, categorised by country and region. For each operator there are a number of different links, e.g. for timetables, for fares, and in different languages.
- (2) **List of Products**. This is a summary of the products examined.
 - a. There is an entry for every type of fare recorded, including single trip fares, passes and supplements. (generally, each of these corresponds to a NeTeX FARE PRODUCT &/or SALES OFFER PACKAGE).
 - b. There is also a 'Discount Profile' entry for each type of customer eligible for a discount (NeTeX 'USER PROFILE') – such as *children, students, seniors, veterans*, etc., discovered, either from an explicit tariff, or implicit in a condition of purchase or use.
- (3) **Analysis Statistics** giving some summary counts for product categories by country.

3.1 Organisation of the Fare Product Spreadsheet

3.1.1 Spreadsheet Tab1: List of Railway Undertakings

This shows the operators in the study and is an augmented version of the list in the ITT for the project. Some additional summary columns are added to the original ERA spreadsheet to note their coverage in the study.

3.1.2 Spreadsheet Tab2: List of Products & Profiles

The main tab shows the data for the RUs analysed by the project, sorted by country and operator. There is a row for each product and for each user profile.

The columns of the Fare Product Data Set spreadsheet are organised into a series of columns, coloured by functional group, with the most significant columns on the left. The following is an overview of the column groups.

- (1) **Operator identification**, [*light blue colour*] indicating the country & operator.
 - ⇒ Data is ordered by country. Arbitrary sequence numbers are also added so that the data may be presented in a meaningful order within country and operator. For example, within country, national operators are shown first; within operator, basic trip products are shown first; passes are shown next; user profiles are shown last.
- (2) **High level Product Classification** [*uncoloured*], indicating the nature of the product (Trip fare, trip supplement, season pass, etc.). further qualified to a varying degree of specificity as to access rights and eligibility, for example *Single, Return, Adult Single, Child Single*, etc., etc.



- (3) **Product name** [*tan colour*] and **description**. A product name, either in the national language or translated into English.
- (4) **Comments**: [*uncoloured*]. Highlighting notable conditions.
- (5) **Fare Structure** [*purple colour*]. An approximate characterisation of the product's tariff structure (as zonal, point-to-point, etc.).
- (6) **Eligibility** [*salmon colour*]. User types, discounts associated with product or profile.
- (7) **Temporal validity conditions** [*pale blue colour*]. Indication of Duration and validity.
- (8) **Access right Scoping parameters** [*light green colour*]. Indicating travel rights granted by the product, e.g. allowed modes, routing restrictions etc.
- (9) **Conditions of Use** [*Light orange colour*]. Interchanging, transferability etc.
- (10) **Distribution channels** [*pale yellow colour*]. Information where the product may be purchased over the counter, online etc [Only partially populated].
- (11) **Sales conditions**: [*light brown colour*]. Refunds, returns, cancellations, compensation etc.
- (12) URL's to the relevant operator web site pages [*grey colour*]. The web page has also been saved to the appropriate directory for the operator. In some cases, an additional url with a pdf document is included.
- (13) **Date of logging** [*grey colour*]. Data capture audit data.

3.1.3 Spreadsheet Tab3: Summary Statistics

This page of the fare product data set gives totals by country for different categories of product/sales offer. It is only very approximate, as operators differ greatly in the way they package their products: for example, some list just a few products (e.g. a *single trip* and *return trip*) with many types of user profile (e.g. see Romania, with *adult, child, veteran, student, academic*, etc.), while others have specific named products for each target user group (*Student single, senior single*, etc).

3.2 Collecting data for the Fare Product Data Set

The methodology has been to read through the different RU sites (including many downloadable documents and tariff sheets), examining the names and nature of the fare products described and creating entries to record them in the product data set, as well as systematically filing the pages and documents found in a folder structure.

- Selected extracts have also been filed as rough notes in a separate document.
- The main goal of the exercise has been to *identify the distinctive feature found in practice, not necessarily to fill out every actual feature in the Data Set*.

Where the pages are not in English they have been translated crudely using online translation tools. Note that in a number of countries basic product pages are available in English but additional products for locals (e.g. student passes) and detailed conditions of carriage are only available in the local language(s).

Product names appear in the Product data set a mixture of the local language and English, most other terms are in English. Ideally the names in both National Language and in English would be given for products.



For some sites PDF documents are additionally available. These are of four main types

- a) Detailed terms of carriage, typically covering statutory requirements, penalties and guarantees;
- b) Tariff sheets providing compact tabular representations of the available products and tariffs including prices;
- c) Fare zone maps,
- d) Fare product marketing brochures describing specific products, for example railcards.

PDF documents have not generally been translated but have been examined – in most cases the content is also described in translated form on web pages or is self-evident from the tabular format.

3.3 Populating the Fare Product Data Set spreadsheet

The level of detail given about different products varies significantly for different operators, as does their approach to combining different options into different products. For example, one might refer to just one standard fare with single or return, adult and child, and first and second-class options. Another might offer separate first class and second-class products. In the spreadsheet the operator's own product composition and description is generally followed, with categorisation indicating the approximate contents. (A more extensive analysis might attempt to break the products down in to comparable subcomponents – but this might risk losing traceability back to the data source).

Typically, the rows and columns of the fare product data set spreadsheet are not completed for every cell. The basic columns on the left-hand side that identify and classify the product are always filled in. The detailed conditions on the right-hand columns are only sporadically filled in where information to do so is readily available. The url records a web page from which the data was taken. In some case a secondary URL is also given.

In some cases, only a summary line is given for an operator, in particular where their products are similar to those of other operators in the country and there are many operators in the country.

The terms and distinctions have been harmonised to a degree but may be refined further.



4 Analysis

In practice, although there is a wide variation in how domestic rail fares are described and presented to the public, only a subset of all the possible combinations of PT tariff structures, products and conditions are typically found in domestic & interregional rail tariffs.

We note that the pricing structure presented to the user may not necessarily expose the underlying fare structure use by the operator – for example:

- What are actually kilometre distance-based fares may be resolved into simple point-to-point fares (for example by ticket machines or online ticketing software).
- Price bands or price groups may be used to give the same fare to many different trips, but users will not necessarily be aware of the price groups as they will only see the resolved prices assigned to each individual trip.
- Separately priced product elements (such as parking, a trip, with the addition of travel on local transport in a destination zone) may be compounded into a single sales offer so that the underlying discrete pricing of elements is not visible.
- There may be complicate rules to compute which routes are allowed for travel – however these may not all be explained to the traveller, who will just see specific routings being offered.

In some European countries there is a statutory requirement to publish a Kilometre based tariff (e.g. Italy, Poland) and pages and documents with these tariffs can be found duly filed on-line, though they are not directly referenced by ticketing systems.

4.1 Summary of Common Rail Product Features

The following set of tables summarises the main features noted in actual domestic rail products in the study.

4.1.1 Commonly found Fare Products on Domestic Rail

Most domestic rail products fall into one of a small number of categories of product type as to the overall access rights they grant; for example, single, return, day pass, season pass, carnet of products, etc. Some products grant the right to travel; others grant the right to buy other products at a discount, or to get a discount based on usage.

Table 2 shows the main product types found. The products build on underlying tariff structures described later below. They are further modulated by a large number of parameters and sales conditions also summarised in the following sections.

	Nature	Description	Note/ Example
Trip	Single	A single trip between an origin and destination. May or may not allow a journey break (in which case a maximum	Romanian standard single.



ERA-2017-3-NP – Tariff Data Exchange Report

		travel time will apply). Some local rail systems also have a short trip of a limited number of stops or duration.	<ul style="list-style-type: none"> ❖ Represented in NeTEx by a PRE-DEFINED ACCESS RIGHT)
	Period Return 	A return trip between an origin and destination. Must be completed in a certain period.	<ul style="list-style-type: none"> ❖ Represented in NeTEx by a NeTEx PRE DEFINED ACCESS RIGHT.
	Day Return 	A return trip between an origin and destination. Must be completed in the same fare day (which might extend into the next calendar day e.g. till 4am).	<ul style="list-style-type: none"> ❖ Represented in NeTEx by a PRE-DEFINED ACCESS RIGHT.
Multi Trip Carnet 	Carnet of Trips 	A bundle of individual trips sold together at a discount, typically to be consumed within a certain time limit.	<ul style="list-style-type: none"> ❖ Represented in NeTEx by a NeTEx AMOUNT OF PRICE UNIT.
	Carnet of Day Passes 	A bundle of individual day passes sold together at a discount, typically to be consumed within a certain time limit.	<ul style="list-style-type: none"> ❖ Represented in NeTEx by a NeTEx PRE-DEFINED ACCESS RIGHT.
Stored Value	Predefined Units 	<p>A bundle of units that may be marked as used to make an arbitrary trip.</p> <p>Relevant for stage fares with a fixed price per stage. If the units are money, corresponds to the balance on a smartcard.</p>	<p>Czech Kilometric fare product (2000km to be used in 6 months)</p>
Pass 	Day Pass, zonal 	The right to make an unlimited number of journeys within a one or zones within a day (Which may run into the next day in certain cases).	<ul style="list-style-type: none"> ❖ Represented in NeTEx by a PRE-DEFINED ACCESS RIGHT.
	Season, P2P Routed 	The right to make a number of journeys between two points within a certain period. The number may unlimited or of a set frequency e.g. once a day in each direction. May be constrained to a route or routes and operator or operators.	<ul style="list-style-type: none"> ❖ Represented in NeTEx by a PRE-DEFINED ACCESS RIGHT.
	Season, Zonal 	The right to make an unlimited number of journeys within a given area for certain	<ul style="list-style-type: none"> ❖ Represented in NeTEx by a PRE-DEFINED ACCESS RIGHT.

		period (e.g. 1 day, 2 days, 1 week, 1 month, 1 year, etc.).	❖ Represented in NeTeX by a PRE-DEFINED ACCESS RIGHT.
	Season Pass Routed+ Extension 	A hybrid pass allowing commuters to travel a route and a central zone.	Anglia season pass + London Travel card
Discount 	Discount Right (TravelCard) 	A product that gives the right to buy other products at a discount. May be packaged separately or bundled with another product.	E.g. DB BahnCard25 ❖ Represented in NeTeX by a SALES DISCOUNT RIGHT
	Capped Discount 	A product that gives the right to buy other products at a discount, with a further limit on charges within a given period.	TfL Oyster, German VRN “Crow Tariff” ❖ Represented in NeTeX by a CAPPED SALES DISCOUNT RIGHT
	Usage Right 	A product that gives the right to a rebate according actual usage. Requires either a smartcard or an account or both.	Danish <i>Rejsekort personligt</i> ❖ Represented in NeTeX by a USAGE DISCOUNT RIGHT
Other	Third Party Entitlement 	A third-party product or membership schema that gives the holder rights to obtain or purchase a travel product. Can be sued for example to represent an identity card issued to authenticate a user as belonging to a specific eligibility group.	❖ Represented in NeTeX by a THIRD PARTY PRODUCT

Table 2 – Commonly found Rail Products

- ❖ The products described all correspond to various types of NeTeX fare product (PRE-DEFINED ACCESS RIGHT, DISCOUNT RIGHT, USAGE RIGHT, FARE SUPPLEMENT, etc). In some cases, several different types of NeTeX product may be bundled together in a single sales offer. For example, rail season passes such as the UK GOLD CARD often combine a Season pass with a Discount Card giving rights to buy other products at a discount).

4.1.2 Commonly found Tariff structures in EU domestic rail

The fare products given above can be based in a number of different possible tariff structures; point-to-point, zonal, flat, etc.

Although classical rail tariffs were either kilometre distance based or used arbitrary point-to-point pricing, zonal fares are now quite common, particularly in metropolitan areas and where there are integrated multimodal transport systems. There may also



be differential pricing for other factors such as the distribution channel (online, mobile app, ticket machine, etc). Flat fares are often found for supplement products such as seat reservations and may also be offered for zonal fares and for special offers. For long distance fares and most standard national products, point-to-point fares remain the primary tariff structure.

In general, we may distinguish between those aspects of tariffs representing *access rights*, that is, the rights to consume different types of public transport service, and *usage parameters* which further moderate or qualify the consumption of services. Table 3 (below) and Table 4 (later) show common spatial and temporal access right concepts respectively. Usage parameters are discussed later below.

4.1.2.1 Network access rights for tariff structures

Name	Description	Comment	Note/example
Point-to-point (P2) 	Access right is to travel between two named points.	Explicit: Separate prices (or price groups) are given for each named Origin and Destination Pair. <ul style="list-style-type: none"> ❖ Each O/D pair is represented in NeTEx by a DISTANCE MATRIX ELEMENT. ❖ Where the network has multiple routes, or operators there may be constraints by route and or by operator. ❖ Represented in NeTEx by a SERIES CONSTRAINT 	Widespread – e.g. UK standard fares. Access in different directions may have different price (e.g. on circular route).
Distance 	Access right is to travel between two named points, the pricing being based on a shortest path distance through the network.	Distance Based: A table of distances and a price per kilometre is given This can be used to compute a P2P price based on the timetable distance. <ul style="list-style-type: none"> ❖ Represented in NeTEx by a set of GEOGRAPHICAL INTERVALs with GEOGRAPHICAL INTERVAL PRICES that can be used to price the distance from a DISTANCE MATRIX ELEMENT. 	Common Romanian standard fares.
Zonal 	Access right is to travel in named zones.	There is an absolute price for each zone or zone combination. The specific origin and destination zones determine the price. <ul style="list-style-type: none"> ❖ The tariff zones are represented in NeTEx by a TARIFF ZONE or FARE ZONE, which can be used to assign stations to one or more tariff zones. ❖ Each Zone O/D pair is represented in NeTEx by a DISTANCE MATRIX ELEMENT. 	Widespread e.g. Denmark, Luxembourg.

<p>Stage Counting</p> 	<p>Access right is to traverse a certain <i>number</i> of stages or zones.</p>	<p>Each stage or zone has a unit cost associated with traversing it. the number of zones traversed is used to determine the price.</p> <p>A given stop may be in several zones (e.g. also a 'near to' zone) so as to smooth the prices of short trips. (A stop may be assigned to a FARE ZONE, or to a specific FARE SECTION within a SERVICE PATTERN).</p> <ul style="list-style-type: none"> ❖ Represented in NeTEx by one or more GEOGRAPHICAL INTERVAL, where the unit is a zone or section. <p>A GEOGRAPHICAL INTERVAL PRICE may be given to each interval.</p>	<p>"Short Trip, Some Estonia ".</p>
<p>Flat Rate</p> 	<p>Access right is regardless of distance or time.</p>	<p>Price is fixed. Commonly used for supplements.</p> <p>Represent in NeTEx by some form of FARE PRODUCT PRICE associated directly with the priced supplement product.</p>	<p>Bicycle fees, Airport Express fare, some night trains.</p>
<p>Trip+ Extension (Hybrid)</p>	<p>P2P with one or more zones added.</p>	<p>The overall combination of base product plus extension is offered at a discount.</p> <p>NeTEx can bundle multiple products into a single SALES OFFER PACKAGE made up of distinct SALES OFFER PACKAGE ELEMENTs.</p>	<p>Often provided for metropolitan destinations.</p>

Table 3 – Common Network access aspects of Tariff Structures

4.1.2.2 Tariff parameter values versus Tariff calculation

The calculation of rail fares may entail complex rules with different tariffs and discounts applying for different parts of the trip and on different train types and classes of carriage, along with additional rules concerning the combination of existing access rights and discounts for which the user is eligible. It should be emphasised that the exact nature of these calculations is not covered by a data exchange standard such as NeTEx; a data exchange standard merely aims to describe all the data values that are relevant for making the calculation.

In particular, ***where multiple tariffs and fareProducts are applicable to a route, NeTEx does not say which is "best"; it mere allows them all to be specified.*** Typically, it is the task of journey planning and fare finding software (whether in an online service, ticket machine or station office terminal) to decide which fares it wishes to show as available and in which order they should be presented. Various criteria are possible – cheapest for the user; most flexible for the user; most profitable for the operator; satisfying regulatory strictures, etc.

4.1.2.3 Illustrating spatial aspects of tariff structure

This section presents simple visualisations of different spatial concepts found in rail fare tariffs.

4.1.2.3.1 Distance based tariff structure

Figure 11 shows a price / distance graph for a **distance** tariff system where the price is a function of distance. There may either be:

- (a) a uniform rate per unit distance, in which case the line is straight (or rather slightly stepped by rounding factors to reflect rounding up and down to amounts convenient to handle in a specific currency), or
- (b) A stepped distance function, with different rates (usually decreasing progressively) per kilometre applying to different ranges of distance.

The units of distance may be actual kilometres, or a notional fare distance that is slightly different from the actual distance, or even some arbitrary unit. There may be minima and maxima for the overall fare prices.

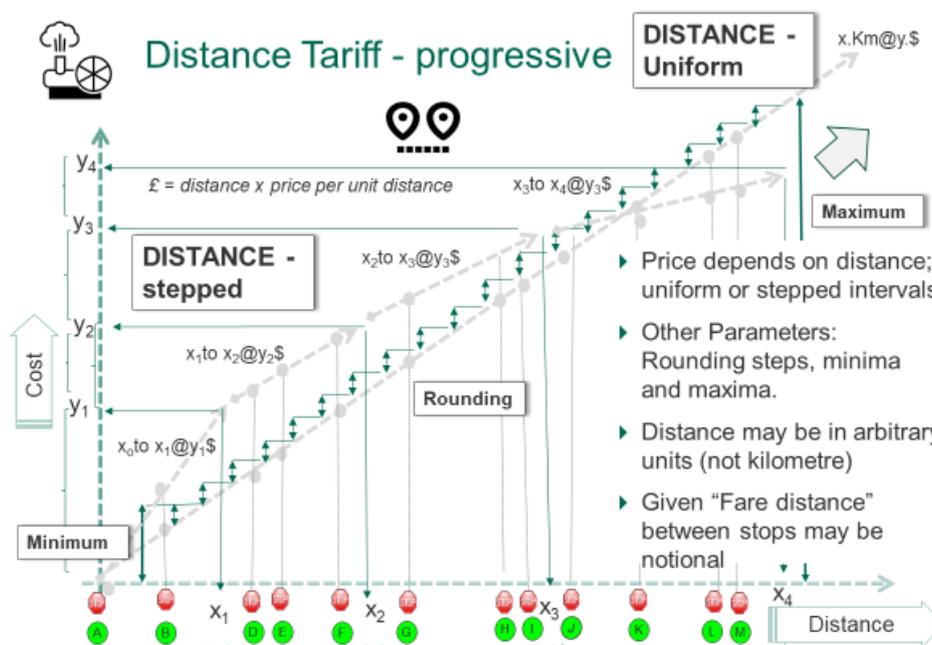


Figure 6 – Distance based tariff structure

- ❖ In NeTeX, such kilometre distance tariffs are typically represented by a set of GEOGRAPHICAL INTERVALS, each with a price. Distances between stops, as say stated by a matrix of DESTINATION MATRIX ELEMENTS, are used to compute the price. ROUNDING parameters are used to round up and down. LIMITING RULES are used to set minima and maxima.

4.1.2.3.2 Flat tariff structure

Figure 7 shows the price / distance graph for a **flat** tariff system, where the price is set regardless of distance.



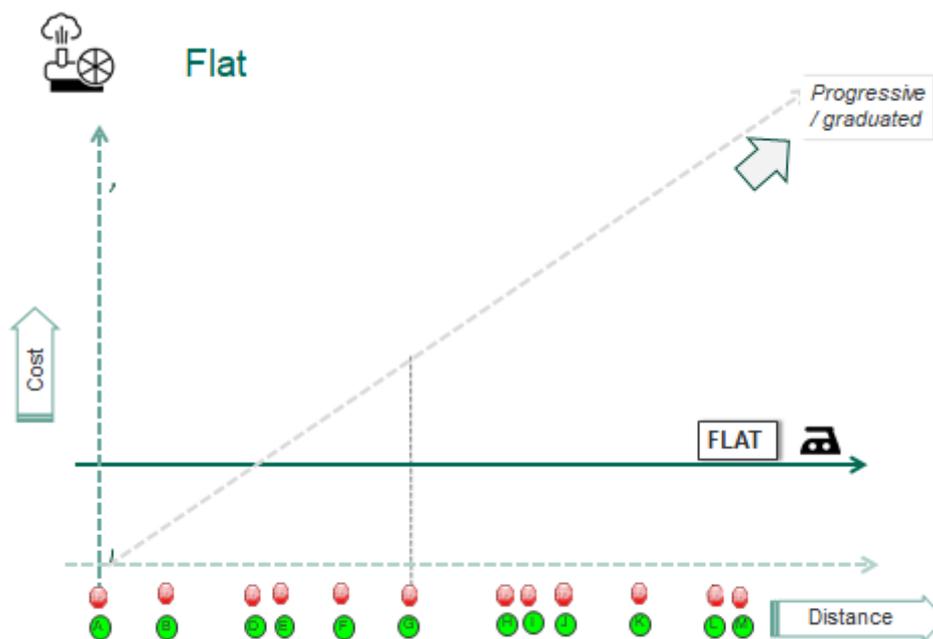


Figure 7 – Flat tariff structure

- ❖ In NeTEx, such tariffs are typically represented simply by associating a price with the product or product element or parameter that is subject to a flat rate. For example, a flat rate seat reservation might be associated directly with a FARE SUPPLEMENT product.

4.1.2.3.3 Point-to-point tariff structure

Figure 8 shows the price / distance graph for a point-to-point tariff system where the price between any two points can be set arbitrarily. While the pricing is usually progressive – i.e. increases with distance – it does not have to be, and there may be anomalies to improve yield or discourage use of congested sections of the network.

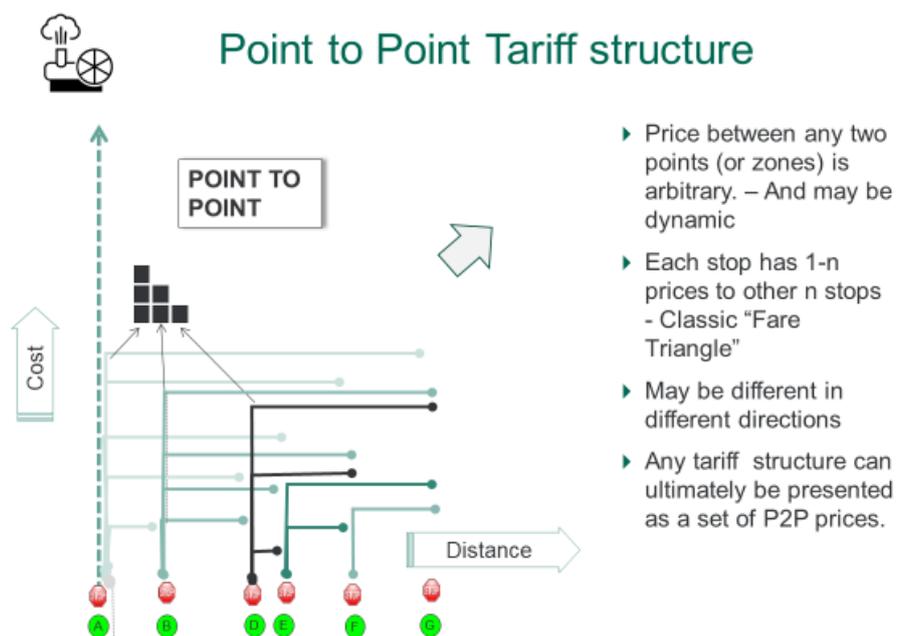


Figure 8 – Point-to-point based tariff structure

- ❖ In NeTEx, point-to-point tariffs are typically represented by a set of DESTINATION MATRIX ELEMENTs, each representing the possibility of travel between two points. Prices may be associated with these origin/destination pairs. Where multiple routings are possible. The routing(s) may be indicated by one or more SERIES CONSTRAINTs, INTERVALs, each with a price.
- ❖ Some online systems may apply dynamic pricing, such that individual train journeys are each priced differently in real time. Prices can attach to individual SERVICE JOURNEYs that follow JOURNEY PATTERNs that relate to the destination origin and destination.
- ❖ There may be many different tariffs that apply to the same DESTINATION MATRIX ELEMENT.
- ❖ A tariff presented to the user as a point-to-point price may actually be computed from another tariff structure (distance, zonal, etc), applying rounding, tax etc.

4.1.2.3.4 Zonal tariff structures

Figure 9 shows relative pricing of zones of a zonal tariff system. Again, the pricing is usually progressive – i.e. increases with zone size and so travel distance – but does not have to be so. Zonal systems may be arranged according to different topologies – e.g. disjoint, nested, overlapping, etc.

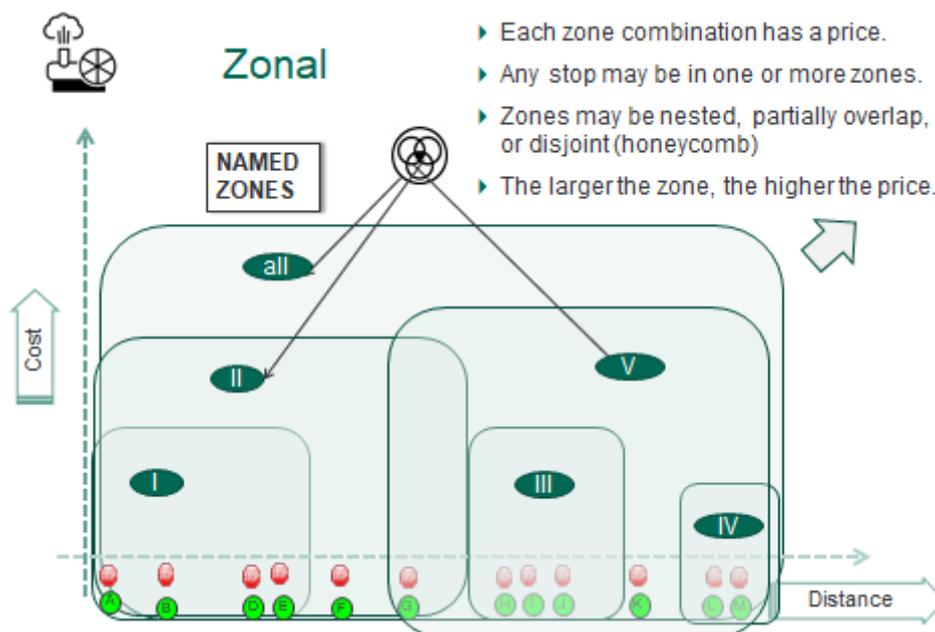


Figure 9 – Zonal tariff structure

- ❖ In NeTeX, FARE ZONES (a specialisation of TARIFF ZONE) are used to describe groups of stops making up a zone. DESTINATION MATRIX ELEMENTS can be used to specify the allowed transitions between zones and the prices attached to them.
- ❖ A stop may be in more than zone; it is up to the trip planner to find the cheapest zone for a passenger to use for a given journey.
- ❖ In most fare systems the zones are predefined by the transport operator. A few modern account-based products for multimodal urban fares allow the user to define a “personal zone”; a centre point is chosen and then stops within a given radius may be added. The tariff structure is thus based on the zone size supported for the radius rather than any specific zone. This can be represented in NeTeX by FARE QUALITY FACTORS. A process is needed to build and store the customers personal zone and associate it with their account and travel document. In other respects, it can be regarded as a normal zone tariff.

4.1.2.3.5 Zonal / Stage / Section count tariff structures

Figure 10 shows a price / distance graph for the tariff steps of a unit fare system, in which the network is divided into similar sized zones or sections and a unit price is assigned for use of a single zone or section. The price of travel then depends uniformly on the number of zones or sections consumed.

