BS EN 12896-3:2016

BSI Standards Publication

Public transport — Reference data model

Part 3: Timing information and vehicle scheduling

bsi.

National foreword

This British Standard is the UK implementation of EN 12896-3:2016. Together with BS EN 12896-1:2016, BS EN 12896-2:2016, BS EN 12896-4, BS EN 12896-5, BS EN 12896-6, BS EN 12896-7 and BS EN 12896-8 it supersedes BS EN 12896:2006 which will be withdrawn upon publication of all parts of the series.

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Public transport - Reference data model - Part 3: Timing information and vehicle scheduling

Télématique du transport routier et de la circulation - Modèle de données de référence - Partie 3 : Informations horaires et horaires des véhicules

Öffentlicher Verkehr - Datenreferenzmodell - Teil 3: Taktinformationen und Fahrzeugdisposition

This European Standard was approved by CEN on 5 May 2016.

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European foreword

This document (EN 12896-3:2016) has been prepared by Technical Committee CEN/TC 278 “Transmodel”, the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by March 2017, and conflicting national standards shall be withdrawn at the latest by March 2017.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document together with documents EN 12896-1:2016 and EN 12896-2:2016 supersedes EN 12896:2006.

The series composed of the following documents:

Public transport - Reference data model - Part 1: Common concepts

Public transport - Reference data model - Part 2: Public transport network

Public transport - Reference data model - Part 3: Timing information and vehicle scheduling

Public transport - Reference data model - Part 4: Operations monitoring and control

Public transport - Reference data model - Part 5: Fare management

Public transport - Reference data model - Part 6: Passenger information

Public transport - Reference data model - Part 7: Driver management

Public transport - Reference data model - Part 8: Management information and statistics

Together these create version 6 of the European Standard EN 12896, known as “Transmodel” and thus replace Transmodel V5.1.

The split into several documents intends to ease the task of users interested in particular functional domains. Modularisation of Transmodel, undertaken within the NeTEx project, has contributed significantly to this new edition of Transmodel.

In addition to the eight Parts of this European Standard, an informative Technical Report (Public transport – Reference data model – Informative documentation) is also being prepared to provide additional information to help those implementing projects involving the use of Transmodel. It is intended that this Technical Report will be extended and republished as all the eight parts are completed.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

EN 12896-3 presents the following items:

— rationale for the Transmodel Standard;

— use of the Transmodel Standard;

— applicability of the Transmodel Standard;

— conformance statement;

— Transmodel origins;

— reference to the previous version and other documents.

The data structures represented in EN 12896-1 are generic patterns that are referenced by different other parts.

EN 12896-2 presents space-related data structures.

This European Standard presents time-related data structures and replaces the sections of EN 12896:2006 referring to the *time-related* tactical planning components and to vehicle scheduling.

1 Scope

1.1 General scope of the Standard

The main objective of the present standard is to present the reference data model for public transport, based on:

— the reference data model, EN 12896, known as Transmodel V5.1;

— EN 28701, known as IFOPT;

incorporating the requirements of:

— EN 15531-1 to –3 and CEN/TS 15531-4 and CEN/TS 15531-5, *Service interface for real-time information relating to public transport operations (SIRI)*;

— CEN/TS 16614-1 and CEN/TS 16614-2, *Network and Timetable Exchange (NeTEx)*, in particular, the specific needs for long distance train operation.

A particular attention is drawn to the data model structure and methodology:

— the data model is described in a modular form in order to facilitate the understanding and the use of the model;

— the data model is entirely described in UML.

In particular, a Reference Data Model kernel is described, referring to the data domain:

— network description: routes, lines, journey patterns, timing patterns, service patterns, scheduled stop points and stop places.

This part corresponds to the Transmodel V5.1 network description extended by the IFOPT relevant parts.

Furthermore, the following functional domains are considered:

— timing information and vehicle scheduling (runtimes, vehicle journeys, day type-related vehicle schedules);

— passenger information (planned and real-time);

— fare management (fare structure, sales, validation, control);

— operations monitoring and control: operating day-related data, vehicle follow-up, control actions;

— management information and statistics (including data dedicated to service performance indicators);

— driver management:

  — driver scheduling (day-type related driver schedules);

  — rostering (ordering of driver duties into sequences according to some chosen methods);

  — driving personnel disposition (assignment of logical drivers to physical drivers and recording of driver performance).

The data modules dedicated to cover most functions of the above domains will be specified.

Several concepts are shared by the different functional domains. This data domain is called “common concepts”.

1.2 Functional domain description

The different functional domains taken into account in the present standard and of which the data have been represented as the reference data model are described in “Public transport reference data model - part 1: Common concepts”.

They are:

— public transport network and stop description;

— timing information and vehicle scheduling;

— passenger information;

— fare management;

— operations monitoring and control;

— management information;

— personnel management: driver scheduling, rostering, personnel disposition.

The aspects of multi-modal operation and multiple operators’ environment are also taken into account.

1.3 Particular scope of this document

The present European Standard entitled “Reference data model for public transport – Part 3: Timing information and vehicle scheduling” incorporates:

— journey and journey times model: describes the time-related information at the level of vehicle journeys, i.e. planned timing for the vehicles at day-type level;

— dated journey model: describes the link of the timing information for a single operating day and the day type related timing;

— passing times model: describes all the different types of passing times for the day type related information;

— vehicle service model: describes the information related the work of vehicles as planned for days types. it constitutes the main part of the vehicle scheduling data domain;

— vehicle journey assignment model: describes operational assignments (advertised vehicle labels, stopping positions) related to particular vehicle journeys.

This document itself is composed of the following parts:

— main document (normative) representing the data model;

— Annex A (normative), containing the data dictionary and attributes tables, i.e. the list of all the concepts present in the main document together with the definitions;

— Annex B (informative), indicating the data model evolutions.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 12896-1:2016, *Public transport - Reference data model - Part 1: Common concepts*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 12896-1:2016 apply.

4 Symbols and abbreviations

AVM	Automated vehicle monitoring
AVMS	Automated vehicle management system
IFOPT	Identification of fixed objects in public transport
ISO	International standards organization
IT	Information technology
NeTEx	Network and Timetable Exchange
PT	Public transport
PTO	Public transport operator
SIRI	Service interface for real-time information
UML	Unified modelling language
URI	Uniform resource identifier
URL	Universal resource locator

5 Timing information and vehicle scheduling data domain

5.1 Introduction

The work of the vehicles necessary to provide the service offer advertised to the public consists of service journeys and dead runs (unproductive journeys are necessary to transfer vehicles where they are needed, mainly from the depot into service and vice versa). Vehicle journeys are defined for day types rather than individual operating days. A day type is a classification of all operating days for which the same service offer has been planned. The whole tactical planning process is seen on the level of day types in the reference data model, with all entities necessary to develop schedules. These include a series of entities describing different types of run times and wait times, scheduled interchanges, turnaround times etc.

Chaining vehicle journeys into blocks of vehicle operations, and cutting driver duties from the vehicle blocks, are parts of the main functions of vehicle scheduling and driver scheduling, respectively. The corresponding entities and relationships included in the reference data model allow a comprehensive description of the data needs associated with this functionality, independently of the particular methods and algorithms applied by the different software systems.

5.2 Overview

5.2.1 Model and document structure

The timing information model is splits into four main sub-models defined as UML packages.

- Journey and journey times model: describes the time-related information at the level of vehicle journeys, i.e. planned timing for the vehicles at day-type level. It splits into:
  - vehicle journey model;
  - service journey model;
  - time demand times model;
  - journey timing model ;
  - journey pattern times model;
  - vehicle journey times model;
  - interchange model;
  - interchange rule model;
  - coupled journey model;
  - flexible service model;
  - journey accounting model;
- dated journey model: describes the link of the timing information for a single operating day and the day type related timing;
- passing times model: describes all the different types of passing times for the day type related information;
- vehicle service model: describes the information related the work of vehicles as planned for days types. It constitutes the main part of the vehicle scheduling data domain.

5.3 Journey and journey times

5.3.1 Vehicle journey

5.3.1.1 VEHICLE JOURNEY – Conceptual model

5.3.1.1.1 General

The daily operation of a vehicle is described by VEHICLE JOURNEYs. A VEHICLE JOURNEY is the defined movement of a vehicle using a specified JOURNEY PATTERN on a particular ROUTE. This movement is made between the first and the last POINTs IN JOURNEY PATTERN. Being defined for a DAY TYPE (cf. [7]), a VEHICLE JOURNEY is a class of journeys that would take place at the same time on each day of a specific DAY TYPE.

5.3.1.1.2 Basic vehicle journey – Conceptual model

There are two different main types of VEHICLE JOURNEYs: passenger-carrying SERVICE JOURNEYs and non-service DEAD RUNs.

— A SERVICE JOURNEY is a VEHICLE JOURNEY on which passengers will be allowed to board or alight from vehicles at stops. These journeys are usually published and known by passengers.

— A DEAD RUN may be necessary for the vehicle to proceed from the PARKING POINT (cf. [7]) at which it was parked to the first SCHEDULED STOP POINT of the JOURNEY PATTERN (cf. [8]) where it will start its service operation. In the opposite direction, a DEAD RUN may relate the last SCHEDULED STOP POINT the vehicle has stopped at (finishing its service) to the PARKING POINT where it will be parked. A DEAD RUN may also occur when a vehicle changes from one ROUTE (cf. [8]) to another one in order to continue its service there, or for various other reasons.

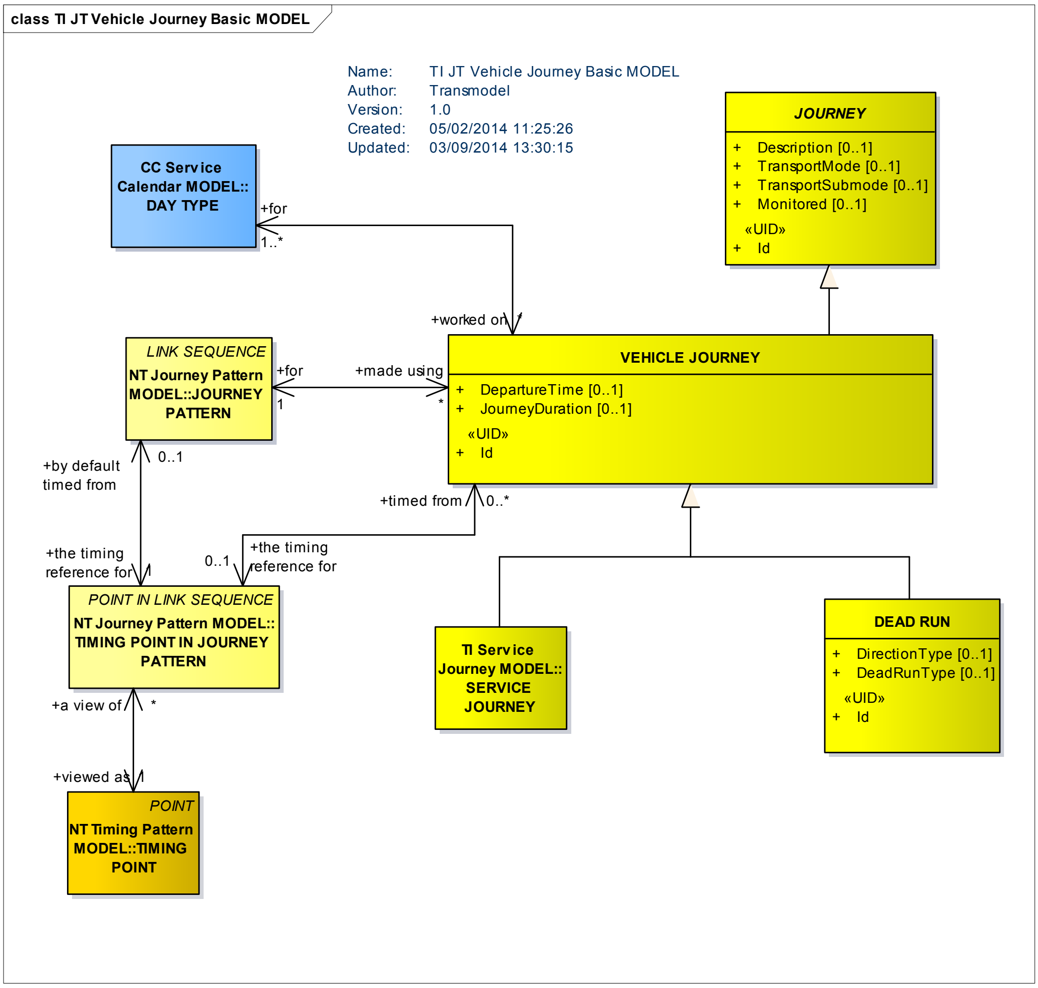

Figure 1 — Vehicle journey – Basic conceptual model (UML)

5.3.1.1.3 Vehicle journey details – Conceptual model

A VEHICLE JOURNEY may be further defined by a number of other elements, as shown in Figure 2. These include interactions with other journeys (JOURNEY PART, JOURNEY MEETING, etc.); temporal and other conditions (DAY TYPE, VALIDITY CONDITION, cf. [7]); further descriptive and classification information (TRAIN NUMBER, PRODUCT CATEGORY, TYPE OF SERVICE, stops etc,); and operational data (BLOCK).

A TEMPLATE JOURNEY allows a set of VEHICLE JOURNEYs to be defined that follow a common temporal pattern.

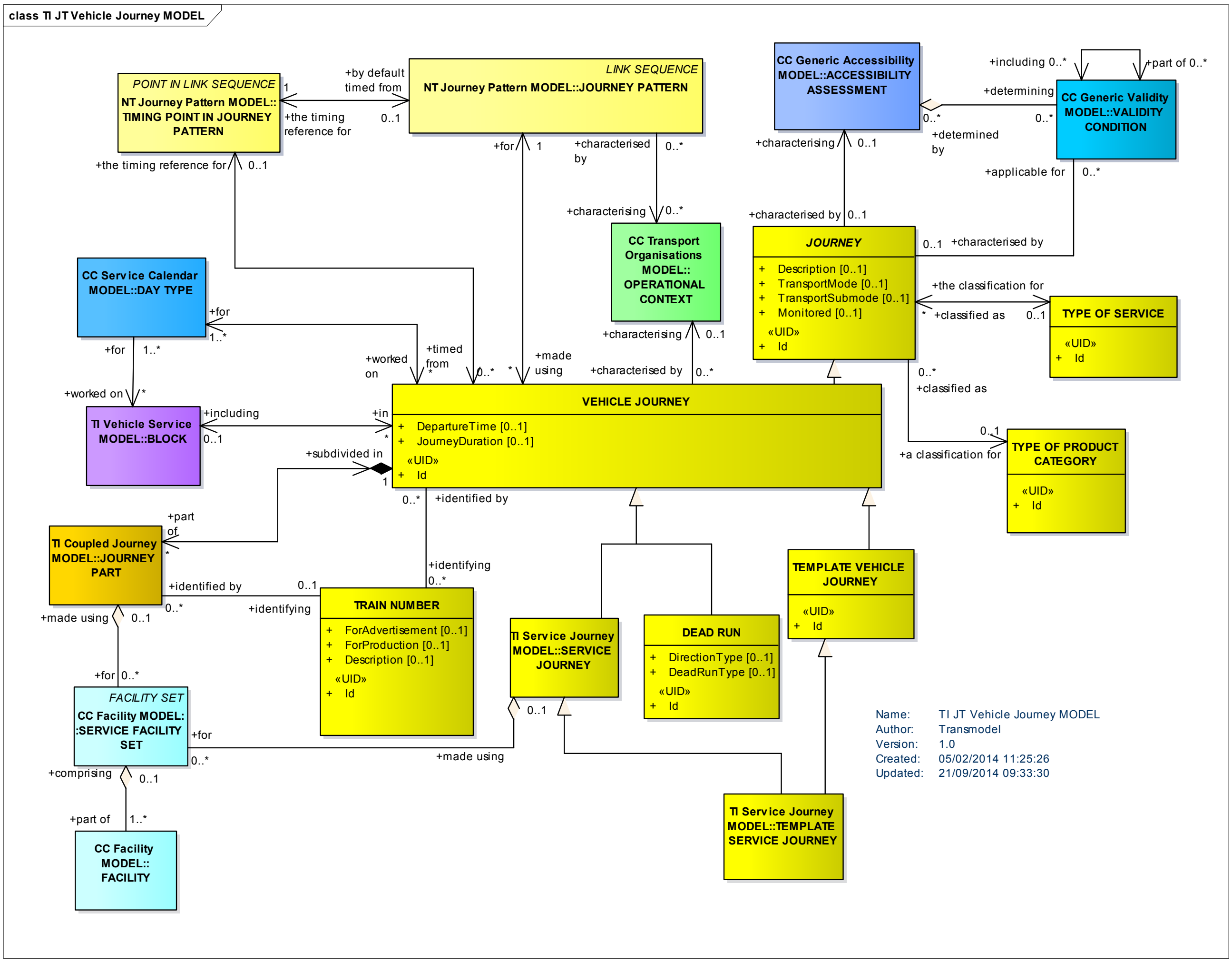

Figure 2 — Vehicle journey – conceptual model (UML)

5.3.1.2 Vehicle journey notice assignment

For passenger information (or sometimes driver information) purposes, it is often useful to attach remarks to various parts of the supply (a point, a line, a section, etc.). For instance, the fact that a shortened journey pattern is used exceptionally may be emphasized. Such remarks are usually printed as footnotes on public timetables at stops, timetable booklets or, for driver information, on driver cards.

The entity NOTICE (cf. [7]). describes such remarks. It may concern a whole LINE, or a GROUP OF POINTS, e.g. one or several STOP AREAs.

More frequently, a NOTICE will be assigned to a JOURNEY PATTERN, a COMMON SECTION (cf. [8]), or even a specific VEHICLE JOURNEY. In such a case, the same NOTICE often will be assigned to several objects (e.g. to several consecutive VEHICLE JOURNEYs).

Moreover, the validity of a NOTICE, for instance on a JOURNEY PATTERN or a COMMON SECTION, may be restricted from a POINT IN JOURNEY PATTERN, or to another POINT IN JOURNEY PATTERN.

The entity NOTICE ASSIGNMENT (cf. [8]) describes these spatial or operational assignments. Only the most frequent assignments are represented in the model. Other may be added using the same construction.

A NOTICE ASSIGNMENT may be subject to various other conditions of validity (such as DAY TYPE, TIME BAND), represented by VALIDITY CONDITIONs.

A NOTICE has a different meaning than a DESTINATION DISPLAY (cf. [8]). The first is designed to specify some characteristics of a journey or a journey pattern which are likely to evolve. They are in most cases printed in leaflets, but may also be queried by dynamic trip planning tools. A DESTINATION DISPLAY corresponds to stable information attached to a JOURNEY PATTERN, for instance the destination announcement displayed on bus headsigns.

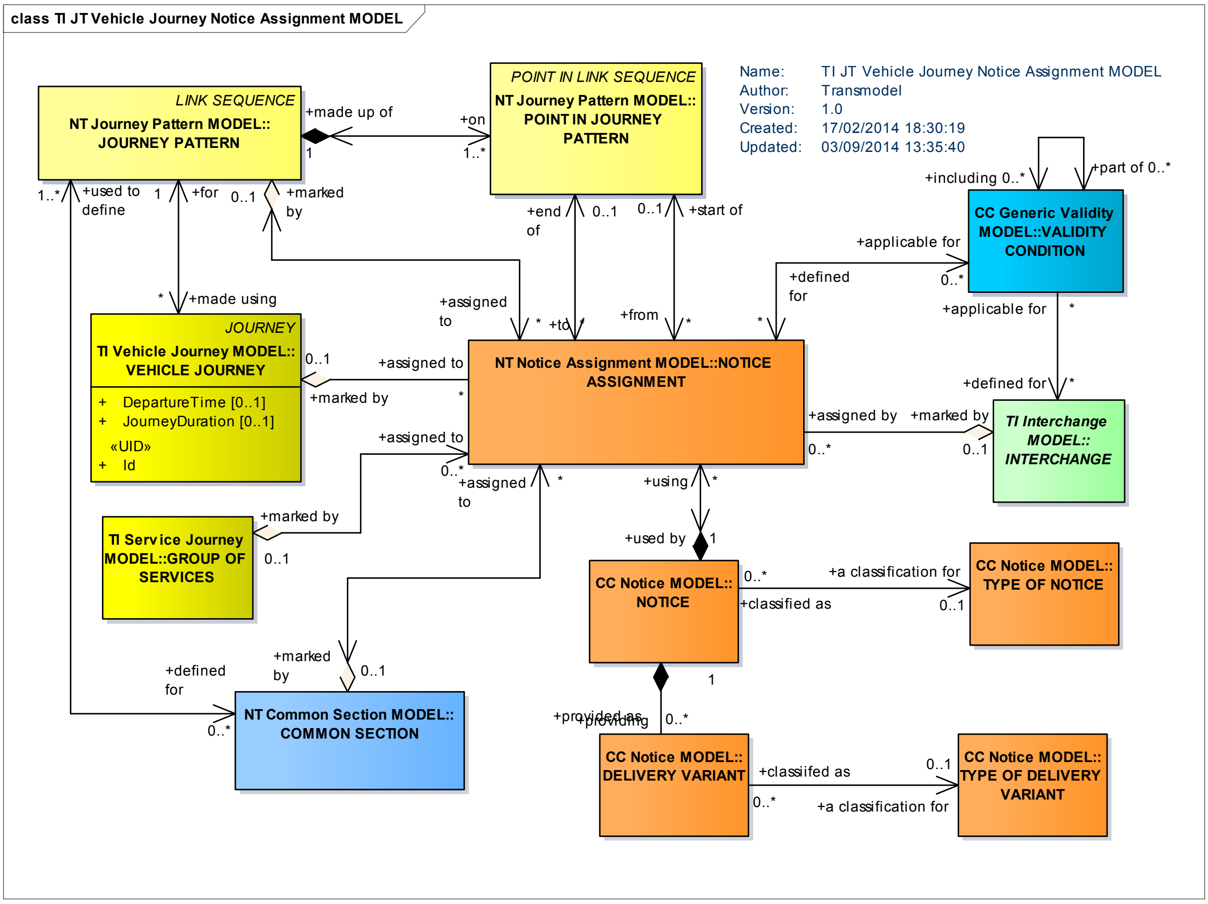

Figure 3 — Vehicle journey notice assignment – Conceptual model (UML)

5.3.2 Service journey

5.3.2.1 SERVICE JOURNEY – Conceptual model

A SERVICE JOURNEY is a VEHICLE JOURNEY on which passengers will be allowed to board or alight from vehicles at stops. There are several different possible ways to define SERVICE JOURNEYs, in particular the two following:

— as the service between an origin and a destination, as advertised to the public;

— as the longest service during which a passenger is allowed to stay on the same vehicle.

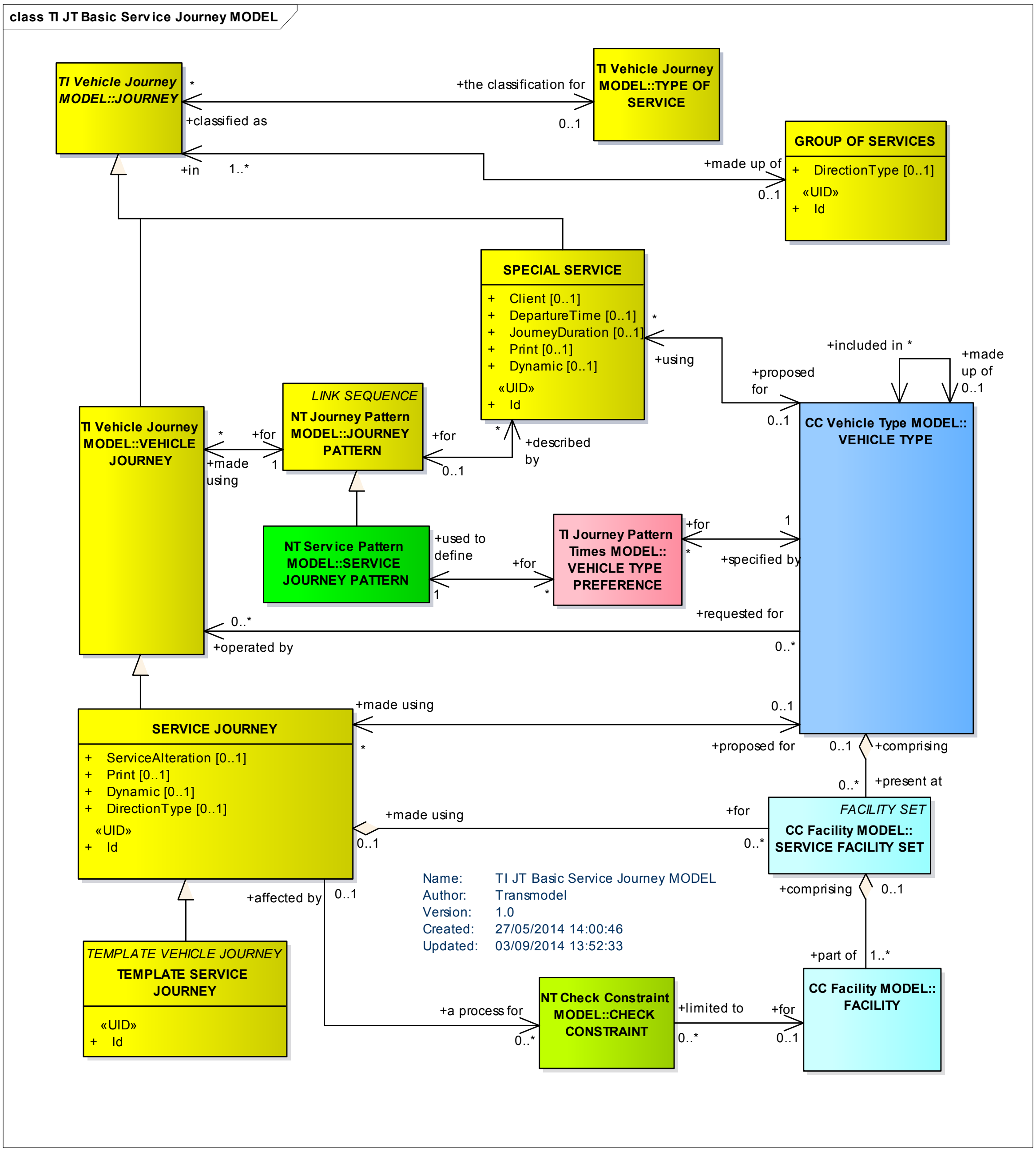

Figure 4 — Service journey – basic conceptual model (UML)

In addition to the distinction between SERVICE JOURNEYs and DEAD RUNs, operators may wish to classify VEHICLE JOURNEYs by further criteria. For these purposes a TYPE OF SERVICE may be assigned to a VEHICLE JOURNEY, which would express other common properties (e.g. “journey at the maximum load period”).