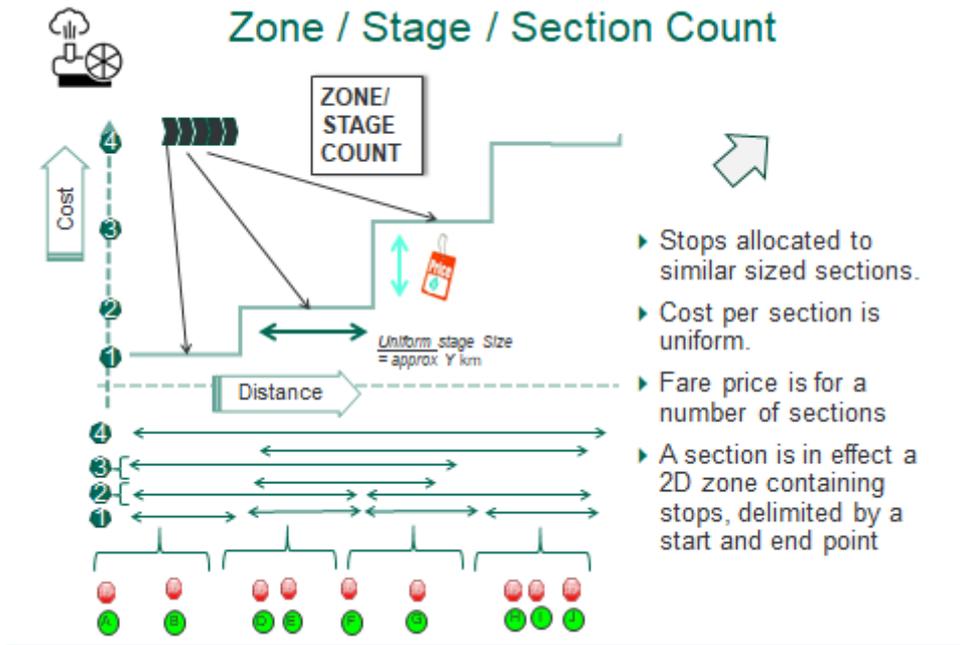
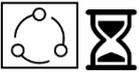


Figure 10 – Zone / Stage count tariff structure

- ❖ In NeTeX, sequences of stops can be described as a FARE SECTION. FARE ZONES can also be used to describe groups of stops making up a zone. A GEOGRAPHICAL INTERVAL can be used to define a number of sections or zones and a price attached to it.
- ❖ A stop may be in more than section or zone; it is up to the trip planner to find the cheapest section to use for a given journey.

4.1.2.4 Temporal fare aspects of Tariff structures

Temporal constraints may apply to the tariff structure (Table 4). Some of these can be regarded as fundamental to the access rights of the tariff structure, for example the period of a season pass, or the duration of a trip, or when travel may take place; others may apply to ancillary factors such as the commercial conditions attached to the fare, for example, the purchase window within which the ticket may be bought. In both cases different prices may attach to different conditions.

Nature	Description	Comment	Examples
Pass duration (Access Time Limited) 	The traveller may have the rights access the network for a specified period –ranging from a day to one year	As in day and season passes. Prices typically depend on the duration, with discounts for longer periods. discounts for longer periods. For a day pass, the start and end times may be fixed (the fare day) of variable (from the time of purchase. For a season pass the start day and duration may be fixed (e.g. Monday fo	Available intervals are represented in NeTeX by a TIME INTERVAL

		seven days, or the 1 st of the month for one month) or variable.	
<p>Trip duration (Access Time Limited)</p> 	<p><i>Once started the passenger may be required to complete an individual trip within a certain time</i></p>	<p>In a zonal system, different time intervals may be offered at different prices (e.g. 1 hour, 2 hours, 3 hours, etc.), in effect constituting a form of distance-based fare.</p> <p>In a point-to-point system where the destination is already fixed, the time represents the maximum time allowed to make the trip – relevant in particular if journey breaks are allowed.</p>	<p>Represented in NeTEx by a TIME INTERVAL</p>
<p>Use by date (Usage Validity)</p> 	<p>Once purchased. the product may be required to be used within a certain period.</p>	<p>Applies mainly to trip products – most standard tickets must be used within a certain time.</p> <p>A return trip may have to take place within a certain time after the outbound trip.</p>	<p>Represented in NeTEx by a USAGE VALIDITY PERIOD.</p>
<p>Time of Travel (Fare Demand) limited</p> 	<p>Travel may be limited to travel only at certain days or times of day.</p>	<p>Standard tickets can be used anytime, other tickets may be restricted to various Off peak timebands and or day types.</p> <p>There may be different time band bands for different directions of travel.</p>	<p>Represented in NeTEx by a FARE DEMAND FACTOR.</p>
<p>Purchase Window</p> 	<p>The product may only be available a certain in advance or up to a certain time before travel</p>	<p>Discount and group products in particular tend to have limits as to when they can be purchased. These may vary by distribution channel and period. There may for example be different prices associated with purchasing or changing a fare within a given time.</p> <p>Different times may apply to initial purchase and renewal.</p>	<p>Represented in NeTEx by a PURCHASE WINDOW.</p>
<p>Post-sales conditions</p> 	<p>The time conditions as to when a product may be may modified, exchanged, refunded, renewed, etc.</p>	<p>Limits may apply to the period in which exchanges and refunds are allowed. For passes</p>	<p>Represented in NeTEx by a EXCHANGING, or RETURNING.</p>

Table 4 – Some temporal concepts applying to fares

4.1.2.5 Illustrating temporal factors for tariff structures

This section presents visualisations of different temporal concepts found in rail fare products in order to distinguish between the different possible usages and to indicate how they can be represented in NeTEx.



4.1.2.5.1 Basic temporal elements for a single trip

Figure 11 introduces the simple case of a single one-way trip, shown as an arrow indicating a directional traversal of space over time in a specific direction (outbound is up, return is down). Basic temporal concepts relevant to the access rights include:

- The **usage validity period** within which the product must be used; this may be relative to the original date of purchase or otherwise, such as the day of activation for travel. Choice of a period for a product will be subject to rules as to **when the journey may start**. The start time may be **fixed** (typically by being tied to the choice of a specific journey) or **variable**, the same ticket, allowing the user to take any train within the usage validity period (as opposed to requiring an exchange and a reissue of another ticket for a different date).
- The **maximum permitted trip duration**, once the journey is started. For how long the user may travel. (Applicable mainly in zonal systems where the user may travel anywhere by any route). A tariff structure might allow several different intervals at different prices.
- The **purchase window**. The period before (and if onboard sales are allowed, during) travel within which the product can be purchased.

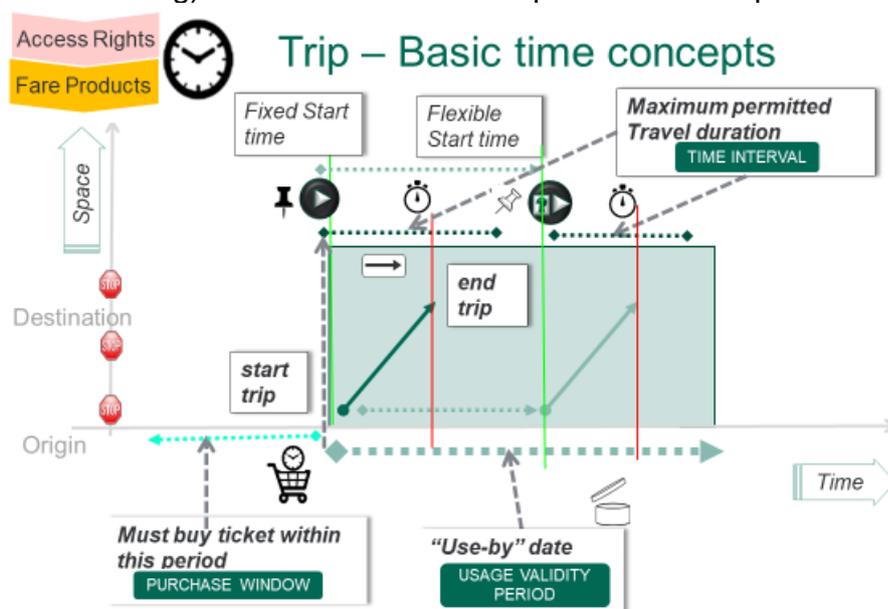


Figure 11 – Basic Time concepts for a single trip

- ❖ In NeTEx, for time limited products such as short-hop trips in a zone, one or more TIME INTERVALs (possibly elaborated as TIME STRUCTURE FACTORS) are used to indicate the permitted maximum trip duration – different TIME INTERVAL PRICES may be associated with different intervals.
- ❖ A USAGE VALIDITY PERIOD can be used to specify the overall period within which a product must be consumed, and whether it may be given a fixed or variable start time; if the purchase is tied to a specific journey then it will be fixed by the time of the journey, in other cases the user can catch any train.
- ❖ The period within which a ticket must be purchased can be represented by a PURCHASE WINDOW. There may be different windows for different sales channels, fulfilment methods, etc.

4.1.2.5.2 Further temporal elements for a single trip



Figure 12 elaborates the case of a single trip to consider in addition trips involving several legs - and also possible temporal restrictions in the commercial conditions:

- The **usage validity period** as introduced above may actually be stated in terms of when the journey is started or completed (or even both)).
- **Interchanging window:** if interchanges between services allowed, there may be a maximum period within which interchanges must be made.
- **Exchanging window:** the period with which any exchange of ticket is allowed (Which may be relative to the original date of purchase or of travel).
- **Refunding window:** the period with which any refund must be claimed. (Which may be relative to the original date of purchase or to the date of travel).
- **Charging moment:** the moment relative to actual travel at which the journey is actually charged to the customer is material for representing tariff structures: most classical travel is prepaid, but modern pay-as-you-go systems (see later below) may instead charge after travel is completed, or take an initial fee, followed by a later adjustment when the total consumption within a period is known.

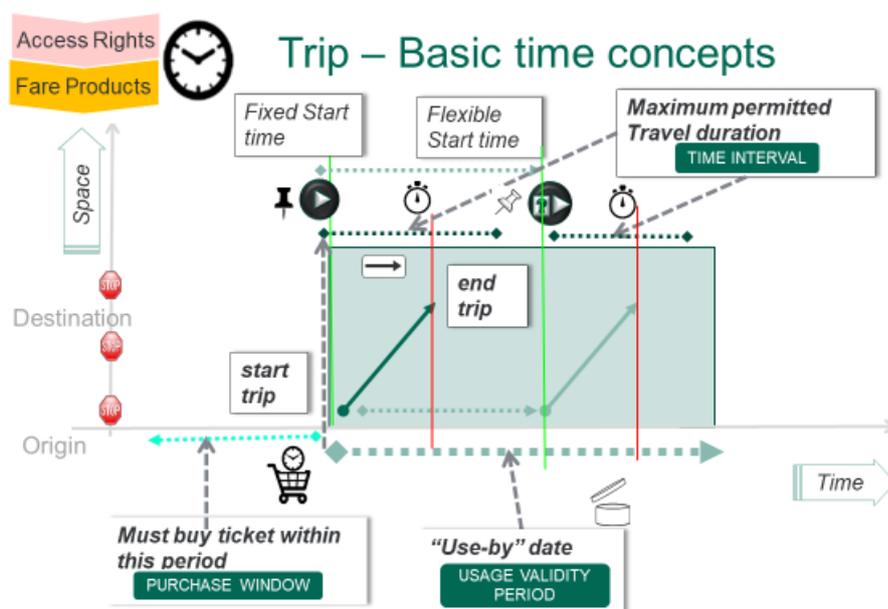


Figure 12 – Further Time concepts for a single trip

- ❖ In NeTEx, an INTERCHANGING usage parameter can be used to set whether interchanges are allowed, the maximum allowed time to make the interchange and whether the journey can be broken.
- ❖ EXCHANGING and REFUNDING usage parameters specify conditions on modifying or refunding a ticket, and can entail with time limits.
- ❖ The point in time at which the user pays for the access rights can be described by a CHARGING MOMENT.

4.1.2.5.3 Temporal elements for a return trip

Figure 13 shows temporal concepts for a return trip which will in addition have separate validities for the outbound and inbound legs:

- The **usage validity period for the outbound leg** may be stated in terms of when the outbound trip was started or was completed, or when the product was purchased.



- The **minimum stay** can set a minimum period which must be passed at the destination before commencing the return.
- The **usage validity period** for the **inbound leg** may be stated in terms of a period, commencing when the outbound journey is completed, by which the return journey must be started or completed.

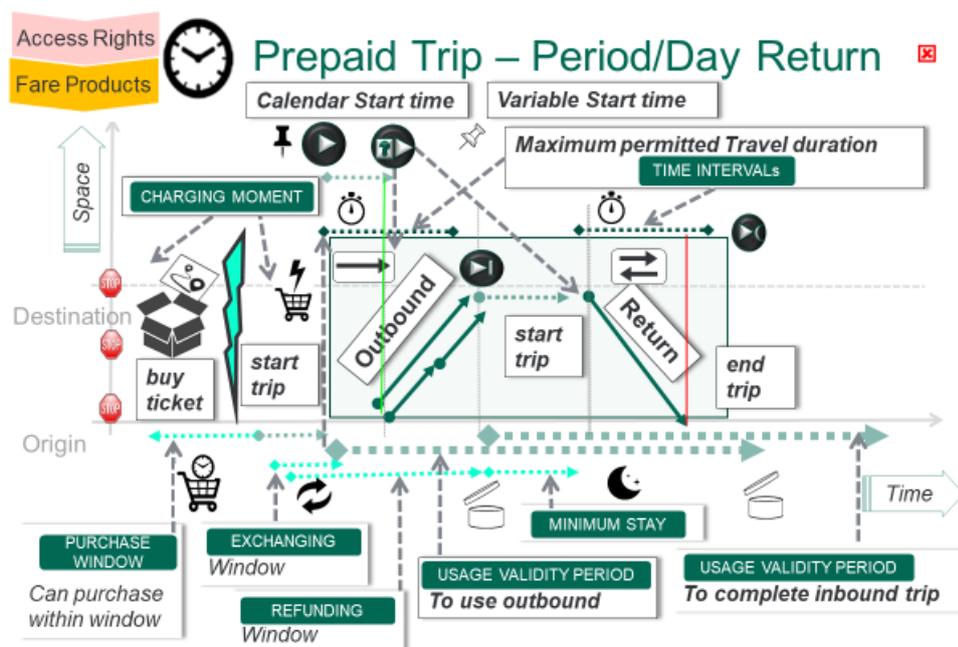


Figure 13 – Time concepts for a return trip

- ❖ In NeTEx, for a return trip, there may be separate USAGE VALIDITY PERIODs for the outbound and the return trip; a MINIMUM STAY usage parameter can be used to set requirements for minimum trip length. As for a single trip, any time restrictions on the purchase, exchange and refunding of a product may be represented by durations associated with parameters.

4.1.2.5.4 Charging moments for a prepaid pay as you go trip

Figure 14 introduces the temporal aspects of charging involved in a simple prepaid “pay as you go” trip, made using, for example, a product permitting multiple trips that are charged for only when consumption of each trip starts. Typically, there is a charging moment when an initial purchase of a smartcard or registration in an Account Based Ticketing system is made, and then a further charging moment at the start of each trip when the smartcard or account is debited by a specific amount.

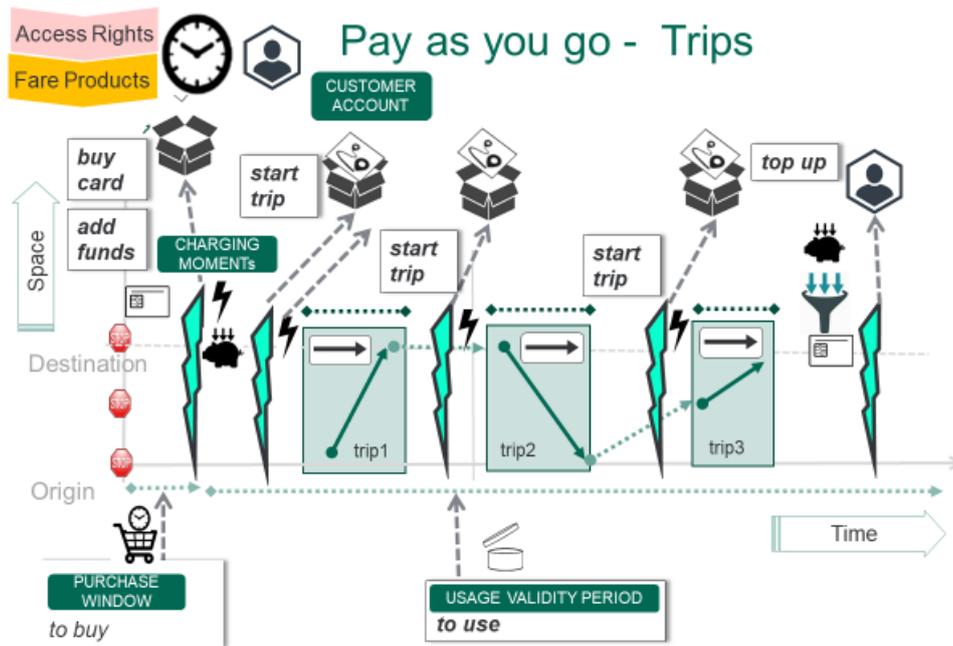


Figure 14 – Charging moments for a prepaid pay as you go trip

4.1.2.5.5 Charging moments for a capped pay as you go trip

Figure 15 shows the more complex temporal aspects of charging involved in a capped pay-as-you-go trip. As for the simple example above, the initial charging moment procures the product; then there is a debit for each trip, however the actual price of the trip is not known until all consumption within a period is complete.

- Capping Rule Time Interval:** within a given time period, the overall price may be limited such that the total amount paid by the user is capped (for example, no more than a day ticket within a given day, or no more than a weekly ticket within a given week). Users are charged on an individual trip basis until they reach the cap, after which trips are in effect free.

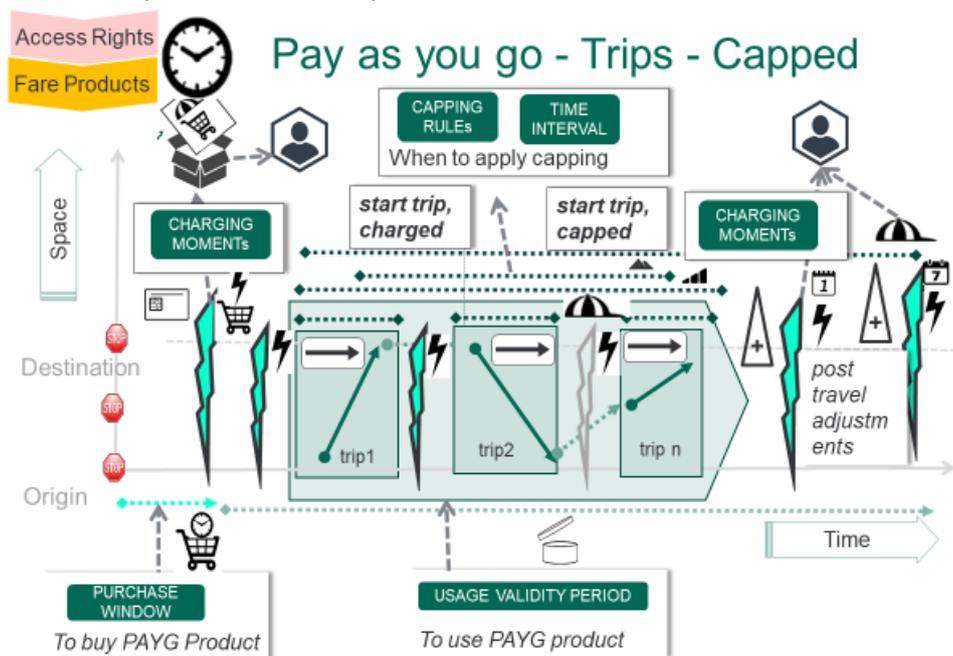


Figure 15 – Charging moments for a capped pay as you go trip

- ❖ In NeTeX, a CAPPED DISCOUNT RIGHT product is used to describe pay as you go products: it can have one or more CAPPING RULEs, each with a TIME INTERVAL setting the window within which it applies. CHARGING MOMENTs occur when the product is bought and when trips are made – depending on the control technology used, further moments may be needed to make adjustments.

4.1.2.5.6 Charging moments for post-paid trips and for usage-based discounts

Figure 16 shows the use of a capping rule time interval for a post-paid product, where the charge to the user is noted at the start of each journey but is only made to the user at the end of a set period (possible subject to a capping rule); the time interval indicates when this will occur (end of day, end of week etc). This scenario is typical of the use of EMV credit or debit cards as travel documents; the user does not need to purchase or register directly for a separate smart card to gain the right to travel, and the credit risk for the travel incurred is managed as part of their credit card contract. One or more capping rules can also be used to set usage-based discounts - for example a discount if more than a certain amount of travel is made within a certain period.

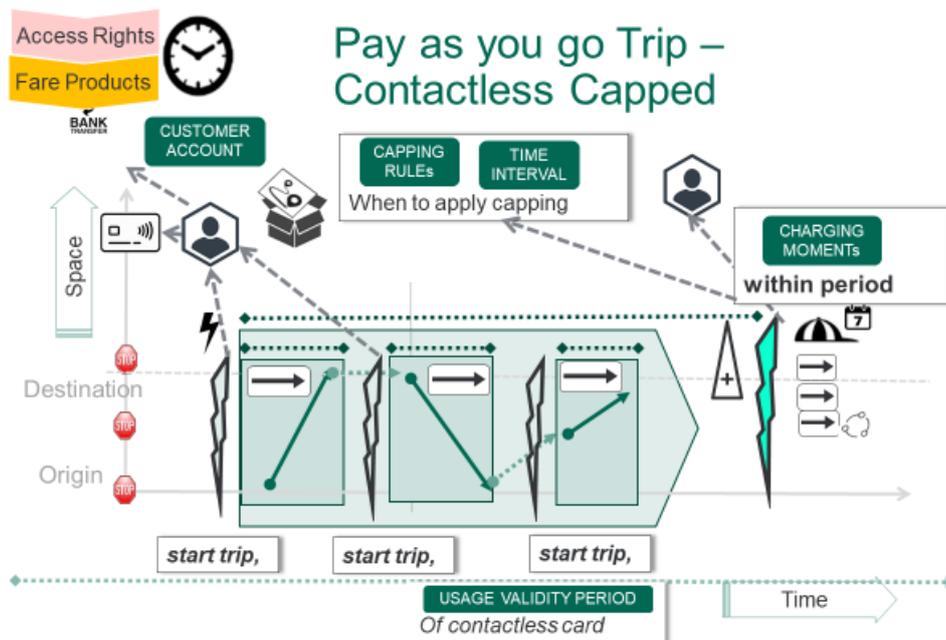


Figure 16 – Charging moments for post-paid trips

- ❖ In NeTeX, a USAGE DISCOUNT RIGHT product is used to represent the right to consumption-based rebates. A TIME INTERVAL can be used to set the window within which it applies. An additional CHARGING MOMENT represents the point at which the rebate is awarded. Use of such a products entails having a CUSTOMER ACCOUNT against which the trips are reconciled.



4.1.2.6 Illustrating temporal factors for period passes

This section presents visualisations of different temporal concepts found in rail period passes (day, week, season, etc.) products in order to distinguish between the different possible usages and to indicate how they can be represented in NeTEx.

4.1.2.6.1 Basic temporal elements for a prepaid pass

Figure 17 introduces the case of a pass that allows repeated travel within a given period. Temporal concepts include:

- **Pass duration.** For how long the pass is valid (1-day, 1-week, etc.).
- **Trips per period:** a frequency of use can indicate whether the pass allows permit unlimited travel or is limited (e.g. to two trips per day, one in each direction, as with some rail commuter products).
- A **usage validity period** may further qualify the validity. The start date may be **fixed** according to the calendar (e.g. *Monday*, or “*1st of the month*” or “*1st Jan*”) or **variable** allowing the user to choose any start date in advance, or simply by activation. The pass may run up either to the **end of the calendar day** or to the fare **operating day** (which may be different from the former). Some passes even allow a grace period to travel after the notional expiry of the pass, in case it has not been possible to renew the pass that expired on a holiday or weekend.
- **Pass holidays.** Some longer season passes allow one or more intervals during which the pass can be suspended for holiday or for sickness (the time being added to the end). Note that this is not currently represented in NeTEx but could be added with a simple extension.
- The **purchase window.** The period before travel within which the product can be purchased. This may be different for **initial purchase** and for **renewal**.
- **Exchanging window:** the period with which any exchange of the pass is allowed.
- **Refunding window:** the period with which any refund or partial refund can be claimed.

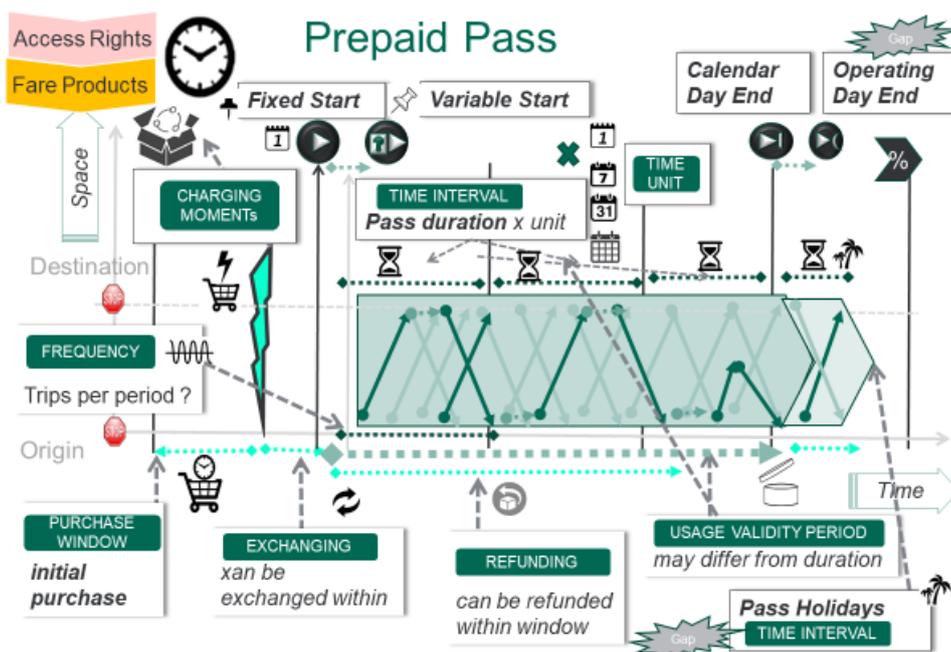


Figure 17 – Temporal concepts for a pass

- ❖ In NeTeX, TIME INTERVALs are used to represent the available durations of a pass where these are predefined (1D, 1M,,etc). A FREQUENCY OF USE usage parameter can set the number of trips allowed in a given period.
- ❖ EXCHANGING, REFUNDING and PURCHASE WINDOWs usage parameters specify time limits for buying and refunding, as for trip products.

4.1.2.6.2 Payment temporal elements for a pass

Figure 18 extends the case of a season pass to consider subscriptions. Additional concepts include:

- **Subscription validity period:** The period for which a subscription lasts, during which a pass for a given interval (Weekly, monthly etc) will be purchased. The subscription may be **fixed** or **rolling**, i.e. renew automatically or not.
- **Charging moments:** the point at which the pass is purchased or renewed.

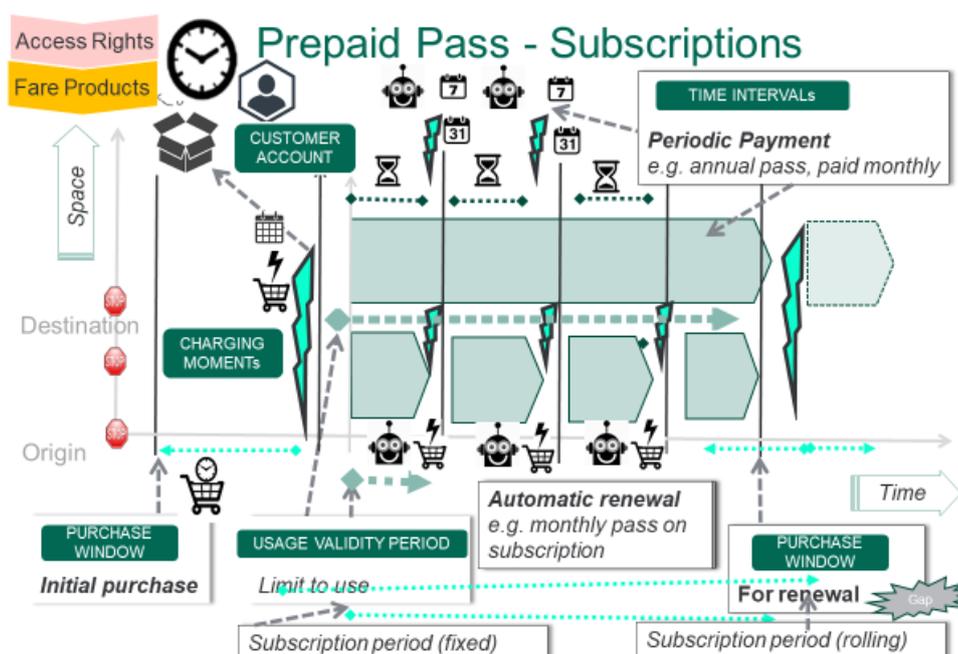


Figure 18 – Subscription Temporal concepts for a pass

4.1.3 Commonly found Product Durations

Although products in principle could be created with a validity period of any duration, in practice certain durations are much more commonly found (see Table 5). Note however, that some passes allow the number of days or months to be chosen arbitrarily.

	Nature	Description	Comment
Trip	1-Hour	Ticket valid for up to 1 hour’s travel.	E.g. Short Trip



ERA-2017-3-NP – Tariff Data Exchange Report

			
	90-Minutes	Ticket valid for up to 1.5 hours travel.	E.g. Zonal.
	120-Minutes	Ticket valid for up to 2 hours travel.	
	180-Minutes	Ticket valid for up to 3 hours travel.	
Pass 	24-Hour 	Ticket valid for up to 24 hours travel starting at the time of activation.	e.g. Variable start Day Pass
	1-Day 	Ticket valid from start of day (or moment of purchase if later) until the end of fare day.	e.g. Fixed start Day Pass.
	3-Day 	Ticket valid for up to 72 hours travel.	
	5-Day	Ticket valid for up to 5 days travel.	May be fixed (Monday) or variable day start.
	1 Week 	1 Week pass, fixed or variable start.	May be fixed (e.g. Monday) or variable start day.
	Weekend Only	Pass only valid Saturday and Sunday	
	1 Month 	1-month pass.	May be fixed (e.g. 1 st of month) or variable (i.e. any day) start day.
	3-Month	2-month pass.	
	6-Month	3-month pass.	
	12-Month 	1-year pass.	May be fixed (e.g. 1 st of year) or variable (i.e. any day) start day.
	2-Year	2-year pass.	
3-Year	3-year pass.	Some Rail cards.	
Student / Youth Pass	Term (semester)	Valid any day during term-time.	Specific to local academic calendar.



			
	Term - Schooldays	Valid only on schooldays during term time.	Specific to local academic calendar.
	Academic Year	Valid any day during academic year.	Specific to local academic calendar.
	Holiday	Valid for a holiday period. Summer holiday tickets are most common	Specific to local calendar.

Table 5 – Common Product Duration

- ❖ In NeTEX, a TIME INTERVAL, and or a TIME STRUCTURE FACTOR is used to represent each different duration. A different TIME INTERVAL PRICE can be associated with each interval.
 - ❖ Calendars for School and University terms and holidays may be defined using a SERVICE CALENDAR FRAME. A SERVICE CALENDAR relates a DAY TYPE to an actual calendar day using a DAY TYPE ASSIGNMENT.

4.1.4 Commonly found Product Charging moments

An important characteristic of Fare Products is the moment of actual payment for access rights (Table 6).

Nature	Description	
Prepaid	Product is bought outright before travel.	E.g. Classical tickets.
Prepaid Subscription	Product is bought by a regular monthly or other period automated subscription at a discounted rate.	E.g. ABO products.
In transit	Product is bought onboard during travel or at exit point.	
Pay as you go at start of travel	The user is charged on starting the journey at check in.	E.g. Dutch system.
Pay as you go Prepayment with adjustment	The user is charged on starting the journey, either for the correct amount, or for an average fare. On completion of the journey, any difference from actual rights consumed is used to make an adjustment. The user may be required to keep a credit balance on the card, either manual or using an auto top up.	e.g. Danish local fares.
Pay as you go post payment	The user is charged on completion of the journey according to the access rights consumed (by explicit or implied check out). Fare calculation may include capping or usage-based rebates.	e.g. TfL Oyster, TfL Oyster Contactless.

Prepaid with rebate.	Account based and smart card systems may offer the user rebates if they exceed certain usage thresholds.	e.g. Danish local fares.
-----------------------------	--	--------------------------

Table 6 – Common Product Charging moments

- ❖ In NeTEx, a NeTEx CHARGING MOMENT is used to represent the time of payment. A CHARGINGMOMENT is associated with a FARE PRODUCT.

4.1.5 Commonly found Time Demand

Non-flexible Rail tariffs are often restricted to certain periods so as to spread demand on congested networks. Table 7 shows some common distinctions found.

Nature	Description	
Peak / Unrestricted 	Tariff may be used at any time including at weekends and on public holidays	E.g. Standard walk u tickets.
Off-peak 	Tariff may be used only at off peak times, for example, outside of the morning and / or evening rush hours on working days, and anytime at weekends and on public holidays. Definitions may depend on direction of travel.	E.g. ABO products.
Super off Peak 	Tariff may be used only at times of lowest demand, e.g. late morning early afternoon.	
Weekends and holidays 	Tariff may be used only at weekends and on public holidays	
Night 	Tariff applies only at evenings or at night;	

Table 7 – Common Time demand types

4.1.5.1 Temporal factors for peak and off-peak demand

This section presents visualisations of temporal concepts concerning time demand periods – in order to spread demand on the network to less congested periods, differential pricing is common for peak and off-peak periods.

4.1.5.1.1 Blackout periods

Figure 19 shows that a travel period may be banded so as to create peak and off-peak periods that meet various conditions

- **Day Type.** Specifying the type of day (week day, holiday, etc.) under which the condition applies.



- **Timeband:** specifying a period within the day.
- **Time at stop.** A further complication is that the time-band may be directional (e.g. into or out of a specific station) and that the specific time may vary station by station, so for example the time band starts at 08:50 at station A, 08:53 at Station B, 08.58 at station C, etc.

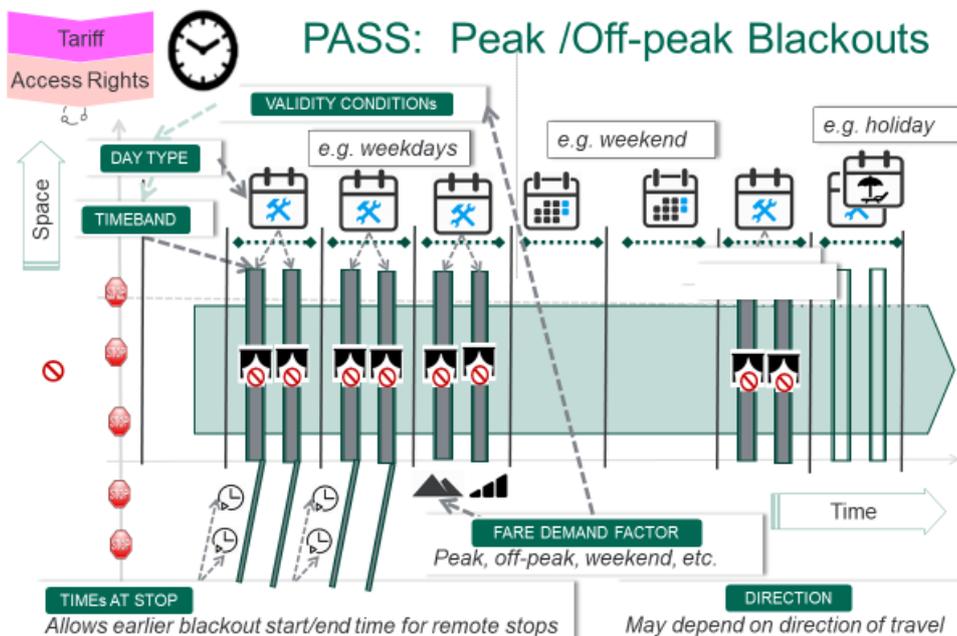


Figure 19 – Blackout day types and timebands

- ❖ In NeTEx, different demand periods can be represented as FARE DEMAND FACTORS. These be defined in terms of DAY TYPEs, TIME BANDs and other validity conditions. A TIME AT STOP element can be used to define the time relative to a specific stop.
- ❖ A SERVICE CALENDAR can be used to specify which DAY TYPEs apply on a given calendar day.

4.1.5.1.2 Time demand restrictions on an individual Trip

Figure 20 shows time demand restrictions as applied to an individual trip. The restrictions may apply to any or all of the start of the trip, the end of the trip or the course of the trip

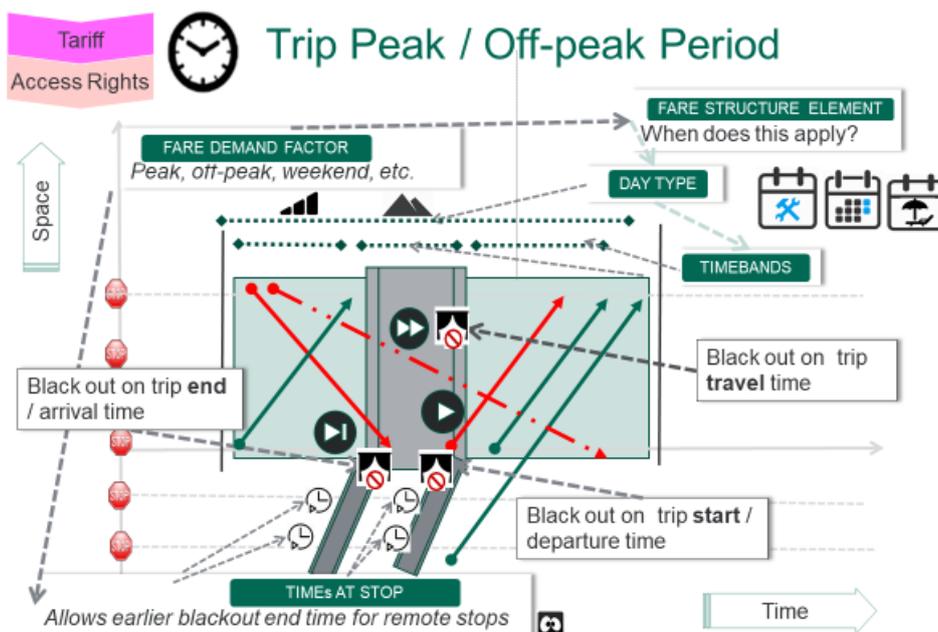


Figure 20 – Time demand restrictions on an individual Trip

4.1.6 Commonly found Passenger Types in Domestic Rail

Tariffs usually segment the market, with different prices for different types of users. Certain products or certain discounted tariffs for products may be restricted to specific types of user who must meet specified eligibility criteria.

- Some of these categories may be immediately available to anyone (e.g. *Adult, child*), others may require documentary proof (e.g. a disabled card) and/or prior registration (e.g. to get a senior discount in the UK you must have a Senior Railcard).
- Some profiles entitle the user to take companions (children, assistants, dogs, etc.) either free or at a discount.
- Certain user profiles may be ordained by statutory measures, with eligible users being allowed a concessionary discount.

User profiles may also apply to eligibility to purchase group tickets – see next section.

Commonly found user profiles in many countries are shown in Table 8. Although broadly the same categories are found in most countries, for the age-dependent user types, there are distinct variations between countries as to the ages for eligibility in specific groups.

A user profile could in principle also be used to describe a non-human companion such as a dog or other pet. Alternatively pets can be described as a form of luggage, especially if they are in a basket or cage that must meet restrictions on its dimensions.

Nature	Description
Adult	Any person too old for a child or youth discount. Some products may have a minimum age. E.g. in order to gain the right to take an infant free or a child at a discount.



ERA-2017-3-NP – Tariff Data Exchange Report

	
Infant 	Babes in arms and children. Maximum age varies between countries – from 4 to 6 years old. Usually travel free without a seat. Cannot travel unaccompanied.
Child (Accompanied) 	Children who are no longer infants, accompanied by a parent or sibling. Usually discounted by between 30-50%, or free. Both the minimum and maximum ages for being eligible for child fares vary considerably between countries. Minimum is typically between 5 and 7 years old, maximum varies from 12 to 16 years old. In a few cases there is even variation within a country for specific products (for example, some airport shuttle services). Some countries / products require the child to be a descendant (i.e. son/daughter or grandchild of the adult).
Child (Unaccompanied) 	A child (see above) travelling without an adult. Usually eligible for a discounted fare. There is usually a minimum age for being allowed to travel unaccompanied.
Youth 	Young person over the minimum age for child discounts (see above - typically 15 years) and below the age for adult (e.g. between 18 and 26 years).
Pupil 	School children in full time education. Usually under 19.
Student 	Person attending an accredited college. Usually under a certain age (e.g. 26), with special provision for PhDs and mature students.
Exchange Visitor 	Student or volunteer from another (European) country visiting on an exchange program.
Trainee / Intern 	Accredited Interns and Apprentices under a certain age. In some countries not distinguished from a student.
Senior	Persons over a certain age (or formally registered as a pensioner), often statutory. Usually eligible for a discount. Age varies between countries (typically between 60 and 65 years old, but in some cases as high as 70). Some rights may be restricted to local

ERA-2017-3-NP – Tariff Data Exchange Report

	<p>residents or nationals. A few countries have different age bands for seniors (e.g. 0-65, 65-70, 70+) with different rights.</p>
<p>Disabled</p> 	<p>Usually Statutory. May be subdivided into different categories, e.g., Blind, severely handicapped, handicapped child, invalid, etc.</p>
<p>Disabled Companion</p> 	<p>Companions to disabled, veterans or other specific types of user. Usually discounted or free.</p>
	<p>Dog or other animal when not carried as luggage in a cage or basket.</p>
<p>Veteran or Victim</p> 	<p>Statutory. War Veterans, Refugees and Political Victims. Discounted or free.</p>
<p>Social Benefits</p> 	<p>Unemployed, qualifying for special social benefits, etc. Usually registered membership scheme.</p>
<p>Special Occupation</p> 	<p>Teachers, Members of Parliament, Military, Military conscript, Railway staff. Sometimes extends to family members. Discounted or free.</p>
<p>Member of a Large Family</p> 	<p>May be statutory. Member of a family with more than a certain number of children (usually at least 3). May be eligible for discounted tickets for individuals as well as for group travel</p>
<p>Employee</p> 	<p>Member of an organisation participating in an employee ticket scheme. Discounted, sometimes with tax benefits.</p>
<p>Member</p> 	<p>Member of a membership scheme offering discounts to its members (e.g. the Austrian OATMC).</p>

<p>New resident</p> 	<p>Someone who is newly resident – a number of German operators offer a special, short pass to new arrivals in an area on a one-off basis in order for them to try out the local transport. An individual is only eligible once.</p>
--	--

Table 8 – Commonly found categories of passenger

- ❖ In NeTeX, USER PROFILE elements are used to represent different types of individual user and their eligibility conditions such as age, registration, etc. COMMERCIAL PROFILE elements are used to represent different types of corporate and organisational user.
- ❖ In specify age conditions, precision is needed to say when the age is actually measured (e.g. actual birthday, age on 1st January, etc), especially in the cases of season passes valid for an extended period during which a user’s eligibility may change. NeTeX allows various specific conditions to be expressed.
- ❖ Often a profile is distinguished so that a different price can be offered to eligible users (as indicated by a DISCOUNTING RULE).

4.1.7 Commonly found Group Tickets in Domestic Rail

Tariffs usually offer a discount to groups of users travelling on a single ticket. There may be complex rules as to how these groups are made up of specific types of user, with minimum and maximum numbers of users of a specific type (e.g. Two to five adults with up to three children). Groups commonly found in domestic rail tariffs are shown in Table 9.

Nature	Description
<p>Family</p> 	<p>Family with at least one child under a qualifying age (e.g. 15). In some cases, children must be related to the adult (child or grandchild).</p>
<p>Group</p> 	<p>Groups travelling together on a single product, usually at least three.</p>
<p>Large Group</p> 	<p>Large groups travelling together on a single product. Usually require longer lead times to book, and conditions for modifying the number of users closer to time of travel may be material.</p>
<p>Student Group</p> 	<p>Groups of school pupils or students, accompanied by supervisors. A certain ratio of adults to students is required. Places for supervisors may be free or discounted.</p>
<p>Duo / Two Together</p>	<p>Two adults at a discount, usually off peak.</p>

**Table 9 – Commonly found Group tickets passenger**

- ❖ In NeTEx, the GROUP TICKET element describes allowed combinations of user types (i.e. USER PROFILES) and their associated discounts.

4.1.8 Commonly found Conditions of Use in domestic rail

Products may be subject to specific conditions about the consumption of access rights. Commonly found distinctions include.

Condition	Name	Note
Can break Journey 	Whether the user can break the journey along the route, as long as the overall travel time limit is met.	E.g. A UK rail single allows a break of journey. E.g. VVO Dresden-Wroclaw special does not.
Can interchange 	Whether the user can make an interchange to another service or can only use one vehicle. This constraint is meaningful for zonal or stage counting journeys.	<ul style="list-style-type: none"> ❖ In NeTEx, specified by the INTERCHANGING usage parameter.
Any route permitted 	Whether the user is limited to a specific route.	<ul style="list-style-type: none"> ❖ In NeTEx, specified by the Exact Routes can be specified using the SERIES CONSTRAINT mechanism
Frequency 	How many times the fare product may be used in a given period.	<ul style="list-style-type: none"> ❖ In NeTEx, specified by the FREQUENCY usage parameter.
Is transferable 	Whether another person can use the product or whether it is personal to a user.	<ul style="list-style-type: none"> ❖ In NeTEx, specified by the TRANSFERABILITY usage parameter.
Maximum distance 	Maximum distance allowed for a product.	E.g. Romanian student ticket must be less than 300 km.
Maximum journey time	See temporal conditions.	

Table 10 – Commonly found conditions of use

- ❖ In NeTEx, a number of different types of USAGE PARAMETER are used to set additional conditions as to how a product may be used. These can include ROUTING, INTERCHANGING, TRANSFERABILITY, FREQUENCY, etc., etc.

- ❖ Maximum distance can be specified by a DISCOUNTING RULE associated with a ROUTING usage parameter.

4.1.9 Commonly found Supplement Products on Domestic Rail

Most domestic rail offerings include additional supplement products which a ticket holder can purchase to complement their basic access rights. For example, an upgrade to first class, or a ticket for an accompanying bicycle.

Table 11 shows some commonly found product supplement types found in domestic rail tariffs. The products build on underlying tariff structures described later below. They are further modulated by a large number of parameters and sales conditions also summarised in the following sections.

	Nature	Description	Note/ Example
Trip Supplement  	Seat Reservation 	Seat reservation may be included in price or may be charged extra. May include reservation of night train accommodation, e.g. couchette, compartment, reclining seat.	Wheelchair reservation usually free. Usually a flat fee.
	Bicycle Ticket 	Extra ticket for a bicycle on the trip.	Usually limited capacity. Both flat fee and distance based found.
	Animal Ticket 	Extra ticket for a dog or other animal on the trip.	Guide dogs are usually free. Usually a flat fee.
	Excess Luggage 	Extra for luggage that exceeds free allowance, e.g. outside sports equipment, extra suitcases, buggy, etc. Can also be used to describe dimensions for pets or other animals.	Usually a flat fee.
	Parking 	Parking at origin station for duration of return trip at discounted or free price.	
Trip Modification  	Seat Upgrade 	Upgrade from one class of use to another, e.g. to 1 st class. Can also be used for a Couchette reservation.	Both flat fee and distance based found.
	Train Upgrade 	Upgrade to allow use of a different category train, usually an express train e.g. ICE	Both flat fee and distance based found.

	Trip Extension	Extension to travel further than originally purchased.	Typically used when holder has a pass for one area and needs to travel to a nearby stop.
	Privacy Upgrade 	Supplement to obtain exclusive use of a sleeper compartment.	SNCF <i>Espace privatif</i>
Pass Supplement  	Bicycle Pass 	Right to take a bicycle for a given period.	Usually a flat fee.
	Animal Pass 	Right to take an Animal for a given period.	Usually a flat fee.
	Parking 	Daily parking at origin station for duration of pass.	
	Seat Reservation 	A pass may still require an additional seat reservation on an express train. Sometimes this will be included, for some or all journeys. Sometimes a carnet of reservations is sold.	Usually a flat fee.
	Seat Upgrade 	Right to better class of accommodation for period of pass.	Trip upgrade can be used for a single trip made using a pass.
	Train Upgrade 	Upgrade to allow use of an express train e.g. ICE for period of pass.	Trip upgrade is used for a single trip.

Table 11 – Commonly found Rail Supplement Products

- ❖ A supplement product is normally represented in NeTEx by a FARE SUPPLEMENT (If it involves complex access rights a PREASSIGNED FARE PRODUCT may also be used). ENTITLEMENT GIVEN and ENTITLEMENT REQUIRED usage parameters can be used to indicate the dependencies between fare products.

4.2 Overview of product features

4.2.1 Summary of the features of rail tariffs

Commonly found features of rail domestic products as presented to the user include:

- **Tariff Structures** – Spatial & Network
 - Arbitrary point-to-point fares (the most common).



- Distance based point-to-point fares (Though often the distances are not exposed to users who only see point-to-point fares computed by applying the distance tariffs to the distances).
- Routing restrictions on point-to-point fares (some routings may be more expensive).
- Zonal fares.
- Section or Stage based fares, where a sequence of stops all have the same price).
- Flat Fares (mainly for supplements such as seat reservations, bicycle and animal tickets, etc., but also for some zonal passes and offers).
- **Tariff Structures – Temporal**
 - Validity period for making use of a ticket.
 - Maximum trip duration.
 - Different time intervals for passes (day, month year).
 - Pass start dates fixed to calendar or variable.
 - Fare Demand Periods: (Peak, off Peak, etc.).
- **Tariff Structure – Other factors**
 - Classes of use.
 - Night Train accommodation (Couchette, berth, cabin, etc.)
 - Inclusion / Exclusion of specific lines.
 - Inclusion / Exclusion of specific journeys run within a timetable.
 - Inclusion / Exclusion of specific operators.
 - Available facilities on the service (wifi, meal, etc.).
- **Eligibility**
 - Standard products for anyone (or sometimes adult only) purchasers.
 - Concessionary products or discounts for different classes of user (Child, Senior, Student, etc.).
 - Accessible products allowing registered disabled travellers and their companions discounts.
 - Group tickets for more than a certain number of travellers travelling together.
- **Products & Sales Packages**
 - Single trip (single or return) products for use at any time.
 - Single trip products with travel restrictions as to time, route etc.
 - Carnets or Multi-trip products.
 - Day Passes.
 - Carnets of day passes to be used in a certain period.
 - Season passes.
 - Discount Right products given the right to purchase other products at a discount
 - Usage Reward products giving the passenger a rebate or discount based on their previous consumption.
 - Supplement products such as seat reservations, couchettes, bicycle tickets etc.
 - Service products such as accompanying minors, transporting baggage
 - Additional facilities such as parking, meals, wifi, newspapers, refreshments, etc.
- **Conditions**
 - Conditions of use (reservation required variable time of travel, interchanging, journey breaks, etc.).



- Conditions of purchase (exchangeability, refunds, Time of purchase etc.).
- Distribution & Fulfilment conditions (ticket media, sales channels, etc.).

4.2.2 Classifying the features of rail tariffs

Domestic rail tariffs may be based on many different factors – all the above factors (spatial, temporal, type of user, etc., time) but also additional factors such as class of use, distribution channel, payment method, etc., etc.).

A provisional classification scheme for the different aspects used has been devised and applied to the Fare Product Data set. This seeks to categorise each fare product found in terms of a number of distinct aspects as discussed above and below. Each of these aspects correspond to specific components in the NeTEx Model, some relevant components are noted in each section so as to give an indication as to how the fare might be encoded as a NeTEx document.

Within the above outline high-level classification, there are a large number of more detailed properties found within the several thousand products of the 200 odd operators in the study, however while it is useful to identify examples of each different type of condition, not every occurrence of every condition needs recording for the purposes of the project.

The purpose of this study rather has been to identify both the common and occasional properties in order to make a gap analysis against NeTEx.

4.2.3 Commonly found Accommodation categories in EU domestic rail

Fare structures have different pricing (and pre and post-sales conditions) for different types of on-board accommodation. First and Second class are found on all long-distance networks and there are further gradations on night trains as to sleeper compartment, couchette etc.

4.2.3.1 Seat Classes

The names given to classes of use vary between countries and networks. Sometimes the first class is differentiated into a premium and a non-premium variant, making the second class in effect a third class (though it will never be branded as such!). (Table 13).

A higher degree of differentiation can be seen where there is opportunity to segment the market. For example, *IZY* a new budget operator between Brussels and Paris has launched with four classes of seat (a) *Standard XL*, their “first” class, with a power socket at every seat; (b) *Standard*, with guaranteed seats, (c) *Folding Seat*, (d) *Non-Guaranteed Seat* – a fourth class (of non-seating rather than of seating!).

Band	Class of Use	Description
Comfort / First	Premium Class	An enhanced “First Class” Premium



	First Class	Aka Business Class, “Standard Premier”, Preferente, etc
Economy / Second	Second Class	Aka Economy, Standard, Turista, Eco. Etc. Sometimes the only class available.
	“Ultra-economy” Class(es)	See IZY example above.

Table 12 – Commonly found Classes of use

4.2.3.1.1 Accommodation Classes

There are further gradations on seating, especially on night trains as to compartment, couchette etc, - the offer may be for individual places in a shared compartment (as say for a couchette place), or for exclusive use of a whole compartment.

	Nature	Private Use	Public Shared	Description
	Couchette (2, 4, 6)	Y	Y	A shared compartment with convertible beds for two or more passengers.
	Sleeper Berth (1, 2, 3)	Y	Y	A separate cabin with bed at night for one or more passengers. With bedlinen and possibly a washbasin
	Sleeper chair	N	Y	Reclining sleeper chair
	Compartment	Y	Y	A day compartment with 2- 6 seats
	Family Compartment	Y	Y	Segregated compartment for young families.
	Seat	N	Y	Reserved seat.
	Group Seating	N	Y	Reserved seating as a group.
	Family Group Seating	N	Y	Segregated seating for young families.
	Wheelchair Space	N	Y	Space for a Wheelchair.

Table 13 – Commonly found Accommodation types

Where a tariff is for an accompanying vehicle the tariff will charge according to the nature of the vehicle.

Nature	Description
 Car / vehicle	Space for a four wheeled vehicle. Price depends on vehicle Type/ size. E.g. see TAP TSI. B.5.29 which defines Eight categories of vehicle size.

<p>Bicycle</p> 	<p>Space for a Bicycle.</p>
<p>Motorcycle</p> 	<p>Space for a Motorcycle.</p>

Table 14 – Commonly found Stowage

- ❖ In NeTeX, CLASS OF USE specifies the main categories of seating. Additional details about accommodation (for example sleeper couchette / cabin type etc) can be specified with a FACILITY SET with ACCOMMODATION elements.