A default VEHICLE TYPE (cf. [7]) may be proposed for a journey, chosen according to the time of day at which a SERVICE JOURNEY takes place, and the ROUTE and JOURNEY PATTERN (cf. [8]) it covers. The proposed VEHICLE TYPE preferably will be taken into account by the scheduling algorithm used to compile blocks of vehicle operation. The choice of such a preference may take into account a ranked list of VEHICLE TYPEs for each SERVICE JOURNEY PATTERN. This is described by the class VEHICLE TYPE PREFERENCE, depending on a particular SERVICE JOURNEY PATTERN, for which a priority ‘rank’ is given for each VEHICLE TYPE, for each DAY TYPE and TIME DEMAND TYPE.

SERVICE JOURNEY INTERCHANGE (the scheduled possibility for transfer of passengers between two SERVICE JOURNEYs at the same or different SCHEDULED STOP POINTs) occurring on the SERVICE JOURNEY and facilities (grouped in a SERVICE FACILITY SET) available for the SERVICE JOURNEY, are also important related information, especially when advertising to the public.

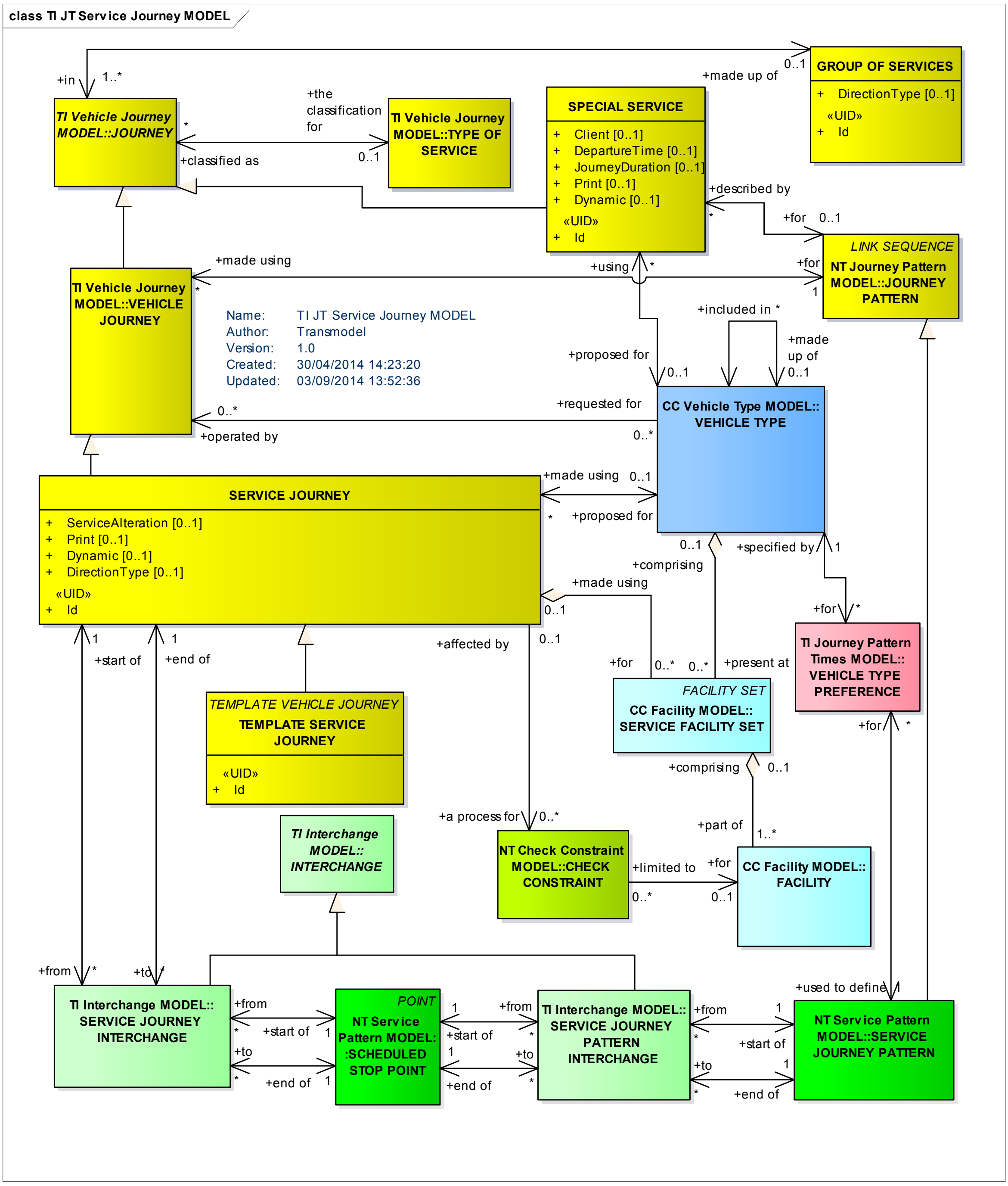

Figure 5 — Service journey – Conceptual model (UML)

5.3.2.2 Special services

Most public transport services are operated in a classical way, on a LINE grouping two or more SERVICE JOURNEY PATTERNs, along which passengers may board or alight at fixed stop points, paying fares according to the fare system in use. However, some other types of service may be offered (school services, occasional services, demand-responsive services, etc.). They are usually named “special” services.

The differences between classical services and special services may refer to a number of different aspects, the most important being that the access rights to SPECIAL SERVICEs may differ from the others. Besides occasional services for which the usual fare system applies (e.g. a football match), there are other services using a different system: special fares, access restricted to certain population groups (e.g. pupils from a particular school), etc. In some cases, the service is not directly ordered by the authority in charge of the classical services, but by another authority or by a particular client (which for instance books a bus for a trip or a whole day). Special services are generally not planned in a schedule designed for a DAY TYPE, though it may be the case for very regular services (e.g. school service planned between two SERVICE JOURNEYs). More often, they are added to the production plan for each particular operating day, according to the requirements for that day. The mission for a special service is usually not described using classical ROUTEs and JOURNEY PATTERNs. Regular special services may have only a rough indication of their origin and destination, which is the case for most occasional services. Some places may play the role of SCHEDULED STOP POINT for a special service but are not registered as such by the operator, because no equipment (post or shelter) is installed, etc.

The entity SPECIAL SERVICE describes a service that is not operated in the classical way, i.e. differing from a VEHICLE JOURNEY by some characteristics. A SPECIAL SERVICE is a regular service planned for a DAY TYPE. It has as main attributes a ‘start time’ and an ‘end time’.

A SPECIAL SERVICE is characterized by a TYPE OF SERVICE, which allows various distinguishing categories of services, according to the needs of the user. This classification also allows distinguishing the DEAD RUNs necessary to perform the sold services. SPECIAL SERVICEs are usually grouped into GROUPs OF SERVICES, which sometimes may be advertised (e.g. the school services may have a published number).

The mission corresponding to a special service may be described by a JOURNEY PATTERN, as classical VEHICLE JOURNEYs. This is the case for some relatively frequent services, using normal SCHEDULED STOP POINTs (e.g. service for football match). More frequently, they are only described by a ROUTE, often reduced to an origin and a destination POINTs. However, as these end points shall be TIMING POINTs, the mission of a SPECIAL SERVICE is described by a simplified JOURNEY PATTERN.

5.3.3 Time demand times

5.3.3.1 TIME DEMAND times – Conceptual model

Run times and wait times vary during the day, depending in particular on traffic conditions and on the number of passengers boarding or alighting from vehicles at stops. A classification of these conditions into arbitrary levels of demand is defined by the TIME DEMAND TYPE concept (cf. [8]).

The TIME DEMAND TYPEs mainly indicate situations like “peak hour traffic conditions”, “off-peak traffic”, “night-owl traffic” etc. In bus operation for instance, the duration of run times usually differs between these situations. Wait times at stops rather depend on the passenger demand, which also varies with the time of day, but in a very similar pattern to the traffic conditions on the roads. Therefore, the TIME DEMAND TYPE serves as an indicator to classify standard run times as well as wait times, depending on specific conditions.

Each VEHICLE JOURNEY takes place at a defined time which can be characterized by specific traffic conditions and a certain passenger demand level. To express these characteristics, a TIME DEMAND TYPE may be assigned to a VEHICLE JOURNEY, in order to choose easily the appropriate run and wait times.

Figure 7 represents timing information associated with the TIME DEMAND TYPE: RUN TIMEs, WAIT TIMEs, and a few other timing information like HEADWAY frequency, TURNAROUND TIME LIMIT and JOURNEY PATTERN LAYOVER.

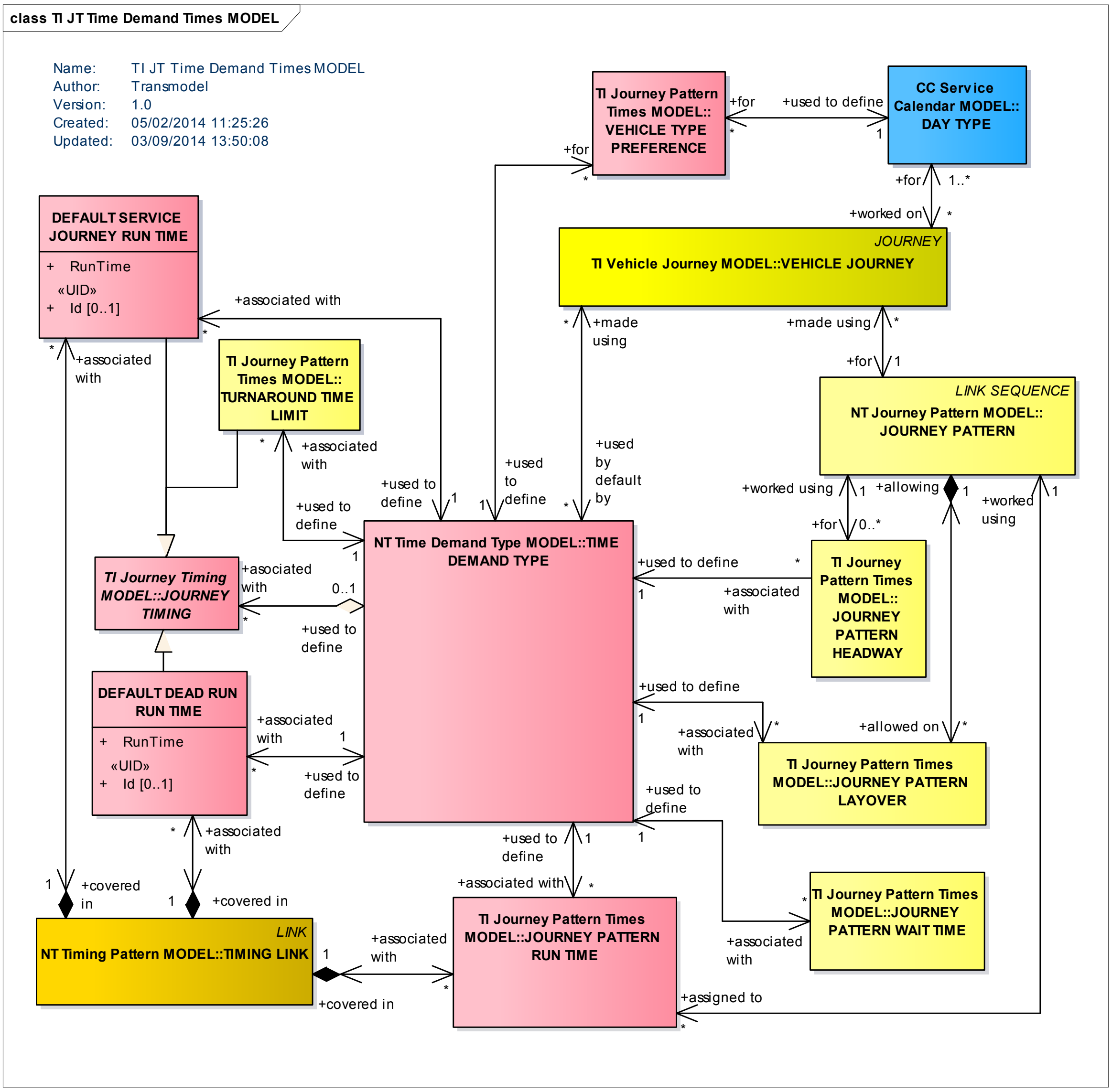

Figure 6 —Time demand times – Conceptual model (UML)

A set of DEFAULT RUN TIMEs (for SERVICE JOURNEYs and DEAD RUNs) may be recorded for any TIMING LINK, one run time corresponding to one TIME DEMAND TYPE. If the TIMING LINK (cf. [8]) is used by several JOURNEY PATTERNs, the default times may be applied any time it is covered by a VEHICLE JOURNEY, regardless of the JOURNEY PATTERN.

A more precise control of run times is possible: a JOURNEY PATTERN RUN TIME is a run time for a TIMING LINK that will be valid only for VEHICLE JOURNEYs made on the specified JOURNEY PATTERN. It will override the default run times for this TIMING LINK.

JOURNEY PATTERN RUN TIMEs are sets of run times for different TIME DEMAND TYPEs. The TIME DEMAND TYPE for a particular VEHICLE JOURNEY is used to select the appropriate time from the set recorded for a particular TIMING LINK belonging to the JOURNEY PATTERN covered.

A JOURNEY PATTERN WAIT TIME may be recorded to define the time a vehicle will have to wait at a specified TIMING POINT, e.g. to allow a large number of passengers to board or alight, or to wait for a connecting vehicle on another LINE. These wait times depend on the JOURNEY PATTERN that the VEHICLE JOURNEY covers, and on the TIME DEMAND TYPE.

JOURNEY PATTERN WAIT TIMEs may occur on DEAD RUNs also, e.g. at a certain TIMING POINT in a DEAD RUN PATTERN where the driver will be relieved.

A minimum layover time may be defined separately at the end of each JOURNEY PATTERN. This will be stored in the JOURNEY PATTERN LAYOVER entity, depending on a TIME DEMAND TYPE.

A turnaround time is the time taken by a vehicle to proceed from the end of a ROUTE to the start of another. The TURNAROUND TIME LIMIT is dependent on a TIME DEMAND TYPE and is stored against a pair of TIMING POINTs.

The VEHICLE TYPE PREFERENCE, depending on a particular SERVICE JOURNEY PATTERN, defines a priority 'rank' given for each VEHICLE TYPE, for each DAY TYPE and TIME DEMAND TYPE.

Lastly, HEADWAY JOURNEY GROUP (5.3.4 and 5.3.6) and JOURNEY PATTERN HEADWAY, used to define services based on headway frequencies (defined in 5.3.5), are both potentially dependent on TIME DEMAND TYPE.

5.3.4 Journey timing

5.3.4.1 JOURNEY TIMING – Conceptual model

5.3.4.1.1 General

The JOURNEY TIMING model defines common properties for timing elements that can be specialized in the VEHICLE JOURNEY and JOURNEY PATTERN timing models.

A JOURNEY TIMING provides an abstract type for a number of different specialized types of timing information:

— JOURNEY LAYOVER;

— JOURNEY WAIT TIME;

— JOURNEY HEADWAY;

— JOURNEY RUN TIME;

— TURNAROUND TIME LIMIT;

— DEFAULT DEAD RUN TIME;

— DEFAULT SERVICE JOURNEY RUN TIME.

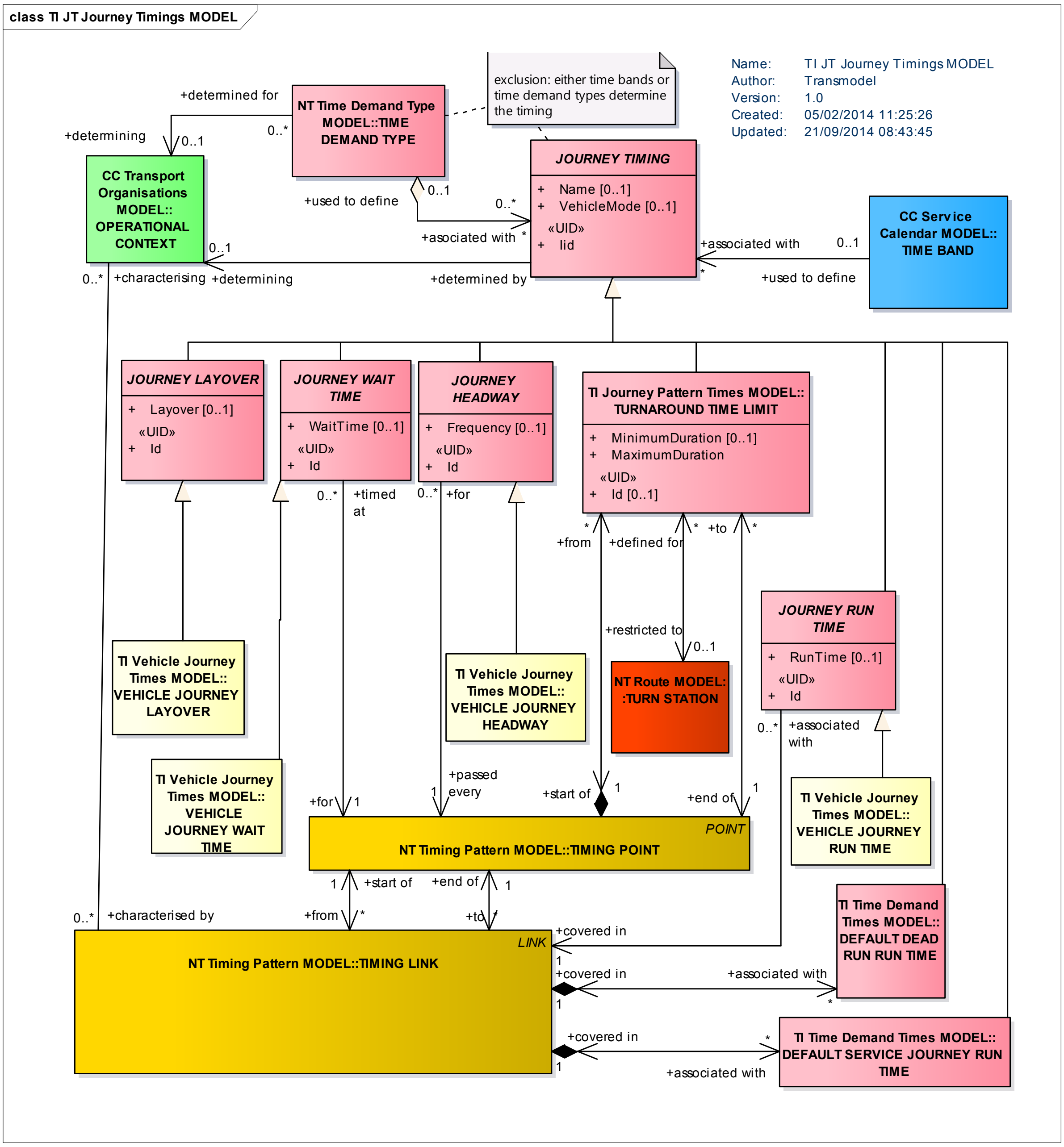

Figure 7 — Journey timing – Conceptual model (UML)

5.3.4.1.2 Layover times

LAYOVER TIMEs describe a certain time allowance that may be given at the end of each VEHICLE JOURNEY, before starting the next one, to compensate for delays or for other purposes (e.g. rest time for the driver). This "layover time" can be regarded as a buffer time, which may or may not be actually consumed in real time operation.

A minimum layover time may be defined separately at the end of each JOURNEY PATTERN. This will be stored in the JOURNEY PATTERN LAYOVER entity, depending on a TIME DEMAND TYPE.

Such standard layover times may be superseded by a layover time defined for a specific VEHICLE JOURNEY.

5.3.4.1.3 Wait times

A WAIT TIME may be recorded to define the time a vehicle will have to wait at a specified TIMING POINT, e.g. to allow a large number of passengers to board or alight, or to wait for a connecting vehicle on another LINE. These wait times depend on the JOURNEY PATTERN that the VEHICLE JOURNEY covers, and on the TIME DEMAND TYPE. JOURNEY PATTERN WAIT TIMEs may occur on DEAD RUNs also, e.g. at a certain TIMING POINT in a DEAD RUN PATTERN where the driver will be relieved.

A JOURNEY WAIT TIME may be stored for each individual VEHICLE JOURNEY, at any TIMING POINT IN JOURNEY PATTERN, in the covered JOURNEY PATTERN.

A VEHICLE JOURNEY WAIT TIME, if it exists, overrides any JOURNEY PATTERN WAIT TIMEs that may have been stored for the TIMING POINT in question.

5.3.4.1.4 Headway times

Headway frequency information that is available for a VEHICLE JOURNEY supersedes the JOURNEY PATTERN HEADWAY. It has to be understood as the time interval between the previous and the next VEHICLE JOURNEY. This information shall be consistent with HEADWAY JOURNEY GROUP if available (HEADWAY JOURNEY GROUP being a more detailed way of describing headway services).

5.3.4.1.5 Run times

A precise control of run times is possible by using the JOURNEY RUN TIME. It defines a run time for a TIMING LINK that will be valid only for specific VEHICLE JOURNEYs and overrides the default run times for this TIMING LINK.

JOURNEY RUN TIMEs are sets of run times for different TIME DEMAND TYPEs. The TIME DEMAND TYPE for a particular VEHICLE JOURNEY is used to select the appropriate time from the set recorded for a particular TIMING LINK belonging to the JOURNEY PATTERN covered.

A VEHICLE JOURNEY RUN TIME is specific to one VEHICLE JOURNEY and applies to a particular TIMING LINK. If it exists, it overrides any run time that may have been stored for the TIMING LINK in question.

5.3.4.1.6 Turnaround times

Another constraint to be taken into account in fixing layover times may be a maximal or minimal turnaround time. A turnaround time is the time taken by a vehicle to proceed from the end of a ROUTE to the start of another. There are some limitations for turnaround times, which are used as parameters by scheduling systems for the vehicle scheduling procedure.

The TURNAROUND TIME LIMIT is dependent on a TIME DEMAND TYPE and is stored against a pair of TIMING POINTs. These points represent a TIMING POINT where a vehicle may end a SERVICE JOURNEY and a TIMING POINT where a subsequent SERVICE JOURNEY may start from. The duration of a DEAD RUN (relating the two TIMING POINTs) possibly scheduled between these two SERVICE JOURNEYs is included in the turnaround time.

5.3.4.1.7 Times for dead runs

The path to proceed from the end point of a SERVICE JOURNEY to the start point of the following is normally described by a DEAD RUN PATTERN. However, it is often not worth modelling explicitly a short movement as a DEAD RUN, covering an explicit DEAD RUN PATTERN. In such a case, a 'minimum duration' may be stored in the TURNAROUND TIME LIMIT, as the minimum time needed by a vehicle to cover this short path. This minimum duration will of course be superseded by the run times (plus wait times, if any) associated with an explicitly modelled DEAD RUN between the two TIMING POINTs concerned.

In the case of a SERVICE JOURNEY, there are SCHEDULED STOP POINTs in the JOURNEY PATTERN where passengers can board or alight from the vehicle. Therefore, run times probably will be different if a vehicle crosses a TIMING LINK during a SERVICE JOURNEY or a DEAD RUN. Default run times are hence recorded in two different entities: DEFAULT SERVICE JOURNEY RUN TIME and DEFAULT DEAD RUN RUN TIME.

Using these default run times, the timing information for each VEHICLE JOURNEY can be derived by looking for the TIMING POINTs in the associated JOURNEY PATTERN, accessing the TIMING LINKs between these TIMING POINTs and choosing the appropriate run time. These times will be found, for each TIMING LINK, in the DEFAULT SERVICE JOURNEY RUN TIME or DEFAULT DEAD RUN RUN TIME entity, according to the type of journey.

The choice among the run times recorded for one TIMING LINK is determined by the TIME DEMAND TYPE which has been assigned to the VEHICLE JOURNEY.

5.3.5 Journey pattern times

5.3.5.1 JOURNEY PATTERN TIMES – Conceptual model

5.3.5.1.1 Default times

For any TIMING LINK, run times corresponding to one TIME DEMAND TYPE may be recorded. In some cases, such run times are default run times and if the TIMING LINK is used by several JOURNEY PATTERNs, the default times may be applied any time it is covered by a VEHICLE JOURNEY, regardless the JOURNEY PATTERN.

5.3.5.1.2 Journey pattern run times

A more precise control of run times than is possible by using default times at TIMING LINK level, can be achieved using JOURNEY PATTERN RUN TIMEs. A JOURNEY PATTERN RUN TIME is a run time for a TIMING LINK that will be valid only for VEHICLE JOURNEYs made on the specified JOURNEY PATTERN. It overrides the default run times that might have been defined for this TIMING LINK.

JOURNEY PATTERN RUN TIMEs are sets of run times for different TIME DEMAND TYPEs. The TIME DEMAND TYPE for a particular VEHICLE JOURNEY is used to select the appropriate time from the set recorded for a particular TIMING LINK belonging to the JOURNEY PATTERN covered.

A JOURNEY PATTERN WAIT TIME may be recorded to define the time a vehicle will have to wait at a specified TIMING POINT, e.g. to allow a large number of passengers to board or alight, or to wait for a connecting vehicle on another LINE. These wait times depend on the JOURNEY PATTERN that the VEHICLE JOURNEY covers, and on the TIME DEMAND TYPE.