4.2.4 Facilities and Fare Products on Domestic Rail

Certain facilities are often explicitly listed as part of a class. In a few cases they may be charged for separately as supplements (e.g. wifi), so are relevant for fare structures. For example, WIFI, power socket, beverage, meal.

- ❖ In NeTeX, a SERVICE FACILITY SET (for onboard facilities such as WIFI) or SITE FACILITY CLASS (for at stop facilities such as 1st class lounges) can be used to described groupings of facilities that are used as tariff elements.

4.2.5 Commonly found Types of Travel Document in domestic rail

In order to travel, passengers require some form of travel document to prove they have purchased the required access rights. Travel document may take the form of either paper, plastic or electronic media. For either commercial or technical reasons, certain products may be available only on certain media. Electronic and Account Based Ticketing fares are also becoming increasingly common, in some systems a payment card or device may be used as a travel document.

Type of Travel Document	Name	Note
<p>Paper Ticket</p> 	<p>Printed or handwritten paper ticket.</p>	<p>Not machine readable.</p>
<p>Machine readable printed ticket</p> 	<p>Machine printed ticket.</p>	<p>Readable by OCR, barcode, shot code or magnetic stripe</p>
<p>Self-print ticket</p>	<p>Self-print ticket (on paper or held electronically).</p>	<p>Machine readable by OCR/barcode.</p>

		
Smartcard 	Card containing chip able to store apps and /or documents. May be used in conjunction with an online account.	Usually machine readable either by OCR, Barcode or NFC.
Device App 	On device application holding ticket.	Machine readable by OCR, barcode, or NFC.
EMV 	Credit or Debit card used as an identity token.	Machine readable by magstripe, or NFC.
SMS 	Token held as SMS on device.	Not machine readable.
Identity Card 	Membership card accepted as document.	
Passive Card	Pass or other proof of rights.	Not machine readable.

Table 15 – Commonly found Types of Travel Document

- ❖ The available ticket formats can be indicated in NeTeX by a TYPE OF TRAVEL DOCUMENT.

4.2.6 Commonly found Fulfilment Methods for domestic rail

Fulfilment describes how a travel document certifying the purchase of access rights is delivered to the customer. The methods used will typically vary according to the nature of the channel and the types of travel documents available (Electronic, printed etc). or any given channel there will be one or more possible methods

- There may be surcharge for certain methods, such as post.

Fulfilment	Fulfilment	Description	Note
Collect at Counter 	Collect at Counter	Travel document is collected at ticket counter.	Widest selection.

ERA-2017-3-NP – Tariff Data Exchange Report

Collect from Ticket Machine 	Collect from Ticket Machine	Travel document is collected from an automatic self-service machine.	Standard products.
Collect at barrier / validator 	Collect at barrier / validator	Product is collected by using a validator or barrier	
Collect on Board 	Collect on Board	Product is issued on board from conductor or machine on board.	Often at a premium
Download and print 	Download and print	Downloaded and printed onto paper.	
Download as e-document 	Download as document	Downloaded and held on a mobile device for inspection.	
Postal mail 	Mail	Travel document is sent by post.	
Courier 	Courier	Travel document is sent by courier	Usually additional fee.
Mobile App 	Mobile App	Travel document is downloaded to a mobile device and held in electronic form.	The app may apply additional intelligence as to how the document is used, e.g. activation or validating it.
SMS 	SMS	Travel document is sent as an SMS message.	

Table 16 – Commonly found Fulfilment Methods

- ❖ The available methods be indicated in NeTeX by a FULFILMENT METHOD. Particular payment methods and fulfilment methods can be associated with a specific DISTRIBUTION CHANNEL by means of a DISTRIBUTION ASSIGNMENT.



4.2.7 Commonly found Payment Methods for domestic rail

The permitted methods of payment may vary from channel to channel and product to product. Most channels will limit payment to one or more methods.

There may be a discount for payment with a specific method. For example, in France there is a - 50% discount during the “blue/white” period if you pay a minimum of half of the ticket price with "chèques vacances" (holiday cheque).

Method	Method	Description	Note
	Cash	Currency – notes and or coins	On Board May be limited to exact fare
	Debit/Credit card	Payment from account by standard EMV card.	Some operators participate in credit card schemes.
	Contactless card	Payment from account standard EMV card with NFC to a terminal.	
	Mobile Payment	Mobile device Payment system such as Apple pay, Google pay, etc.	May be linked to a Mobile app.
	SMS	Payment by SMS from mobile operator account of user.	Low value fares only
	Cheque	Cheques are still supported in some countries	May be subject to limit.
	Direct transfer	By direct transfer from a bank account.	Used for Season tickets.
	Standing order	Products on subscription may be paid for by direct debit at a specified interval (monthly, quarterly, etc)	Used for subscriptions for season tickets.

<p>Coupon</p> 	<p>Coupon</p>	<p>Payment or part payment may be by redeeming a coupon.</p>	<p>Usually additional fee.</p>
<p>Mileage Points</p> 	<p>Mileage Points</p>	<p>Payment or part payment may be by redeeming accumulated mileage points form a frequent traveller scheme.</p>	<p>Requires an account.</p>
<p>Warrant</p> 	<p>Warrant</p>	<p>Payment may be by submitting a travel warrant (e.g. for armed forces).</p>	
<p>Gift voucher</p> 	<p>Gift voucher</p>	<p>Payment or part payment may be by redeeming a gift voucher for a specified amount.</p>	

Table 17 – Commonly found Payment Methods

- ❖ The available payment methods can be specified in NeTeX by a PAYMENT METHOD. Particular payment methods and fulfilment methods can be associated with a specific DISTRIBUTION CHANNEL by means of a DISTRIBUTION ASSIGNMENT.

4.2.8 Commonly found Distribution Channels for domestic rail

Different products are typically made available for purchase by the public through different sales channels. There may be specific conditions as to which distribution channel can be used to obtain a product. The separate concepts of fulfilment method and payment method are discussed in subsequent sections.

- There will often be discounts for products bought through self-service and advance purchase channels – and a premium for on-board sale.
- There may be different after-sales conditions attached to different channels. For example, the right to refund or exchange a ticket may only apply if the ticket was bought over the counter.

Channel	Description	Note
<p>At Counter</p> 	<p>In station counter.</p>	<p>Widest selection of products. May exclude online-only offers.</p>
<p>At stop Machine</p>	<p>Automatic self-service machine at stop.</p>	<p>Standard products.</p>

		
On Board 	On board from conductor or machine.	Often more expensive and restricted as to products and discounts offered.
Online Web 	One line from a web interface. Subsequent	Fulfilment may be self -print or electronic, or by mail.
Mobile App 	Self-service mobile app using mobile data or wifi.	Fulfilment will normally be handled via the app
SMS 	Self-service using GSM phone with SMS.	
Account Based Ticketing with PAYG 	Pay as you go. May be smartcard or online account based (e.g. for contactless EMV card), or both.	
Central Office 	Certain products may only be available at central ticket offices in person.	Common for Annual passes and special discounts
Call centre 	Certain products may only be available by phone or by emailing a service centre.	May be different prices for different speeds of fulfilment: first class post, courier, etc. Email may also be used for fulfilment
Third Party Retailers 	Including kiosks, newsagents etc with retail footfall.	May charge an additional fee.

Table 18 – Commonly found Distribution Channels

- ❖ The available channels can be represented in NeTex by DISTRIBUTION CHANNELS. Particular payment methods and fulfilment methods can be associated with a specific DISTRIBUTION CHANNEL by means of a

DISTRIBUTION ASSIGNMENT that applies to a specific SALES OFFER PACKAGE.

4.2.9 Commonly found After Sales conditions in domestic rail

Fare Products and/or sales packages may be subject to specific conditions about the after sales commercial rights of the user.

Trip	Single	
Can modify time of travel/ Exchange 	Whether the time of travel or route can be modified.	EXCHANGING usage parameter.
Can Refund 	Whether the user can obtain a refund for and unused or partly used product, either ahead of travel or after having failed to use it.	Non-flexible fares typically do not offer a refund. E.g., UK Advance fare. REFUNDING usage parameter.
Replacement possible 	Whether a replacement can be obtained if lost, possibly retain balance on an account-based product.	REPLACING usage parameter.

Table 19 – Commonly found After Sales Conditions

- ❖ In NeTeX, a number of different types of USAGE PARAMETER are used to set additional commercial conditions on post-sales handling of the ticket. These can include EXCHANGING, REFUNDING, REPLACING, etc., etc.

4.2.10 Common Combinations of conditions

Although the many different types of product and parameter for domestic rail products could in theory be combined in many thousands of ways, in practice certain travel and commercial conditions are commonly combined so as to create a product set that maximised yields and spreads load on the network. This also has the advantage of making it simpler for the user who is presented with only a small number of products from which to choose.

For standard trips (single, day return and period return), three particular combinations are commonly seen:

- **Flexible – Full fare**, Allowing travel at any time, fully exchangeable and refundable.
- **Semi-Flexible** – Cheaper, with some changes or refunds allowed (possibly for a fee.), and possibly with some restrictions as to time of travel.
- **Non-flexible** – Cheapest, but restrictions on travel and changes or refunds not allowed. Usually requiring advance purchase.



ERA-2017-3-NP – Tariff Data Exchange Report

For passes, particular combinations are commonly seen (it is also common to have *Adult, Student, Youth and Senior* variants of each of these):

- **Day pass**, A day's travel, usually zonal.
- **Period zone pass**, Allowing unlimited travel in a zone for a week, month, semester or longer period.
- **Period P2P pass**, Allowing unlimited travel between two points for a week, month, semester or longer period.
- **Weekend excursion pass**, Allowing travel for a group at weekends.

For discounts particular combinations are commonly seen in account-based products:

- **Rail card**, discounted travel for a period in return for an upfront fee. (Again, it is also common to have *Adult, Student, Youth and Senior* variants of each of these):
- **Usage right**: a bonus for consumption, either as frequent flier points, or as capping to daily, weekly or monthly limits.

4.2.11 Other factors used in Tariff Structures

There may be other factors relevant for tariff structures, either limiting tariffs more specifically, or offering a set of prices based on a further factor (see Table 20).

Nature	Description	Comment	Examples
Specific Journey limited (non-flexible vs flexible) 	The passenger may be required to make the journey on a specific service at a certain time.	<p>Normal for intercity fares requiring a reservation on a specific train (though if a flexible fare this may be changeable).</p> <p>Also normal for advance fares sold at a discount to the standard fare, which require travel by a specific train.</p> <p>Certain tariffs may include or exclude one or more specific journeys.</p>	Most semi flexible fares and TGV tickets
Quota steps 	Operators may place quotas on the numbers of seats available for a specific product at a specific price.	<p>Operators may simply wish to indicate that supply is limited i.e. quota applies (but not reveal what the specific thresholds are).</p> <ul style="list-style-type: none"> ❖ In NETEX the fare product summary conditions can indicate if a quota applies. <p>In other cases, the operator may want to provide the size of the quotas and /or the different pricing steps so as to indicate the range of possible prices that may be found for a given product.</p>	<p>Italian and UK Advance tickets.</p> <p>Where price comparison engines are used, the quota price range may be used to populate a "Prices from x" value.</p>
Operator	The passenger may be restricted to only using a specific operator's products	<ul style="list-style-type: none"> ❖ In NeTeX access rights and tariffs may be specific to an 	



	/ different operators may have different prices.	OPERATOR or GROUP OF OPERATORS.	
Corporate Schemes 	Operators may offer a discount on price to employers according to the number of Employees.	In some cases, the operator will publish a scale of prices – in others it is by negotiation. ❖ In NeTEx Can use Fare Quality Factors to define Pricing steps for different numbers of employees.	Silesian Railways

Table 20 – Other aspects used in rail tariff structures

- ❖ NeTEx allows a number of different validity parameters (to be used in fare structures These can be used to reference network and service elements (for example, SERVICE JOURNEY, OPERATOR, TRAIN CATEGORY, etc etc.) to specify conditions and exclusions. A GENERIC PARAMETER ASSIGNMENT can be used to associate various logical combinations of conditions with specific FARE STRUCTURE ELEMENTs and VALIDABLE ELEMENTs, as well as FARE PRODUCTS.
- ❖ NeTEx also provides a general-purpose QUALITY FACTOR that can be used to include any arbitrary additional quantitative or range-based criteria (such as the quota given above) in a tariff structure.

4.2.11.1 Train Categories

Access rights are commonly limited to specific types of train. While trains can be broadly categorised by speed and distance between stops, there is not a uniform practice across Europe for naming and classifying them, especially at the local and regional level.

See https://en.wikipedia.org/wiki/Train_categories_in_Europe.

One can remark though, that tariff structures in all countries usually distinguish between similar groupings, with separate and more expensive tariffs for high speed trains and intercity express trains (see Table 21 for some approximate groupings, based on the TAP TSI B. B.4.7009 table). Holders of access rights to fast trains may usually access slower trains, but not vice versa.

Nature	Description	Comment
High speed 	Very high-speed trains running between major cities. E.g. French TGV, or Italian Freccia, etc. Long distance	Reservation required
Intercity Express	Express trains running between major cities and across national borders	Reservation usually required

		
Interregional Express 	Express trains running between regions of a country.	Reservation usually required
Regional express 	Express trains running within a region	Usually Excluded from urban zonal passes.
Local Express 	Trains running in a local area omitting minor stops.	No reservations. Often included in urban zonal passes.
Local & Suburban 	Slow trains stopping at all stations. Not commanding any premium.	Included in urban zonal passes.
Night Train	Long distance train with special accommodation for sleeping.	Reservation required
Motor rail	Long distance train with special accommodation for cars and their passengers.	Reservation required

Table 21 – Common Types of Train Category

- ❖ In NeTEx, the TYPE OF PRODUCT CATEGORY can be used to indicate the service type.

4.2.12 Other conditions of carriage that relate to fares

We note there are other aspects of fare offerings and fare validation that are not covered in the study.

4.2.12.1 Travel Performance guarantees/ Compensation

Many countries define statutory compensation rights to users for cancelled or late travel (as ordained by EU regulations). Some account-based rail products include features to automatically credit users with compensation for late travel where the fault is with the operator.

These are not essential to basic tariff structures and so are outside of the scope of this study.



4.2.12.2 Penalty fares

Many networks have penalty fares for when a user does not have a valid ticket. The conditions may be complex and relate to validation: for example, in some systems a user must buy a ticket from an at stop machine if available (or be liable to a penalty fare) but may buy one on board or at their destination station if there is no machine or the machine is broken, or they are a particular type of user (e.g. disabled).

- ❖ Some aspects of penalty fares can be represented in NeTeX by the PENALTY usage parameter but they are not essential to basic tariff structures and are outside of the scope of this study.

4.2.13 Frequent traveller products

Some operators offer “frequent flyer” travel card schemes with stepped discounts or other privileges for travellers who achieve various levels of consumption. For example, the SNCF *Voyageur /Grand Voyageur / Grand Voyager Plus / Grand Voyager Club*.

- ❖ In NeTeX, mileage point schemes can be represented by a USAGE DISCOUNT RIGHT fare product that specifies how rebates are earned.
- ❖ The consumption tariffs can be modelled in NeTeX as tariffs comprising either GEOGRAPHIC INTERVALs (if they are simply distance based) or with Fare Quality Factors if they use some other metric.
- ❖ Coupons or points can be specified as an allowed means of payment.
- ❖ When passengers redeem their points by buying further travel, different mechanisms are encountered for translating the points into discounts or rebates.
 - In the simple case, a point is converted into a monetary value at a uniform rate (this can be represented by a PRICING RULE).
 - In the more complex case, individual prices in mileage points may be offered on specific tariffs (perhaps to promote certain routes) for purchase with mileage points. This can be represented in NeTeX by a separate set of prices in *mileage-point* PRICE UNITS.

4.3 Summary of rail price features

An important aspect of fares is of course the fare price, that is, the monetary amount associated with each selectable combination of tariff feature.

- ❖ In NeTeX, prices are represented separately from the elements that are priced, making it possible to have successive prices sets at different times with different validity periods without altering the tariff structure. It also allows for prices for the same products to be stated in different currencies, or even, for example, be stated in other valuation units such as frequent flier points from a membership scheme.
- ❖ Sets of prices can be organised using a FARE TABLE – see later below.
- ❖ It is also possible to indicate that some or all prices are supplied dynamically through a pricing service, as for many yield managed products.



4.3.1 Absolute and derived prices

Domestic rail fares include both prices stated as absolute amounts (e.g. 12.00 Euros) and prices stated as a derivation of another price (E.g. *The child price is 50% of the adult price*), or *each additional person on a group ticket is 5.00 Euros*).

- ❖ NeTeX supports complex price derivation rules, with discounting factors and minimum and maximum limits, so that one price may be derived from another (using a PRICE RULE, DISCOUNTING RULE or LIMITING RULE).
- ❖ ROUNDING rules may be specified for the calculation so that the result is quantized to specific currency units.
- ❖ The derivation of a price may be recorded as a RULE STEP.
- ❖ Prices may be attached to many different types of tariff structure and fare product element. The allowed combinations of prices of the different types of factor can be used to create an n-dimensional pricing matrix.
- ❖ Rules may be chained, so for example one might apply successive discounts and then calculate added tax.

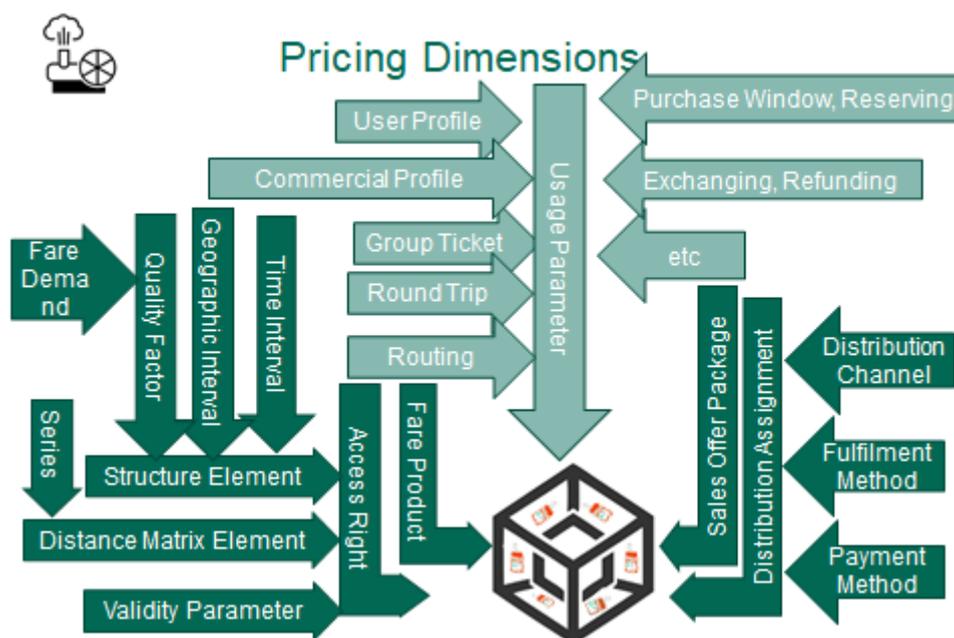


Figure 21 – Pricing elements

4.3.2 Indirection -Use of Price groups

It is common practice to simplify tariffs by grouping prices into price bands (For example *Band A = EURO 10, Band B=Euro 15*, etc). Sometimes these will be used as an internal mechanism that is not exposed to passengers, in other cases they will be shown on published tariffs (e.g. see Figure 22).

TARIFE ABBONAMENTI FERROVIARI S.T.

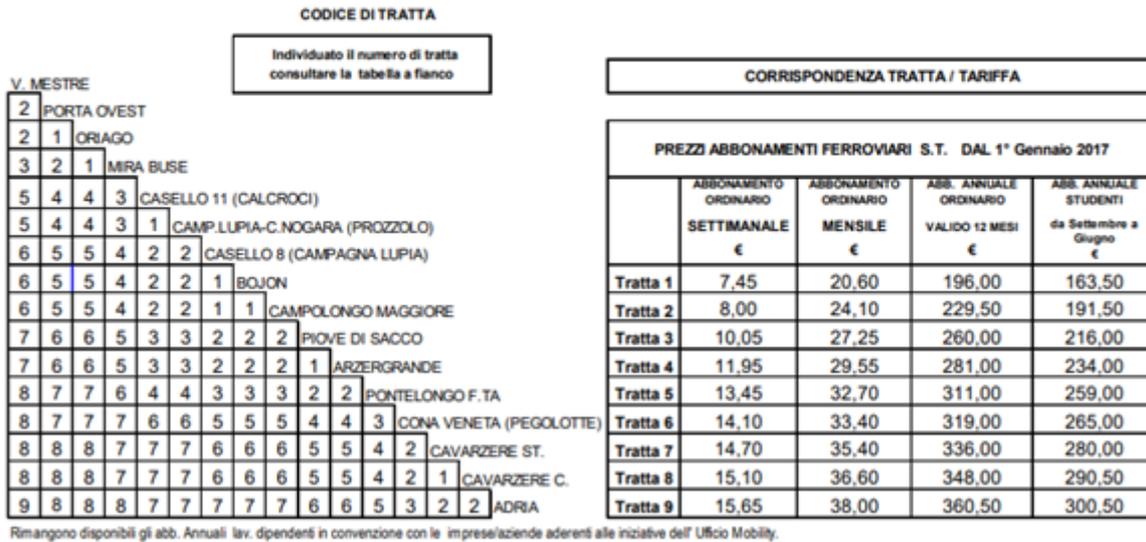


Figure 22 – Example of use of price groups in a tariff (Adria Mestre)

- ❖ The PRICE GROUP element can be used in NeTEx to represent a shared price.

4.3.3 Organisation of rail prices

The exchange of fare data typically involves the exchange of large numbers of prices. Typically, there will be a separate price for each permitted combination of the discrete tariff and product elements.

- ❖ NeTEx provides a structure, the FARE TABLE to allow the efficient organisation of prices as nested tables. A fare table is made up of CELLS. Prices can be arranged as hierarchically nested rows, with tariff elements attached to each nesting level, as shown in Figure 23.

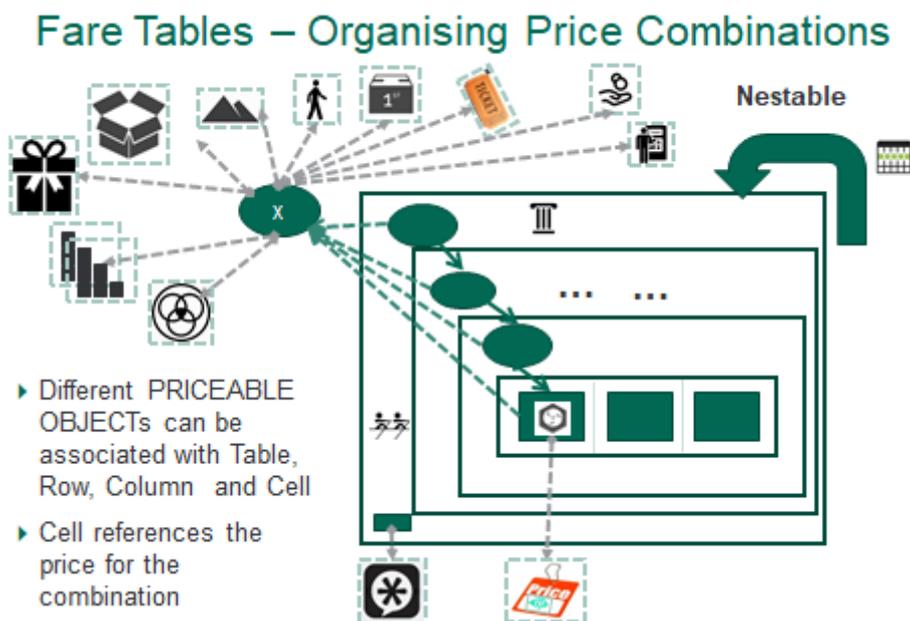


Figure 23 – Nesting prices for fare elements

The optimum hierarchy can be chosen for any given application

The following table (Table 18) gives some examples of price data for some products and their permitted combinations of parameters that might be nested in various alternate hierarchies, for example, as shown in the table:

- *A to B / Product / Class of Use / User Type / Channel / Media*

However, it would so be possible to nest the data according to any arbitrary alternative hierarchy, for example:

- *A to B / Product / User Type / Class of Use / Channel / Media*
- *A to B / Product / Channel / Media / User Type / Class of Use*
- *Class of Use / User Type / Product / Channel / Media / A to B*
- *etc*

Product	Type	Class of Use	User Type	Channel	Media	Amount
Single	Trip	1 st Class	Adult	online	selfprint	10.00
Single	Trip	1 st Class	Adult	online	mobile app	9.00
Single	Trip	1 st Class	Adult	at stop	smart card	9.00
Single	Trip	1 st Class	Adult	at stop	printed	11.00
Single	Trip	1 st Class	Adult	onboard	printed	12.00
Single	Trip	2nd Class	Adult	online	selfprint	7.00
Single	Trip	2nd Class	Adult	online	mobile app	6.00
Single	Trip	2nd Class	Adult	at stop	smart card	6.00
Single	Trip	2nd Class	Adult	at stop	printed	8.00
Single	Trip	2nd Class	Adult	onboard	printed	8.50
Return	Trip	1 st Class	Adult	online	selfprint	18.00
Return	Trip	1 st Class	Adult	online	mobile app	16.00
Return	Trip	1 st Class	Adult	at stop	smart card	17.00
Return	Trip	1 st Class	Adult	at stop	printed	19.00
Return	Trip	1 st Class	Adult	onboard	printed	n/a
Return	Trip	2nd Class	Adult	online	selfprint	12.00
Return	Trip	2nd Class	Adult	online	mobile app	10.00
Return	Trip	2nd Class	Adult	at stop	smart card	10.00
Return	Trip	2nd Class	Adult	at stop	printed	11.00
Return	Trip	2nd Class	Adult	onboard	printed	n/a



Pass	1 week	1 st Class	Adult	At counter	smart card	100.00
Pass	1 month	1 st Class	Adult	At counter	smart card	350.00
Pass	1 week	1 st Class	Child	At counter	smart card	50.00
Pass	1 month	1 st Class	Child	At counter	smart card	175.00
Pass	1 week	2nd Class	Adult	At counter	smart card	60.00
Pass	1 month	2nd Class	Adult	At counter	smart card	200.00
Pass	1 week	2nd Class	Child	At counter	smart card	40.00
Pass	1 month	2nd Class	Child	At counter	smart card	120.00

Table 22 – Sample Product Price data for trip from A to B

4.3.4 Presentation of fares and fares prices

NeTeX is concerned primarily with the semantic aspects of representing fare, rather than with presentation aspects such as layout, formatting and fonts of tariff tables. It does however have some basic capabilities that are useful to guide some presentations, as indicated in Figure 24.

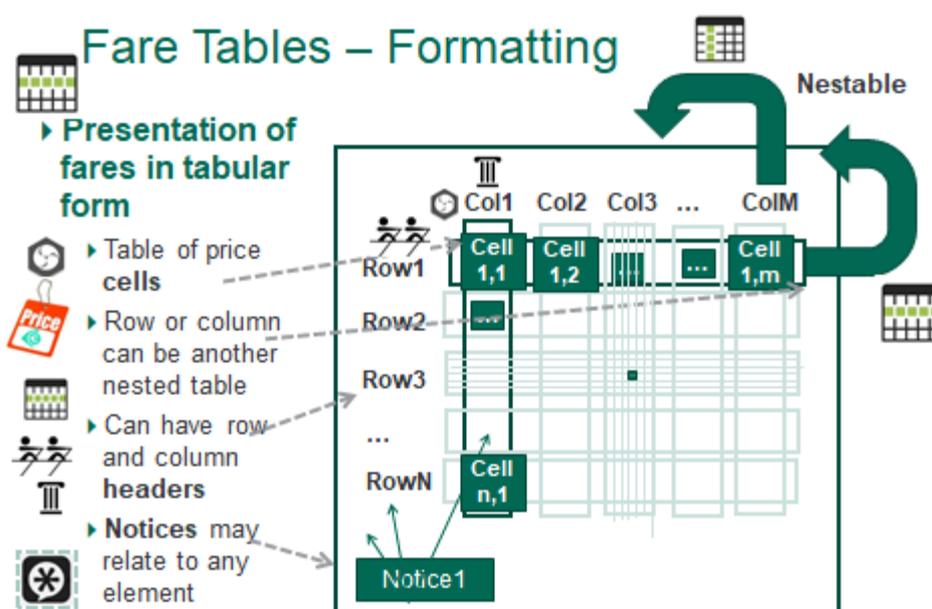


Figure 24 – Formatting a fare table

- ❖ In NeTeX, the PRESENTATION element can be used to set standard colours, fonts, etc for consistent presentation for zones, lines etc.
- ❖ The rows and columns of a FARE TABLE can have headings.
- ❖ The BRANDING element can be used to associate logos and branding names with products.
- ❖ The NOTICE element can be used to associate footnote with the cells, to the rows and columns of a fare table.

5 XML Examples

The project has developed three main XML examples that take a number of tariffs and fare products for rail operators as described online and encode them as XML documents. The examples are intended to range from simple single operator products to complex multi-operator offerings..

5.1 Summary

This chapter gives a brief overview of each of the examples, as summarised in Table 23. Further descriptive details are found in the XML documents that comprise the actual examples.

- Each example is contained in a single XML document, organized internally with NeTeX version frames that group data into related sections.
- The examples are 'skeletons'; they are populated only with a bare bone set of instance data to illustrate the use of NeTeX and do not constitute a full data set.

Example	Description	Further details
<i>Transferoviar Calatori</i> distance-based fare example	A simple network with distance-based tariffs and basic trip (single and return) and season pass products. Statutory discount products.	<i>netex_era_distance_ro.xml</i> (12.5k lines)
<i>Greater Anglia</i> and UK National Rail fares	A regional operator offering multi tariffs and interoperating with a national system. Multiple operator and national products. Complex time conditions. Point-to-point and zonal fares. Trip and season pass products, Railcards for different types of user.	<i>netex_era_toc_uk.xml</i> (8.3 lines)
<i>Trilex</i> Cross border multi-operator tariffs example	Multiple tariffs from different operators applying to different sections of a network in a border region. Point-to-point and flat fares.	<i>netex_era_crossborder_de.xml</i> (3.2k lines)

Table 23 – Summary of XML Examples

The examples include over 21 separate FARE PRODUCTS and over 65 different SALES OFFER PACKAGES with over 35 USER PROFILES. (See Table 24.)

		PRODUCTS & SALES OFFER PACKAGES					
		Trip	Trip Supplement	Pass	Discount	Other Product	Profiles
Transferoviar	Product	2	4	1	1	0	15
	Sales Offer	3	4	1	1		
Greater Anglia	Product	3	5	1+1+2	1+3	1+1+1	14



	Sales Offer	9+10+9	2	2+5+5	1+8	2	
Trilex	Product	2		1			8
	Sales Offer	1		2			
Total		7/ 32	9 /6	6/15	5 / 10	3 /2	

Table 24 – Summary of Products in XML Examples

5.1.1 General comments

5.1.1.1 Scope and extent of examples

The skeleton XML examples attempt a semi-realistic organisation and coding of the main fare products and categories of user, but do not fully populate each document with all the network (stops, zones, etc.), tariffs, products or price data that would be needed to describe the entire tariff system. (In reality this would be very large document for a given region and probably be broken down into multiple files).

- **Organisation within Version frames:** Data is organised into coherent sets of elements with a common validity using NeTeX version frames.
 - ❖ composite version frames are typically used for each operator. This encapsulates related data together and makes the examples more manageable. (In a full implementation these would probably be in separate documents).
 - ❖ **Organisation of product data:** Within each composite frame separate version frames are used for each product group (Trip, Season, Railcard), etc. This encapsulates related data together and makes the examples more manageable.
- **Network data:** The examples are populated with a small amount of network data (stops, lines etc) with comments to indicate where further data should be added. In a real implementation a full set of Network data would exist for which tariff structures could then be created.
 - ❖ Common Network data is placed separately in NeTeX SERVICE FRAMEs, TIMETABLE FRAMEs or RESOURCE FRAMEs so that it can be reused in both trip and pass products.
- **Identifier Systems:** Codespaces and systematic identifiers are declared and used so that different data sets (*uic*, *aura*, national and operator specific) provided by different stakeholders (each of whom may potentially use different identifier systems) can be integrated in the same document without clashes.
 - ❖ **Stations:** UIC station codes are used where possible. For the UK example UK station acronyms are used but the UIC code is shown on the station definition.
 - ❖ **Operators:** UIC RU (operator) codes are used to identify operators. In countries with multiple local operators, country specific operator codes are also used.
- **Standard Code Values:** NeTeX allows the declaration of open ended code values for a number of properties (e.g. TYPE OF PRODUCT, etc.). A set of commonly found values for European domestic rail is developed. Two levels of standardisation of such values is used:

- ❖ **Common European values:** A common set of “ERA code values” is developed that is used across all the examples. The common values are placed in a separate ‘European’ version frame.
- ❖ **Common National values:** Some properties for example the definition of an “infant” or a “child” or a “senior” can be standardised at a national level but not at European level. These are placed in a separate ‘national’ version frame.
- **Referential integrity** checking is used wherever possible to ensure that the examples are consistent and complete
 - ❖ Explicit cross references using the *version* attribute, requiring the referenced element to be present in the same XML document.
 - ❖ Where a referenced object is omitted this is indicated by an attribute value *versionRef*="TODO".
- **Data sources** and **Responsibility sets** are indicated only at the frame level. In principle it is possible to assign them at fine-grained level, i.e. to have specific responsibilities and sources on specific elements.
- **Use of National Languages:** Names and descriptions of places and products are in a mixture of English and specific national languages (Romanian, German, Polish), tagged using the *lang* attribute. Examples of multilingual alternative text are included.
- **Descriptions and URLs:** A number of the examples are documented with textual descriptions (using the DESCRIPTION attribute) and/or urls from the web pages from which the information is taken.
- **A few sample prices are provided in each example.** In two of the examples these are separated and placed in a separate frame. Examples of both base prices and prices derived from other prices are included.
- **Versioning:** Only a single version of the data is provided: Note that NeTEx additionally supports the fine-grained versioning of all elements as a uniform generic feature.
- **Sample transactions:** tariffs and fare products represent the entire set of options from which a user may choose when they buy a specific instance of a product. To help understand how these alternate options relate to individual purchases, sample transactions are included that show realistic choices of parameters for actual journeys.
 - ❖ Sample transactions are placed in a SALES TRANSACTION frame

5.1.1.2 Representing complex conditions

NeTEx can be used to represent precise conditions as to travel and usage rights so that they may be validated by computer-based systems; for example, to match available fares to trips in a journey planner. The exact conditions as to time of travel, type of user, etc., that determine which products are relevant can be very complicated and can include complex rules that are often not handled by traditional fare systems except as text annotations (E.g. (“*a senior railcard discount is only available on journeys arriving into London King’s Cross station after 9.30 on a weekday (or any time on a public holiday)*”).

Some judgement is needed as to how detailed a representation is required to meet the specific business requirements of an organisation. In the examples, a number of fairly complex cases are included to illustrate the possibility of such rules, but by no means

all the rules seen in the web pages are encoded. See the gap analysis for discussion of complex conditions that are not currently handled by NeTEx except as comments.

- ❖ In NeTEx, complex rules can be expressed using GENERIC VALIDITY PARAMETER ASSIGNMENTS on FARE PRODUCTS, FARE STRUCTURE ELEMENTS and certain other elements.

Human readable textual descriptions for these conditions, with alternatives in multiple languages can also be represented in NeTEx, and in some cases this is sufficient for business requirements.

5.2 Example 1: Kilometre Distance Tariffs: TFC

The example encodes a distance-based fare structure and products for a Romanian operator, TRANSPORT FERROVIAR CĂLĂTORI, including some sample prices for one line.

<https://www.transferoviarcalatori.ro/tarife.html>

5.2.1 Key features

- Kilometre-distance based tariffs.
- Single and return fares.
- Trip Supplements for Seat Reservations, Bicycles, Dogs, etc.
- Season Passes; point-to-point and zonal, for varying periods.
- Multiple user types.
- Statutory Sale Discounts, including the right to a certain number of free trips per year for certain categories of user.
- Online, in-station and onboard sales channels.
- Group discounts.
- Derived prices with rule steps showing price derivation.
- Explicit tax on a price derivation.

5.2.2 Network

A map of the TFC Network is shown in the following figure. It is a relatively simple network and set of fare products, making a good introductory example



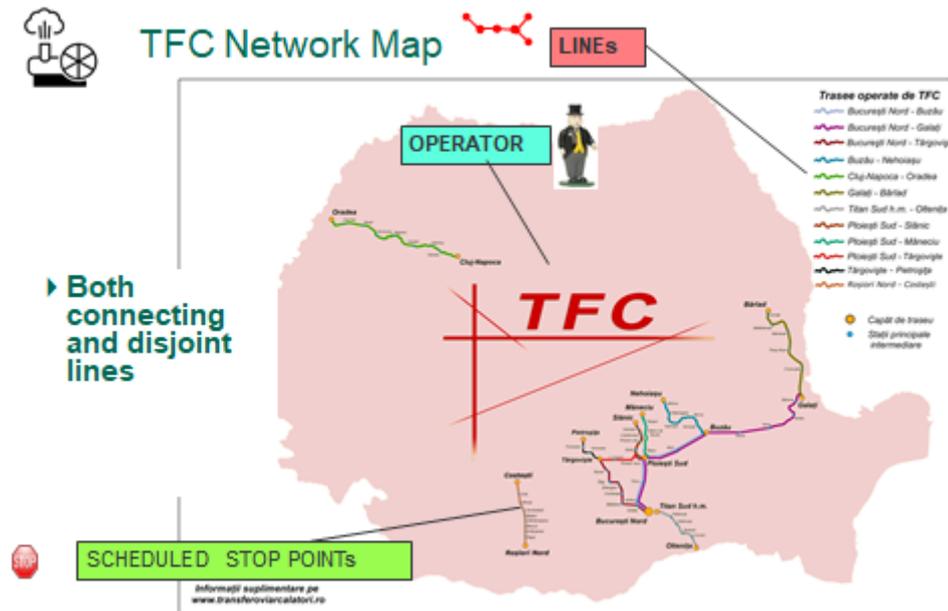


Figure 25 – Example #1: Map of TFC Network

5.2.3 Kilometre distance-based fares

TFC, like other Romanian rail operator use a classical kilometre-distance-based fare structure which is exposed directly to users.

- The timetable indicates the distance between stations.
- Prices are given per kilometre interval.

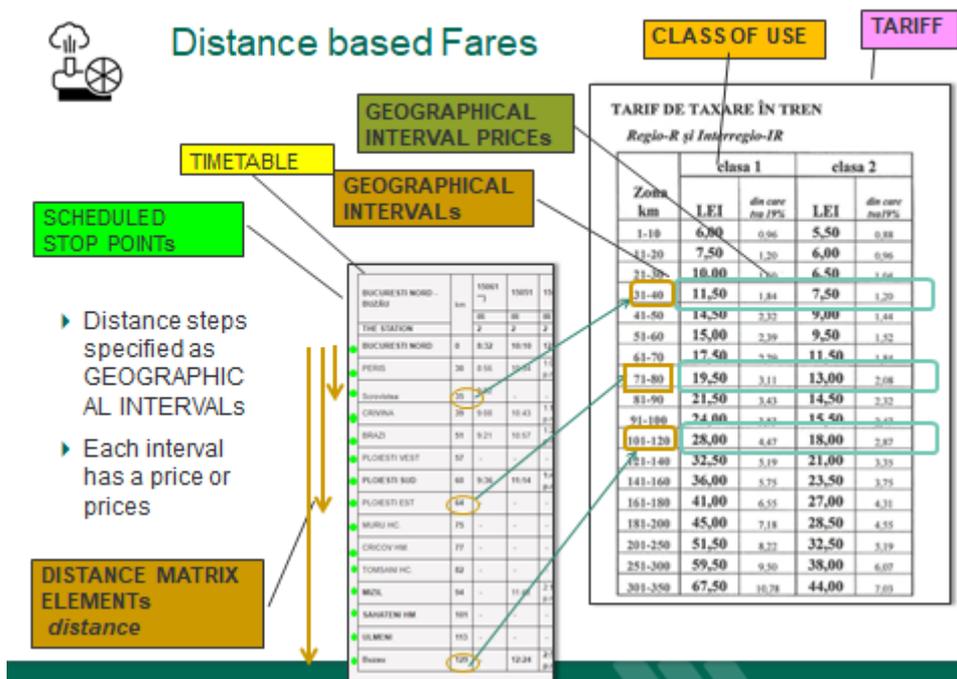


Figure 26 – Example #1: Distance based fare example



5.3 Example 2: Multi Operator Tariffs: Greater Anglia

The example encodes the common UK rail products (Standard flexible, off-peak, and semi-flexible advanced fares, railcards and season passes) and some operator specific fares for *Abelio Greater Anglia*, a UK rail operator providing services into London from the east of England. Abelio offers a typical mix of standard and operator specific products.

5.3.1 Key Features

The example illustrates a number of issues in organising a complex set of products with common components and operator specific variants.

- National and operator specific product sets.
- Point-to-point fares.
- Flexible (anytime) and semi flexible (advance) fares.
- Complex timed demand rules (peak off-peak etc.).
- Season Passes.
- Railcards for sales discounts.
- Carnets of tickets and of day passes.
- Supplement products for Seat reservations, Bicycles etc.
- Add-ons for urban zonal travel on bus (Plusbus) or metro (London Travelcard).
- Quota based products.
- Multiple user types.
- Multiple media types (paper, app, smartcard), with different products specific to different media.
- Different sales channels (online, at station, phone).
- Sample point-to-point prices.

The UK has a complex railway tariff system, involving multiple operators in different regions, in some cases offering competing services over the same routes.

- All operators support a number of core rail products, including single and return trip tickets, railcards and season tickets, which are described on the National Rail enquiries site.
- The network is congested and to spread demand there are significantly different fares for peak and off-peak travel (subject to complex rules, with different blackout periods for travel into and out of London).
- There are discounts for children, and also discounts for different categories of railcard holder (senior, disabled, etc).
- Most fares are point-to-point, but there are zonal rail fares within the Greater London area, and zonal day season passes are available in certain areas of the network.
- There is a national scheme, *PlusBus*, to add for zonal bus tickets at the origin and destination stations.



5.3.2 Network Map

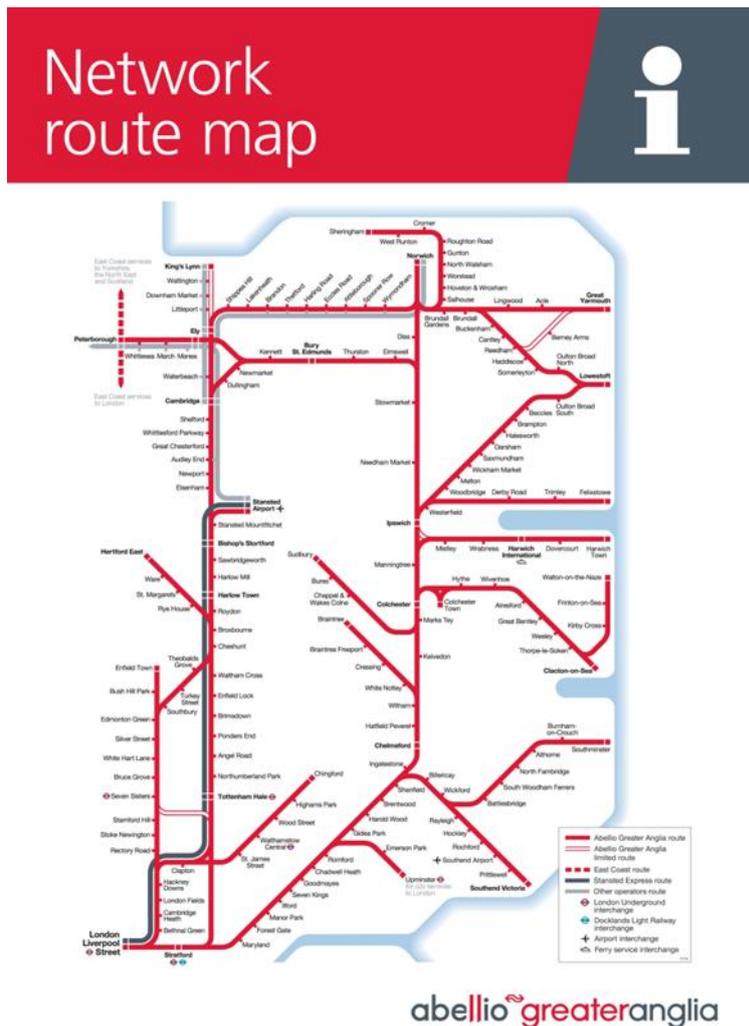


Figure 27 – Example #2: Map of Greater Anglia Network

5.3.3 Business segments

Some of the Greater Anglia products are targeted at the distinct business segments found within the network (Figure 28).

- **Intercity routes** between London and Norwich and London and King's Lynn.
- **Regional branch** lines in Norfolk and Sussex connecting rural towns.
- **London commuter belt** services connecting to the TfL Network.
- **Stansted express** – A regular shuttle service to Stansted airport





Figure 28 – Example #2: Greater Anglia Business segments

5.3.4 Common National Trip products

Passengers may plan rail journeys and examine fares on a number of different web sites, including those provided by Greater Anglia, National Rail Enquiries (A consortium of UK Rail operators) and third parties such as *TheTrainLine*. All sites show common products such as those in Table 25

	Anytime (Flexible)	Off-peak (Semi flexible)	Advance (Semi-flexible)
Single	Y	Y	Y
Day return	X	Y	X
Period Return	Y	Y	X

Table 25 – Example #2: Common UK Rail Trip Products



Examples of all the above are included in the XML example. See discussion on the representation below,

When users search for a journey using a trip planner (either from Greater Anglia, National Rail Enquiries or a third party such as The Train Line), they are presented with a choice of products that are valid for the selected route, etc.

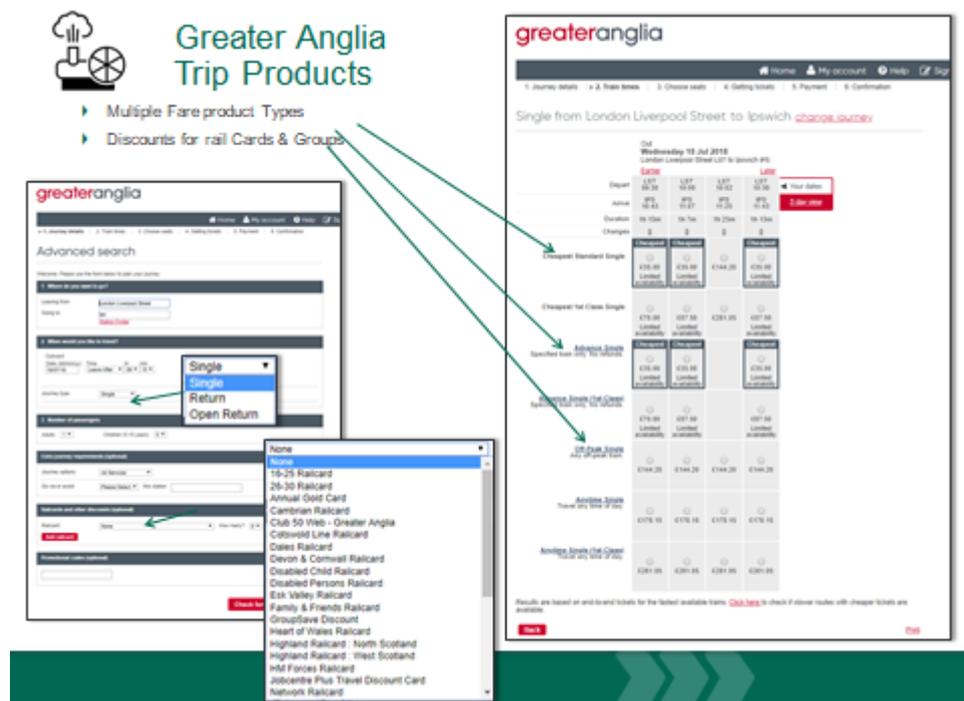


Figure 29 – Example #2: Example fare offerings –Greater Anglia web site

5.3.5 Time restrictions

The conditions governing off-peak and peak travel are fairly complex. Figure 30 shows rules for off-peak and peak periods into and out of London.





Complex time restrictions - Directional

When are Off-Peak and Super Off-Peak tickets valid?

Off-Peak, Off-Peak Day and Super Off-Peak Day tickets (including First Class versions and Day Family Travellers) to and from London* are valid at the following times:

Times	Arriving into London*	Departing from London*	Exceptions
Morning (Monday - Friday)	Off-Peak and Off-Peak Day: Not to arrive Liverpool St before 10:00. Super Off-Peak Day: Not to arrive Liverpool St before 12:30 (Stratford 11:00).	Off-Peak: Not to leave Liverpool St before 09:30. Barnet and Tottenham Hale 09:45. Off-Peak Day: Not to leave 08:30 from all stations. Super Off-Peak Day: Not to leave 10:30 from Liverpool St (Stratford 12:00).	Off-Peak and Off-Peak Day: From London: Valid on the following services: 09:28 to Cambridge (to Cheam and beyond); 09:32 to Ipswich (Stratford, 09:30), (to stations on the Sudbury branch only); 09:18 to Clacton-on-Sea (Stratford, 09:20), (to Wrentham and beyond, including to Walsingham-Ripon); To London: Valid on the following services: 08:11 from Clacton-on-Sea and intermediate stations to Wrentham, including the 08:30 from Walsingham-Ripon by changing at Thorpe-Boken; 08:28 from Norwich, Topp and intermediate stations to Muffley.

Please note that London includes Liverpool Street, Stratford, Seven Sisters, Tottenham Hale and intermediate stations such as Highbury Chase. (Unless specified, restrictions from stations other than Liverpool Street are assumed to be when the service arrives at or departs from Liverpool Street (ie Stratford where trains start and finish).

Tickets which do not include travel to, from or via central London are generally restricted to the morning period only. Typically, Off-Peak and Off-Peak Day tickets are valid after 08:00 or 09:00 outside Greater London, and after 08:30 for journeys outside from the London suburbs, and Super Off-Peak Day tickets are valid after 10:30. Please enquire as to the restrictions applying to the journey you wish to make.

Times	Arriving into London*	Departing from London*	Exceptions
Evening (Monday - Friday)	No restrictions	Off-Peak: Not to leave Liverpool St before 18:00. 18:10 Stratford or 18:11 Tottenham Hale (to 18:45). Seven Sisters 18:10-18:45. Off-Peak Day: No restriction on arrival on the Stratford to Seven Sisters and beyond, which have Off-Peak restrictions as above. Super Off-Peak Day: Not to leave Liverpool St before 17:00. 18:01 (Stratford 16:30) 18:00.	During school holidays* and bank holidays, including the Christmas and New Year period, evening restrictions on off-Peak tickets departing London are lifted. Restrictions remain in force on Super Off-Peak Day tickets. *Off-Peak period tickets are only valid at all times on the following services: 18:00, 18:10 and 18:30 to stations on the Fintona Island only, including Off-Peak Day, Fintona and Off-Peak Single; 18:00 (Stratford, 18:00) to stations on the Stratford branch only; 18:10 (Stratford, 18:00) to stations on the Highbury branch only; 18:30 (Stratford, 18:45) to Muffley, Fintona, Alford and Wrentham to Walsingham-Ripon only.
Weekends and Bank Holidays	No restrictions	No restrictions	None

Off-Peak and Super Off-Peak tickets for long-distance journeys via London have specific restrictions depending on the journey being made. The time restrictions in the table may not apply, especially for routes from south of Morningside Harrold and Ely/Cambridge to destinations outside the London and South-East area. Please check our online booking engine or ask ticket office staff.

If you're unsure about the time restrictions that apply to your journey, it's always recommended to check with the ticket office or the Greater Anglia Contact Centre on 0345 600 7245.

Figure 30 – Example #2: Time demand periods – for Greater Anglia LST

Examples of all the above are included in the XML example.

5.3.6 Types of Travel Document

Tickets are available for Greater Anglia trains in multiple formats, included paper, smart cards (on certain routes) passes, and mobile applications. The Smart cards may only be used on certain routes.



Travel documents & Media #1

Formats

- Printed
- Mobile
- Self print (advance tickets)
- Smartcards on commuter lines & London (Oyster)
- Photocards & Railcards

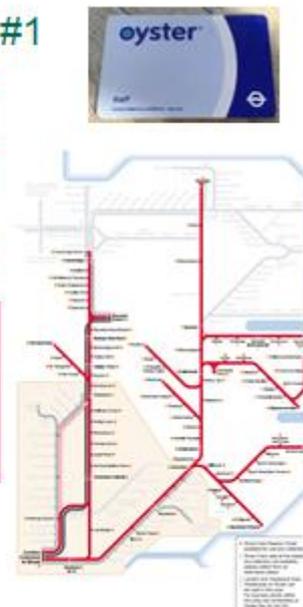


Figure 31 – Example #2: Types of Travel Document

Examples of all the above are included in the XML example.

- ❖ The NeTex TYPE OF TRAVEL DOCUMENT is used to indicate the media format. Complex rules may be specified as to which TYPES OF TRAVEL



ERA-2017-3-NP – Tariff Data Exchange Report

DOCUMENT are available for a given SALES OFFER PACKAGE; in this case the use of a Smartcard is limited to routes of a specific FARE ZONE.



5.3.7 Specifying Interoperable products

As in most European countries, the UK fare products can be represented as a small number of common basic products which are then packaged in many different ways with by different operators to give branded offerings to the user, sometimes with slightly different additional conditions applying.

- ❖ Such a representation can be captured efficiently in NeTeX by using GROUP OF SALES OFFER PACKAGE elements to describe common properties that are shared by many different individual SALES OFFER PACKAGES.

For instance, in the XML example of encoding Greater Anglia fares in NeTeX, reusable components for the common UK products for single and return trips are defined, as follows:

- ▶ Common UK definitions for basic *Single* trip and *Return* trip products (as instances of PREASSIGNED FARE PRODUCTS) are created, along with common usage parameters, based on a point-to-point tariff structure (defined with common DESTINATION MATRIX ELEMENTs between each UK station).
- ▶ Additional products are defined for add-ons, such as, (a) a *PlusBus* zonal day pass for local bus use at either end of the journey and; (b) a *cross-London transfer* on the metro. (Trip supplements such as reservations, upgrades to first class, etc., can also be added but are not shown).

To specify the common conditions applying to UK offers, GROUP OF SALES OFFER PACKAGE are as follows:

- ▶ Two separate *Single* and *Return* GROUP OF SALES OFFER PACKAGE instances are created to specify common sales and distribution properties for single and return trips respectively.
- ▶ Three separate *Anytime*, *Off-peak* and *Advance* GROUP OF SALES OFFER PACKAGES to specify common product properties that relate to the usage conditions of the different offerings for flexible and semi-flexible fares.