5.3.5.1.3 Layover times

A certain time allowance may be given at the end of each VEHICLE JOURNEY, before starting the next one, to compensate delays or for other purposes (e.g. rest time for the driver). This “layover time” can be regarded as a buffer time on a specified JOURNEY PATTERN for the different TIME DEMAND TYPEs. This layover may be superseded by a specific VEHICLE JOURNEY LAYOVER.

5.3.5.1.4 Frequency-based services

In the case of frequency-based services, another type of information is needed, namely headway duration information. It is given by JOURNEY PATTERN HEADWAY that is available for all the VEHICLE JOURNEYs running on the JOURNEY PATTERN at the TIMING POINTs IN JOURNEY PATTERN depending upon the different TIME DEMAND TYPEs.

5.3.5.1.5 Journey pattern wait times

The JOURNEY PATTERN WAIT TIME represents the time a vehicle has to wait at a specific TIMING POINT IN JOURNEY PATTERN, for a specified TIME DEMAND TYPE. This wait time can be superseded by a VEHICLE JOURNEY WAIT TIME (described in 5.3.6).

5.3.5.1.6 Vehicle type preference

The VEHICLE TYPE PREFERENCE represents a default VEHICLE TYPE proposed for the journeys, depending on the JOURNEY PATTERN covered and the TIME DEMAND TYPE. It is not a truly temporal concept but has to be understood as a proposal to be taken into account for BLOCK compilation (described in 5.3.9.2 and 5.6.3.2). It may be a ranked list of VEHICLE TYPEs for each SERVICE JOURNEY PATTERN and for each DAY TYPE and TIME DEMAND TYPE.

5.3.5.1.7 Operational context dependency

Figure 10 provides a reminder that all this timing information is to be considered in a specific OPERATIONAL CONTEXT, that expresses the characterization of a set of operational objects, such as timing or links determined either by a DEPARTMENT or by an ORGANIZATIONAL UNIT (cf. [7]).

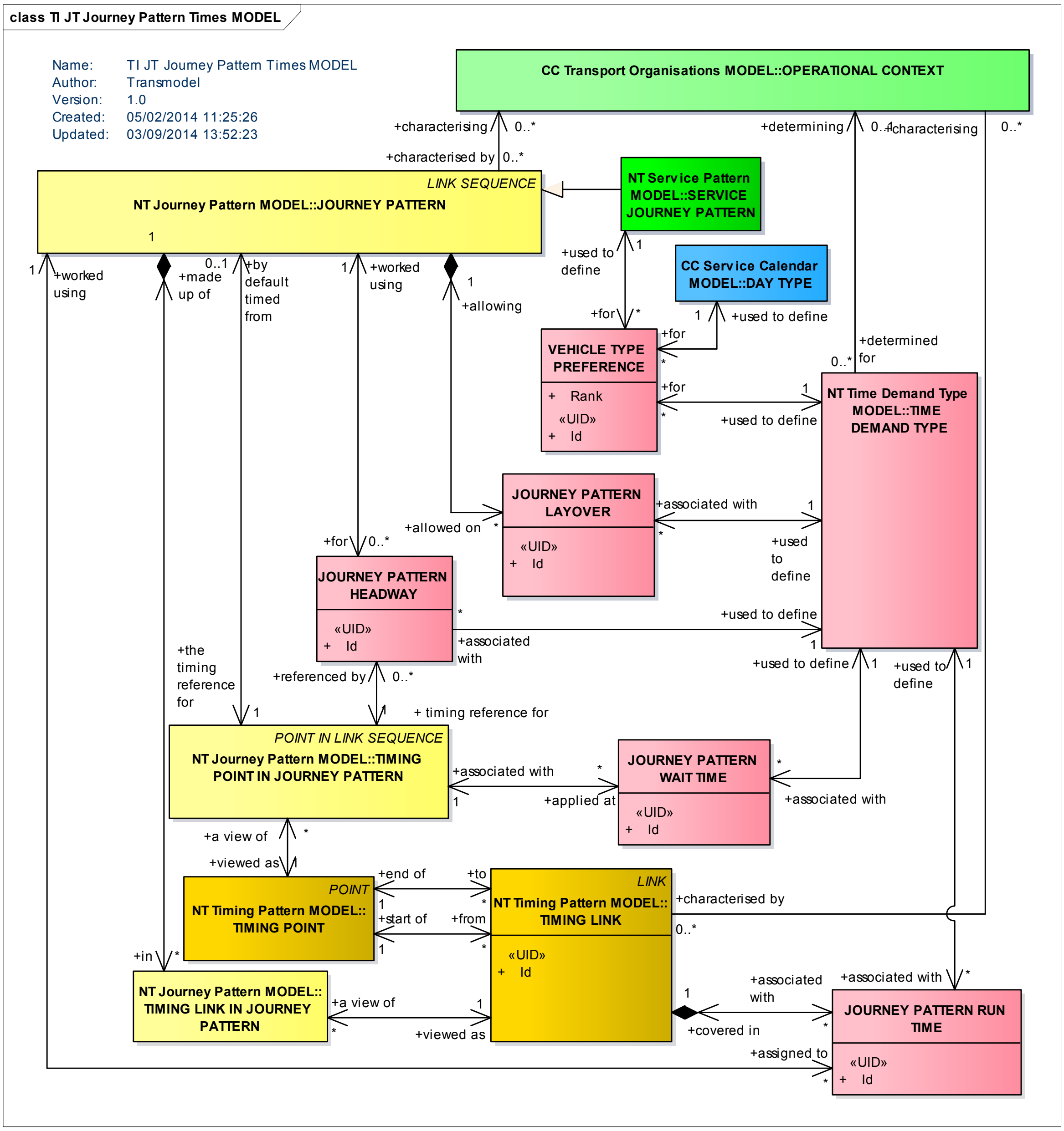

Figure 8 — Journey Pattern Times – Conceptual Model (UML)

5.3.6 Vehicle journey times

5.3.6.1 VEHICLE JOURNEY TIMES – Conceptual model

5.3.6.1.1 Requirements for exceptions

There may be reasons for needing a more precise control of run and wait times than is possible using the standard times at JOURNEY PATTERN level. Some exception times may be required for a single VEHICLE JOURNEY. For instance, a vehicle may be slowed intentionally on a particular VEHICLE JOURNEY to meet a scheduled interchange. Some companies adjust the times (e.g. wait times, but even run times) to cope with driver scheduling regulations. In the case of a very long VEHICLE JOURNEY, e.g. in a rural area, a single TIME DEMAND TYPE may not apply to the whole journey, because traffic conditions change substantially between its start and end.

It is hence necessary to be able to override the standard times by times for a specific VEHICLE JOURNEY.

5.3.6.1.2 Journey timing overview

A number of specializations of JOURNEY TIMING are used to provide VEHICLE JOURNEY:

— VEHICLE JOURNEY RUN TIME is the time taken to traverse a specified TIMING LINK IN JOURNEY PATTERN on a specified VEHICLE JOURNEY. This gives the most detailed control over times and overrides the DEFAULT SERVICE JOURNEY RUN TIME, the JOURNEY PATTERN RUN TIME and the DEFAULT DEAD RUN RUN TIME.

— VEHICLE JOURNEY WAIT TIME is the time for a vehicle to wait at a particular TIMING POINT IN JOURNEY PATTERN on a specified VEHICLE JOURNEY. This wait time will override the JOURNEY PATTERN WAIT TIME.

— VEHICLE JOURNEY LAYOVER is the time allowance at the end of a specified VEHICLE JOURNEY. This time supersedes any global layover or JOURNEY PATTERN LAYOVER.

— VEHICLE JOURNEY HEADWAY is the headway frequency information that is available for a VEHICLE JOURNEY (to be understood as the time interval between the previous and the next VEHICLE JOURNEY).

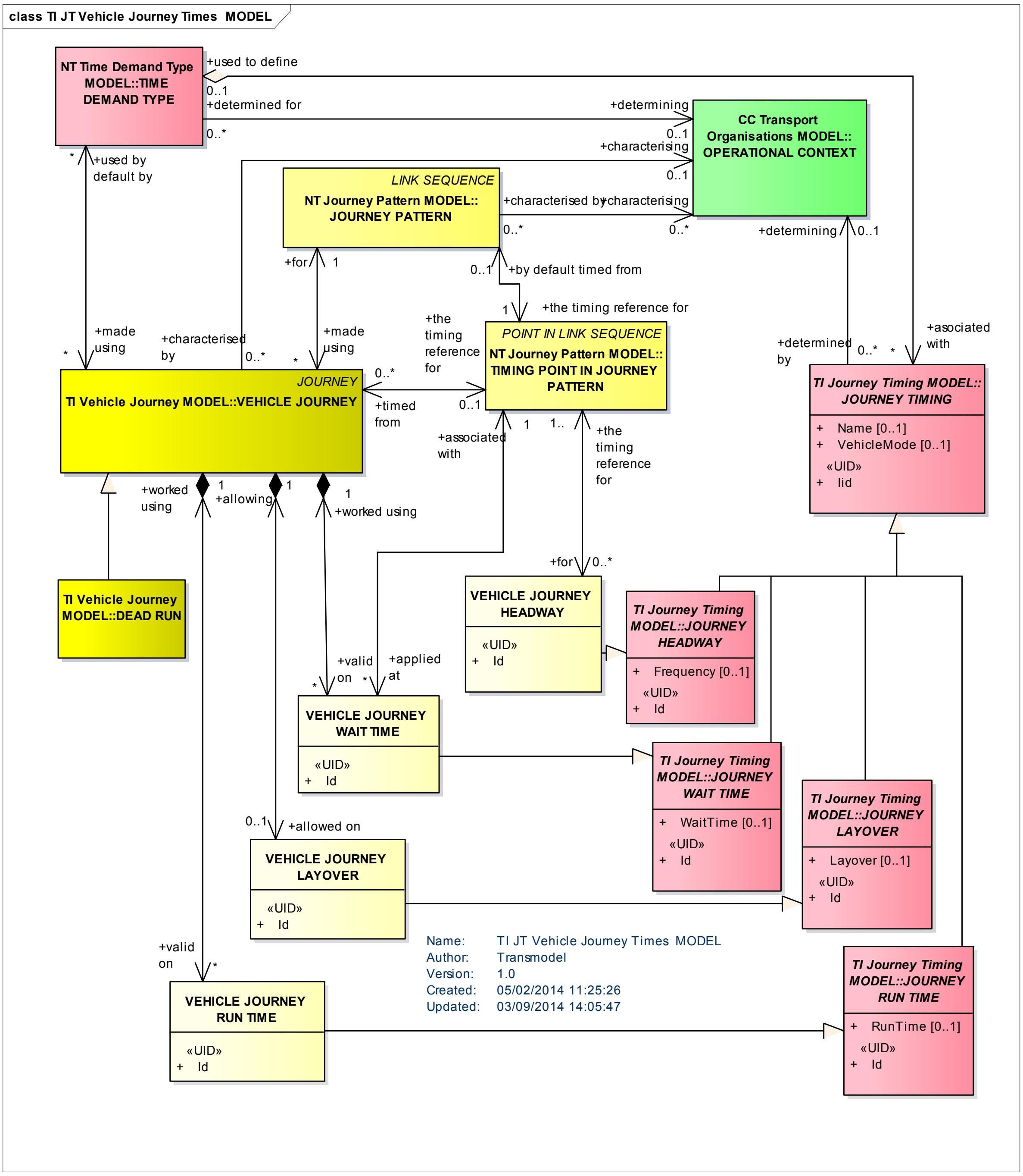

Figure 9 — Vehicle journey times — Conceptual model (UML)

A more detailed model of frequency-based services is discussed in the next section.

5.3.6.2 Frequency based service– Conceptual model

Two different types of services are commonly found, representing journeys with a particular behaviour as to the regularity of their timing.

One of them is the common frequency-based service, based on the concept of HEADWAY INTERVAL, i.e. a regular interval duration between the journeys such as ‘every 10 min’, for example.

Another possibility is that of a particular ‘rhythm’ occurring over every hour, for example, services running at ‘xx10’, ‘xx25’, ‘xx45’ past each hour.

In either case a TEMPLATE VEHICLE JOURNEY is associated with a JOURNEY FREQUENCY GROUP to represents a group of JOURNEYs running at the given frequency. Such behaviour can be conditional upon the TIME DEMAND TYPE and TIME BAND.

Often in passenger information systems there is a requirement to show multiple journeys as a single column in a timetable for example “And then every 20 minutes until 6 pm”. The model allows groups of journeys to be aggregated using a TEMPLATE JOURNEY and an overall frequency to be specified for them, using either a HEADWAY JOURNEY GROUP (e.g. ‘*every 10 min*’) or a RHYTHMICAL JOURNEY GROUP – one that runs at a regular interval past each hour (for example ‘*xx10*’, ‘*xx25*’ and ‘*xx45*’).

Even though every scheduled VEHICLE JOURNEY has a specific set of PASSING TIMEs that it will run to, these will not necessarily be revealed to the passenger and a JOURNEY FREQUENCY can be used to present the journey as frequency based.

For passenger information purposes it is possible to consider a TEMPLATE VEHICLE JOURNEY without any concrete VEHICLE JOURNEYs.

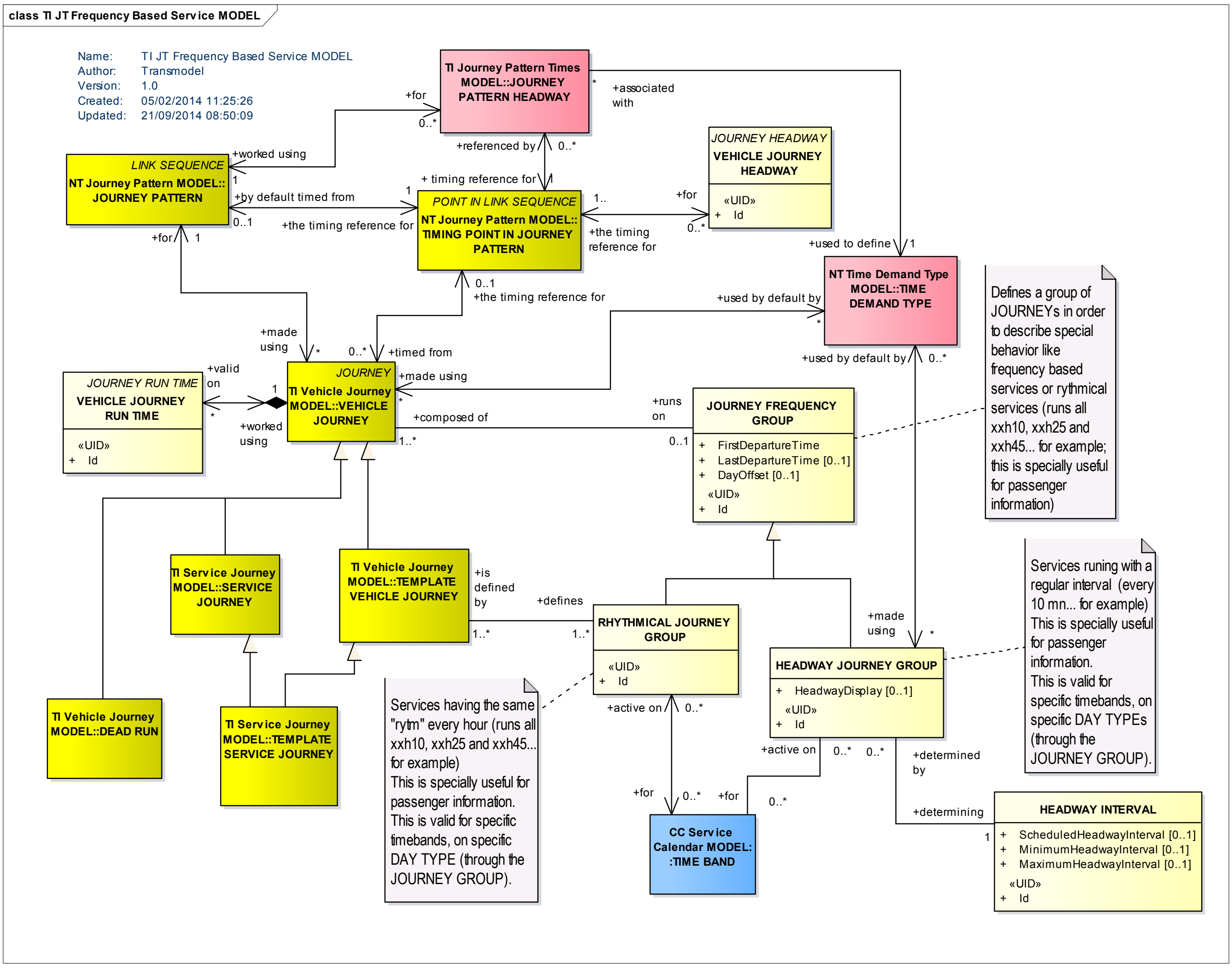

Figure 10 — Vehicle journey frequency – Conceptual model (UML)

5.3.7 Interchange

5.3.7.1 INTERCHANGE – Conceptual model

5.3.7.1.1 Interchange, connection and navigation path

In order to reach the destination of a trip if there is no direct service between the origin and the destination SCHEDULED STOP POINTs, a passenger will have to interchange between vehicles. A transfer will be necessary where the passenger will leave the vehicle at a particular SCHEDULED STOP POINT and enter another vehicle (which serves another SERVICE JOURNEY, usually on a different LINE (cf. [8]) at the same or another SCHEDULED STOP POINT.

Each SERVICE JOURNEY INTERCHANGE involves two different SERVICE JOURNEYs. The passenger makes the transfer from a feeder SERVICE JOURNEY to a distributor ("fetcher") SERVICE JOURNEY.

Sometimes both SERVICE JOURNEYs are planned to stop at exactly the same SCHEDULED STOP POINT but in other cases there are two different (but nearby) SCHEDULED STOP POINTs involved. In such a case, these SCHEDULED STOP POINTs will often (but need not necessarily) belong to the same STOP AREA. Passengers will have to walk a certain distance after disembarking from the feeder SERVICE JOURNEY to reach the stop position of the distributor SERVICE JOURNEY.

A CONNECTION (cf. [8]) expresses that there is a possible walking link that is suitable for a passenger to interchange from one public transport vehicle to another between two specified SCHEDULED STOP POINTs and the time allocated for a passenger to traverse the link.

Software used to control guaranteed interchanges can use the time information given for using a CONNECTION to calculate how long a distributor SERVICE JOURNEY needs to wait after a fetcher SERVICE JOURNEY has arrived before it can depart. If no specific CONNECTION is available, timings from a DEFAULT CONNECTION may be used.

The CONNECTION time information could also be used for passenger information such as in travel planners, however sometimes more detailed information about timings and suitable paths adapted to the individual traveller's specific preferences and capabilities is necessary. In that case additional information can be retrieved from attributes related to the physical model, such as PATH LINKs and NAVIGATION PATHs (cf. [8]).

5.3.7.1.2 Interchange specific aspects

In some cases, a SERVICE JOURNEY INTERCHANGE expresses an interchange between two SERVICE JOURNEYs specifically planned to be operated by the same physical vehicle. This concept is for instance used for circular lines and coupled journeys. This means that passenger information should be adapted to the fact that the passenger should not change vehicle as the transfer is implicit. In this case it is also important that operation control staff are aware of the consequences to passengers if the operation is altered in such a way that two different vehicles are used for the two SERVICE JOURNEYs involved.

In real-time operation, interchanges that are advertised to the public should be controlled. For instance, vehicles may sometimes have to wait if the arriving vehicle for an interchange is delayed. The company will probably define certain rules and instructions for drivers on how to react in case of deviations from the planned schedule.

The SERVICE JOURNEY INTERCHANGE may be used to store some information on the planned interchange between two SERVICE JOURNEYs such as if it is advertised or not, if it is guaranteed or not and the maximum time a vehicle may wait for a connecting vehicle, beyond the planned departure time.

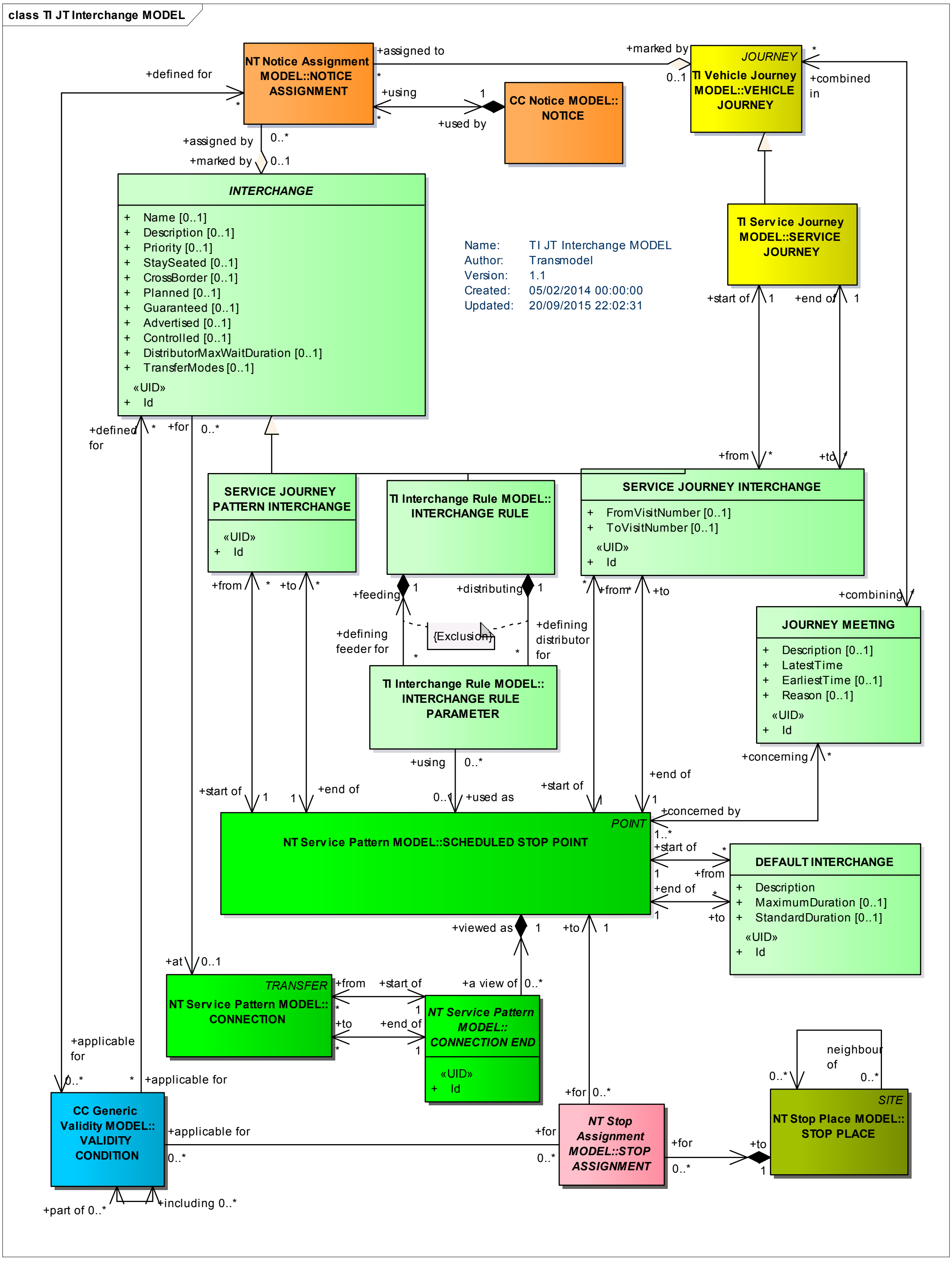

Figure 11 — Interchange – Conceptual model (UML)

5.3.7.1.3 Default timings for interchanges

When optimizing the start times of the SERVICE JOURNEYs, the scheduler shall take into account certain parameters affecting service quality, for example the influence of passenger waiting times at interchanges on their total travel times. Ideally the waiting times for passengers at interchanges resulting from the journey schedule should be as short as possible, allowing for necessary transfer time. But on the other hand, the public transport company shall provide its service efficiently, making best use of the limited number of vehicles and drivers available.

Thus the waiting times of passengers at interchanges, resulting from the schedule, will be a compromise between what is desirable and what is possible. In order to find the best compromise, certain quality parameters are defined that shall be taken into account by the journey optimization and synchronisation process.

The entity DEFAULT INTERCHANGE is used to store such quality parameters. It is recorded against a SCHEDULED STOP POINT where passengers may leave a vehicle and a second SCHEDULED STOP POINT where they can proceed to enter a second vehicle. It may be used for any pair of SERVICE JOURNEYs serving respectively the first and the second SCHEDULED STOP POINT.

One of the stored parameters is the maximum duration that would be allowed for an interchange. If this maximum duration is exceeded for a pair of SERVICE JOURNEYs serving the two SCHEDULED STOP POINTs, this will no longer be regarded as a possible interchange between these journeys. In this situation, the scheduler will perhaps be warned by the system and be asked to retime these journeys; otherwise these journeys may not be advertised as connected at the specified SCHEDULED STOP POINTs.

Another parameter is the standard duration that is aimed at, when planning an interchange. This should be taken into account as a reference value when timing the SERVICE JOURNEYs.

5.3.7.1.4 Journey meetings

A JOURNEY MEETING describes the possibility to plan the schedules according to various interchange possibilities:

— interchange with another service, of which only the arrival or departure time is known;

— more generally, service scheduled according to the time fixed for an external event, which will feed, or be fed by, this service (school, spectacle, etc.);

— organization of a meeting (hub) between several services, during a defined time band; this is a simplified specification of several interchanges. If needed this could be described in detail using several INTERCHANGE RULEs (described in 5.3.8) or SERVICE JOURNEY INTERCHANGEs;

— specification of a rendez-vous (time and place) for any journey that can meet the appointment.

A JOURNEY MEETING may be related to one or several SERVICE JOURNEYs, which are planned according to this JOURNEY MEETING. It may be timed by an earliest time (e.g. the arrival time of a feeder line, plus the duration of a possible transfer) or by a latest time (e.g. the opening hour of the school served by the journey), or both (e.g. the time band of a hub).

A JOURNEY MEETING is located at one or several SCHEDULED STOP POINTs, which shall be also classified as TIMING POINTs. It is planned in principle for VEHICLE JOURNEYs specified for the same DAY TYPE. The timing reference of these VEHICLE JOURNEYs probably will be chosen according to the JOURNEY MEETING specified.

5.3.7.1.5 Service journey pattern interchange

Sometimes, the scheduled possibility to interchange needs to be differentiated, depending on the SERVICE JOURNEY PATTERNs involved. The SERVICE JOURNEY PATTERN INTERCHANGE specifies such an interchange between two particular SERVICE JOURNEY PATTERNs and a corresponding pair of SCHEDULED STOP POINTs, which shall be served by the respective JOURNEY PATTERNs. The quality level to be aimed at will certainly depend on the service frequency on each SERVICE JOURNEY PATTERN. If these frequencies are more or less similar, the default values can be used as maximum and standard duration of interchange times. If the frequency is very low on one SERVICE JOURNEY PATTERN and considerably higher on another, the situation is different. An interchange waiting time of 13 min may be acceptable for passengers if the buses only run every two hours on a particular SERVICE JOURNEY PATTERN, but would not be a good solution if the buses run every 15 min.

The SERVICE JOURNEY PATTERN INTERCHANGE may be used to store some information on the planned interchange between two SERVICE JOURNEY PATTERNs (level of priority, advertised or not, guaranteed or not). It also allows the quality parameters (maximum and standard duration) to be stored and used for scheduling of SERVICE JOURNEYs, which will override any default parameter.

5.3.8 Interchange rule

5.3.8.1 INTERCHANGE RULE – Conceptual model

An INTERCHANGE RULE allows an intended interchange to be recorded in the schedule without having to specify the exact details of both SERVICE JOURNEYs involved in the interchange.

The INTERCHANGE RULE instead provides enough details so that eligible SERVICE JOURNEY INTERCHANGEs can be determined at a later stage after the scheduling is completed. This later stage could be when two schedules from different sources are coordinated in an integrator system, or in real time in a system considering late re-scheduling and delays of involved LINEs.

As described earlier; a SERVICE JOURNEY INTERCHANGE involves two different SERVICE JOURNEYs. The passenger has the possibility to transfer from a *feeder* SERVICE JOURNEY at a SCHEDULED STOP POINT to a *distributor* SERVICE JOURNEY at the same or nearby SCHEDULED STOP POINT.

Often the two involved SERVICE JOURNEYs in the interchange are planned separately. Sometimes the SERVICE JOURNEYs are worked by different companies.

This means that it is not an easy task for a scheduler to keep track of the exact details of the SERVICE JOURNEY at the other end of an intended interchange as the SERVICE JOURNEY at the other end might be altered, deleted or replaced at any time.

Instead of trying to keep track of such external changes and continuously readjust the schedule with the details of the external SERVICE JOURNEY, it is easier in this case to use an INTERCHANGE RULE.

The INTERCHANGE RULE uses INTERCHANGE RULE PARAMETERs which will remain stable over time to identify the involved SERVICE JOURNEYs.

The INTERCHANGE RULE PARAMETER specifies criteria that a candidate SERVICE JOURNEY shall fulfil to be considered. Such criteria can work on a certain LINE in a specific DIRECTION. There also could be criteria relating to time of day or matching a specified SERVICE JOURNEY identifier. Which criterion or combination of criteria that are used will differ for different use cases.

In the same way it is possible to filter the SCHEDULED STOP POINTs at which the INTERCHANGE RULE applies. The SCHEDULED STOP POINTs of the feeder and distributor SERVICE JOURNEYs are defined separately. Instead of specifying a SCHEDULED STOP POINT it is possible to specify a STOP AREA. This is interpreted to say that any SCHEDULED STOP POINT within that STOP AREA is accepted for the related SERVICE JOURNEY. The STOP AREA construction is useful when the exact details of where the vehicle is planned to stop are not known in advance, or might change at a later stage.

There is also a final matching criterion, the maximum interchange window duration. This is used to filter out pairs of feeder and distributor SERVICE JOURNEYs where the feeder is planned to arrive so much earlier than the distributor is planned to depart, that the combination is not of interest as a SERVICE JOURNEY INTERCHANGE.

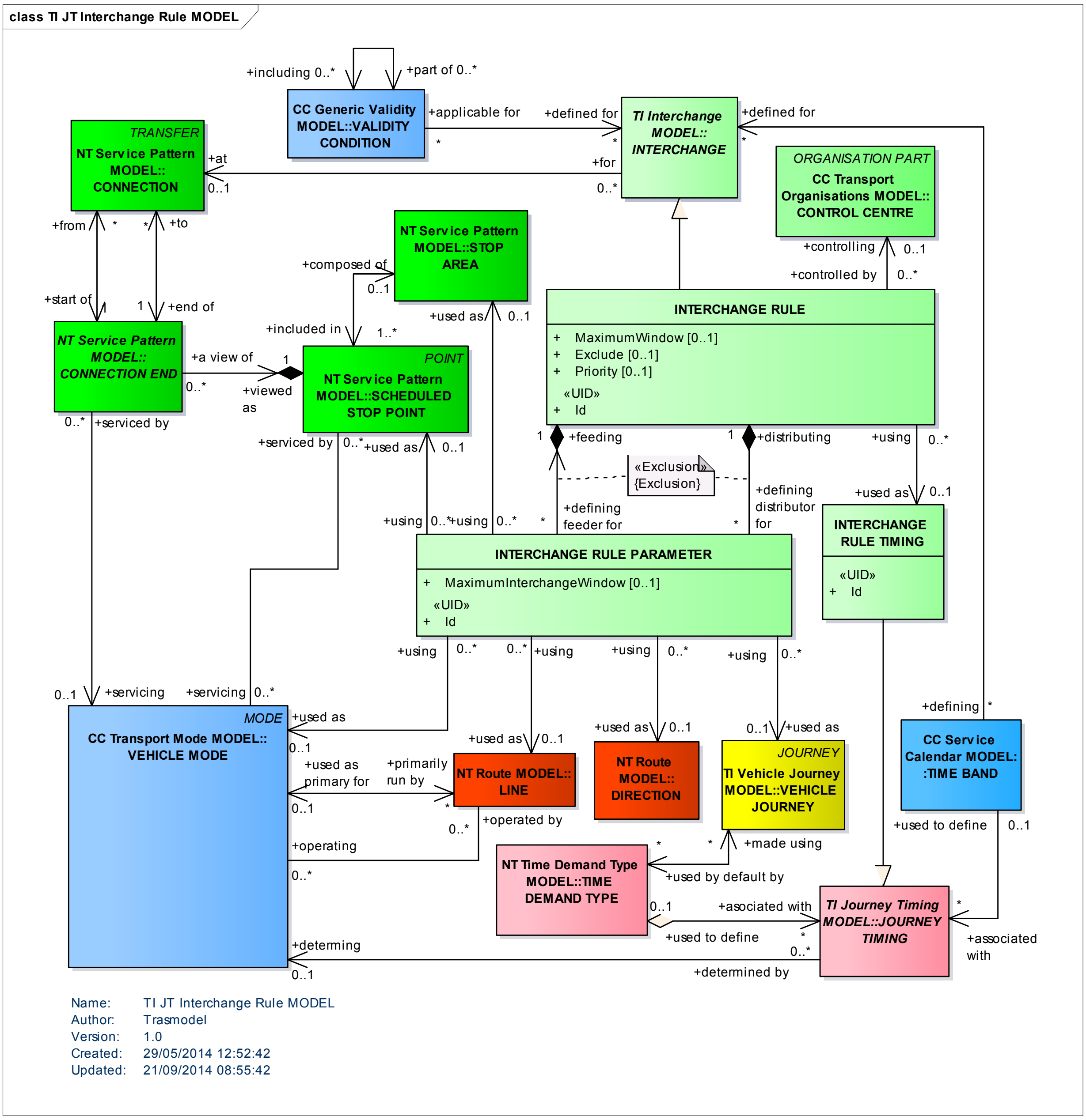

Figure 12 — Interchange rule – Conceptual model (UML)

5.3.9 Coupled journey

5.3.9.1 COUPLED JOURNEY – Conceptual model

An important additional issue for rail systems compared to conventional bus systems, is the operation of vehicles coupled in trains (i.e. vehicles of the type TRAIN or COMPOUND TRAIN (cf. [7]), rather than running as separate autonomous elementary vehicles. One consequence is the additional possibility to adjust the service supply to the demand as regards the types of vehicle. Trains may be shortened or lengthened during the day, or even within one SERVICE JOURNEY.

Furthermore the description of journeys to the passenger is more complex as a train (i.e. a vehicle of the type COMPOUND TRAIN) may be separated in two (or more) parts at a particular branching point, where both train parts continue their journeys on different routes towards separate destinations.

Conversely, two short trains coming from different feeding routes may be scheduled to meet at a joining point, where they are coupled to continue their service as one long train on a common route.

The concept of a COUPLED JOURNEY is related to the action of vehicle coupling. 'Vehicle' is understood as a unit remaining stable all along a VEHICLE JOURNEY. Therefore, a 'vehicle' may be either a single vehicle (e.g. a single tramway vehicle) or of the type TRAIN composed of several TRAIN ELEMENTs or a COMPOUND TRAIN composed of elementary TRAINs.

The entity TRAIN describes an elementary train unit and is thus a VEHICLE TYPE. A TRAIN consists of TRAIN ELEMENTs assembled together. The composition of the TRAIN is provided by a TRAIN COMPONENT, giving the order of the TRAIN ELEMENT in the TRAIN (cf. [7]).

The considerations related to the vehicle coupling actions are based on the concept of VEHICLE TYPE.

Like any vehicle, a vehicle of the type TRAIN operates VEHICLE JOURNEYs. If there is no coupling action during a VEHICLE JOURNEY, there is only one TRAIN for the journey. Two or more TRAINs may be coupled together for a part of a VEHICLE JOURNEY, or for longer periods, during which the composition of the compound train changes (thus the VEHICLE TYPE). Such coupled vehicles are represented by the concept of COMPOUND TRAINs.

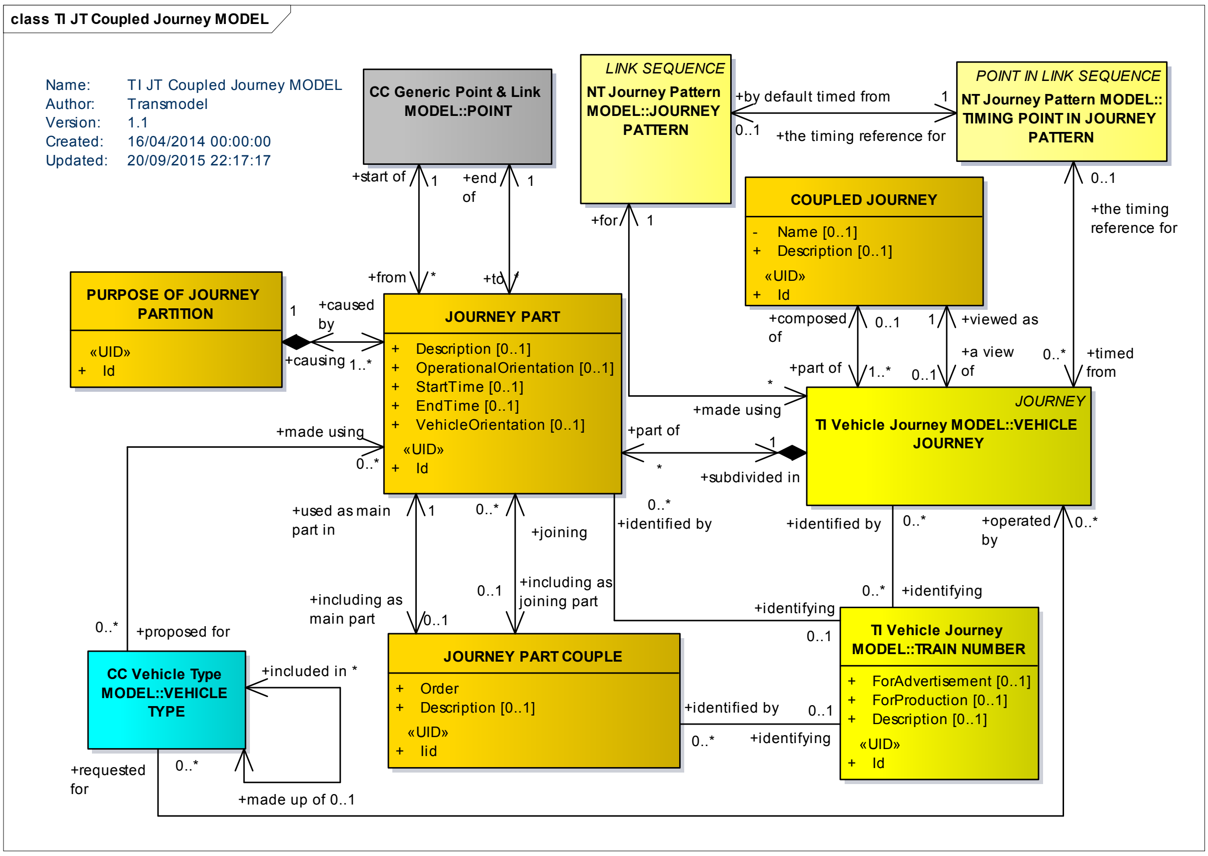

Figure 13 — Coupled journey – Basic conceptual model (UML)

5.3.9.2 Journey part and journey part couple

Two distinct points of view of vehicle coupling need to be taken into account:

— For operational management, which will typically manage work periods for each VEHICLE TYPE. Such periods are described as BLOCKs (described in section 5.6.3.2), worked from a PARKING POINT to another, composed of sets of VEHICLE JOURNEYs. BLOCKs may be coupled (building

COMPOUND BLOCKs, representing the work of a vehicle during the time it is coupled to another vehicle or separated for a while, building BLOCK PARTs, i.e. the parts of a BLOCK corresponding to the different JOURNEY PARTs of the VEHICLE JOURNEYs in a BLOCK. In this modelling TYPE OF COUPLING allows for a classification of BLOCK PARTs, for example to indicate whether the coupling or the separation may occur at the start or at the end of a BLOCK.

— For passenger information, which is not concerned by the BLOCK description but by the fact that VEHICLE JOURNEYs are either coupled or not; these actions are occurring during a journey (at an intermediate point, e.g. where two routes meet, or separation where they diverge). JOURNEY PARTs are considered to describe the different journey parts. Any part of a VEHICLE JOURNEY that is coupled with another is qualified with a JOURNEY PART. In such a case, the PURPOSE OF JOURNEY PARTITION is "coupling". One of the coupled JOURNEY PARTs is considered to be the main part of the compound vehicle formed. The entity JOURNEY PART COUPLE represents the coupling of one JOURNEY PART to the main one. In the case of the separation of vehicles, JOURNEY PARTs are created and the PURPOSE OF JOURNEY PARTITION is "separation".

5.3.9.3 Train numbers

A COUPLED JOURNEY is a complete journey operated by a COMPOUND TRAIN, composed of two or more VEHICLE JOURNEYs remaining coupled together all along a JOURNEY PATTERN. A COUPLED JOURNEY may be viewed as a single VEHICLE JOURNEY. This view of a COUPLED JOURNEY as a single VEHICLE JOURNEY is used for passenger information, as the passenger does not care whether this journey is composite from the vehicle management point of view.

Both operational and passenger information points of view are linked to a concept of TRAIN NUMBER, which gives a specification of codes assigned to particular VEHICLE JOURNEYs, JOURNEY PARTs and JOURNEY PART COUPLEs when operated by TRAINs or COMPOUND TRAINs according to a functional purpose (passenger information, operation follow-up, etc.). Two attributes control the exposing of numbers for use: *ForAdvertisement* and *ForProduction*.

5.3.9.4 Coupled journey – Example

5.3.9.4.1 General

The following examples illustrate the joining and splitting of trains and the relationship to the journey coupling or splitting.

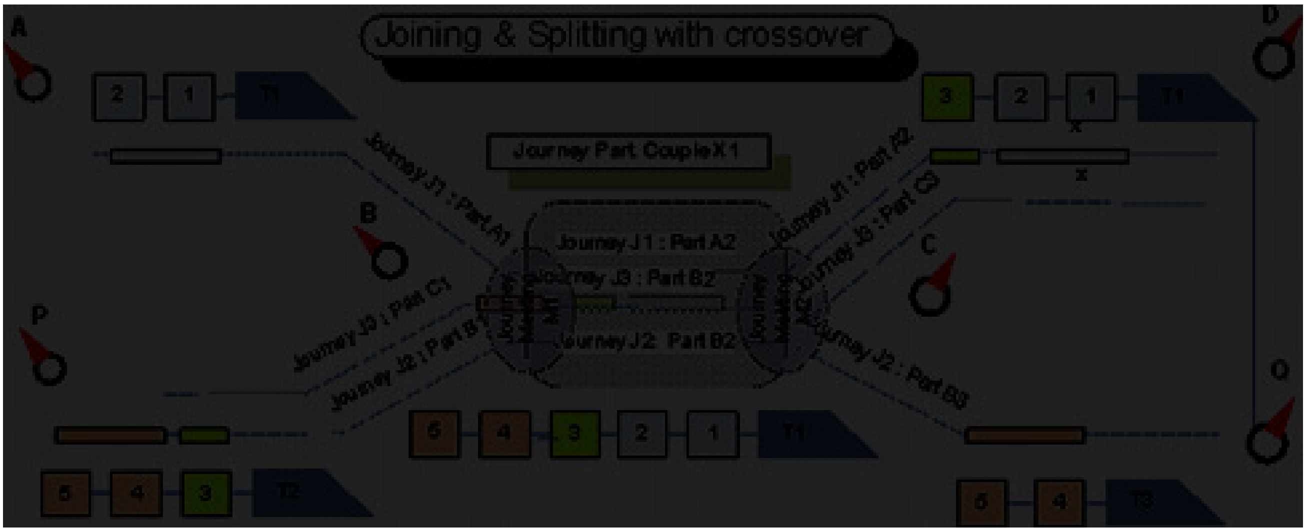

Figure 14 — Example – Joining and splitting trains (source NeTEx)

5.3.9.4.2 Example of joining and splitting: Amsterdam to Warsaw

In this example, we consider a train that starts in *Amsterdam* that has parts that run to three separate destinations, *Warsaw*, *Copenhagen* and *Prague*. *Hannover* and *Berlin* are the splitting points and another train (60467) joins the Berlin to Prague leg. There are multiple TRAIN NUMBERs associated with the respective trains

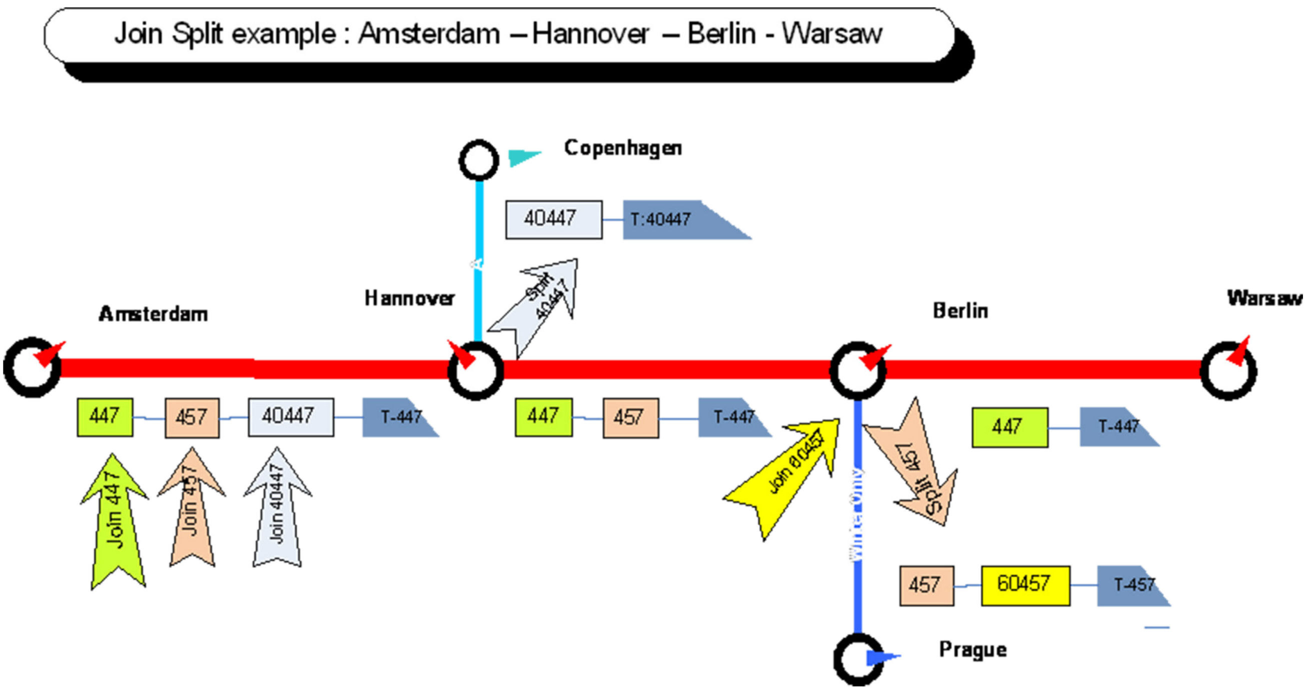

Figure 15 — Example – Joining and splitting: Amsterdam to Warsaw (source NeTEx)

This can be represented by three SERVICE JOURNEYs, each made up of several JOURNEY PARTs.

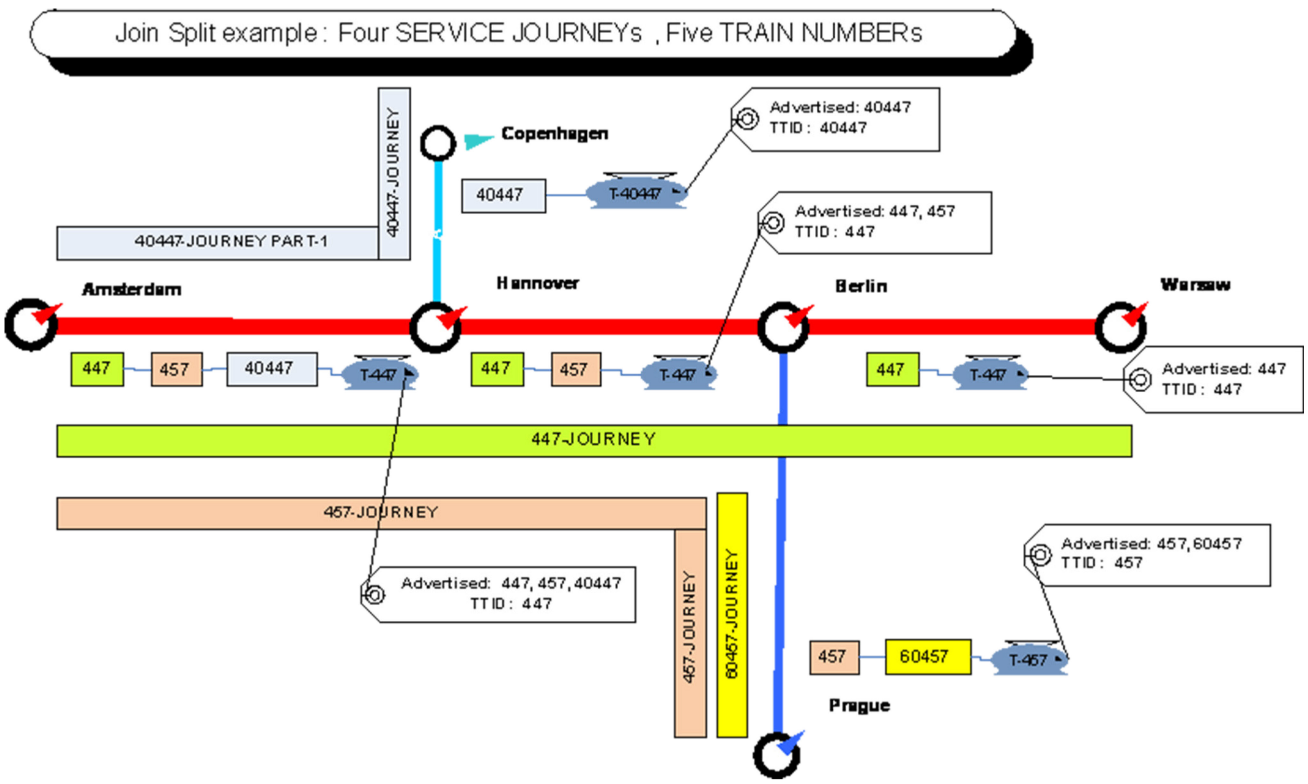

Figure 16 — Example – Journeys: Amsterdam to Warsaw (source NeTEx)

The JOURNEY PARTs are shown in the following diagram.