The above components are all generic to the UK. To create specific offerings for Greater Anglia;

- ▶ Individual SALES OFFER PACKAGES for Greater Anglia are specified simply by referencing the various base components and common GROUP OF SALES OFFER PACKAGES and adding any further conditions and Greater Anglia Branding and contact information.
 - Thus, for example, a “*Greater Anglia Anytime Single*” is made up of a common *Single* FARE PRODUCT (and common *London Transfer* and *PlusBus* supplements), packaged as a *Great Anglia Single* SALES OFFER PACKAGE that takes properties from the common *single* GROUP OF SALES OFFER PACKAGE and the common *Anytime* GROUP OF SALES OFFER PACKAGE.
 - Not all the possible combinations are deemed valid (for example there is no *Advance return*).

An approximate visualisation of this is given in Figure 32. Common basic trip FARE PRODUCTS are shown on the left (with UK rail, TfL and Plusbus brand icons); the common GROUP OF SALES OFFER PACKAGES are shown above and below (all



with UK rail brand icons); the six actual final Greater Anglia SALES OFFER PACKAGES in the centre with a Greater Anglia brand icon.

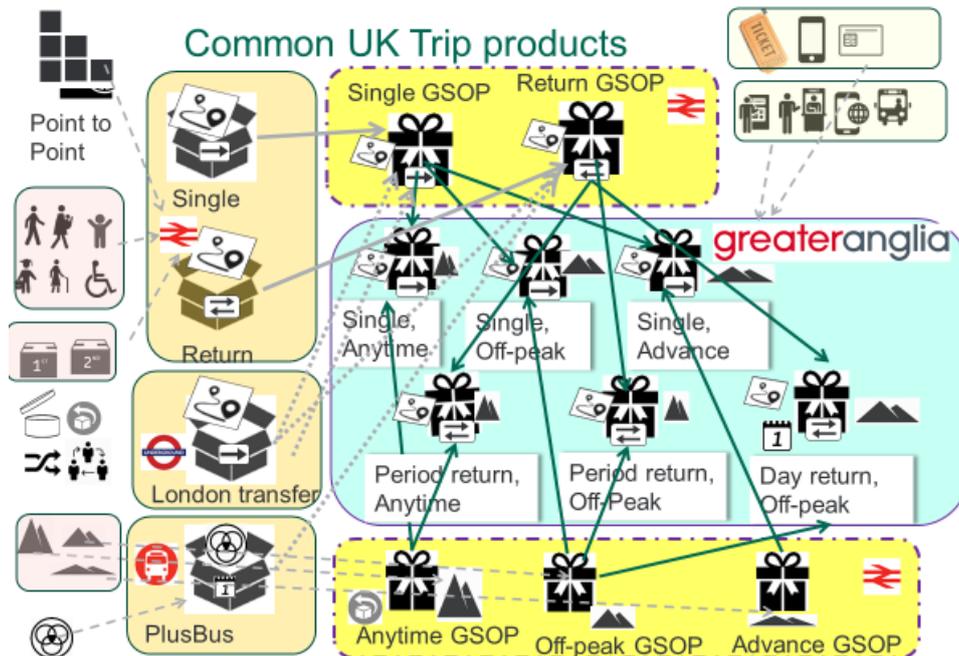


Figure 32 – Example #2: Composing multiple packages from common products

A similar approach is used in the XML example for Railcards, Season Passes, etc, so that the same common products are packaged for many different operators.

5.3.8 Railcards

A Railcard is offered as a product that users can purchase to get discounts on rail travel; this is packaged as different products for different sections of the market.

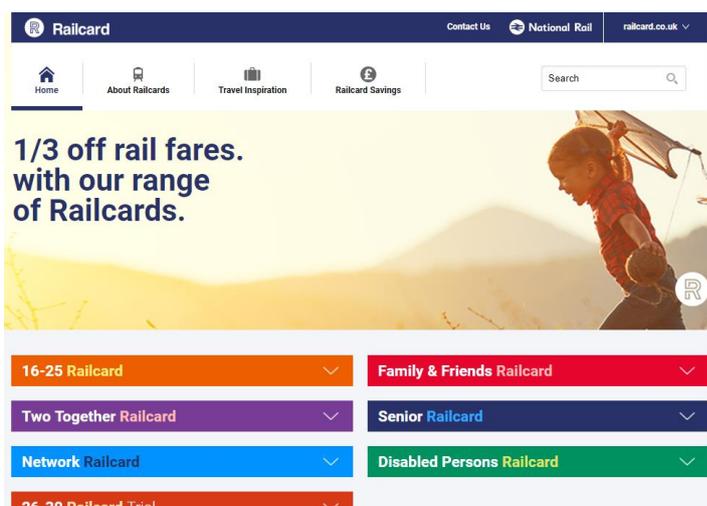


Figure 33 – Example #2: UK Rail cards

- ❖ In NeTEx, a railcard that allows discounted purchases can be represented as SALE DISCOUNT RIGHT fare product. Quite often such a product will be



packaged with another product in a single SALES PACKAGE OFFER, for example SALES DISCOUNT RIGHT (for discounted purchase) may be offered along with a USAGE DISCOUNT RIGHT (that might give frequent flyer points); linked to a CUSTOMER ACCOUNT.

- ❖ The TYPE OF TRAVEL DOCUMENT might place the product on a Smart Card.
- ❖ Most rail cards are tied to specific USER PROFILEs (*Senior, Youth, etc*

Examples of the above are included in the XML example.

In the example a single UK railcard SALES DISCOUNT RIGHT product is defined.

This is packaged into separate SALES PACKAGE OFFERs for different USER PROFILEs: *Senior, Disabled, 16-25 etc.*

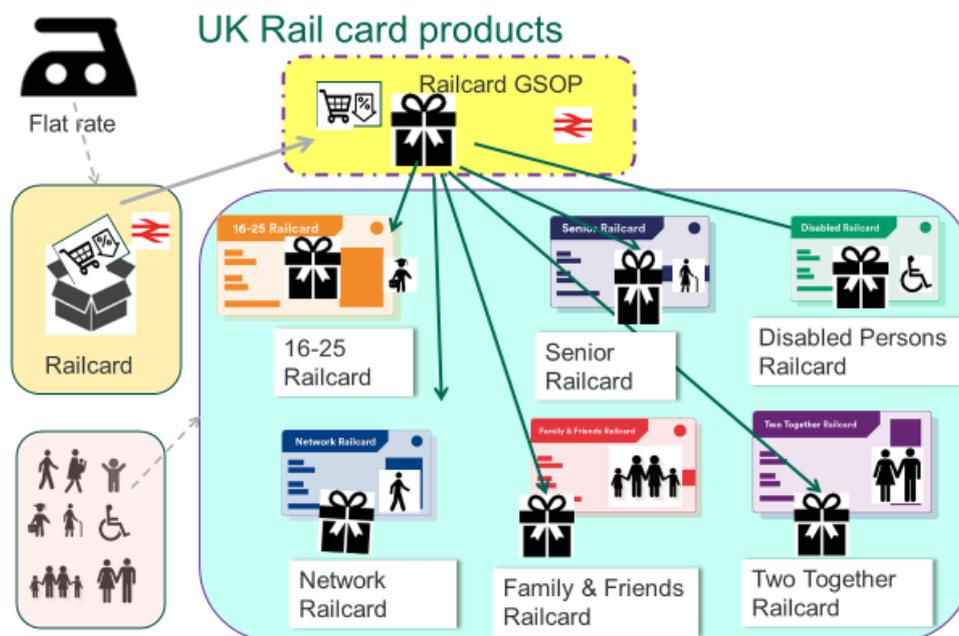


Figure 34 – Example #2: Composing multiple packages from common products

The Network Railcard is for adults but is tied to a specific zone covering operators in the south of England.

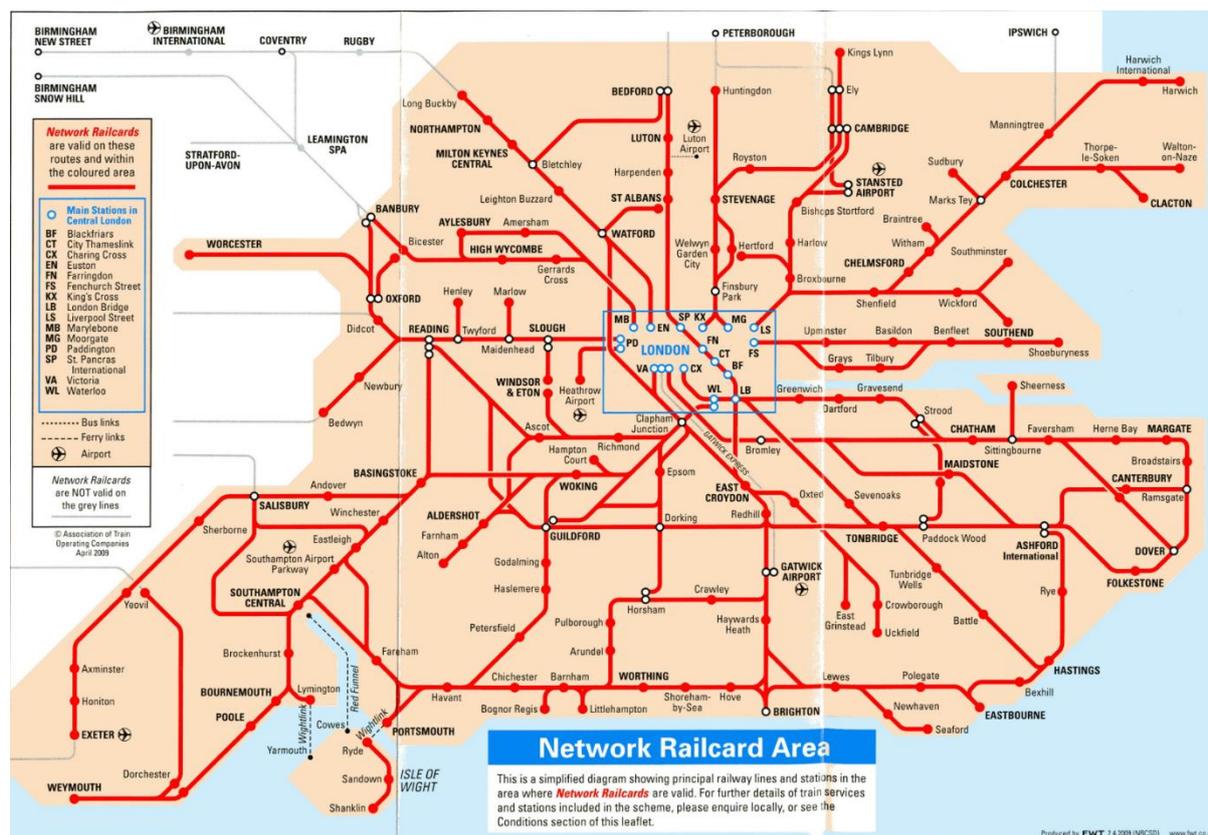


Figure 35 – Example #2: Network Rail card Area

5.3.9 Season Passes

Across the UK, point-to-point season passes are available for commuter routes –only up to a certain distance. Season pass add-ons are also available for PlusBus and for London as London Travelcards.

Season passes are sold by the operator (e.g. Greater Anglia) online or at a counter, but a pricing tool to compare season ticket prices is available on the national site, which is populated with data about specific routes. (Figure 36, Figure 37).

Season tickets are available for some areas as a Smartcard product

Examples of Season ticket Products are encoded in the XML example.

Greater Anglia brands its annual season passes

5.3.9.1 Season Ticket comparison

The comparison tool illustrates a common requirement to use tariff data to compare the relative costs of repeated travel along the same route between a season ticket with and individual tickets.




National Rail Enquiries

Home
Train times & tickets
Stations & on train
Changes to train times

Journey planner
Live departure boards
Season ticket calculator
Your ticket
Discounts
Travel tools
Special offers

How it works

If you are making the same journey on 3 or more days within a week a 7-day Season ticket is likely to save you money compared to buying daily tickets you can use the calculator to find out. You save even more on the 7-day rate when you buy a monthly or longer period Season Ticket. A monthly ticket is valid for a full calendar month, and if you need a longer period you can ask for the specific number of months and additional days needed - all at the same discounted rate!

If you are going to be buying monthly or equivalent tickets for 10 months or more, an Annual Season Ticket will give you an even bigger saving - valid for a full calendar year, you effectively get 12 weeks' free travel.

Season Tickets can be used for unlimited journeys between the two stations printed on the ticket. A passport sized photograph is required for your first purchase. Season Tickets can be purchased at any staffed station, and online in many cases - check out your local train company's website.

Season Ticket prices on this calculator reflect current fares and do not take into account any future changes in prices which normally occur in January each year. Remember though that when you buy a ticket you get to travel at the current price for the whole validity of your Season Ticket, regardless of any future price increase during its validity.

Season Ticket Calculator

From to

Start date

End date

View all options

7 Days



Exact months and days

Ticket Class

Standard

First

Passengers

Adult

Child

Calculate Price

[> Routes, Availability and Fares are subject to these provisions](#)

Figure 36 – Example #2: Season Ticket Calculator Input



87

Season Ticket Costs

Norwich (NRW) to London Terminals

Available Standard Class Adult Season Tickets (Travel is allowed via any permitted route.)

With this ticket, using National Rail services you can travel to / from the following London stations: [Moorgate \(MOG\)](#), [Old Street \(OLD\)](#), [London Liverpool Street \(LST\)](#), [London Kings Cross \(KGX\)](#), [London St Pancras International \(STP\)](#)

Days/Months	Price	Average journey price*
7 Days	£204.10	£20.41
1 Month	£783.80	-
3 Months	£2,351.30	-
6 Months	£4,702.50	-
12 Months	£8,164.00	£17.59

Please check that the route you have selected is permitted. Information about permitted routes can be found on the National Rail Enquiries [ticket types](#) page.

You will need a passport sized photograph for a Photocard when you first purchase a season ticket. You can buy a season ticket from any staffed station.

* Average journey prices have been calculated based upon two daily journeys (i.e. an outward and return journey) with an allowance for annual leave. For more information see [this page](#).

Season ticket prices may not always include cross London or Underground travel.

- > Routes, Availability and Fares are subject to these provisions
- > More information about Season Tickets

Norwich (NRW) to London Travelcard Zones 1-6

Available Standard Class Adult Season Tickets (Travel is allowed via any permitted route.)

Days/Months	Price	Average journey price*
7 Days	£230.10	£23.01
1 Month	£883.60	-
3 Months	£2,650.80	-
6 Months	£5,301.60	-
12 Months	£9,204.00	£19.83

Please check that the route you have selected is permitted. Information about permitted routes can be found on the National Rail Enquiries [ticket types](#) page.

You will need a passport sized photograph for a Photocard when you first purchase a season ticket. You can buy a season ticket from any staffed station.

* Average journey prices have been calculated based upon two daily journeys (i.e. an outward and return journey) with an allowance for annual leave. For more information see [this page](#).

Season ticket prices may not always include cross London or Underground travel.

- > Routes, Availability and Fares are subject to these provisions
- > More information about Season Tickets

Figure 37 – Example #2: Season Ticket Calculator Results

5.3.9.2 Greater Anglia Season Tickets

Greater Anglia offers season passes on a weekly, monthly or annual basis.

- Weekly tickets have a variable start, that is can start on any day of the week.
- Monthly tickets also have a variable start and may be for any number of days (up to 10 months 12 days at which point an annual pass is cheaper).
- Annual tickets can be bought for the whole year or on monthly subscription (*Season Direct*), with the rate maintained for the whole year (prices usually rise in January). Travel is for P2P travel. Annual ticket holders also get an Annual Gold card, a free Railcard offering discounts for the user and companions and other benefits.



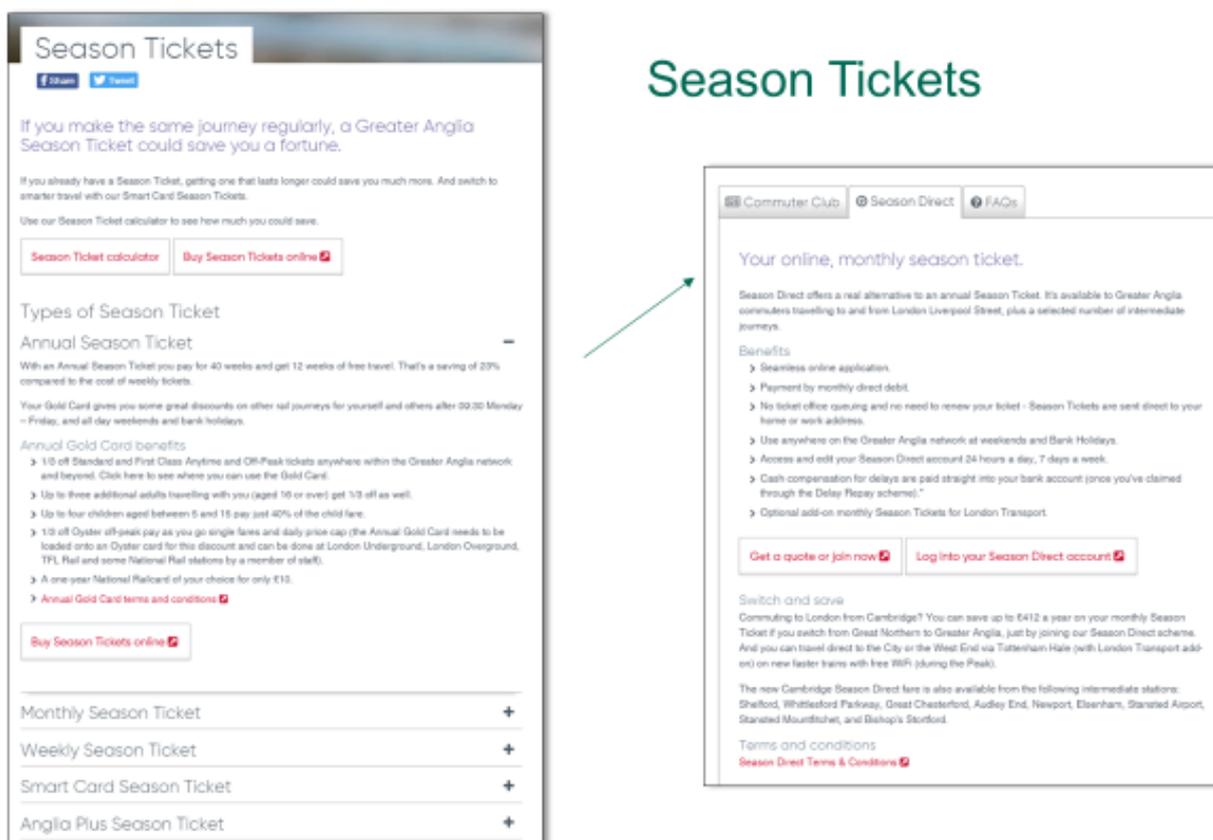


Figure 38 – Example #2: Season Ticket Calculator Results

5.3.10 Additional products

5.3.10.1 Greater Anglia Carnet

Greater Anglia offers a multi-trip carnet giving a 10% discount on 10 return trips. The trips have to be made within three months and are not refundable.

- ❖ This is represented in the example by an AMOUNT OF PRICE UNIT product for 10 trips. A USAGE VALIDITY PERIOD usage parameter limits the time in which it can be used, and a REFUNDING parameter restricts the refund.

5.3.10.2 Greater Anglia Zonal passes

As well as standard products Greater Anglia offers zonal day and season passes over parts of the regional network outside of London. *Anglia Plus*

- ❖ To represent zonal Season passes, FARE ZONES are defined for each zone and a Greater Anglia specific product is defined for the SEASON PASS. Its tariff allows different combinations of zone and TIME INTERVAL to be selected.
- ❖ The *Scholars Pass* is a season pass is targeted at school pupils: eligibility conditions can be specified by a USER PROFILE and the validity period can be defined by a DAY TYPE corresponding to a *school day*, as defined in a SERVICE CALENDAR that specifies the actual school term dates.



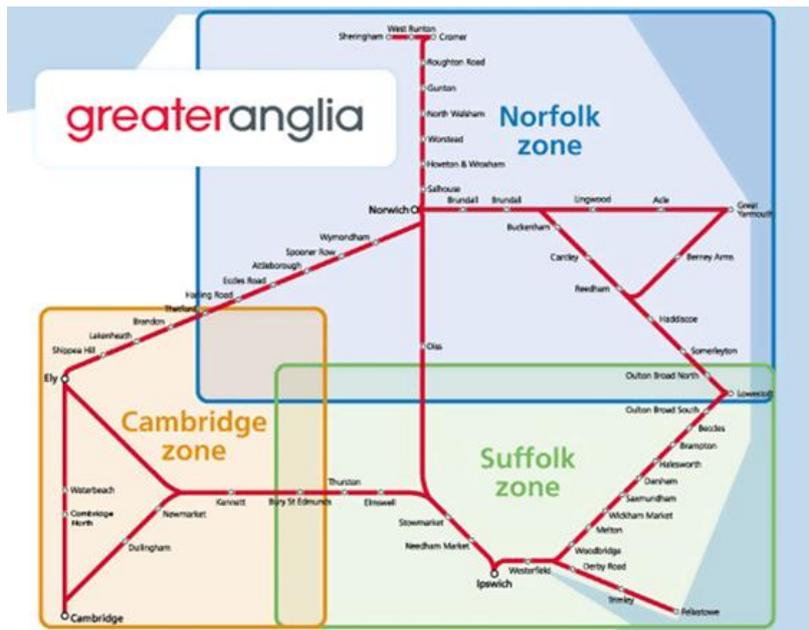


Figure 39 – Example #2: Fare zones for zonal passes

Examples of the above are included in the XML example.

5.3.10.3 Parking add on

Greater Anglia offers a parking add on for its season ticket – but only at Norwich station.

5.4 Example 3: Cross border Tariffs: Trilex, DE/CZ/PL

The example encodes multiple products for some cross-border services between Germany, Poland and Czechoslovakia in including offerings from Trilex, VVO, ZVON and Deutsch Bahn.

The primary purpose of the example is to show how different tariffs applying to different sections of the network can be represented.

5.4.1 Key Features

The example illustrates a number of issues in organising a varied set of products from different operators that apply to common network components:

- Multiple operators.
- Regional cross border tariffs.
- National and operator specific product sets.
- Point-to-point fares.
- Fare zones.
- Flat fares.
- Group discounts.
- Derived prices with rule steps showing price derivation.

5.4.2 Network Map

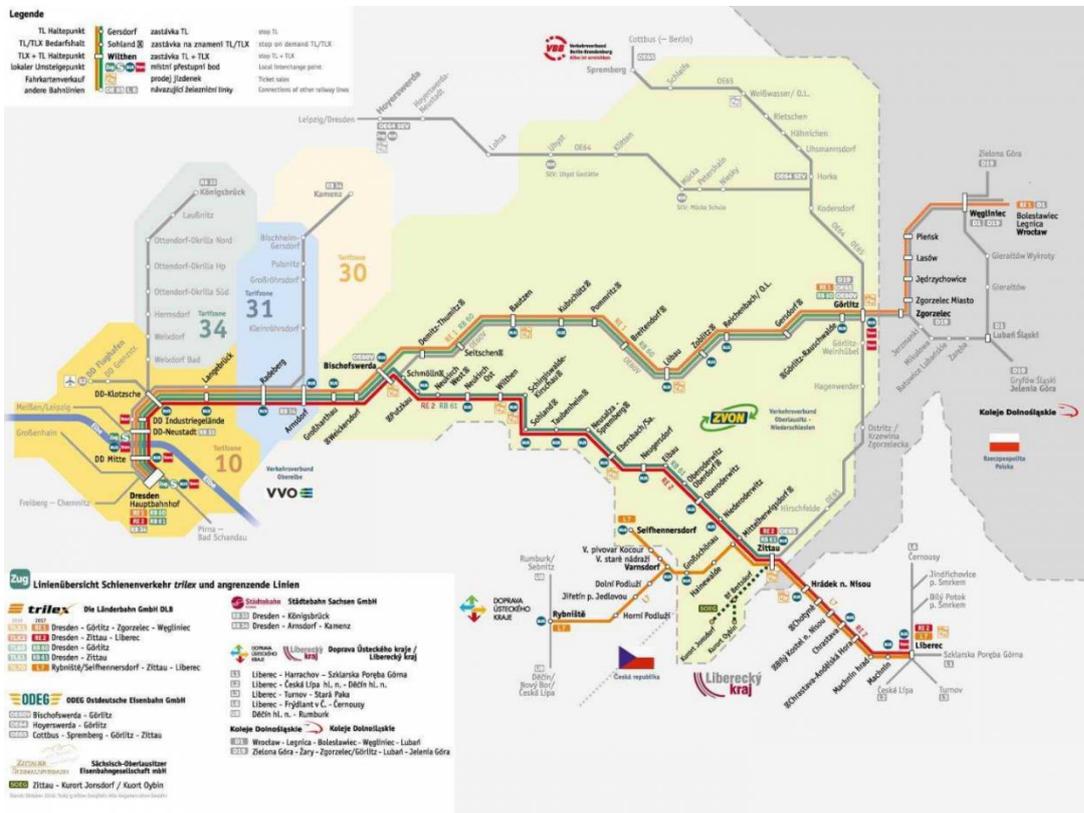


Figure 40 – Example #3: Map of Dresden / Wroclaw /Liberec networks

5.4.3 Saxony Tariff Zones

The Saxony region is split into a number of tariff zones.

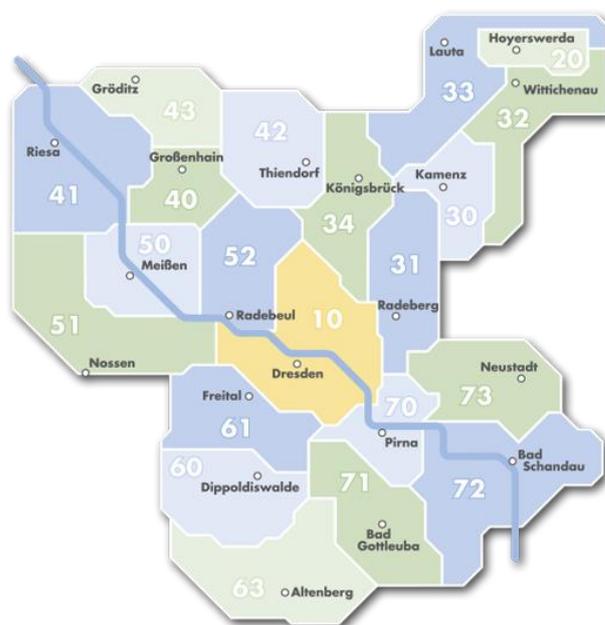


Figure 41 – Example #3: Map of Saxony region Tariff Zones

5.4.4 Tariff Sections

Figure 42 and Figure 43 show tariffs available for Dresden to Wroclaw (Breslau) in Poland and Dresden to Liberec (Reichenberg) in the Czech Republic respectively. t

- The *Tageskarte* tariff [orange colour] is an off-peak flat rate day pass available for journeys crossing the region, and also to go to Liberec in the Czech Republic. Group discounts are available
- The *Katzensprung* tariffs [Pink colour] is an off-peak tariff offering day passes at two different rates for two different sections. It is available only within Saxony and only for the specified routes.
- The *Dresden-Wroclaw-Spezial* is a special discounted period return trip fare valid on a cross-border route between Dresden and Wroclaw in Poland.
- The VVO (*Verkehrsverbund Oberelbe*), and ZVON (*Zweckverband Verkehrsverbund Oberlausitz-Niederschlesien*) tariffs are regional point-to-point tariffs only available on certain parts of the network. Regional expresses ((E.g. RE 20, RB61) are charged at a higher rate.
- The *Saxony tariff* is a regional off-peak day pass offered by Deutsch Bahn and usable as far as the border. Group discounts are available on it.
- *Bahn tariffs* are point-to-point tariffs charged by national rail operators such as Deutsche Bahn and Polish Railways and are available for all sections of the journey.