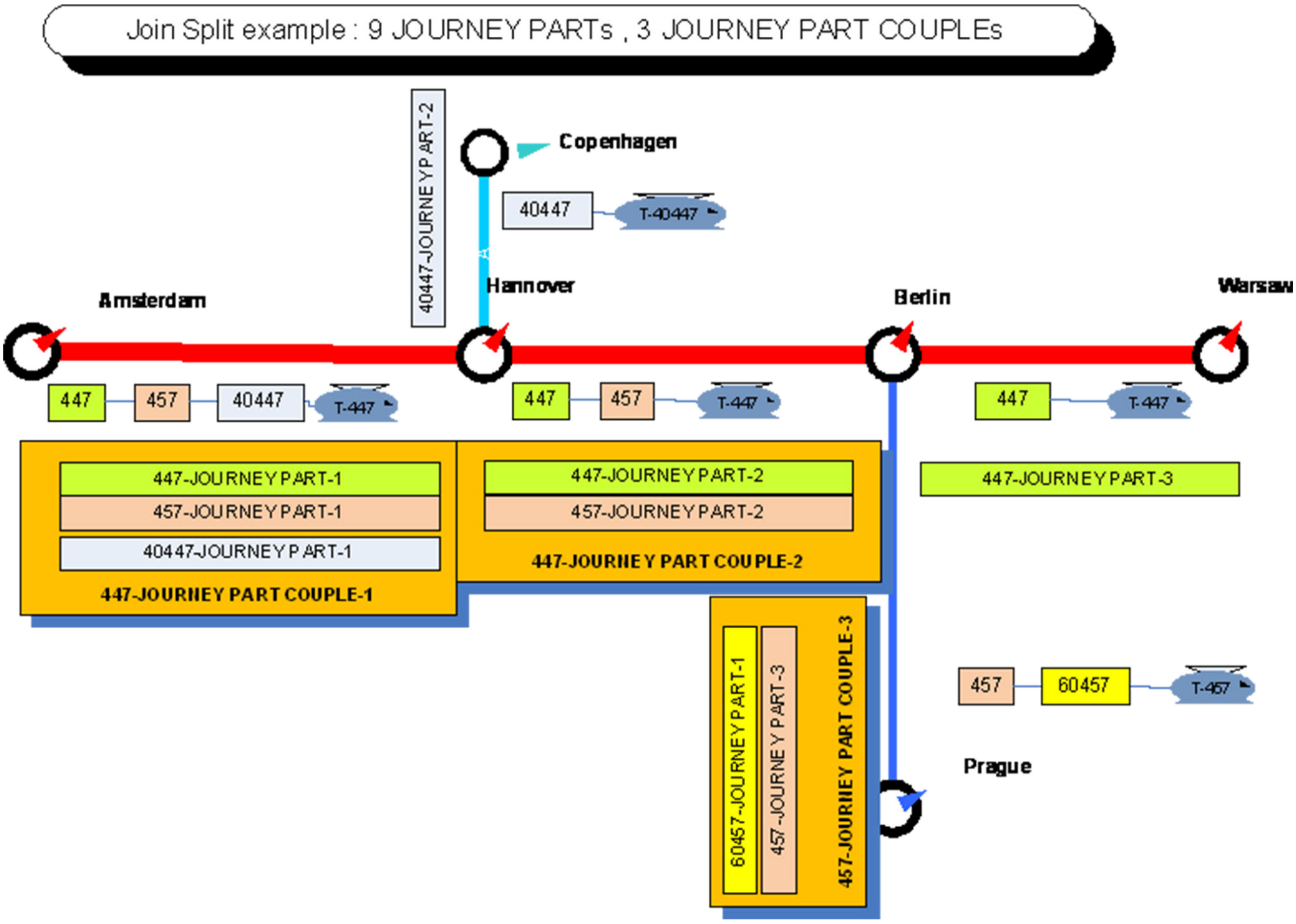

Figure 17 — Example – Journey parts: Amsterdam to Warsaw (source NeTEx)

The points at which the journeys join or split can be represented by JOURNEY MEETINGs.

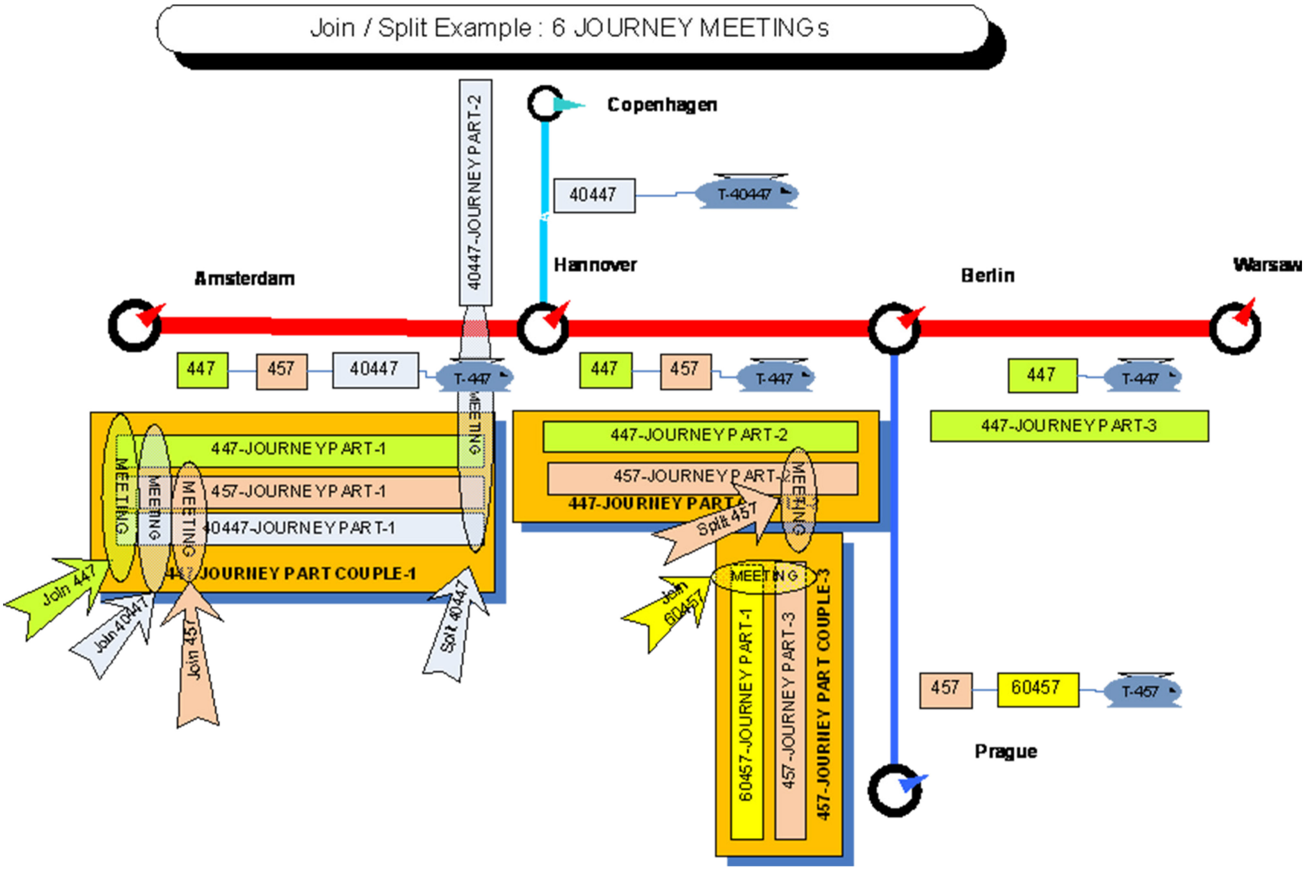

Figure 18 — Example – Six journey meetings: Amsterdam to Warsaw (source NeTEx)

The detailed train makeup of which carriages go to which destinations can be represented with TRAIN, TRAIN COMPONENTs and TRAIN ELEMENTs.

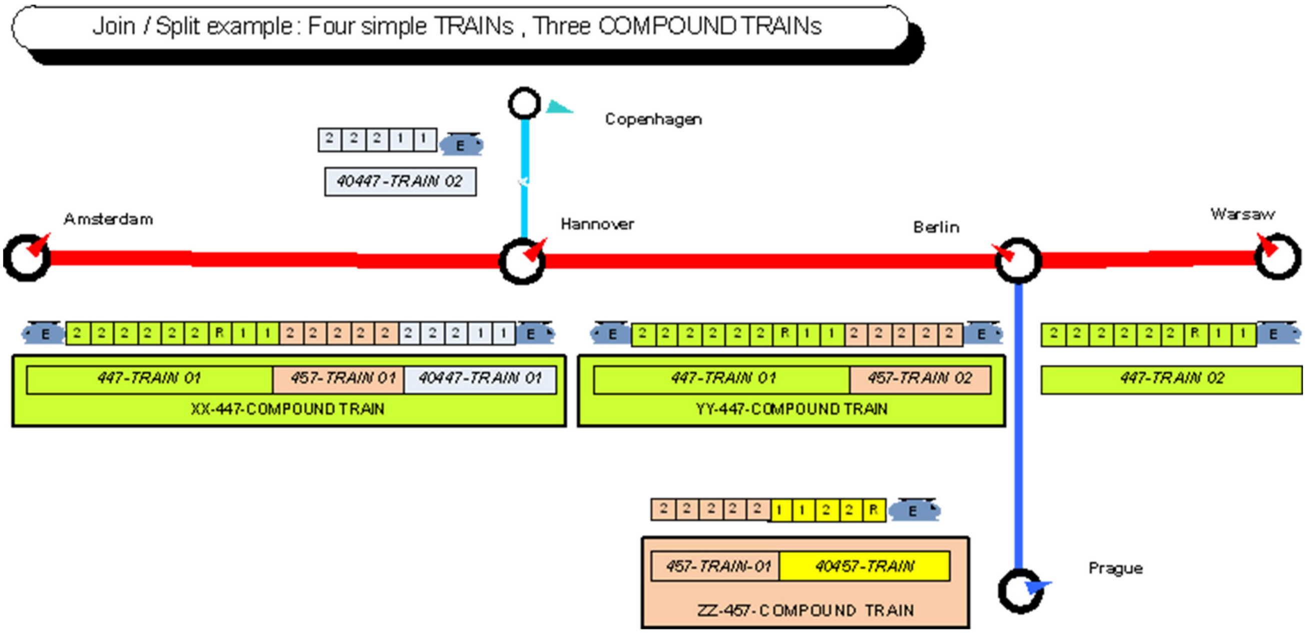

Figure 19 — Example – Journey meetings: Amsterdam to Warsaw (source NeTEx)

5.3.10 Flexible service

5.3.10.1 FLEXIBLE SERVICE – Conceptual model

Flexible transport (i.e. demand responsive transport) is characterized by flexible routing and scheduling. Flexible routing is described in [8].

Flexible services can operate on regular line topologies or on a flexible topology. They are defined by extending the regular services with additional flexibility information, through the TYPE OF FLEXIBLE JOURNEY object. If this information is attached to a SERVICE JOURNEY (through FLEXIBLE JOURNEY PROPERTIEs) then all the service is flexible, but if it is attached to POINT IN JOURNEY PATTERN, the SERVICE JOURNEY having FLEXIBLE JOURNEY PROPERTIEs will only be flexible on the indicated point (usually these POINTs IN JOURNEY PATTERN will also be SCHEDULED STOP POINTs). This can be used either for partially flexible service or for “mixed types of flexible service” inside the same JOURNEY.

Several types of flexible services are available:

— Fixed PASSING TIMEs (i.e. scheduled passing time: there is a timetable, but the service will only run under condition, mainly sufficient demand).

— Dynamic PASSING TIMEs.

— Fixed HEADWAY FREQUENCY (in this case, a maximum waiting time is available through a HEADWAY JOURNEY GROUP, but no passing times are defined, all is done dynamically depending on the demand).

A *NotFlexible* value indicates whether a POINT IN JOURNEY PATTERN is flexible or not.

Two additional properties can also be supplied:

1) whether cancellation is possible or not, even after booking (meaning that the Operator can decide to cancel a service or a stop, usually because there is not enough demand, or the service is too busy;

2) whether the PASSING TIME and place may be updated or not, even after booking (usually passing times update to optimize the service).

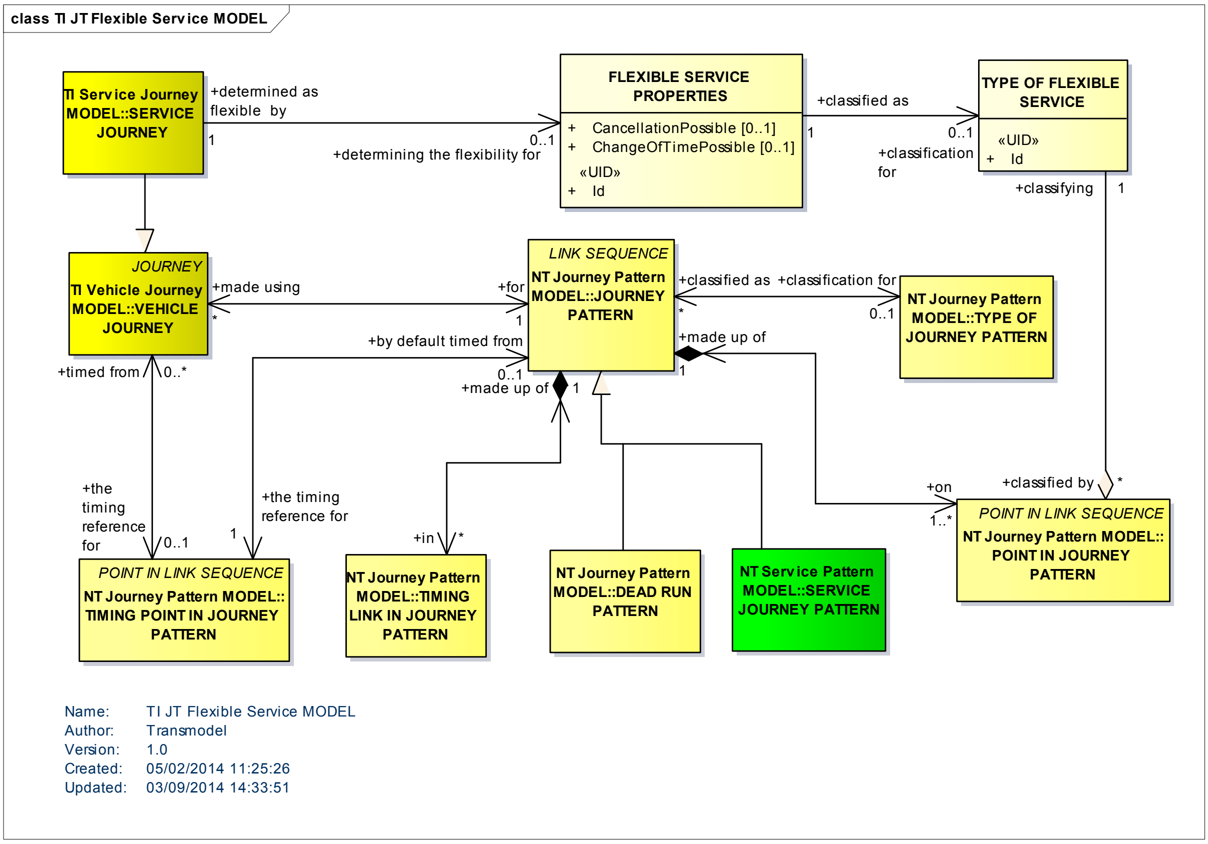

Figure 20 — Flexible service – Conceptual model (UML)

5.3.10.2 Flexible service example

There are numerous examples of flexible services. One of them is the TAD 118 (Tisséo, Toulouse area, France). The figure below provides a schematic map of this flexible service: the red points show the possible stops of the TAD 118 (depending on the demand) and the orange and green lines show the regular service (not flexible) lines.

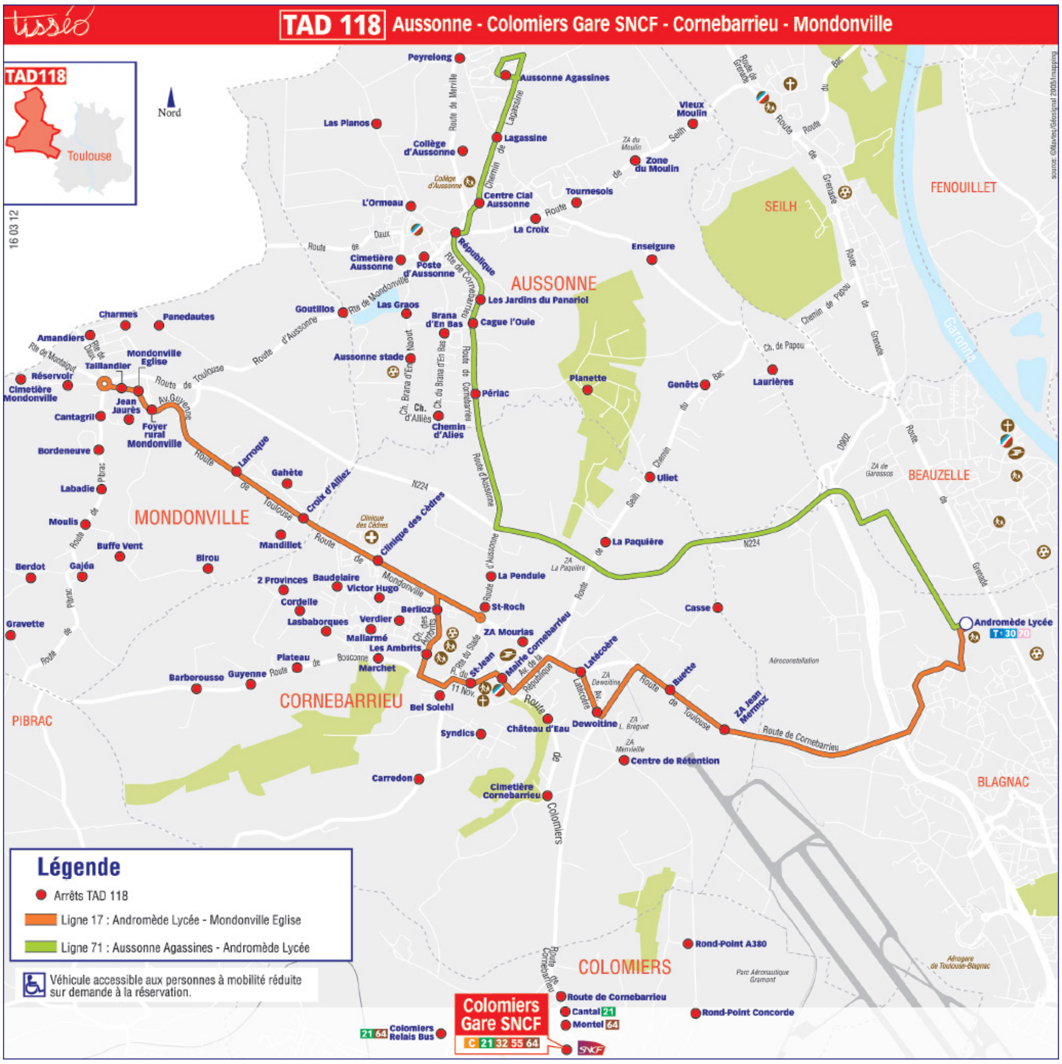

Figure 21 — Flexible service example: Tisseo TAD 118 with courtesy of Tisseo, data from August 2012 (Source NeTEx)

5.3.11 Journey accounting

The JOURNEY ACCOUNTING provides a set of parameters characterizing VEHICLE JOURNEYs or SPECIAL SERVICEs used for accounting purposes in particular in contracts between ORGANIZATIONs.

The accounting can be done based on the distance run by the JOURNEY, on its duration or on both.

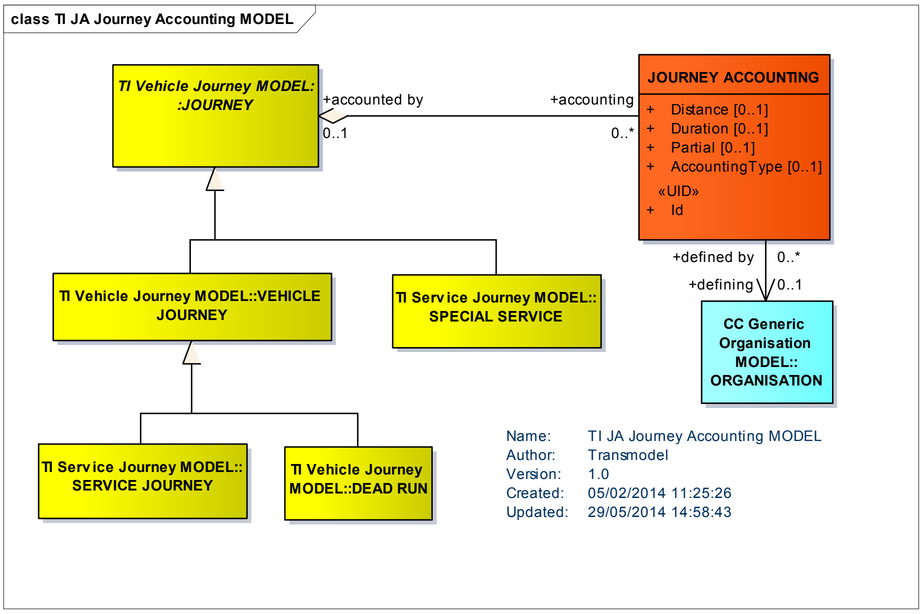

Figure 22 — Journey accounting – Conceptual model (UML)

5.4 Dated journey – Conceptual model

Many reasons lead to modifications of the operational plan in the short term: special events, changes in the road infrastructure, incidents, etc. Some VEHICLE JOURNEYs may be added or deleted, may use alternative or shortened ROUTEs and JOURNEY PATTERNs, occasional services may be added, etc. If these changes are only valid for one or a few days, the reference schedule for a DAY TYPE maybe is not modified, but the changes are only stored for the appropriate OPERATING DAYs: the DATED VEHICLE JOURNEY describes a vehicle journey planned for one specific OPERATING DAY (cf.[7]).

The NORMAL DATED VEHICLE JOURNEYs are based upon a VEHICLE JOURNEY, as produced for a DAY TYPE by the scheduling process. If there is no disturbance in the service, these normal journeys will be an exact image of the theoretical plan, applied to the specific OPERATING DAY. However, short-term modifications may be applied to these journeys, for instance when the controller decides to let a vehicle turn before the terminus. Such a control action updates the latest valid plan and produces a modified version of the DATED VEHICLE JOURNEY.

A DATED VEHICLE JOURNEY serves one JOURNEY PATTERN. The classification of JOURNEY PATTERNs through TYPE OF JOURNEY PATTERN may include some categories of occasional JOURNEY PATTERNs, to be used only by extra or modified DATED VEHICLE JOURNEYs (e.g. for occasionally shortened or deviated routes). In this situation, Transmodel allows the consideration of such occasional JOURNEY PATTERNs without any VEHICLE JOURNEYs operating them (for example, in the situation when a scheduling system sends these occasional JOURNEY PATTERNs to an AVMS which will use this information for operational control to create extra VEHICLE JOURNEYs serving them).

Figure 23 also describes some PASSING TIMEs although more detailed explanations of PASSING TIMEs are provided in 5.5.

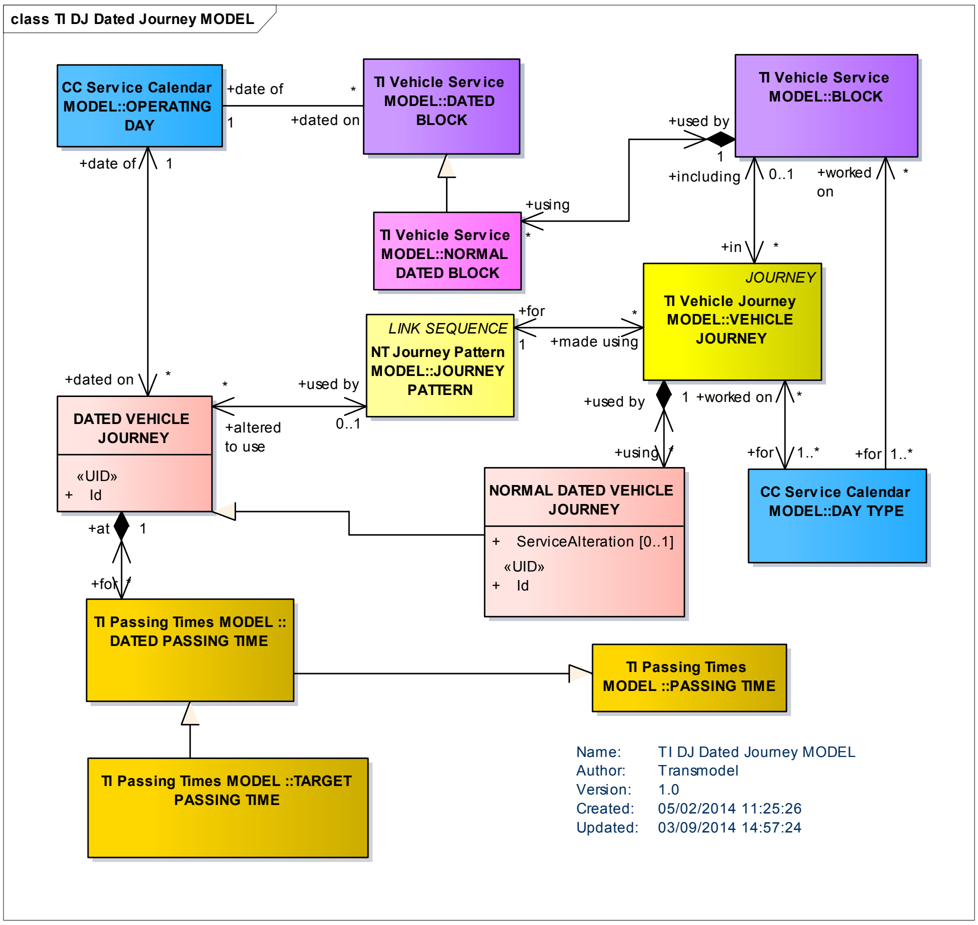

Figure 23 — Dated journey — Conceptual model (UML)

5.5 Passing times

5.5.1 Passing times

5.5.1.1 Timetabled passing times

PASSING TIMEs that are the result of the scheduling process and to be published in a timetable are called TIMETABLED PASSING TIMEs.

TIMETABLED PASSING TIMEs are normally generated a long time before the day of operation and are valid for a long period of time (e.g. summer, winter timetable). They are calculated for the planned NORMAL DATED VEHICLE JOURNEYs that were defined during the scheduling process. They also may be computed for any extra DATED VEHICLE JOURNEY created by a control action (the concept of CONTROL ACTION is discussed in Public Transport Reference Data Model - Operations Monitoring and Control).