Dresden Hbf	Arnsdorf	Großharthau	Bischofswerda	Bautzen	Görlitz	Wrocław
trilex-Tagesticket ab 21 € ¹						
Dresden-Wrocław-Spezial ab 35 €						
Katzensprungticket 15 € ¹						
Katzensprungticket 10 € ¹						
VVO-Tarif			RE 1		ZVON-Tarif	
VVO-Tarif		RB 60			ZVON-Tarif	
VVO-ZVON-Übergangstarif ³						
Sachsen-Ticket						
Bahn-Tarif						

Figure 42 – Example #3: Section Tariffs for Dresden / Wrocław Services

Dresden Hbf	Arnsdorf	Großharthau	Bischofswerda	Witthen	Zittau	Liberec
trilex-Tagesticket ab 21 € ¹						
Liberec-Dresden-Spezial 250Kč ²						
Katzensprungticket 15 € ¹						
Katzensprungticket 10 € ¹						
VVO-Tarif			RE 2		ZVON-Tarif	
VVO-Tarif		RB 61			ZVON-Tarif	
VVO-ZVON-Übergangstarif ³						
Sachsen-Ticket						
			RE 2		EURO-NEISSE-Ticket	
		RB 61			EURO-NEISSE-Ticket	
Bahn-Tarif						

Figure 43 – Example #3: Section Tariffs for Dresden / Liberec Services

- ❖ In order to define a detailed point-to-point tariff (as say for the Bahn tariff) a detailed OD/ matrix of DISTANCE MATRIX ELEMENTs between each origin and destination station would be defined.
- ❖ To indicate common zones for the *Tagesticket* and *Katzensprung* products, FARE SECTIONS can be defined between the origin and destination points.

6 Gap Analysis

One of the purposes of the study was to identify any important aspects of European domestic rail tariffs that could not be represented in NeTEx, so that future extensions could be added to improve its support for rail tariffs. This section discusses gaps and records a number of specific instances of different types of minor gap recorded by the study.

Discussion is done in terms of NeTEx elements and therefore assumes a quite detailed familiarity with NeTEx components. Straightforward possible extensions to NeTEx to address to gaps are indicated for many of the gaps.

6.1 Summary Conclusions

The list of gaps of various types given below is not exhaustive but serves to demonstrate that as far as we are aware, there are no “show stoppers” and any outstanding issues are:

- 1) *Minor detailed issues that are not fundamental to the effective use of NeTEx and*
- 2) *Can be addressed by a few simple additions.*

In particular, all the essential aspects of domestic fares can already be covered: the minor points not covered mostly relate to ancillary features or extra passenger information (which could already be represented in NeTEx as text notes using existing mechanism).

Overall NeTEx gives a vocabulary with which to describe the available tariffs precisely and a flexible framework that can be extended in a systematic and rigorous way.

6.2 What counts as a gap?

Some qualification as to the nature of different types of possible “gap” is useful:

- 1) **Missing feature relevant for tariff structure:** A feature that is currently used in machine readable form in existing tariff systems that cannot be represented by NeTEx 1.1.
 - *Thus, strictly as a gap within the terms of the current study.*
- 2) **Additional feature relevant for passenger information:** A feature, such as a complex condition of use, that is not currently represented in machine readable form in existing tariff systems but could or should be represented quantitatively in an ideal representation format. (Most such features do not give rise to additional tariff price distinctions but merely qualify how products may be used or validated, or to after sales commercial conditions for refunds, etc.)
 - 1) As a strategic standard, it will be desirable for NeTEx to support such features in future (although they are not gaps in terms of the current study).
 - Note that complex conditions can in any case be described textually for passenger information in NeTEx using textual elements, in particular the NOTICE element, which allows arbitrary footnotes to be attached to elements.



- 3) **Internal feature:** A feature affecting the description of fares or pricing that is used in underlying fare planning system but does not need to be exposed to the customer as passenger information or exchanged to provide passenger information.
 - Not all parameters and data used to devise tariff schemes actually constitute passenger information, that is to say, are made visible to the user. For example, routing restrictions and quotas are often hidden. Whether such parameters are relevant depends on the use cases being supported; for example, if NeTEx is used to communication between fare planning systems then additional elements may be relevant for them to perform fare calculation.
- 4) **Ancillary feature:** A number of the gaps described relate to passenger information on the use of fares and are not fundamental to representing the tariff structure (for example the requirement to have the exact change to make payment onboard a vehicle). These are noted in the interest of completeness but are not really gaps in NeTEx's ability to represent the fare structure.
 - See 6.1 for a list of such features.
- 5) **Optimisation:** Tariff features that can be described currently in NeTEx but where the NeTEx representation is verbose, repetitive or otherwise clumsy and could be improved by the addition of extra attributes or element.
 - It is likely in particular that there are certain commonly found combinations of elements data (such as standard prices) for which specialised optimised encodings could be added to handle large volumes of data.
 - See 6.5 for a list of such features.
- 6) **Clarification/Interpretation:** NeTEx is a large and complex standard, (as is the problem domain describes), using a number of powerful abstractions; the ways these can be used to represent particular complex products or tariff conditions is not always immediately obvious – such cases can be considered as gaps in the supporting and expository material, rather than in the representational model, but is nonetheless useful to consider what can be done it clarify how to apply NeTEx.
 - See 6.4 for a list of such features.

6.3 Missing feature context

In considering missing features, one should also clarify the context in which a feature is considered missing. We can distinguish the following four cases:

- 1) **Present in Transmodel v6.0 but not yet implemented in NeTEx 1.1** Certain features are already present in the recent Transmodel 6.0 revision but have not yet been added to NeTEx 1.1 (which in effect a concrete implementation in XML of the Transmodel model). Transmodel thus gives a design as to how these should be added in future. For example:
 - Product ownership / distribution roles – (relevant for Interoperability).
 - Customer Purchase packages and media details / device apps.
- 2) **Missing, but straightforward extensions of framework** NeTEx is designed to be easily extended with further features and specialisation. Many gaps are additional distinctions that can be added trivially to the existing model, for example.
 - Extra enumerated values.



- Extra attributes on existing elements.
 - Extra specialisations of existing elements.
- 3) **Missing, and require an additional submodel.** Some features may require a larger extension to NeTEx and Transmodel, with a careful choice of terminology and modelling of the elements and concepts.
- At least one area has been identified from the study where this is the case (for Vehicle Seating Plans).
- 4) **Missing and would be difficult or impossible to support.** The study has not encountered any features of this type.

6.4 Minor issues – Mainly Interpretation

The following are examples of minor aspects of tariff or product specification noted as interesting cases or novelties while examining the tariffs or coding the examples. Most of them can be addressed with existing NeTEx mechanisms though it may need clarification or guidance how best to do so. In some cases, minor improvements to NeTEx could make the interpretation and implementation more obvious or more efficient.

6.4.1 Different prices for different advance booking periods for the same product.

- ▶ **Interpretation:** Use PURCHASE WINDOW with a different TYPE OF USAGE PARAMETER to indicate the different booking period. More than one PURCHASE WINDOW may be specified for a product

6.4.2 Different purchase windows and prices for renewal versus initial sale

For season passes in particular, different conditions may attach to renewal as compared to the initial purchase. This can be handled at the moment (say by using TYPE OF USAGE PARAMETER to distinguish the cases, but might be improved by adding an *initial/renewal* attribute to PURCHASE WINDOW:

- ▶ **Interpretation:** For example, one could use two instances of PURCHASE WINDOW with a TYPE OF USAGE PARAMETER to indicate the *initial vs, renewal* stage.
- ▶ **Optimisation:** Could be simplified by adding a renew/initial enumeration. Can have a separate price for renewal.

6.4.3 Different purchase windows & after sales for different channels

For smartcards and season passes in particular, different lead times may apply to different channels. For example. a Czech pensioner card is quicker online (21 days) than at station (28 days):

- ▶ **Interpretation:** This can be handled by having conditions on a product (i.e. GENERIC PARAMETER ASSIGNMENTs) that combine a DISTRIBUTION CHANNEL with a PURCHASE WINDOW.



6.4.4 Time to *Pay* vs Time to Book

Similarly, some products that can be reserved before paying may specify separate due dates by which reservation must be done and by which payment must be made. This can be handled at the moment in various ways, but usage might be clarified by adding a *reservation / payment* attribute to PURCHASE WINDOW: The Italian *Postoclick* payment method (Which allow users to book then pay with cash at a kiosk or agency) is a specific example (it must be paid for 48h before travel. Another example is DB group ticket purchase, which requires a deposit on booking and payment by seven days before travel.

- ▶ **interpretation:** For example, could use two instances of a PURCHASE WINDOW with a TYPE OF USAGE PARAMETER to indicate the *reservation* vs, *payment* stage.

6.4.5 Purchase Window vs Minimum period

The PURCHASE WINDOW can be used to indicate the maximum time ahead of travel that a product can be purchased. Products may additionally indicate a minimum time (as say for Hungary Start Klub cards which must be bought at least 15 days ahead of travel but which can be bought 90 days ahead of travel).

- ▶ **interpretation:** Purchase window has both a minimum and a maximum duration.

The card's first day of validity may be 15 days after the date of application, but the first day of validity can be given up to 90 days in advance.

6.4.6 Commercial conditions may be subject to time limits

Some commercial conditions have temporal validity conditions: e.g. refunds may only be done within a certain period. These may be specific to a distribution channel (e.g. a Carnet from ATM is only refundable for 30 minutes after purchase, but one bought from a ticket office can be exchanged up until its expiry date).

- ▶ **Interpretation:** This can be represented by combining parameters in a GENERIC PARAMETER ASSIGNMENT, for example REFUNDING + USAGE VALIDITY CONDITION, + DISTRIBUTION CHANNEL.

6.4.7 Point to Zone? Tariff structures.

Some products are point-to-point in one direction and zone-to-point in the other direction (For example, some Belgium day return trips to the seaside must go to a specific destination but are allowed to return from a number of towns on the coast)). Other products are zone-to-point. For example, the Estonian domestic network has zone sections and point-to-point sections).

- ▶ **Interpretation:** The current Transmodel and NeTEx models suggest that an origin destination pair must be either point-to-point or zone-to-zone (i.e. both ends must be stop points, or both ends must be fare zones). However, the constraint is not enforced by XML and it is possible to code point-to-zone data. This should be reconsidered in the specification.



6.4.8 Complex group discounts

Some products specify complex rules as to group discounts; for example, a *Family discount reduced to 40% if there are more adults than children in the party*.

- ▶ **Optimisation:** This could be captured quantitatively at the moment by coding different GROUP TICKETS for each possible combination, and textually as a comment. It might be more elegant to add some extra attributes to express the rules.

Another example is where the discount is specified as a free ticket for a certain number for users. Although this can be represented by one or more discount pricing rules (e.g. 1 for 4, with four travellers is a 25% discount, with five travellers is a 20% discount, etc.); the actual justification is not currently captured and is slightly verbose (since the respective discounts for intermediate numbers of users (5,6,7) etc have to be stated as well). Another complex variation can be found in the Czech CD (2nd passenger 25%, 3 or more passengers 50%, if more than six 2nd passenger is also 50%)

- ▶ **Optimisation:** and a *1 for an* attribute.

6.4.9 On board surcharge varies by channel/user profile

Some operators (e.g. in Norway) apply a surcharge to onboard purchase of tickets, but not for certain classes of user (e.g. the disabled Norway).

- ▶ **Interpretation:** Tariff can have separate prices for different DISTRIBUTION CHANNELS and USER PROFILES.

6.4.10 Assignment of logical operators

The NeTeX GENERIC PARAMETER ASSIGNMENT provides a powerful mechanism for stating tariff and product rules in terms of parameter values combined with logical operators (AND, OR etc). They can be used to state rules o FARE PRODUCTS, SALES OFFER PACKAGES, FARE STRUCTURE ELEMENTS and other components. The meaning of certain operators when used with parameters that are groups could be made clearer in some cases; this is in particular the case when handling parameters that are groups of elements (predefined groups of elements are used in complex tariffs so as to reuse references).

For example, the following assignment fragment clearly states that the value is one of Lines A, B, C (Since there is and OR, rather than an AND).

```
<GenericParameterAssignment id="PermittedLines"
  <ValidityParameterAssignmentType>OR</ValidityParameterAssignmentType>
  <validityParameters>
    <LineRef ref="A"/>
    <LineRef ref="B"/>
    <LineRef ref="C"/>
  </validityParameters>
</GenericParameterAssignment>
```

But if we replace the individual references with group of elements it is not absolutely clear whether that we mean “all members of one of the groups” or “one member of all the groups”



```
<GenericParameterAssignment id="PermittedLines"
  <ValidityParameterAssignmentType>OR</ValidityParameterAssignmentType>
  <validityParameters>
    <GroupOfLinesRef ref="P"> <!--Lines A and B -->
    <GroupOfLinesRef ref="Q"> <!-- C-->
  </validityParameters>
</GenericParameterAssignment>
```

- ▶ **Interpretation:** Consider OR when used with a single group to mean “one of the group” (and AND to mean “all of the group”).
- ▶ **Optimisation:** add additional operators: *OneOfGroup / AllOfGroup / NoneOfGroup*.

6.4.11 Fulfilment time.

Some fulfilment methods may have an expected duration, e.g. for post or a courier.

- ▶ **Interpretation:** Could use a PURCHASE WINDOW combined with methods to indicate minimum period to allow.
- ▶ **Optimisation:** add duration and instant/delayed directly to Fulfilment method.

6.4.12 Ticket Release dates.

Where there are Quota based fares, tickets are sometimes release at predetermined dates. For example, Swedish Rail has four annual releases. Knowledge of these dates are relevant for passenger information as customer’s may need to act quickly to secure a cheap fare.

- ▶ **Interpretation:** Use a SERVICE CALENDAR and Use VALIDITY CONDITIONS for the Events?
- ▶ **Optimisation:** Support TM EVENTS in NeTEx.

6.4.13 Personal Tariff zones.

Skaneltrafiken in Sweden has introduced a novel concept of a personal tariff zone – the user may choose one of three sizes (8km diameter; 35km diameter; all of Skene) and centre it to suit their own locations (in effect creating a distance-based fare).

- ▶ **Interpretation:** This could be represented by a tariff structure of three fare structure elements, with a QUALITY STRUCTURE FACTOR for each zone size. At product selection time, the Travel Specification could a customer specific travel zone created specifically for the individual sale.
 - <https://www.skaneltrafiken.se/sa-reser-du-med-oss/skaneltrafikens-nya-app/>

6.4.14 Cross border profile differences

There is variation between countries as to the age limits for tariff concessions for children, youths and seniors. For example, in Denmark a child is 7-15, in Sweden 7-19. Where cross border travel products are available, this may mean that access rights differ by profile by country (So for example a 17-year-old with a Skaneltrafiken pass has to buy a supplement when travelling in Denmark).



- ▶ **Optimisation:** Can be represented by a fare structure element that combines a User profile with a country – could be expressed more succinctly by adding a country ref to USER PROFILE (and COMMERCIAL PROFILE).

6.4.15 Obsolete products

Products can have a validity period indicate they are available. A more complicated case arises when a product is no longer on sale, but can still be used, for example for paper carnet tickets, old pass rights, etc.

- ▶ **Clarification:** Can be represented by two different validity conditions, one for sale, one for usage. Could add an attribute to Product Summary Conditions.

6.4.16 Companion Discounts on specific day types

Some Rail cards (e.g. Hungarian Kid Start Club) offer a companion discount that is specific to certain days (e.g. Saturday)

- ▶ **Clarification:** Can be represented by a condition on the companion discount price.

6.4.17 Relative time for access rights

Sometime purchase of a product grants access rights to the local systems to access or depart from the station of a product. The access right may be limited to a time relative to the departure / arrival of the main ticket.

- ▶ **Clarification:** Can be represented by having the fare elements in sequence with an order of use.

6.4.18 Staggered expiry dates for a carnet

The Dutch NS “Optional days” product for seniors provides a carnet of 7 off-peak day passes that must be used within a year. Furthermore, they must be used at a rate of at least one 1 every two months.

- ▶ **Clarification:** Can be represented by having seven separate tickets each with a separate USAGE VALIDITY PARAMETER to set its specific expiry date (2 Months, 4 Months etc).

6.4.19 Personal product allocations

The allocation of products may be limited (for example, the Dutch NS “Optional days” product for seniors (a carnet of seven journeys) can only be bought once a year; Romania gives a number of trips to different user classes, etc).

- ▶ **Clarification:** An allocation can be represented by a DISCOUNT RIGHT (typically associated with an account) that indicates a number of products within a period. A minor enhancement to the Customer eligibility model could be used to record this consumption.

6.4.20 Conditional product elements

Sometimes additional benefits may be conditional on booking in advance, or through a specific channel. For example, Czech railways offers free reservations for group tickets made 72 hours or more in advance but not for purchase for immediate travel.



- ▶ **Clarification:** An element of a sales offer package may be conditional on a usage parameter (e.g. a Trip Supplement for a Seat reservation on a PURCHASE WINDOW) in the above example.

6.4.21 Minimum age for purchasing online tickets?

Booking of online tickets on dbregio-shop.de is subject to a minimum age of 18 years for the purchaser (who can buy tickets for someone else underage)

- ▶ **Interpretation:** This concept could be represented by creating a condition on a SALES OFFER PACKAGE that combines an adult USER PROFILE with a DISTRIBUTION CHANNEL (e.g. online at DB region-shop).

6.4.22 Maximum group size for purchasing online tickets?

Some networks limit the size of groups that can be bought online – for example (For example DB sells tickets groups for 6 to 30 people on line; larger groups have to be bought through a booking office).

- ▶ **Interpretation:** This concept could be represented by creating separate GROUP TICKETs for 6-30 people and for 31+. A SALES OFFER PACKAGE can then set different conditions with different DISTRIBUTION CHANNELs for each GROUP TICKET type.

6.5 Minor issues – Mainly Optimisation

In coding the examples, especially the more complex multi-operator cases, the study has noted several places where the NeTeX representation could be improved by minor enhancements to improve scalability, expressiveness or to reduce verbosity.

6.5.1 Reusing groups of O/D elements

Point-to-point tariffs for large networks will comprise extensive sets of DISTANCE MATRIX ELEMENTs to describe the individual O/D pairs or permitted trips. It is convenient to organise these as reusable GROUPs OF DISTANCE MATRIX ELEMENTs covering specific lines or regions. These can then be reused in different specific tariffs as needed. Support for using GROUPs OF GROUPs DESTINATION MATRIX ELEMENTs could be improved to make specification more efficient

- ▶ **Optimisation:** Allow references to more than one GROUP OF DESTINATION MATRIX ELEMENTs on a FARE STRUCTURE ELEMENT (at present, only reference to a single group is allowed).
- ▶ **Optimisation:** Specialise NETWORK as FARE NETWORK and allow it to have Groups of FARE ZONES and DESTINATION MATRIX elements.

6.5.2 Direction of O/D elements

DISTANCE MATRIX ELEMENTs are notionally directional – it is possible that the possibility of travel and the allowed routings (and even the fare distances) between two points are notionally different in different directions (thus separate *A to B* and *B to A* elements are needed). However, in practice elements are usually symmetric – the travel is allowed both ways and the distances are the same; having separate elements in both directions for a large network the elements can be very verbose.

- ▶ **Optimisation:** Allow DESTINATION MATRIX ELEMENTs to be marked as bidirectional. Allow a reference to DESTINATION MATRIX ELEMENT to indicate the direction (i.e. reverse as well as forward).

6.5.3 Type of Product

The NeTeX TYPE OF PRODUCT mechanism provides an open-ended set of code values with which products can be classified according to arbitrary categories. At present only one category can be added to each SALES PACKAGE ELEMENT (i.e. instance of product in a SALES OFFER PACKAGE), but a given implementation might want to use several.

- ▶ **Optimisation:** Allow multiple TYPEs OF FARE PRODUCT on a SALES PACKAGE ELEMENT.

6.5.4 End of Fare day

In a number of places the effective end time is the “End of fare day” time, which is a common value (e.g. 02:30 am). Rather than having to repeatedly state the value it would be better to have it as a parameter than could be referenced by name.

- ▶ **Optimisation:** Allow Start/End of Fare day as a named value.



6.5.5 Distribution Channel group of points

At present if a distribution channel is restricted to specific places, e.g. those with at station ticket machines, the points have to be explicitly listed, sometimes leading to repetition of large lists.

- ▶ **Optimisation:** Allow GROUPs of POINTs on a DISTRIBUTION CHANNEL.

6.5.6 Multiple fulfilment methods per Distribution Channel

At present each DISTRIBUTION ASSIGNMENT can only specify a single fulfilment method per channel, in practice several may apply.

- ▶ **Optimisation:** Allow multiple FULFILMENT METHODS per DISTRIBUTION CHANNEL.

6.5.7 Multiple types of travel document per Sales Offer Package

It is common now for a product to be available on multiple media (Paper, smart card mobile app etc). At present each SALES OFFER PACKAGE ELEMENT can only specify a single TYPE OF TRAVEL DOCUMENT. This can be worked around either by adding additional Generic Assignments or by defining composite TYPEs OF TRAVEL DOCUMENT. It would be clearer to allow a list of products.

- ▶ **Optimisation:** Allow multiple TYPE OF TRAVEL DOCUMENTs per SALES OFFER PACKAGE ELEMENT.

6.5.8 Additional Documentation attributes

Many of the fare elements already allow a DESCRIPTION and URL attribute which is extremely useful for documenting instances of the element with content taken from web pages. There are a few elements (e.g. FARE PRICE, DISTRIBUTION ASSIGNMENT, SALES PACKAGE etc) where either URL or DESCRIPTION elements are not available and it would be useful to add them for documentation purposes.

- ▶ **Optimisation:** Add URL to all PRICEABLE OBJECT and PRICEs. Add DESCRIPTION to FARE PRODUCT PRICE.

6.5.9 Characterising Fare Quality Factors

FARE QUALITY FACTORs are an important mechanism for describing unusual or complex additional aspects of fares (Such as demand types). It would be useful to be able to categorise them to aid interpretation.

- ▶ **Optimisation:** Add TYPE OF QUALITY FACTOR to FARE QUALITY FACTOR so that they can be categorised.
- ▶ **Optimisation:** Add PrivateCode to FARE QUALITY FACTOR so that they can be related to legacy tariff codes (also add to FARE STRUCTURE ELEMENT?)

6.5.10 Improve Parameter Assignments

Several elements are not currently present on VALIDITY PARAMETER ASSIGNMENTs that assist with a precise statement of certain conditions.

- ▶ **Optimisation:** Add reference FARE SECTION to validity parameters.
- ▶ **Optimisation:** Add reference TYPE OF USER PROFILE, TYPE OF USAGE PARAMETER to validity parameters.



6.5.11 Improve Properties of Day

Currently, it is straightforward to specify that day type applies for several days of the week, but only one individual Month of the year can be specified at a time, making certain day type definitions verbose.

- ▶ **Optimisation:** Allow several months to be specified at a time on a PROPERTY OF DAY.

6.5.12 Sales offer Packages in Multiple groups

Often there will be multiple similar but variant SALES OFFER PACKAGEs with many common properties. A GROUP OF SALES OFFER PACKAGE element can be used to specify these common properties.

For simplicity, at present a SALE OFFER PACKAGE can reference just one GROUP OF SALES OFFER PACKAGEs (Though more than one GROUP OF SALES OFFER PACKAGEs can reference a specific SALES OFFER PACKAGE package).

- ▶ **Optimisation:** For clarity, allow a SALES OFFER PACKAGE to reference several GROUPs OF SALES OFFER PACKAGE at a time.

This raises a further question as to how parameters that may be specified on the group are combined with those in the SALES OFFER PACKAGE. At present the assumption is that all are included

- ▶ **Optimisation:** Add a means of indicating if a particular parameter is included replaced or excluded.

6.5.13 Improve Reservation

Often the reservation is not refundable even if the ticket is. At present this requires adding separate usage parameters and conditions – would be simpler to have a refunding attribute on RESERVING.

- ▶ **Optimisation:** Allow RESERVING to indicate if refundable.

6.5.14 Paying with Usage points

Some usage schemes allow users to accumulate points which may then be used to purchase tickets (e.g. *SJ-Prio*, *Eurostar*, etc). The points can be used as a currency to indicate price. Payment method current includes *coupons* – might be clearer to add a separate *usage Points*, should also add a mixed payment attribute to indicate that a combination of methods is allowed on a single purchase.

- ▶ **Clarification/Optimisation:** Add enumerations to PAYMENT METHOD for points.

6.5.15 Easements

The rules for interoperability for PKP intercity tickets include complex easement conditions for acceptance of tickets by other carriers in the event of certain circumstances.

- ▶ **Clarification:** Although some aspects of easements can be represented by the use of VALIDITY CONDITIONS and parameter assignments, easements fall outside the scope of basic tariff definition.



6.5.16 Multiple Machine reading methods per Type of Travel document

At present each TYPE OF TRAVEL DOCUMENT can only specify a single method of reading by machine (NFC, OCR etc). There may be multiple methods that apply to a single type of document (e.g. both barcode and shotcode, or NFC and magstripe). A workaround is to specify multiple TYPEs of TRAVEL DOCUMENT.

- ▶ **Optimisation:** Allow multiple methods per TYPE OF TRAVEL DOCUMENT.

6.5.17 Fare table cells for Fare Section.

Fare sections cannot be directly referenced by a fare table CELL – (the workaround is to wrap the section in a fare structure element). This could make price tables more verbose.

- ▶ **Optimisation:** Add reference to FARE SECTION to CELL.

6.5.18 Relationship between Tariff and product.

At present NeTEx does not hold a direct relationship between named TARIFFs and FARE PRODUCTS. This is because the relationship can be derived from other lower level relationships: a tariff knows which FARE STRUCTURE ELEMENTs comprise it; a VALIDATION ELEMENT may reference FARE STRUCTURE ELEMENTs; and a FARE PRODUCT reference one or more VALIDATION ELEMENTs.

- ▶ **Optimisation:** Sometimes it is useful to indicate for passenger information that one or more named Tariffs apply to a product, without having to include all the data necessary to compute this from first principles. This could be addressed by adding references between FARE PRODUCT and TARIFF.

6.5.19 Lines allowing onboard payment

Some passenger information indicates whether a line (a) allows onboard payment (b) requires exact change. This is useful information rather than being essential to the tariff structure.

- ▶ **Optimisation:** NeTEx holds payment details at the product level, so this information could be derived (assuming at least one product exists). NeTEx does not currently hold an attribute on a LINE to indicate that exact change is required. This could be added as an enumeration (for example – *cashExact*).
- ▶ **Optimisation:** NeTEx holds information about payment methods at a detailed product level – for example on DISTRIBUTION ASSIGNMENTS and SALES OFFER PACKAGES for specific products. This could also be added to NETWORK and LINE to indicate a policy regardless of any specific product and to make it easy to show on passenger information.

6.5.20 Activation process

For pre-purchased tickets that are used at a subsequent date, e.g. Carnets, some singles and returns, various activation processes are found – for example, by in-station validator machine, mobile app, prior issue of a PNR code / Seat reservation, conductor marking, etc. In some cases, activation requires a specific act by the user, such as scanning or stamping with a reader. In other cases, the system will automatically activate a product at a given point.

- ▶ **Clarification/Optimisation:** It might be better to add an explicit enumeration, to specify the different means that may or must be used to activate a product (for example to FULFILMENT METHOD) or even a separate VALIDATION METHOD usage parameter.

6.5.21 Add Train number etc to Travel Specification

Where an access right or product condition applies to a specific train, one of the ways of indicating this, already supported by NeTEx, is to reference the TRAIN NUMBER. However, by oversight, the TRAIN NUMBER cannot currently be explicitly referenced on a TRAVEL SPECIFICATION, used in NeTEx to specify the details the customer wishes to purchase. A work around is to use a reference to a SERVICE JOURNEY (which can be associated with a TRAIN NUMBER).

- ▶ **Optimisation** – Add a reference to TRAIN NUMBER to TRAVEL SPECIFICATION.
- ▶ **Optimisation** – Add a reference to TRAVEL DOCUMENT to TRAVEL SPECIFICATION.

6.1 Minor issues – Optimisations relevant for tariff structure?

The following two optimisations would be valuable for describing interoperable tariffs simply.



6.1.1 Multiple operators for Tariff Zone

For multi-operator zonal systems, need to be able to associate multiple operators with a single Tariff, without having to repeat Tariff for each operator.

- ▶ **Optimisation:** Add GROUP OF OPERATORS to Tariff.

6.1.2 Rules for Choosing from Multiple Tariffs

Some DB regional offers (for example *Regio-Ticket Donau-Isar*) have the condition that “The starting and finishing stations may not be within the same transport network.” Another example is shown in Figure 44.



Figure 44 – Example Tariff selection rules

This can be expressed in NeTeX at the moment in two ways:

- 1) “Bottom up” by explicitly populating all the individual the O/D pairs using DISTANCE MATRIX ELEMENTS” and associating the respective tariffs with them. (so that only the products for the valid tariffs are found);

- Note if the price depends on the number of zones, one or more GEOGRAPHICAL INTERVALS can be used to set a price for the number of zones traversed.
- 2) “Top down”, by creating a fare zone for each network and specifying a minimum and maximum values for a STEP LIMIT (in effect limiting the number of transitions between different networks, regardless of what the actual zones are). However, in the case of a trip that has multiple steps but starts and ends in the same zone, this does not quite distinguish between a trip that goes via a different zone from one that stays in the same zone.
 - 3) In addition, one as a work around could further classify the tariff with a TYPE OF TARIFF as *same, adjacent, via third, etc.*

STEP LIMIT	NumberOfSteps		StepUnits (current)
	Min	Max	Zone
OD in same Zone	0	0	Zone
OD in adjacent Zone	1	1	Zone
OD in same, via Third	2	unlimited	Zone
OD in different Zones, via Third	2	unlimited	Zone

Table 26 – Step Limits for Zones

- ▶ **Optimisation:** Also allows Networks and Operators to be Step units, so that the network to network and operator to operator conditions can be specified without indicating a specific network or operator.
- ▶ **Optimisation:** Add a “O/D must be different” attribute as” well.

STEP LIMIT	NumberOfSteps		StepUnits (current)			StepUnits (Add>)	
	Min	Max	Stop	Section	Zone	Operator	Network
Same	0	0	Y	Y	Y	Add?	Add?
Adjacent	1	1	Y	Y	Y	Add?	Add?
Via Third	2	unlimited	Y	Y	Y	Add?	Add?

Table 27 – Step Limits for

As noted previously, where multiple tariffs and fareProducts are applicable to a route, NeTex does not say which is “best”; it mere allows them all to be specified and it is the task of trip planning software to select and present them. There is an implicit assumption in this that there is a straightforward way to rank products (usually “best” is “cheapest”!). NeTex has one mechanism (the SALES OFFER PACKAGE SUBSTITUTION) which can be used to set a relative priority for using packages.



6.2 Minor issues – Additional features relevant for passenger Information

The following are examples of minor aspects of tariff or product specification noted in the study where small enhancements (e.g. addition of an enumeration or attribute or subtype) to NeTEx are desirable to achieve a precise specification of domestic rail tariffs.

6.2.1 Subscriptions – Auto-renewal / Top up

One cannot currently formally specify that a product can be bought on renewable subscription (i.e. payable at specific intervals for a specific period). Current workaround is to use an extra purchase window with a comment). Subscriptions may have additional cancellation conditions such as a notice period and fixed periods in which to make a cancellation (e.g. see DB annual subscription).

- ▶ **Gap** – Add a SUBSCRIPTION Usage parameter describing the exact subscription parameters.
 - Subscription sign up interval; may be longer or shorter than product life.
 - Payment method for periodic payment.
 - Distinguish between subscription renewal and payment by instalment of an annual or period subscription.
 - Grace period for payment.
 - Enhanced customer account capabilities as in Transmodel 6.0 (e.g. Customer Payment means that are not yet implemented in NeTEx) are also relevant.
 - Cancellation: to any date or to validity date + increments only.
 - Cancellation charge remaining: prorata before or after fee.
 - Cancellation notice period.

6.2.2 Partial Refunds of Season Passes

Some season passes have complex rules for partial refunds. For example; refunds may only be allowed if there is a certain period or percentage of the pass life remaining, and the amounts returned may vary according to the amount left, with minima and maxima. There may be a separate handling fee.

- ▶ **Interpretation/Gap:** Currently parameters relating to refunds are stated on the REFUNDING usage parameter, which may a price to describe the refund fee, including a DISCOUNTING RULE or a LIMITING RULE (which can be used to set a discounting percentage and maxima). There could be multiple prices each specifying a different limiting rule). Can currently specify such rules as a percentage or an amount – need to be able to specify that the units the amount can be in days/months rather than just currency.
- ▶ **Gap:** Refunding may be permitted only if certain circumstances are met, each with accompanying proof (proof of death, sickness, redundancy, etc). Currently this is only handled as a text comment.
- ▶ **Gap:** Some conditions specify a notice period for termination, __, for example 10 days before the end of the month.
- ▶ **Gap:** Some regulations allow termination of a subscription by the customer within a certain time if the offer conditions change, for example if the price of a



subscription rises (E.g.as for the conditions German VRN transport authority annual ticket). One might distinguish (a) Early termination by the customer (b) Early termination due to special circumstances (c) Extraordinary termination due to changes by the operator to the offer.

- ▶ **Gap:** Methods can be more exactly classified; for example (a) unused months, (b) Unused days pro rata, (c) use month rate instead of annual rate (E.g. see VRN annual passes).

6.2.3 Products that have a minimum or maximum distance allowed

Some products are only valid up to a certain distance (e.g. some Romanian student fares).

- ▶ **Interpretation / Gap?** Can use LIMITING RULE – But need to add a PRICE UNIT (so can have kms rather than monetary amount) to pricing rule?
 - Might be simpler / more useful to add distance to round trip as well.

6.2.4 Social media Tariffs.

Several operators (e.g. SNCF) are offering novel Social media tariffs whereby users are encouraged to form a group of travellers and then get a group ticket price. If successful they are all individually issued a code (in effect a coupon) with which to purchase the ticket at the offered price.

- ▶ **Interpretation:** The social media process is in effect an additional process for forming a group to buy a normal product (possibly one with a dynamic price) – they do not require additional types of product per se – once priced, they are issued a discount code (which can be represented by a Coupon) to pay, so can be treated as a METHOD OF PAYMENT.
- ▶ **Gap:** There is however a slight different twist: classical Group Tickets have a single purchaser undertaking the contract (and payment) on behalf of all the users. The Social Media ticket may have multiple parties, each paying their own share directly. Formally, it would be useful to clarifying that the contract is direct with each party, and not through a single purchaser. This could be expressed by an attribute on GROUP TICKET.

6.2.5 Flexible Reservations

Thalys subscription products include the right to travel on “framing” trains immediately before or after the booked train (with no guarantee of a seat).

- ▶ **Gap:** At present the framing trains would have to be stated explicitly on the travel specification. Would be more elegant to add the Add access right concept of Preceding train/ successive train to validity parameters.

6.2.6 Proof of eligibility

Currently a USER PROFILE allows only one type of document for proof of eligibility; also birth certificate is missing as a document type (this is required to prove age for some child and student passes)

- ▶ **Gap:** Revise enumeration values: add *birthCertificate* to values. Note that *other* may be used as a workaround.
- ▶ **Optimisation:** allow multiple values for proof documents on a USER PROFILE.



- ▶ **Workaround.** Use a text note.

6.2.7 Native born

Some user types require not only a local residency qualification (As supported by USER PROFILE) but also a native birth (E.g. The *Sudtirol senior pass* can be bought by local residents over 65s but also who reside elsewhere but were born in the South Tirol).

- ▶ **Gap:** Add native country region / element to USER PROFILE.

6.2.8 Annual Season pass allows breaks for holiday /sickness

Some longer duration season passes allow the user to suspend the pass (up to a specified maximum duration), either to take a holiday or for a period of sickness; the suspended period is added to the overall validity of the pass.

- ▶ **Gap:** While this could be captured textually, and the maximum extension described by an extra instance of a USAGE VALIDITY PARAMETER it would be better to add an explicit attribute or element that clarifies the possible parameters (e.g. max extension period).

6.2.9 Preferred order of use of products on Smartcard

Where there are multiple products on a smartcard, that are all applicable to a journey, there may be an order of preference as to their use.

- ▶ **Gap:** The Media app model that is added in Transmodel 6.0 has not yet been implemented in NeTEx. It would be straightforward to include a relative ranking attribute when it is added.

6.2.10 Retail Consortium – Need to be linked to Country

Various elements such as tariffs are linked to operators. NeTEx supports another type of organisation – a RETAIL CONSORTIUM – to describe a group of organisations that can sell a product but do not necessarily provide the travel services (such as UK National Rail Enquiries). An operator may be associated with a specific country, but by oversight, this cannot be done for a Retail Consortium.

- ▶ **Gap:** A country cannot currently be specified for a RETAIL CONSORTIUM.

6.2.11 Extending a journey

The NeTEx EXCHANGING usage parameter describes various conditions on aftersales exchanging of a product once it is purchased, for example to change the date and time, or class of use. It already covers common exchanges such as upgrades, etc. A type of exchange not covered is extending an existing ticket.

- ▶ **Gap:** Add *sameProductLongerJourney* to enumerated values for **TypeOfExchange**.

6.2.12 Calendar day on Capping Products

Capping may take place on a specific day type e.g. every Thursday rather than just at a pre-set interval after product activation.

- ▶ **Gap** –Add attribute to distinguish between usages.



6.2.13 Floating or Fixed start for Passes etc

The start date of certain product may be restricted to specific days – e.g. week passes might only start on a Monday. This could be capture more precisely

- **Gap:** Add an attribute to USAGE VALIDITY PERIOD to if start is floating or fixed. Allow day type so that any required day of week, day of month, month of year can be indicated.

6.2.14 Extend built in fare demand types

NeTeX currently has only a few of predefined fare demand types – *Peak / Off-peak / Anytime, Night*; others are found in practice.

- ▶ **Gap:** add extra enumerations e.g. *Super off-peak*. Add more values to enum for fare demand types.

6.2.15 Improve fare demand types

Support for directional constraints on FARE DEMAND TYPEs could be improved slightly – that is where the definition of the fare demand types is in terms of arrivals / departures at multiple stations.

- ▶ **Gap:** The TIME AT STOP element allows a departure time but not an arrival time to be specified. Add arrival time and indicate into / out of / through constraint.

6.2.16 Maximum number of fail-to-checkout events allowed before suspension.

Some pay as you go tariffs systems explicitly limit the maximum number of fail to check out events before a pass is suspended.

- ▶ **Gap:** Add attribute to Penalty USAGE PARAMETER.

6.2.17 Additional Fulfilment methods.

Some online distribution channels support multiple fulfilments methods for despatching the ticket to the user, and in particular may offer separate rates for postal delivery and for a faster guaranteed delivery by a courier. While mail is already supported as method, a separate value for *Courier* is missing from **FulfilmentMethodType**.

- ▶ **Gap:** Add *Courier* value to enumeration.

6.2.18 Transferability relative to time of travel.

The conditions of use for a product may wish to clarify whether the product is transferable (i.e. may be used by anyone rather than a specific person) only before the product has started to be used or afterwards as well. For example, the return leg of a return ticket might be restricted to the same person who mad the outbound leg – or not.

- ▶ **Gap:** Add a new attribute to TRANSFERABILITY to cover different variations.



6.2.19 Distinguishing between single and return outbound legs

The ROUND TRIP parameter allows a trip leg to be described as *single* or *return inbound*. This does not distinguish between *single* and *return outbound*; sometimes it is necessary to do so.

- ▶ **Clarification/Gap:** An additional enumeration to distinguish between *single* and *return outbound* would be clearer.

6.2.20 Distinguishing between one-at-a-time and transferability

It is already possible to specify in NeTEx whether a product is for personal use of a single individual or is transferable to others using the TRANSFERABILITY parameter. This covers most cases. However, there is a separate more specific distinction as to whether more than one person may make use of a ticket from a carnet at the same time (along with the person for whom personal use is granted), especially if it is on a pay as you go card (e.g. *Trenord* in Italy has a card for which this is not allowed).

- ▶ **Clarification/Gap:** Add an attribute to specify whether multiple users may use a product at the same time.

6.2.21 Eligible for frequent traveller points

Some products (e.g. *Trenord* monthly pass) indicate whether they can be used to earn frequent traveller points.

- ▶ **Gap:** Add eligible for frequent traveller points to Product summary. Actual points earned can be specified by a separate price in points. Price unit of points should be declared.

6.2.22 Family members

Some products (e.g. DB) require offer discounts to children that require them to be relatives (grandchildren or children) rather than simply children. (Current workaround – use a NOTICE comment).

- ▶ **Gap:** add a legal relative attribute to companion profile.

6.2.23 Break of Journey Validation

Some networks require the passenger to register a break of journey by a stamp from the conductor or station. (Current workaround – use a NOTICE or comment on INTERCHANGING).

- ▶ **Gap:** Attribute to the INTERCHANGING parameter to note whether breaks of journeys must be explicitly validated to be allowed.

6.2.24 Changing the number of travellers on a group ticket

Some tickets for large groups (typically ordered a long time in advance) allow for the number of travellers to be changed but charge a fee to do so. (For example, DB does this for groups of more than 60 people) – this may be per ticket or per user and may be subject to a time window as well.

- ▶ **Gap:** The EXCHANGING and REFUNDING parameters and their prices are normally applied to the whole product – in this case one wants to additionally specify a per user condition. Could add an attribute to make this clear.



6.2.25 Billing frequency

Subscription products typically raise an invoice on a regular basis. Account based Pay As You Go products may actually vary their invoicing periods according to the amount of use that has taken place (e.g. See German VBN BOB (*Bequem ohne bargeld*) product, and also TfL's *Oyster Contactless*), so that invoices are only raised once a threshold is reached that it is economic to charge. Similarly for corporate products where a single account is used to pay for consumption by multiple users, the invoicing period is actually an independent parameter.

- ▶ **Gap:** The invoicing frequency is not formally described in NeTEx. Could be added to the subscription properties to the CHARGING usage parameter. Needs to have a threshold.
- ▶ **Gap:** The usage threshold for raising a debit or invoice is not formally described.

<https://www.vbn.de/tickets/ticketangebot/tickets-fuer-erwachsene/uebersichtsseite-bob.html>

6.3 Additional models - Missing Features

6.3.1 Seating Plan Model

Passenger information may include information about the seating plan of a train so that users can select the exact seat they want. For example, the seat selected needs to be recorded on the Travel Specification / Document.

- ▶ **Gap:** add a Seat Number to TRAVEL SPECIFICATION and CUSTOMER PURCHASE PACKAGE.
- ▶ **Gap:** add a Seating Plan MODEL to Transmodel and to NeTEx. This is a bigger change.
 - Include seat places and numbers
 - Include location of equipment (WC, luggage etc)
 - Include Separate plan for motorail car sizes

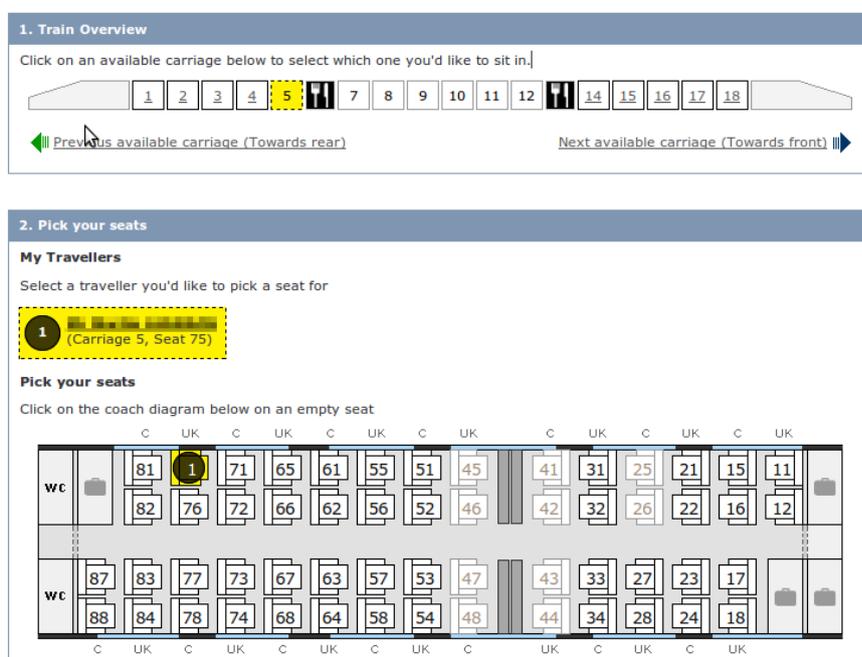


Figure 45 – Eurostar carriage seating plan



e320 SEATING PLAN COACHES 1-8

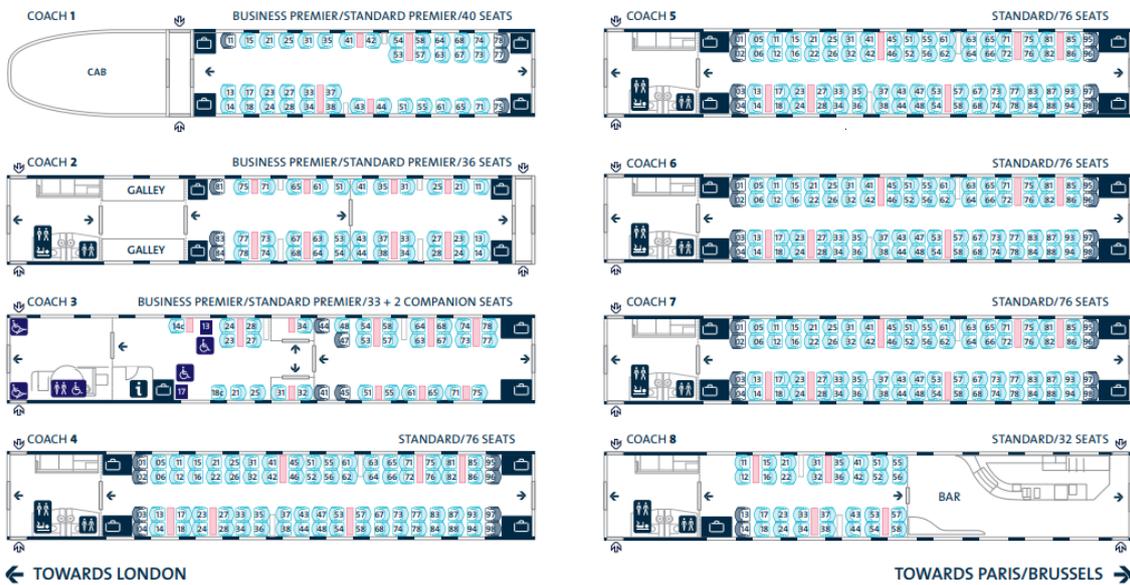


Figure 46 – Eurostar train seating plan

6.3.2 Eligibility Model

Some products are restricted to users who meet specific criteria; often these criteria are age related and so may change over time. Other criteria such as employment by a specific organisation or residence may also change. Within rail products, different rules are found (e.g. stop/start at exact date, stop at end of calendar year, stop at end of currently held product date, stop on cessation of employment etc. Transmodel 6.0 has a Customer eligibility model to hold the necessary data to support many of these conditions, but it is not yet implemented in NeTEx.

- ▶ **Gap:** Implement a Customer Eligibility model (already defined in Transmodel) in NeTEx.



Annex A

Transmodel & NeTEx specifications

Further information on NeTEx can be found



NeTEx v1.1 - <http://netex-cen.eu/>

- [NX_NT] TS 16614-1:2014, *Network and Timetable Exchange - Part 1: Network Topology (NeTEx)*
- [NX_TI] TS 16614-2:2014, *Network and Timetable Exchange - Part 2: Timing Information (NeTEx)*
- [NX_FM] TS 16614-3:2015, *Network and Timetable Exchange - Part 3: Public Transport Fares Exchange Format (NeTEx)*



Transmodel

Transmodel v6.0 <http://www.transmodel-cen.eu/>

- [TM_CC] EN12896-2014-1: *Public Transport Reference Data Model - Part 1: Common Concepts (Transmodel V6)*
- [TM_ND] EN12896-2014-2: *Public Transport Reference Data Model - Part 2: Public Transport Network (Transmodel V6)*
- [TM_TI] EN12896-2014-3: *Public Transport Reference Data Model - Part 3: Timing Information and Vehicle Scheduling (Transmodel V6)*
- [TM_OM] EN12896-2014-4: *Public Transport Reference Data Model - Part 4: Operations Monitoring and Control (Transmodel V6)*
- [TM_FM] EN12896-2014-5: *Public Transport Reference Data Model - Part 5: Fares (Transmodel V6)*
- [TM_PI] EN12896-2014-6: *Public Transport Reference Data Model - Part 6: Passenger Information (Transmodel V6)*
- [TM_DM] EN12896-2014-7: *Public Transport Reference Data Model - Part 7: Driver Management (Transmodel V6)*

Annex B

TAP TSI annexes B1, B2 and B3 mapping

The NeTEx Part3 model is intended to support a full mapping of the TAP TSI models for rail fare data.

- B1 (NRT Fares) – non reserved standard fares.
- B2 (IRT fares) - reserved standard fares.
- B3 Special fares

A brief summary is provided here.

B.1 Summary of mapping of B1 (NRT) fares

	Tap	Name	NeTEx
B.1	TCVG	Station list (Gare)	FARE SCHEDULED STOP POINT
B.1	TCVC	Carrier	OPERATOR
B.1	TCVS	Series	FARE STRUCTURE ELEMENT + TARIFF + (GENERIC PARAMETER ASSIGNMENT + DISTANCE MATRIX ELEMENT + SERIES CONSTRAINT
B.1	TCVM	SeriesInfo	NOTICE + DELIVERY VARIANT
B.1	TCVT	Product Table (Trains)	FARE PRODUCT
B.1	TCVO	Product Offer	SUPPLEMENT PRODUCT
B.1	TCVP	Fare Table	TARIFF + GENERIC PARAMETER ASSIGNMENT
B.1	TCVP-H	Distance Based	STANDARD FARE TABLE
B.1	TCVP-I	Route Based	STANDARD FARE TABLE
B.1	TCVP-J	Set Based	STANDARD FARE TABLE + USAGE PARAMETER
Code List	B.1.1.	Type Of Fare	TYPE OF TARIFF
Code List	B.1.3.	Border Point	BORDER POINT

B.2 Summary of mapping of B2 (IRT) fares

Tap	Name	NeTEx
B2	Tariffs	SALES OFFER PACKAGE + FARE PRODUCT + TARIFF + (ACCESS RIGHT PARAMETER ASSIGNMENT → (GROUP TICKET, USER PROFILE, MINIMUM STAY, PURCHASE WINDOW, EXCHANGING) + AVAILABILITY CONDITION + ALTERNATIVE NAMES
B2	Range	GROUP OF SALES OFFER PACKAGES
B2	Cards Memo	NOTICE + DELIVERY VARIANT
B2	Exclusion	ACCESS RIGHT PARAMETER ASSIGNMENT + AVAILABILITY CONDITION
B2	Sales Conditions	DISTRIBUTION ASSIGNMENT
B2	After Sales	EXCHANGING
B2	Price	DISTANCE MATRIX ELEMENT + DISTANCE MATRIX PRICE (and CELL + PRICE)
B2	Zone	TARIFF ZONE
B2	Grouped OD	GROUP OF DISTANCE MATRIX ELEMENTs
B2	Name Cards Memo	SALES NOTICE ASSIGNMENT
B2	Distribution	DISTRIBUTION CHANNEL
B2	Combinations	SALES OFFER PACKAGE SUBSTITUTION
B5.1	Train Category (B.2.3 / B.4.7009)	TYPE OF PRODUCT CATEGORY
B5.1	Passenger Type (B.2.4 / B.4.5261)	TYPE OF CONCESSION
B5.1	Tariff Code (B.2.2 / B.5.42)	TYPE OF TARIFF

B.3 Summary of mapping of B3 (Special) fares

Tap	Tap	Name	NeTEx
B3	OFAT	Offer Authorisation	
BF	OFOF	Offer	SALES OFFER PACKAGE + RESERVING + VALIDITY CONDITION + ALTERNATIVE NAME + FARE PRODUCT/SUPPLEMENT PRODUCT



ERA-2017-3-NP – Tariff Data Exchange Report

B3	OFCO	Conditions of offer	SALES OFFER PACKAGE SUMMARY + [GENERIC PARAMETER ASSIGNMENT → USER PROFILE + GROUP TICKET + TRANSFERABILITY + USAGE VALIDITY PERIOD + EXCHANGING + TRANSFERABLE + MINIMUM STAY + PURCHASE WINDOW] + USAGE PARAMETER PRICE + DISCOUNTING RULE + ROUNDING + AVAILABILITY CONDITION
B3	OFFC	Fare table per class	FARE TABLE + TARIFF + FARE PRICE + LIMITING RULE
B3	OFTP	Type of passenger	USER PROFILE + ALTERNATIVE NAME + FARE PRODUCT
B3	OFPA	Passenger	USER PROFILE + COMPANION PROFILE+ FARE PRICE + ROUNDING + DISCOUNTING RULE + FARE PRODUCT
B3	OFNP	Number of passengers	GROUP TICKET + USER PROFILE + GENERIC PARAMETER ASSIGNMENT + FARE PRODUCT?
B3	OFRE	Type of discount	FARE PRODUCT + ALTERNATIVE NAMES
B3	OFAR	Additional discount	USER PROFILE + CELL + FARE PRICE + ROUNDING + DISCOUNTING RULE
B3	OFFP	Companion	USER PROFILE + CELL + FARE PRICE + ROUNDING + FARE PRODUCT
B3 (B1)	OFSE	Series	GENERIC PARAMETER ASSIGNMENT + SERIES CONSTRAINT
B3	OFTR	Trains	GENERIC PARAMETER ASSIGNMENT + AVAILABILITY CONDITION + TRAIN NUMBER
B3	OFID	Blackout periods	GENERIC PARAMETER ASSIGNMENT + AVAILABILITY CONDITION
B3	OFGB	After sales	GENERIC PARAMETER ASSIGNMENT + EXCHANGING + USAGE PARAMETER PRICE + DISCOUNTING RULE + LIMITING RULE
B3	OFME	Memo	NOTICE + DELIVERY VARIANT
B3	OFFS	Fare and supplement	GENERIC PARAMETER ASSIGNMENT + SERVICE JOURNEY + FACILITY SET
B3	OFRT	Reservations (reservation table)	RESERVING + CELL + FARE PRICE + (GENERIC PARAMETER ASSIGNMENT --> CLASS OF USE)
B5.1		Facility codes	FACILITY SET + FACILITY
B5.1	B.2.3	Train Category (B.2.3 /B.4.7009)	TYPE OF PRODUCT CATEGORY
(B1)	TCVP	Fare table explanations (Prix)	NOTICE + NOTICE ASSIGNMENT
(B1)		H-Distance-based fare tables	STANDARD FARE TABLE
(B1)		I- Route-based fare tables	STANDARD FARE TABLE
(B1)		Set fare tables	STANDARD FARE TABLE
B5.1	B.2.4	Passenger Type (B.2.4 / B.4.5261)	TYPE OF CONCESSION
B5.1	B.2.2	Tariff Code (B.2.2 / B.5.42)	TYPE OF TARIFF