The TIMETABLED PASSING TIMEs can be calculated for the TIMING POINTs that were used for scheduling, but they are often also generated through interpolation, for POINTs that were not defined as TIMING POINTs (for instance for all SCHEDULED STOP POINTs of a JOURNEY PATTERN). Therefore, a TIMETABLED PASSING TIME is defined for a POINT IN JOURNEY PATTERN that the journey in question is serving.

5.5.1.2 Actual passing times

The PASSING TIMEs that are computed on a specific OPERATING DAY are called DATED PASSING TIMEs. DATED PASSING TIME has several subtypes:

— TARGET PASSING TIME, the latest official plan for a DATED VEHICLE JOURNEY, on a POINT IN JOURNEY PATTERN;

— ESTIMATED PASSING TIME, a forecast for a monitored vehicle journey, on a POINT IN JOURNEY PATTERN;

— OBSERVED PASSING TIME, recorded for a monitored vehicle journey, at a particular POINT.

The concept of a monitored vehicle journey, i.e. a journey that is monitored and, according to the monitoring system capabilities, may be related to a DATED VEHICLE JOURNEY, or only to a JOURNEY PATTERN, is discussed in Public Transport Reference Data Model - Operations Monitoring and Control.

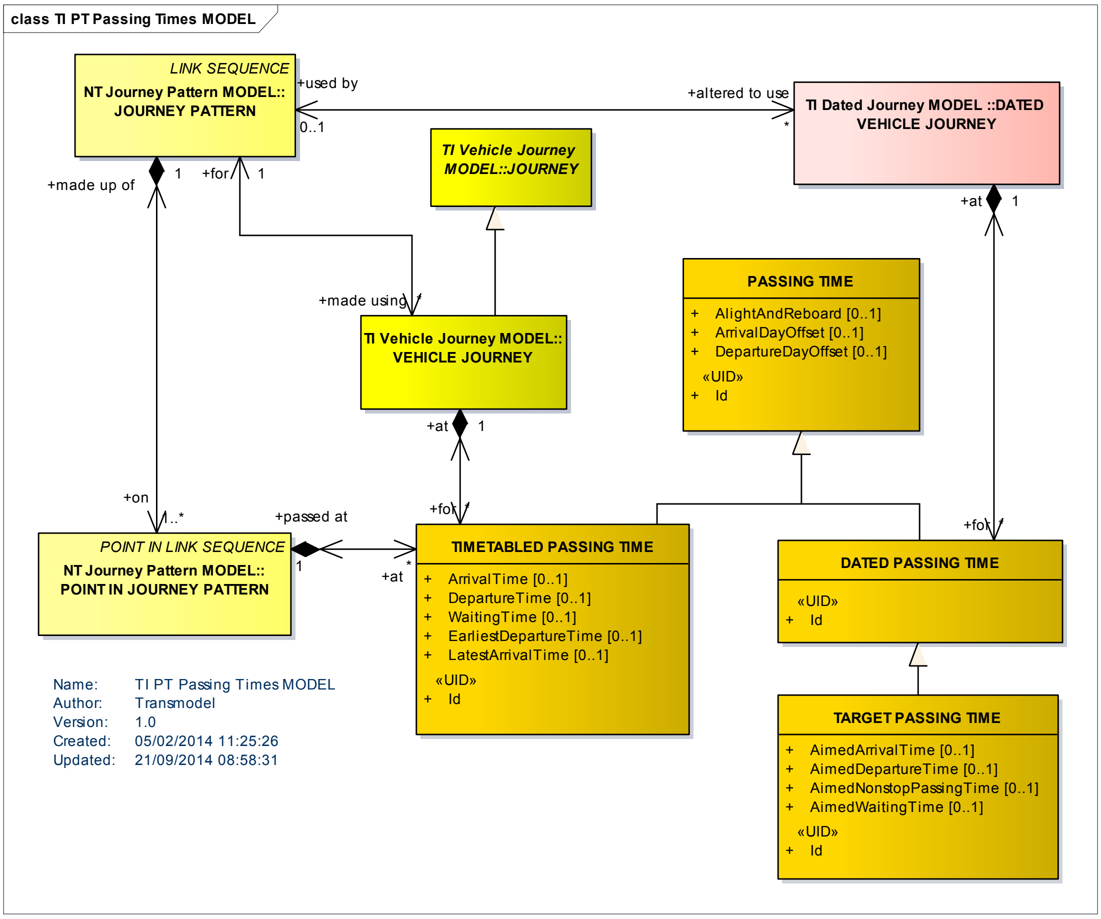

Figure 24 — Passing times — Conceptual model (UML)

5.5.1.3 Passing times attributes

The sub-types of PASSING TIME have several optional attributes, expressing the time value of a possible:

— arrival time;

— departure time;

— waiting time (in general associated to one of the previous two);

— non-stop passing time when the vehicle is not obliged to stop;

— latest arrival time, being the operator or authority commitment, and very useful for dynamic interchange management (e.g. for a journey planner), it also provides some accuracy information on the arrival time;

— earliest departure time, being the operator or authority commitment, and very useful for dynamic interchange management (e.g. for a journey planner), it also provides some accuracy information on the departure time.

In the operation of transport modes such as railway, ferry, etc., the functions carried out when a vehicle passes a stop point are much more complex than, for instance, in bus operations. Passengers may be allowed, when the stopping time is sufficient, to alight for a while (e.g. for refreshment) before resuming their trip on the same vehicle. Some facilities or some specific passenger information may be provided for such occasions.

A PASSING TIME may be a simple passage (e.g. of a bus at a stop point) or a longer stay (e.g. in a maritime port of call). The attribute *AlightAndReboard* expresses the possibility for a passenger to alight for a while, during the PASSING TIME of a VEHICLE JOURNEY at a particular SCHEDULED STOP POINT.

5.5.1.4 Timing computation of a journey

To compute the timing of a VEHICLE JOURNEY an initial TIMING POINT belonging to the JOURNEY PATTERN for the journey is chosen as a timing reference and a ‘departure time’ is specified for the journey at this point. An initial TIME DEMAND TYPE is chosen that applies for that moment in time. The standard run and wait times for the TIMING LINK to be applied for that TIME DEMAND TYPE are used to compute the time to the next TIMING POINT. The standard times for the TIMING LINKs may be overridden by specific times from the journey pattern, if they exist. The process is repeated for each TIMING POINT and each TIMING LINK in the JOURNEY PATTERN, if necessary changing the TIME DEMAND TYPE in effect at that time in the journey (and hence the wait and run times in effect). The VEHICLE JOURNEY is hence timed at all TIMING POINTs served by the JOURNEY PATTERN.

A journey that acts as a distributor journey for an incoming feeder journey may be further constrained as to its possible departure times by the JOURNEY MEETING or INTERCHANGE RULEs in effect for the meeting.

As already mentioned, not all the SCHEDULED STOP POINTs served by the JOURNEY PATTERN are necessarily TIMING POINTs. It is still useful to compute passing times at such intermediate SCHEDULED STOP POINTs. This is made by interpolation, taking into account, for instance, the distance between SCHEDULED STOP POINTs.

5.6 Vehicle scheduling

5.6.1 Tactical resource planning

The tactical planning of operations in public transport involves designing and building a reference schedule. This reference is defined for a given period (e.g. “full traffic”, or “summer holidays”) and for a given type of operating day (e.g. “weekday”). This phase takes place in “anticipated time”, before online implementation.

The two main activities of the tactical planning phase are:

— designing work plans for vehicles (vehicle scheduling);

— designing work plans for personnel (driver scheduling, described in public transport reference data model - driver scheduling, rostering, personnel disposition).

The elements describing work plans for vehicles are presented in the sections below.

5.6.2 Resources for tactical planning

The reference schedules are mainly described by:

— theoretically available (logical) resources;

— production activities (e.g. journey performance); and

— sets of activities (e.g. vehicle blocks or driver duties) attached to logical resources.

The most usual planning practice is to assign the activities included in a schedule to individual resources, supposed to perform these elementary activities. However, it is not possible or convenient for many functions to consider physical resources (a physical vehicle or a physical driver). Therefore, most plans are built on by assigning activities to a logical resource (logical vehicle or logical driver). A logical vehicle, for instance, is a theoretical anonymous vehicle, often only identified by a simple number within a schedule. The schedule components assigned to this logical vehicle describe all activities it is supposed to perform during a day. With this method, the management of vehicle assignments may be disconnected from the planning of operations.

According to the modelling of versions, a logical resource may be considered as a VERSION FRAME for versions of the work (cf. [7]). In this respect, logical vehicles and drivers may be defined for any TYPE OF VALIDITY. During the long-term design of the reference schedules, this type of validity corresponds to a DAY TYPE (other categories of TYPE OF VALIDITY for logical resources are described in the public transport reference data model - operations monitoring and control).

The work of a logical resource is usually described by various activity sets, each corresponding to a certain portion of work (e.g. BLOCK, etc.). These concepts are very useful for the planning and the management of resources. However, they may not be relevant in other functional contexts (e.g. passenger information).

The reference schedules relate to several types of resources. Vehicles and drivers (involved in the supply production) are the most frequently considered and form the basis of the reference data model. Many other types of resources may be referred to in the schedules. Among those in direct relation with the production process (i.e. excluding sales or information duties, for instance), plans for conductors, controllers or maintenance staff may be designed. These are not covered by the current version of the reference data model.

5.6.3 Vehicle service

5.6.3.1 VEHICLE SERVICE – Conceptual model

The whole work of a logical vehicle for a DAY TYPE is described by a VEHICLE SERVICE, composed of one or several VEHICLE SERVICE PARTs.

Three levels of activities (BLOCK, VEHICLE SERVICE PART, and VEHICLE SERVICE) are possible, but will not always be described. The concept of VEHICLE SERVICE is not strictly necessary, once the number of required vehicles has been optimized and, in many situations, the distinction between BLOCK and VEHICLE SERVICE PART is not useful. Therefore quite often only a subpart of this model will be used (e.g. BLOCK).

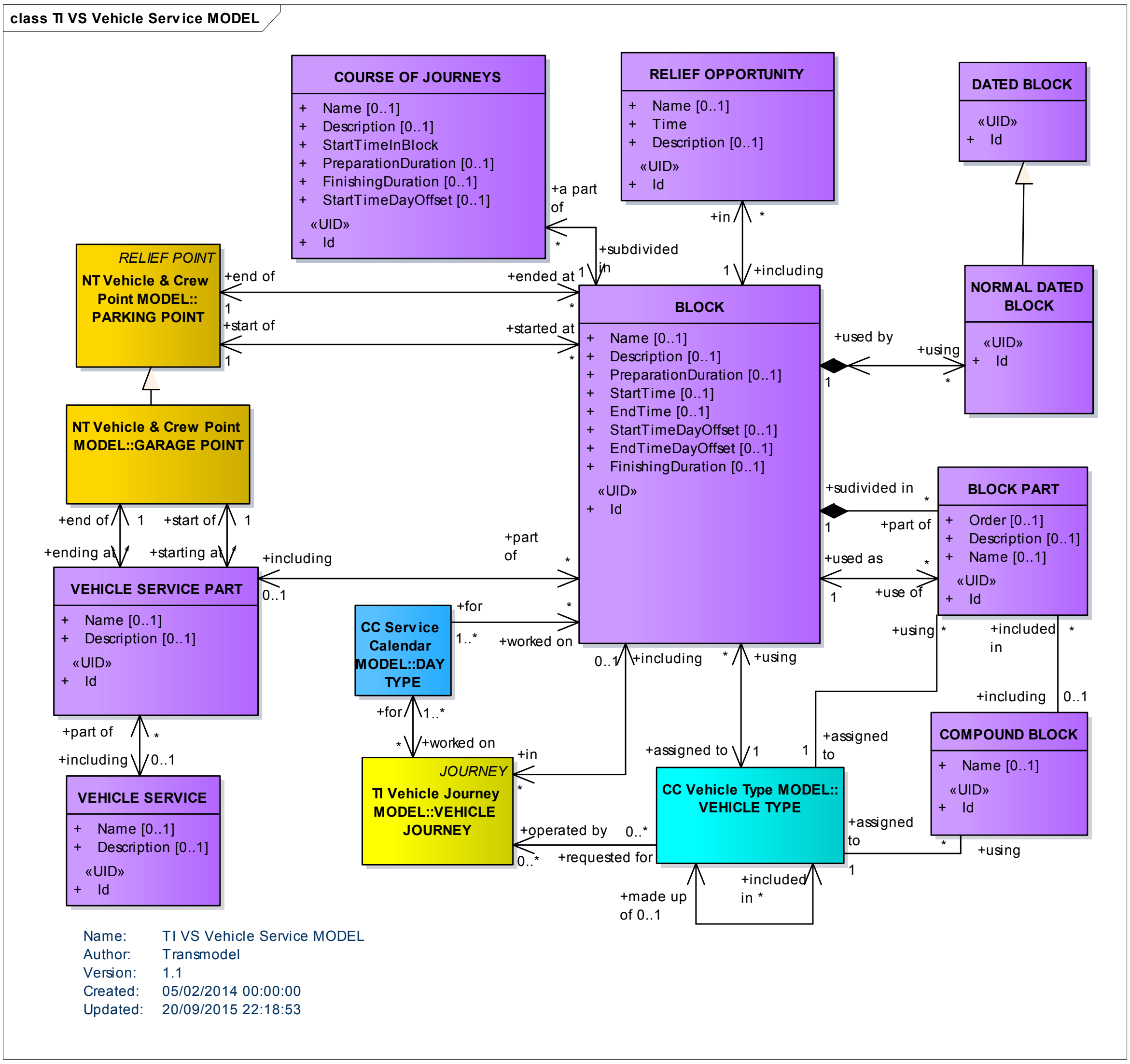

Figure 25 — Vehicle service – Conceptual model (UML)

5.6.3.2 Block

In vehicle planning for day types, the activities of a logical vehicle are grouped into BLOCKs, which describe continuous periods during which, in principle, the vehicle constantly requires a driver. A BLOCK starts from the time it leaves a PARKING POINT (cf.[8]) and ends at the time it returns to park at this or another PARKING POINT.

A BLOCK includes in particular all VEHICLE JOURNEYs (SERVICE JOURNEYs and DEAD RUNs) planned for this period. It also may include SPECIAL SERVICEs. Between two journeys or services, a pause may be planned, during which the driver is still responsible for the vehicle.

A necessary constraint is that all VEHICLE JOURNEYs included in a BLOCK shall refer to the same DAY TYPE. The DAY TYPE of a BLOCK may hence be derived from the DAY TYPE of the VEHICLE JOURNEYs it includes.

Some operators also distinguish sequences of BLOCKs starting and ending in a garage (i.e. the end points shall be GARAGE POINTs (cf.[8]), but not necessarily a real garage). Such a VEHICLE SERVICE PART may be composed, for instance, of two BLOCKs, separated by a parking period spent, without any driver, at a PARKING POINT which is not a GARAGE POINT (e.g. parking periods at off-peak hours for buses, at a parking point in the city). This concept is useful when no maintenance facility is available at this PARKING POINT or if only a few parking places are available: the physical VEHICLE assigned to this VEHICLE SERVICE PART may not be maintained or exchanged during the parking period without a relatively complex action.

5.6.3.3 Relief opportunity

One BLOCK for a vehicle may last for many hours or even the whole day. Drivers cannot work such long hours and arrangements shall be made to relieve drivers during the BLOCKs. RELIEF POINTs (cf.[8]) are predefined for this purpose. Every point of time within a BLOCK when the vehicle passes a RELIEF POINT is known as a RELIEF OPPORTUNITY. RELIEF OPPORTUNITies may or may not be taken for actually relieving the driver. Each RELIEF OPPORTUNITY will occur at a RELIEF POINT that is viewed as a TIMING POINT IN JOURNEY PATTERN (cf.[8]).

5.6.3.4 Course of journeys

Another classical method of designing the work of logical vehicles uses the concept of COURSE OF JOURNEYS. This method starts with the definition of VEHICLE JOURNEYs for all the LINEs of an ORGANIZATIONAL UNIT (e.g. a depot, or even the whole network). All these VEHICLE JOURNEYs are then chained into suitable BLOCKs of vehicle operation. As a result of this method, one BLOCK is likely to be operated on several (or even many) different LINEs.

A COURSE OF JOURNEYS is a part of a BLOCK continuously operated on one single LINE, without any interruption. Thus, a BLOCK will include several COURSEs OF JOURNEYS if it consists of VEHICLE JOURNEYs serving more than one LINE.

In some cases, BLOCKs are subdivided into COURSEs OF JOURNEYS using additional criteria, e.g. change of the driver or other (arbitrarily chosen) events or situations. An (optional) attribute giving the start time of a COURSE OF JOURNEYS in the BLOCK will then determine which journeys are included in that course.

Any COURSE OF JOURNEYS shall include only VEHICLE JOURNEYs belonging to the same BLOCK, hence defined for the same DAY TYPE. This entity is hence valid for one DAY TYPE only.

5.6.3.5 Vehicle types and blocks

A VEHICLE TYPE characterizes the common properties of a defined class of public transport vehicle (cf.[7]). The most relevant properties for scheduling are the seating and standing capacities.

Depending on the time of day at which a SERVICE JOURNEY takes place, and on the ROUTE and JOURNEY PATTERN it covers, a default VEHICLE TYPE may be proposed for this journey. The most suitable VEHICLE TYPE will be chosen to meet the demand at various periods of the day, whenever possible. For instance, articulated or double-deck buses will be preferred to standard buses on the lines where the demand is greatest, especially at peak hours.

However, practical limitations, in particular of infrastructure, will also orient the choice of a VEHICLE TYPE, depending on its size: minibuses will be chosen for routes passing through narrow streets, while double-deck buses could not be used where the available height in tunnels is not sufficient. In rail systems, for instance, the VEHICLE TYPE shall be compatible with the length of stations and the height of platforms.

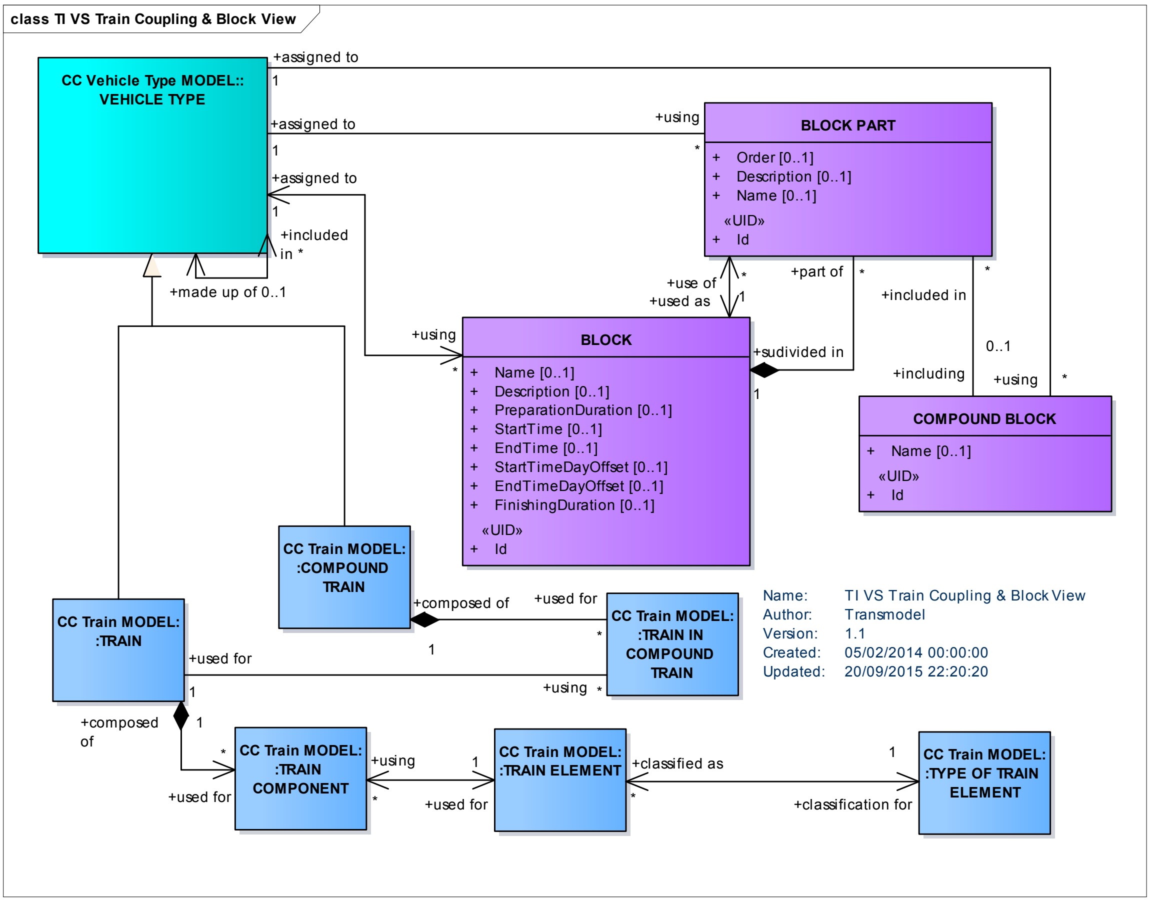

Figure 26 — Train coupling and block view (UML)

Vehicles of the type TRAIN or COMPOUND TRAIN may be coupled or separated. As regards the corresponding journeys, COUPLED JOURNEYs or JOURNEY PARTs are created.

A BLOCK PART is a part of a BLOCK corresponding to the different JOURNEY PARTs of the VEHICLE JOURNEYs in a BLOCK.

One or several vehicle BLOCKs may be coupled together for a while. The entity COMPOUND BLOCK represents the work of a vehicle during the time it is coupled to one or more vehicles. If two different vehicles are coupled at a certain point (e.g. a terminus), a COMPOUND BLOCK is created from that instant on. If this COMPOUND BLOCK is joined by a third BLOCK, coupled later at another point COMPOUND BLOCK, a new COMPOUND BLOCK is formed from that instant on. If one of the BLOCKs is separated before the COMPOUND BLOCK returns to the GARAGE, another COMPOUND BLOCK is formed, composed of the two BLOCKs corresponding to the coupled vehicles.

The composition of a COMPOUND BLOCK is described thanks to the entity BLOCK PART. Each BLOCK PART represents the position (attribute 'order') of a particular BLOCK within a COMPOUND BLOCK.

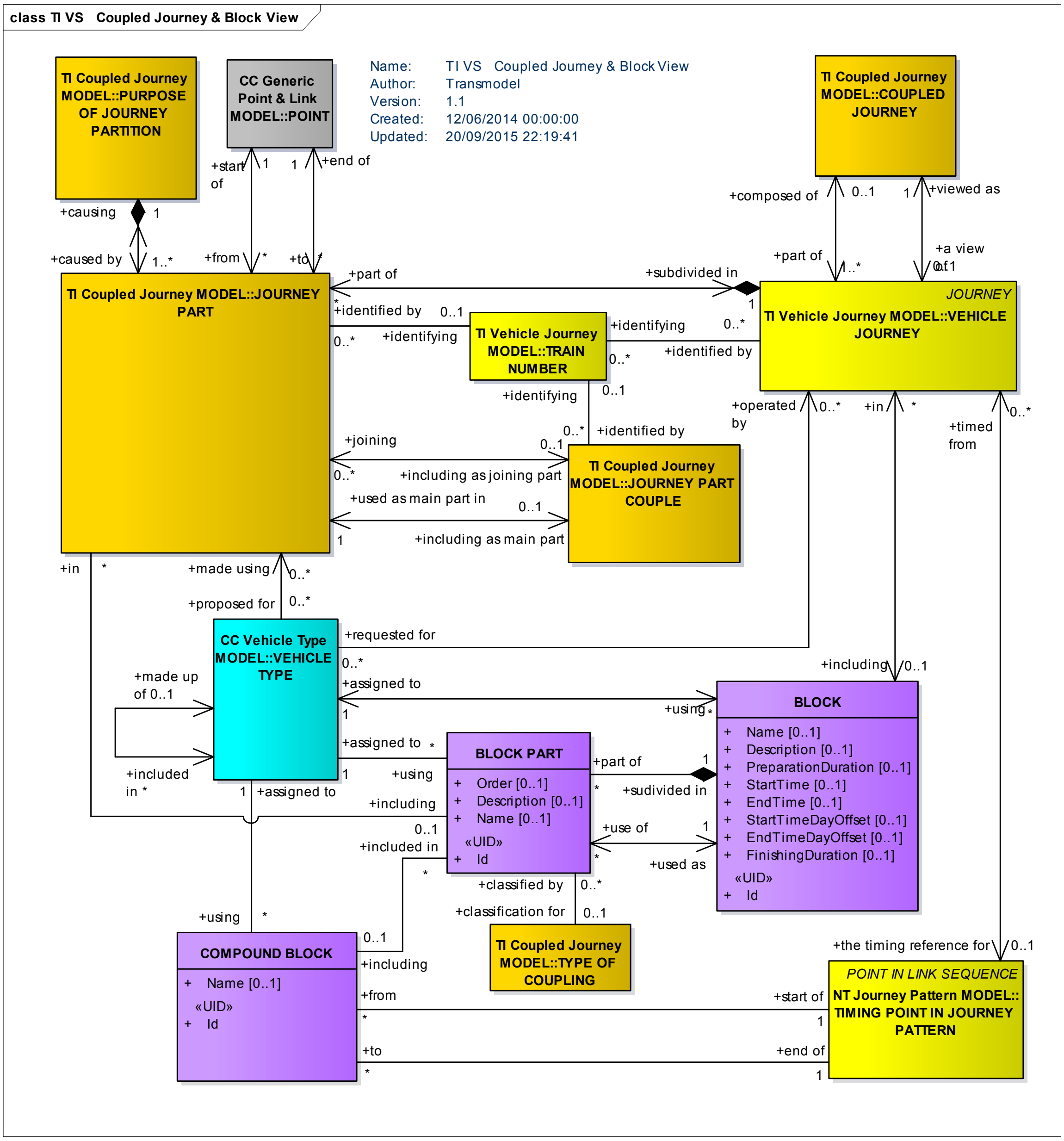

Figure 27 — Coupled journey and block view (UML)

5.6.3.6 Examples of journey parts and block parts

The detailed train makeup can be related to the JOURNEY PARTs using JOURNEY PART COUPLEs and BLOCK PARTs. Here we show the Amsterdam to Warsaw elements.

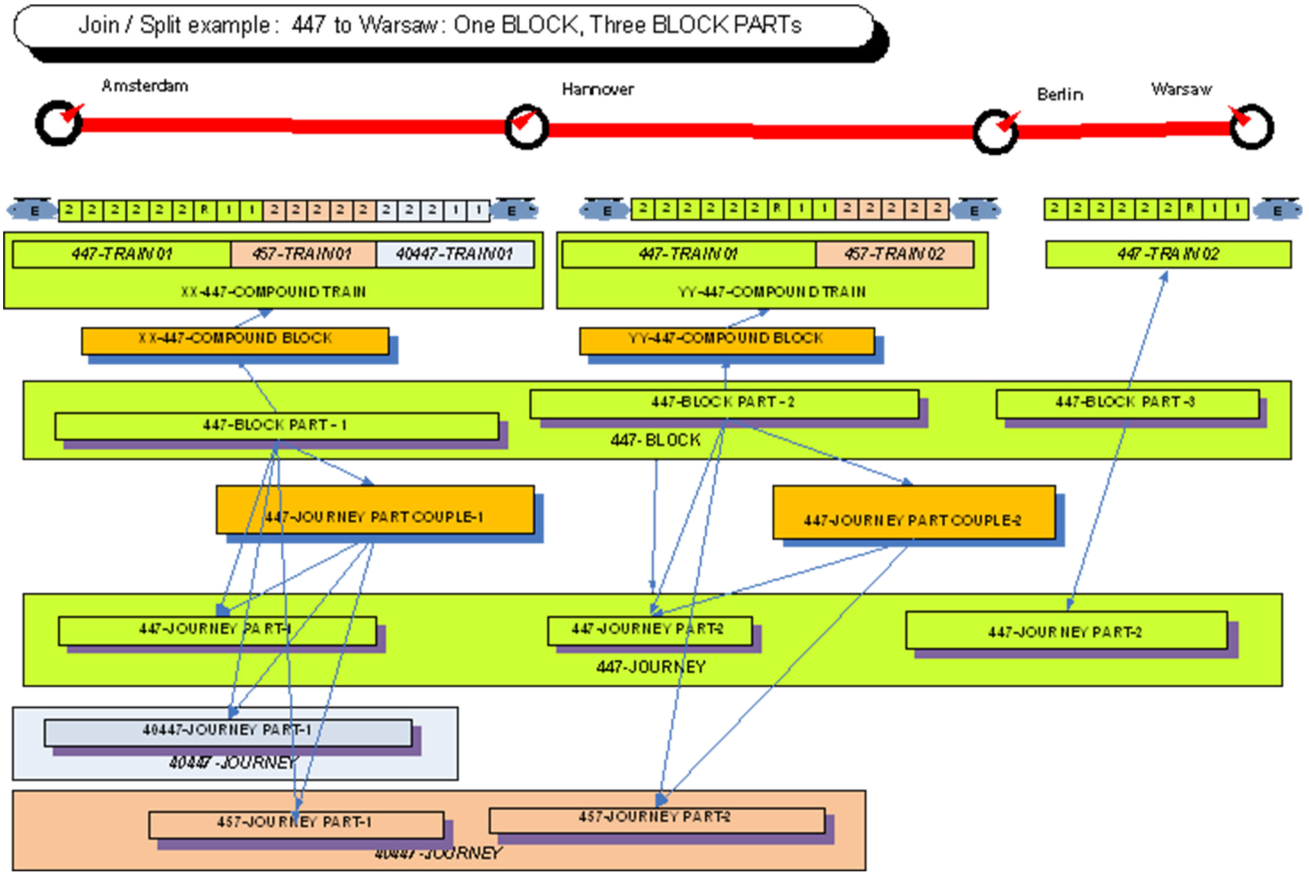

Figure 28 — Example – Train block parts and journey part couples: Amsterdam to Warsaw (source NeTEx)

Here we show the Amsterdam to Copenhagen elements.

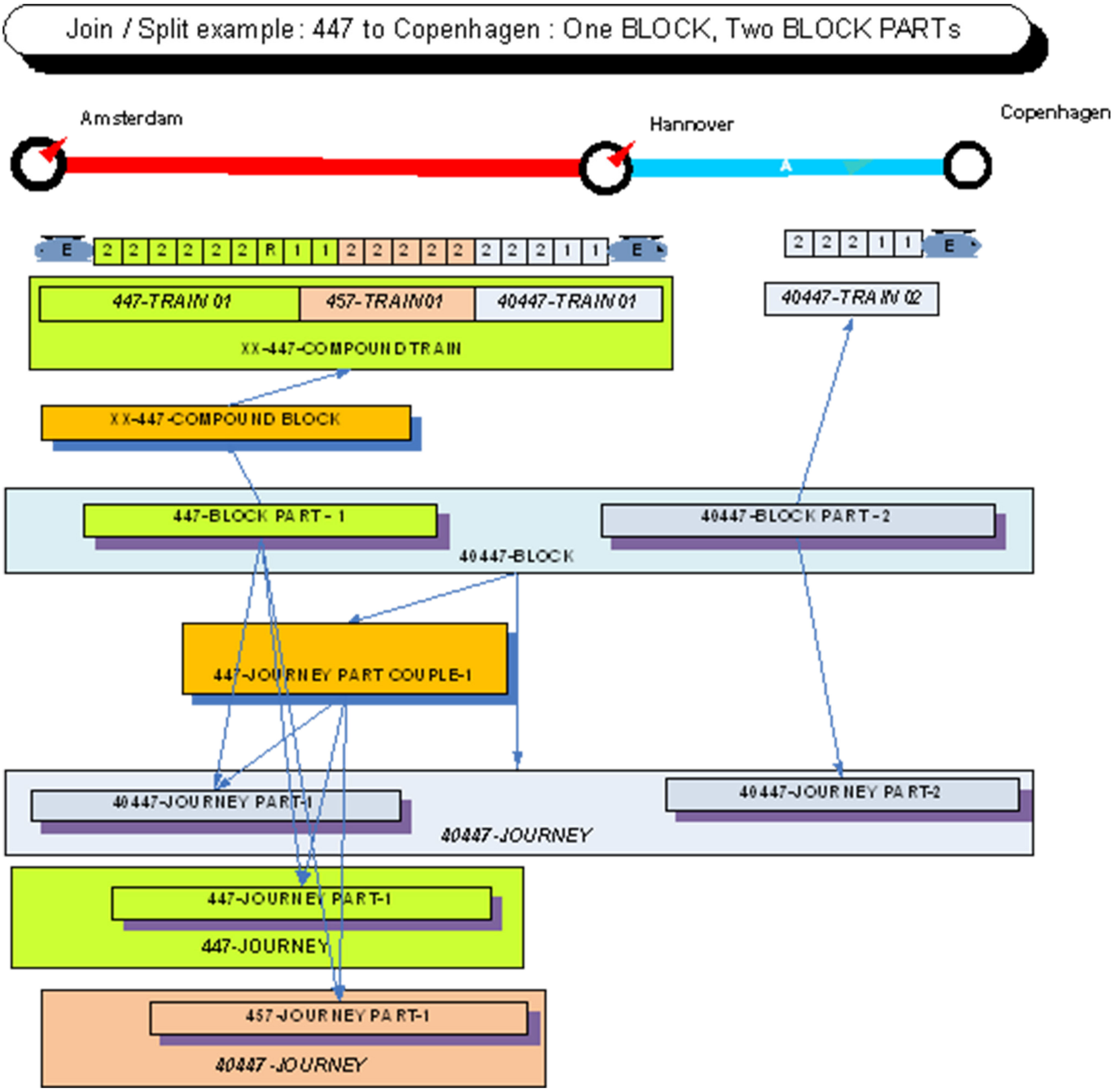

Figure 29 — Example – Train block parts and journey part couples: Amsterdam to Copenhagen (source NeTEx)

5.7 Vehicle journey assignments

5.7.1 Train component label assignment

5.7.1.1 TRAIN COMPONENT LABEL ASSIGNMENT – Conceptual model

For passenger information purposes, vehicles may display particular labels easily recognized by passengers. In rail operation, these labels have particular importance when boarding. The labels, often numbers, are different from numbers determined by the concept of TRAIN NUMBER.

Figure 30 clarifies the situation for the case when two TRAINs are coupled. Arbitrarily chosen labels are assigned to the particular coaches.

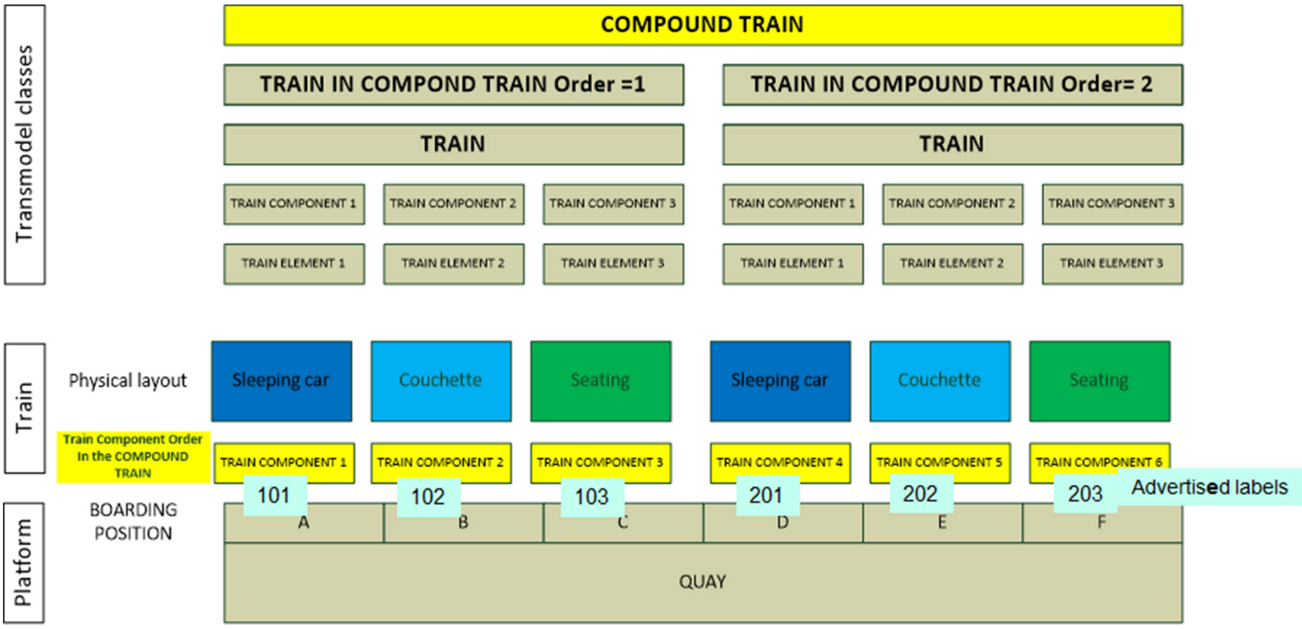

Figure 30 — Example of label assignment

This assignment occurs for a particular VEHICLE JOURNEY as shown on Figure 31:

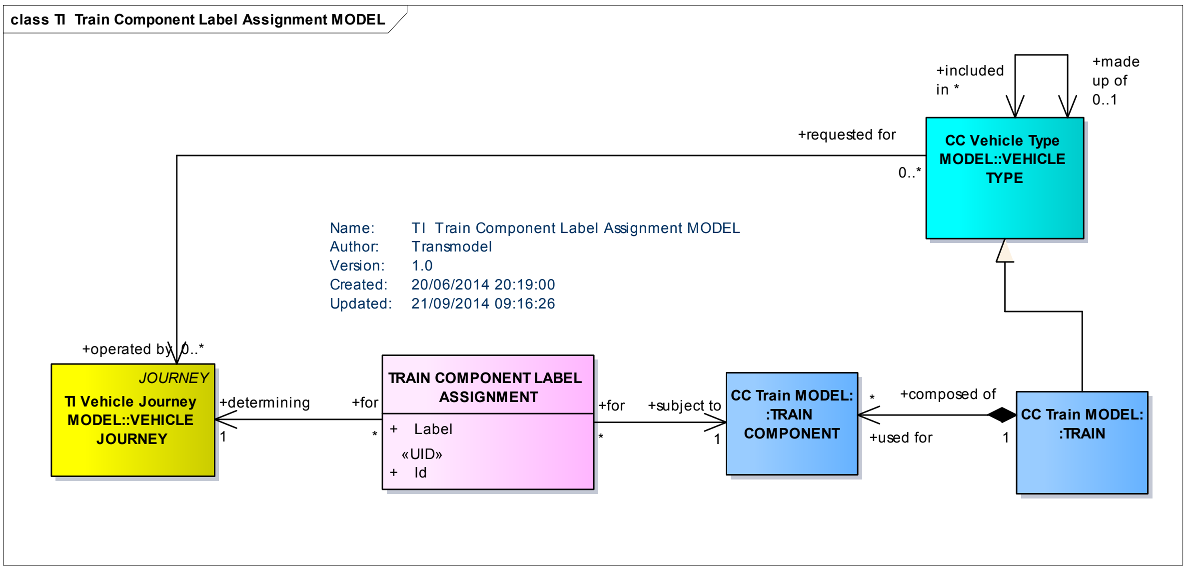

Figure 31 — Train component label assignment – Conceptual model

5.7.2 Stopping position assignment

Fixed locations dedicated to the stopping of vehicles at STOP PLACEs have been described as VEHICLE STOPPING POSITIONs ([8]). Such locations may be specified as a ZONE corresponding to the bounding polygon of the vehicle, or one or more POINTs corresponding to parts of the vehicle such as a door. If given as a single point, a VEHICLE STOPPING POSITION indicates the position for the door relative to an indicated side of the vehicle.

The assignment of a particular VEHICLE STOPPING POSITION to a vehicle of a VEHICLE TYPE depends on VEHICLE JOURNEY. Such an assignment shall take into account the orientation of the vehicle at a stopping location for a particular VEHICLE JOURNEY (relative to the original orientation of the vehicle). This is represented in Figure 32.

For complex VEHICLE TYPEs, the positions of the different components (TRAIN ELEMENTs) may be derived using the physical structure and characteristics of the vehicle.

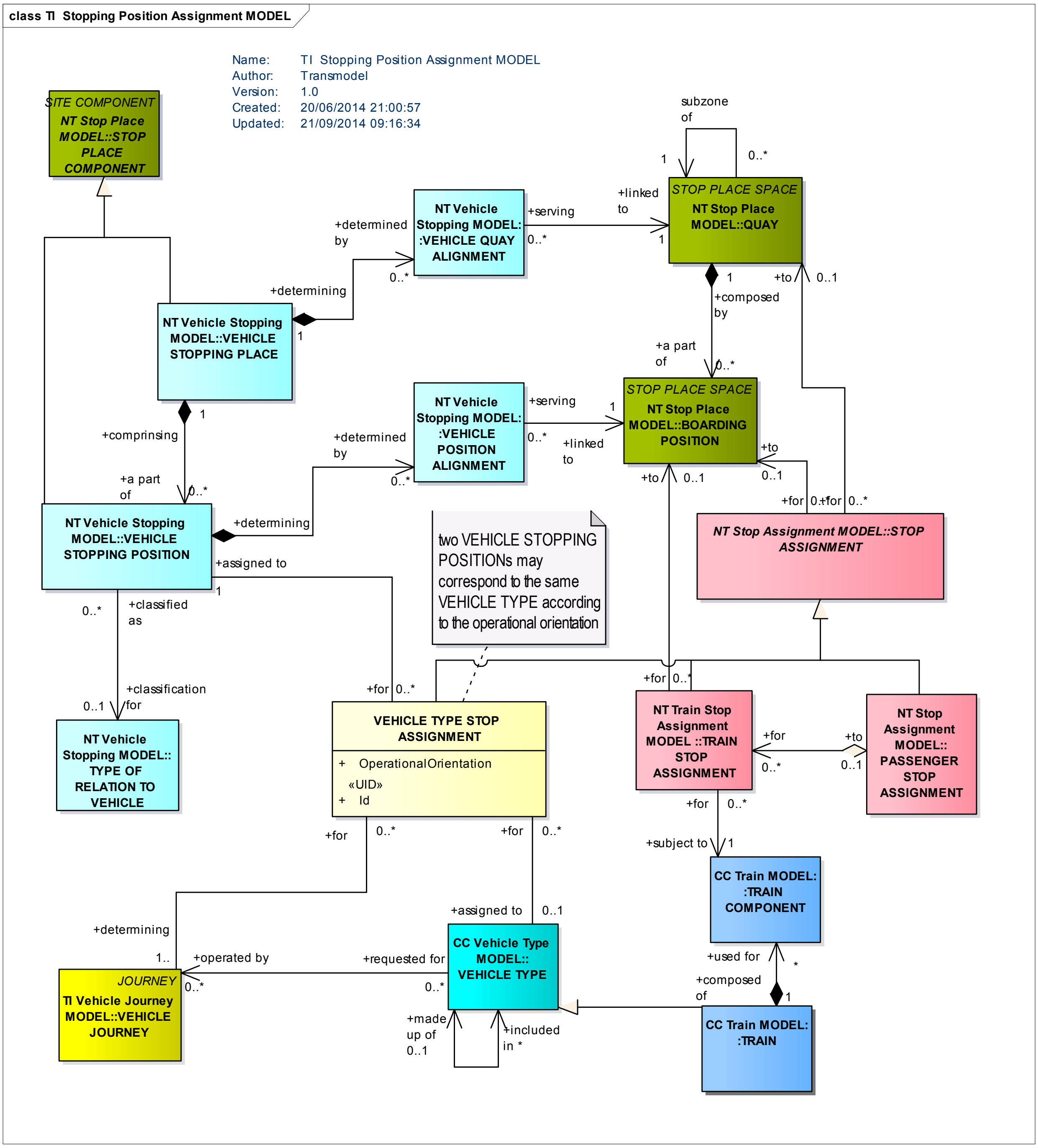

Figure 32 — Stopping position assignment – Conceptual model

5.8 Explicit frames

5.8.1 Timetable frame

The timing information model describes the VEHICLE JOURNEYs and other components making up a timetable. Several data instances referring to these elements may be grouped together for the purpose of a more efficient data management in a database or for data exchanges.

Such groupings are called VERSION FRAMEs and are presented in the reference data model for public Transport– Part 1: Common concepts.

Several explicit VERSION FRAMEs have been defined. One of them is the TIMETABLE FRAME.

The conceptual data model of the TIMETABLE FRAME is shown in Figure 33 in order to represent an overview of the major relevant concepts in the context of Timing Information.

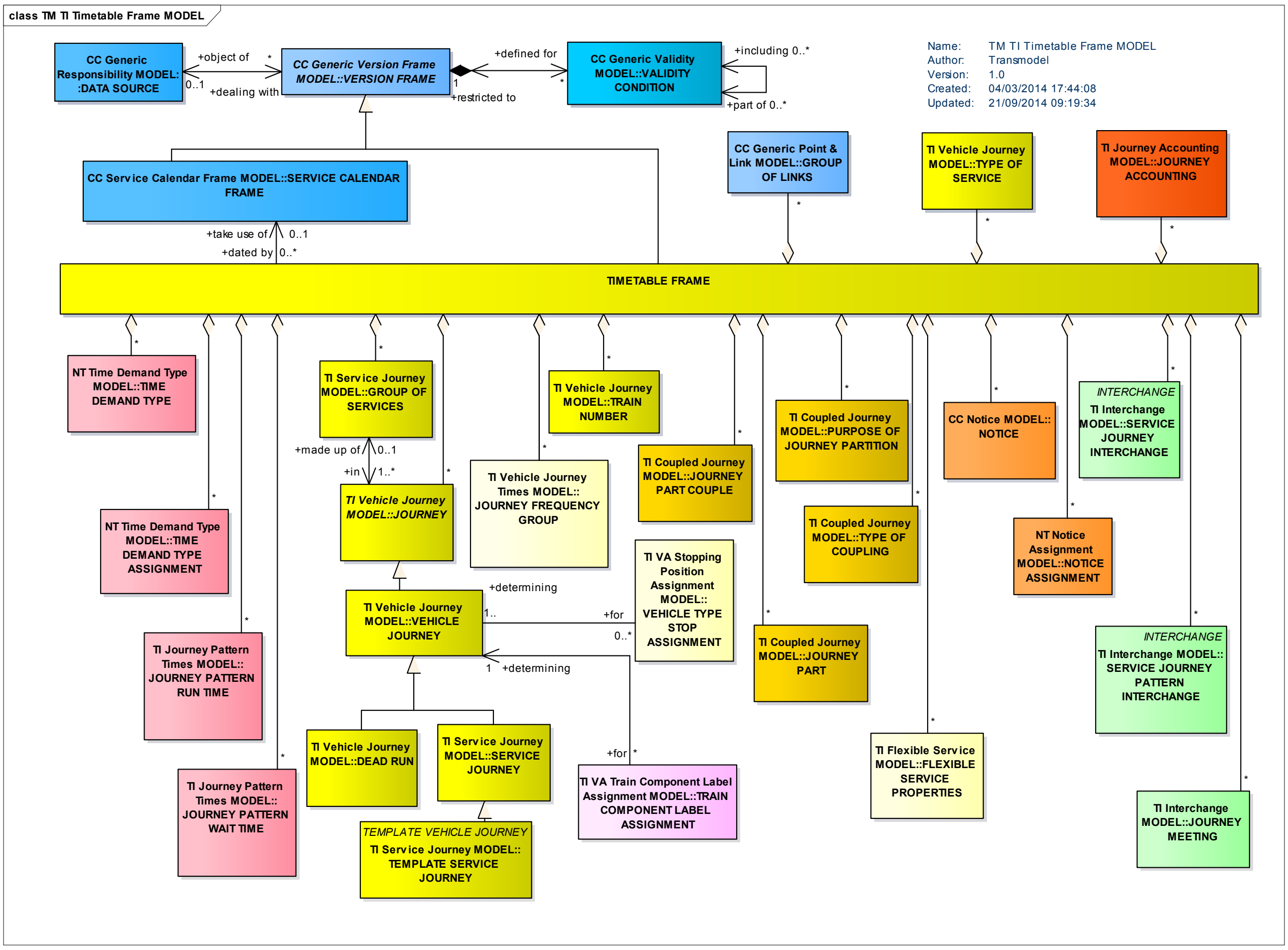

Figure 33 — Timetable frame – Conceptual model (UML)

5.8.2 Vehicle schedule frame

The elements of the VEHICLE SCHEDULE model can be grouped within a VEHICLE SCHEDULE FRAME which holds a coherent set of vehicle related elements, including BLOCKs, COURSEs of JOURNEY, and VEHICLE SERVICE.

The concept of VERSION FRAME is described in Public transport reference data model - Part 1: Common concepts.

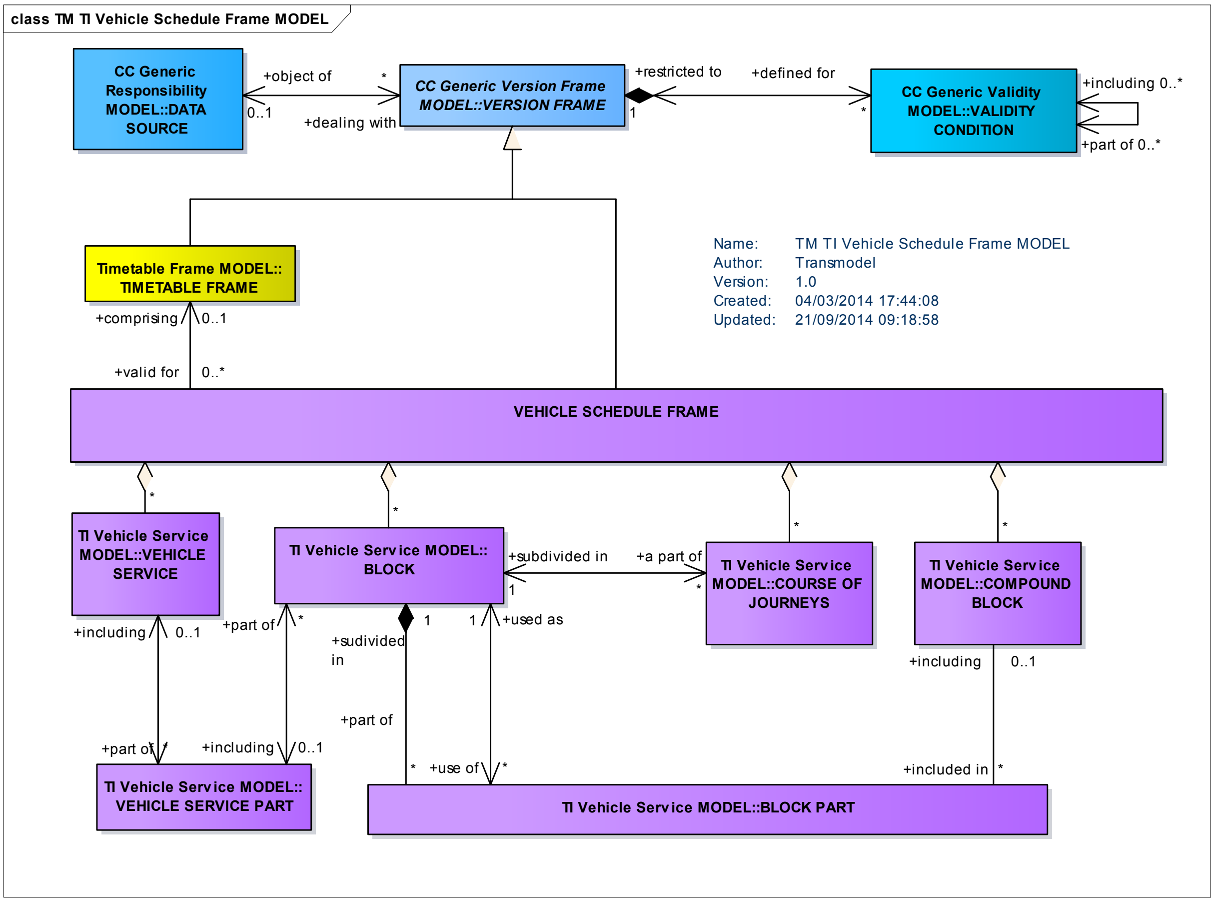

Figure 34 — Vehicle schedule frame – Conceptual model (UML)

Annex A
(normative)

Data Dictionary

In addition to the definitions given in [7] and [8], the following definitions apply for this standard:

BLOCK (TI Vehicle Service MODEL)

The work of a vehicle from the time it leaves a PARKING POINT after parking until its next return to park at a PARKING POINT. Any subsequent departure from a PARKING POINT after parking marks the start of a new BLOCK. The period of a BLOCK has to be covered by DUTies.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Name	*MultilingualString*	0:1
	Description	*MultilingualString*	0:1
	PreparationDuration	*duration*	0:1
	StartTime	*time*	0:1
	EndTime	*time*	0:1
	StartTimeDayOffset	*DayOffsetType*	0:1
	EndTimeDayOffset	*Integer*	0:1
	FinishingDuration	*duration*	0:1

BLOCK PART (TI Vehicle Service MODEL)

Part of a BLOCK corresponding to the different JOURNEY PARTs of the VEHICLE JOURNEYs in a BLOCK.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Order	*integer*	0:1
	Description	*MultilingualString*	0:1
	Name	*MultilingualString*	0:1

COMPOUND BLOCK (TI Vehicle Service MODEL)

The work of a vehicle during the time it is coupled to another vehicle.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Name	*MultilingualString*	0:1

COUPLED JOURNEY (TI Coupled Journey MODEL)

A complete journey operated by a coupled train, composed of two or more VEHICLE JOURNEYs remaining coupled together all along a JOURNEY PATTERN. A COUPLED JOURNEY may be viewed as a single VEHICLE JOURNEY.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Name	*MultilingualSrring*	0:1
	Description	*MultilingualString*	0:1

COURSE OF JOURNEYS (TI Vehicle Service MODEL)

A part of a BLOCK composed of consecutive VEHICLE JOURNEYs defined for the same DAY TYPE, all operated on the same LINE.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Name	*MultilingualString*	0:1
	Description	*MultilingualString*	0:1
	StartTimeInBlock	*time*	1:1
	PreparationDuration	*duration*	0:1
	FinishingDuration	*duration*	0:1
	StartTimeDayOffset	*DayOffsetType*	0:1

DATED BLOCK (TI Vehicle Service MODEL)

The work of a vehicle on a particular OPERATING DAY from the time it leaves a PARKING POINT after parking until its next return to park at a PARKING POINT.

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

DATED PASSING TIME (TI Passing Times MODEL)

A PASSING TIME on a particular OPERATING DAY.

Inherits from *(empty if no inheritance)*: ***PASSING TIME***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

DATED VEHICLE JOURNEY (TI Dated Journey MODEL)

A particular journey of a vehicle on a particular OPERATING DAY including all modifications possibly decided by the control staff.

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

DEAD RUN (TI Vehicle Journey MODEL)

A non-service VEHICLE JOURNEY.

Inherits from *(empty if no inheritance)*: ***VEHICLE JOURNEY***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	DirectionType	*DirectionTypeEnum*	0:1
	DeadRunType	*DeadRunTypeEnum*	0:1

DEFAULT DEAD RUN RUN TIME (TI Time Demand Times MODEL)

The time taken to traverse a TIMING LINK during a DEAD RUN, for a specified TIME DEMAND TYPE. This time may be superseded by the JOURNEY PATTERN RUN TIME or VEHICLE JOURNEY RUN TIME if these exist.

Inherits from *(empty if no inheritance)*: ***JOURNEY TIMING***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		0:1
	RunTime	*duration*	1:1

DEFAULT INTERCHANGE (TI Interchange MODEL)

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

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Description	*MultlingualString*	1:1
	MaximumDuration	*duration*	0:1
	StandardDuration	*duration*	0:1

DEFAULT SERVICE JOURNEY RUN TIME (TI Time Demand Times MODEL)

The default time taken by a vehicle to traverse a TIMING LINK during a SERVICE JOURNEY, for a specified TIME DEMAND TYPE. This time may be superseded by the JOURNEY PATTERN RUN TIME or VEHICLE JOURNEY RUN TIME if these exist.

Inherits from *(empty if no inheritance)*: ***JOURNEY TIMING***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		0:1
	RunTime	*duration*	1:1

FLEXIBLE SERVICE PROPERTIES (TI Flexible Service MODEL)

Additional characteristics of flexible service. A service may be partly fixed, partly flexible.

Inherits from *(empty if no inheritance)*:			
Classif	**Name**	**Type**	**cardinality**

i-cation			
«UID»	***Id***		1:1
	CancellationPossible	*boolean*	0:1
	ChangeOfTimePossible	*boolean*	0:1

GROUP OF SERVICES (TI Service Journey MODEL)

A group of SERVICEs, often known to its users by a name or a number.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	DirectionType	*DirectionTypeEnum*	0:1

HEADWAY INTERVAL (TI Vehicle Journey Times MODEL)

A time interval or a duration defining a headway period and characterizing HEADWAY JOURNEY GROUP (e.g. every 10 min, every 4-6 min).

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	ScheduledHeadwayInterval	*duration*	0:1
	MinimumHeadwayInterval	*duration*	0:1
	MaximumHeadwayInterval	*duration*	0:1

HEADWAY JOURNEY GROUP (TI Vehicle Journey Times MODEL)

A group of VEHICLE JOURNEYs following the same JOURNEY PATTERN having the same HEADWAY INTERVAL between a specified start and end time (for example, every 10 min). This is especially useful for passenger information.

Inherits from *(empty if no inheritance)*: ***JOURNEY FREQUENCY GROUP***			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	HeadwayDisplay	*HeadwayUseEnum*	0:1

INTERCHANGE (TI Interchange MODEL)

The scheduled possibility for transfer of passengers at the same or different SCHEDULED STOP POINTs.

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Name	*MultlingualString*	0:1
	Description	*MultlingualString*	0:1
	Priority	*InterchangePriorityType*	0:1
	StaySeated	*boolean*	0:1
	CrossBorder	*boolean*	0:1
	Planned	*boolean*	0:1
	Guaranteed	*ConnectionCertaintyEnum*	0:1
	Advertised	*boolean*	0:1
	Controlled	*boolean*	0:1
	TransferModes	*AccessModeEnum*	0:1
	DistributorMaxWaitDuration	*duration*	0:1

INTERCHANGE RULE (TI Interchange Rule MODEL)

Conditions for considering JOURNEYs to meet or not to meet, specified indirectly: by a particular MODE, DIRECTION or LINE. Such conditions may alternatively be specified directly, indicating the corresponding services. In this case they are either a SERVICE JOURNEY PATTERN INTERCHANGE or a SERVICE JOURNEY INTERCHANGE.

Inherits from *(empty if no inheritance)*: ***INTERCHANGE***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	MaximumWindow	*duration*	0:1
	Exclude	*boolean*	0:1
	Priority	*integer*	0:1

INTERCHANGE RULE PARAMETER (TI Interchange Rule MODEL)

Assignment of parameters characterizing an INTERCHANGE RULE.

Inherits from *(empty if no inheritance)*:

Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	MaximumInterchangeWindow	*duration*	0:1

INTERCHANGE RULE TIMING (TI Interchange Rule MODEL)

Timings for an INTERCHANGE RULE for a given TIME DEMAND TYPE or TIME BAND.

Inherits from *(empty if no inheritance)*: ***JOURNEY TIMING***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

JOURNEY (TI Vehicle Journey MODEL)

Common properties of VEHICLE JOURNEYs and SPECIAL SERVICEs, e.g. their link to accounting characteristics.

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Description	*MultilingualString*	0:1
	TransportMode	*VehicleModeEnum*	0:1
	TransportSubmode	*TransportSubMode*	0:1
	Monitored	*boolean*	0:1

JOURNEY ACCOUNTING (TI Journey Accounting MODEL)

Parameters characterizing VEHICLE JOURNEYs or SPECIAL SERVICEs used for accounting purposes in particular in contracts between ORGANIZATIONs.

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Distance	*DistanceType*	0:1
	Duration	*duration*	0:1

	Partial	*boolean*	0:1
	AccountingType	*JourneyAccountingEnum*	0:1

JOURNEY FREQUENCY GROUP (TI Vehicle Journey Times MODEL)

A group of JOURNEYs defined in order to describe special behaviour like frequency based services or rhythmical services (runs all xxh10, xxh25 and xxh45... for example; this is especially useful for passenger information).

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	FirstDepartureTime	*time*	1:1
	LastDepartureTime	*time*	0:1
	DayOffset	*integer*	0:1

JOURNEY HEADWAY (TI Journey Timing MODEL)

Headway interval information that is available for all the VEHICLE JOURNEYs running on the JOURNEY PATTERN for a given TIME DEMAND TYPE, at a given TIMING POINT. This is a default value that can be superseded by VEHICLE JOURNEY HEADWAY. This information shall be consistent with HEADWAY JOURNEY GROUP if available (HEADWAY JOURNEY GROUP being a more detailed way of describing headway services).

Inherits from *(empty if no inheritance)*: ***JOURNEY TIMING***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Frequency	*HeadwayInterval*	0:1

JOURNEY LAYOVER (TI Journey Timing MODEL)

Time allowance at the end of each journey to allow for delays and for other purposes.

Inherits from *(empty if no inheritance)*: ***JOURNEY TIMING***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Layover	*duration*	0:1

JOURNEY MEETING (TI Interchange MODEL)

A time constraint for one or several SERVICE JOURNEYs fixing interchanges between them and/or an external event (e.g. arrival or departure of a feeder line, opening time of the theatre, etc.).

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Description	*MultlingualString*	0:1
	LatestTime	*time*	1:1
	EarliestTime	*time*	0:1
	Reason	*ReasonForMeetingEnum*	0:1

JOURNEY PART (TI Coupled Journey MODEL)

A part of a VEHICLE JOURNEY created according to a specific functional purpose, for instance in situations when vehicle coupling or separating occurs.

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Description	*MultilingualString*	0:1
	OperationalOrientation	*VehicleOrientationEnum*	0:1
	StartTime	*time*	0:1
	EndTime	*time*	0:1
	VehicleOrientation	*boolean*	0:1

JOURNEY PART COUPLE (TI Coupled Journey MODEL)

Two JOURNEY PARTs of different VEHICLE JOURNEYs served simultaneously by a train set up by coupling their single vehicles.

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Order	*positiveInteger*	1:1

	Description	*MultilingualString*	0:1

JOURNEY PATTERN HEADWAY (TI Journey Pattern Times MODEL)

Headway interval information that is available for all the VEHICLE JOURNEYs running on the JOURNEY PATTERN. This is a default value that can be superseded by the VEHICLE JOURNEY HEADWAY on a specific journey. This information must be consistent with HEADWAY JOURNEY GROUP if available (HEADWAY JOURNEY GROUP being a more detailed way of describing headway services).

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

JOURNEY PATTERN LAYOVER (TI Journey Pattern Times MODEL)

Time allowance at the end of each journey on a specified JOURNEY PATTERN, to allow for delays and for other purposes. This layover supersedes any global layover and may be superseded by a specific VEHICLE JOURNEY LAYOVER.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

JOURNEY PATTERN RUN TIME (TI Journey Pattern Times MODEL)

The time taken to traverse a TIMING LINK in a particular JOURNEY PATTERN, for a specified TIME DEMAND TYPE. If it exists, it will override the DEFAULT SERVICE JOURNEY RUN TIME and DEFAULT DEAD RUN RUN TIME.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

JOURNEY PATTERN WAIT TIME (TI Journey Pattern Times MODEL)

The time a vehicle has to wait at a specific TIMING POINT IN JOURNEY PATTERN, for a specified TIME DEMAND TYPE. This wait time can be superseded by a VEHICLE JOURNEY WAIT TIME.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

JOURNEY RUN TIME (TI Journey Timing MODEL)

The time taken to traverse a TIMING LINK in a particular JOURNEY PATTERN, for a specified TIME DEMAND TYPE. If it exists, it will override the DEFAULT SERVICE JOURNEY RUN TIME and DEFAULT DEAD RUN RUN TIME.

Inherits from *(empty if no inheritance)*: ***JOURNEY TIMING***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	RunTime	*duration*	0:1

JOURNEY TIMING (TI Journey Timing MODEL)

A time-related information referring to journey timing whose value depends on the time of use and so can be associated with a TIME DEMAND TYPE, TIME BAND or OPERATIONAL CONTEXT.

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Name	*MultilingualString*	0:1
	VehicleMode	*VehicleModeEnum*	0:1

JOURNEY WAIT TIME (TI Journey Timing MODEL)

The time a vehicle has to wait at a specific TIMING POINT IN JOURNEY PATTERN, for a specified TIME DEMAND TYPE.This wait time can be superseded by a VEHICLE JOURNEY WAIT TIME.

Inherits from *(empty if no inheritance)*: ***JOURNEY TIMING***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	WaitTime	*duration*	0:1

NORMAL DATED BLOCK (TI Vehicle Service MODEL)

A DATED BLOCK identical to a long-terms planned BLOCK, possibly updated according to short-term modifications decided by the control staff.

Inherits from *(empty if no inheritance)*: ***DATED BLOCK***			
Classif i-	**Name**	**Type**	**cardinality**

cation			
«UID»	***Id***		1:1

NORMAL DATED VEHICLE JOURNEY (TI Dated Journey MODEL)

A DATED VEHICLE JOURNEY identical to a long-term planned VEHICLE JOURNEY, possibly updated according to short-term modifications of the PRODUCTION PLAN decided by the control staff.

Inherits from *(empty if no inheritance)*: ***DATED VEHICLE JOURNEY***			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	ServiceAlteration	*ServiceAlterationEnum*	0:1

PASSING TIME (TI Passing Times MODEL)

Time data concerning public transport vehicles passing a particular POINT; e.g. arrival time, departure time, waiting time.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	AlightAndReboard	*boolean*	0:1
	ArrivalDayOffset		0:1
	DepartureDayOffset		0:1

PURPOSE OF JOURNEY PARTITION (TI Coupled Journey MODEL)

An operational purpose changing within a JOURNEY PATTERN and with this subdividing the SERVICE JOURNEY into JOURNEY PARTs.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

RELIEF OPPORTUNITY (TI Vehicle Service MODEL)

A time in a BLOCK where a vehicle passes a RELIEF POINT. This opportunity may or may not be actually used for a relief.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**

«UID»	***Id***		1:1
	Name	*MultilingualString*	0:1
	Time	*time*	1:1
	Description	*MultilingualString*	0:1

RHYTHMICAL JOURNEY GROUP (TI Vehicle Journey Times MODEL)

A group of VEHICLE JOURNEYS following the same JOURNEY PATTERN having the same "rhythm" every hour (for example runs at xxh10, xxh25 and xxh45...) between a specified start and end time.

Inherits from *(empty if no inheritance)*: ***JOURNEY FREQUENCY GROUP***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

SERVICE JOURNEY (TI Service Journey MODEL)

A passenger carrying VEHICLE JOURNEY for one specified DAY TYPE. The pattern of working is in principle defined by a SERVICE JOURNEY PATTERN.

Inherits from *(empty if no inheritance)*: ***VEHICLE JOURNEY***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	ServiceAlteration	*ServiceAlterationEnum*	0:1
	Print	*boolean*	0:1
	Dynamic	*DynamicAdvertisementEnum*	0:1
	DirectionType	*DirectionTypeEnum*	0:1

The terms "Print" and "Dynamic" relate to the advertising of journeys.

SERVICE JOURNEY INTERCHANGE (TI Interchange MODEL)

The scheduled possibility for transfer of passengers between two SERVICE JOURNEYs at the same or different SCHEDULED STOP POINTs.

Inherits from *(empty if no inheritance)*: ***INTERCHANGE***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	FromVisitNumber	*integer*	0:1
	ToVisitNumber	*integer*	0:1

SERVICE JOURNEY PATTERN INTERCHANGE (TI Interchange MODEL)

A recognized/organized possibility for passengers to change public transport vehicles using two SCHEDULED STOP POINTs (which may be identical) on two particular SERVICE JOURNEY PATTERNs, including the maximum wait duration allowed and the standard to be aimed at. These may supersede the times given for the DEFAULT INTERCHANGE. Schedulers may use this entity for synchronisation of journeys.

Inherits from *(empty if no inheritance)*: ***INTERCHANGE***			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

SPECIAL SERVICE (TI Service Journey MODEL)

A work of a vehicle that is not planned in a classical way, i.e. that is generally not based on VEHICLE JOURNEYs using JOURNEY PATTERNs. It involves specific characteristics (such as specific access rights) and/or may be operated under specific circumstances.

Inherits from *(empty if no inheritance)*: ***JOURNEY***			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Client	*normalizedString*	0:1
	DepartureTime	*time*	0:1
	JourneyDuration	*duration*	0:1
	Print	*boolean*	0:1
	Dynamic	*DynamicAdvertisementEnum*	0:1

The terms “Print” and “Dynamic” relate to the advertising of special services.

TARGET PASSING TIME (TI Passing Times MODEL)

Time data about when a public transport vehicle should pass a particular POINT IN JOURNEY PATTERN on a particular DATED VEHICLE JOURNEY, in order to match the latest valid plan.

Inherits from *(empty if no inheritance)*: ***DATED PASSING TIME***			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	AimedArrivalTime	*time*	0:1
	AimedDepartureTime	*time*	0:1
	AimedNonstopPassingTime	*time*	0:1

	AimedWaitingTime	*duration*	0:1

TEMPLATE SERVICE JOURNEY (TI Service Journey MODEL)

A passenger carrying TEMPLATE SERVICE JOURNEY. As TEMPLATE SERVICE JOURNEY, it may represent multiple journeys.

Inherits from *(empty if no inheritance)*: ***SERVICE JOURNEY, TEMPLATE VEHICLE JOURNEY***			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

TEMPLATE VEHICLE JOURNEY (TI Vehicle Journey MODEL)

A repeating VEHICLE JOURNEY for which a frequency has been specified, either as a HEADWAY JOURNEY GROUP (e.g. every 20 min) or a RHYTHMICAL JOURNEY GROUP (e.g. at 15, 27 and 40 min past the hour). It may thus represent multiple journeys.

Inherits from *(empty if no inheritance)*: ***VEHICLE JOURNEY***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

TIMETABLE FRAME (Timetable Frame MODEL)

A set of timetable data to which the same VALIDITY CONDITIONs have been assigned.

Inherits from *(empty if no inheritance)*: ***VERSION FRAME***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

TIMETABLED PASSING TIME (TI Passing Times MODEL)

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

Inherits from *(empty if no inheritance)*: ***PASSING TIME***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	ArrivalTime	*time*	0:1
	DepartureTime	*time*	0:1
	WaitingTime	*duration*	0:1
	EarliestDepartureTime	*time*	0:1
	LatestArrivalTime	*time*	0:1

TRAIN COMPONENT LABEL ASSIGNMENT (TI VA Train Component Label Assignment MODEL)

The allocation of an advertised designation for a vehicle or vehicle element for passengers.

Inherits from *(empty if no inheritance)*:			
Classif i-	**Name**	**Type**	**cardinality**

cation			
«UID»	***Id***		1:1
	Label	*multilingualString*	1:1

TRAIN NUMBER (TI Vehicle Journey MODEL)

Specification of codes assigned to particular VEHICLE JOURNEYs when operated by TRAINs or COMPOUND TRAINs according to a functional purpose (passenger information, operation follow-up, etc)

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	ForAdvertisement	*normalizedString*	0:1
	ForProduction	*normalizedString*	0:1
	Description	*MultilingualString*	0:1

TURNAROUND TIME LIMIT (TI Journey Pattern Times MODEL)

The maximum time for which a vehicle may be scheduled to wait at a particular TIMING POINT (often included in a TURN STATION) without being returned to a PARKING POINT. A minimum time for a vehicle to turn its direction may also be recorded. This may be superseded by a DEAD RUN.

Inherits from *(empty if no inheritance)*: ***JOURNEY TIMING***			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		0:1
	MinimumDuration	*duration*	0:1
	MaximumDuration	*duration*	1:1

TYPE OF COUPLING (TI Coupled Journey MODEL)

A classification for COUPLING of BLOCK PARTs.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

TYPE OF FLEXIBLE SERVICE (TI Flexible Service MODEL)

A typology of flexible services:

— Virtual line service

— Flexible service with main route

— Corridor service

— Fixed stop area-wide flexible service

— Free area-wide flexible service

— Mixed types of flexible service (not at POINT level)

The type of flexibility can be defined at JOURNEY PATTERN level or at POINT IN JOURNEY PATTERN level in case of mixed types of flexible service inside the same JOURNEY PATTERN.

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

TYPE OF PRODUCT CATEGORY (TI Vehicle Journey MODEL)

A classification for VEHICLE JOURNEYs to express some common properties of journeys for marketing and fare products

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

TYPE OF SERVICE (TI Vehicle Journey MODEL)

A classification for VEHICLE JOURNEYs and SPECIAL SERVICEs to express some common properties of journeys to be taken into account in the scheduling and/or operations control process.

Inherits from *(empty if no inheritance)*:			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

VEHICLE JOURNEY (TI Vehicle Journey MODEL)

The planned movement of a public transport vehicle on a DAY TYPE from the start point to the end point of a JOURNEY PATTERN on a specified ROUTE.

Inherits from *(empty if no inheritance)*: ***JOURNEY***			
Classif i- cation	**Name**	**Type**	**cardinality**

«UID»	***Id***		1:1
	DepartureTime	*time*	0:1
	JourneyDuration	*duration*	0:1

VEHICLE JOURNEY HEADWAY (TI Vehicle Journey Times MODEL)

Headway interval information that is available for a VEHICLE JOURNEY (to be understood as the delay between the previous and the next VEHICLE JOURNEY). This information must be consistent with HEADWAY JOURNEY GROUP if available (HEADWAY JOURNEY GROUP being a more detailed way of describing headway services).

Inherits from *(empty if no inheritance)*: ***JOURNEY HEADWAY***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

VEHICLE JOURNEY LAYOVER (TI Vehicle Journey Times MODEL)

A time allowance at the end of a specified VEHICLE JOURNEY. This time supersedes any global layover or JOURNEY PATTERN LAYOVER.

Inherits from *(empty if no inheritance)*: ***JOURNEY LAYOVER***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

VEHICLE JOURNEY RUN TIME (TI Vehicle Journey Times MODEL)

The time taken to traverse a specified TIMING LINK IN JOURNEY PATTERN on a specified VEHICLE JOURNEY. This gives the most detailed control over times and overrides the DEFAULT SERVICE JOURNEY RUN TIME and JOURNEY PATTERN RUN TIME and the DEFAULT DEAD RUN RUN TIME.

Inherits from *(empty if no inheritance)*: ***JOURNEY RUN TIME***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

VEHICLE JOURNEY WAIT TIME (TI Vehicle Journey Times MODEL)

The time for a vehicle to wait at a particular TIMING POINT IN JOURNEY PATTERN on a specified VEHICLE JOURNEY. This wait time will override the JOURNEY PATTERN WAIT TIME.

Inherits from *(empty if no inheritance)*: ***JOURNEY WAIT TIME***			
Classif	**Name**	**Type**	**cardinality**

i- cation			
«UID»	***Id***		1:1

VEHICLE SCHEDULE FRAME (Vehicle Schedule Frame MODEL)

A coherent set of BLOCKS, COMPOUND BLOCKs, COURSEs of JOURNEY and VEHICLE SCHEDULEs to which the same set of VALIDITY CONDITIONs has been assigned.

Inherits from *(empty if no inheritance)*: ***VERSION FRAME***			
Classif i- cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1

VEHICLE SERVICE (TI Vehicle Service MODEL)

A workplan for a vehicle for a whole day, planned for a specific DAY TYPE.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Name	*MultilingualString*	0:1
	Description	*MultilingualString*	0:1

VEHICLE SERVICE PART (TI Vehicle Service MODEL)

A part of a VEHICLE SERVICE composed of one or more BLOCKs and limited by periods spent at the GARAGE managing the vehicle in question.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Name	*MultilingualString*	0:1
	Description	*MultilingualString*	0:1

VEHICLE TYPE PREFERENCE (TI Journey Pattern Times MODEL)

The preference for the use of a particular VEHICLE TYPE for a SERVICE JOURNEY PATTERN, depending on the DAY TYPE and TIME DEMAND TYPE. The rank of preferences shall be recorded. Different VEHICLE TYPEs may be given the same rank.

Inherits from *(empty if no inheritance)*:			
Classif i-cation	**Name**	**Type**	**cardinality**
«UID»	***Id***		1:1
	Rank	*positiveInteger*	1:1

VEHICLE TYPE STOP ASSIGNMENT (TI VA Stopping Position Assignment MODEL)

The allocation of a VEHICLE STOPPING POSITION of a VEHICLE TYPE for a particular VEHICLE JOURNEY.

Inherits from *(empty if no inheritance)*: ***STOP ASSIGNMENT***			
Classif	**Name**	**Type**	**cardinality**

i- cation			
«UID»	***Id***		1:1
	OperationalOrientation		1:1

Annex B
(informative)

Status of the Textual Descriptions and Model Evolution

In order to allow the reader familiar with Transmodel V5.1 (marked TM) to appraise the changes each numbered (level 3) section indicates the source of the text:

TM: text incorporating either simple reformulations or taken over from TM;

TM and NeTEx: text based on TM with additions by NeTEx;

IFOPT and NeTEx: text based on IFOPT with additions by NeTEx;

NeTEx: text incorporating significant enhancements or a totally new text compared to Transmodel V5.1. Some of them take over explanations referring to IFOPT.

Table B.1 — Sources of text in the Network Topology Domain

Section	*Topic*	*Source*
5	**Timing information and vehicle scheduling data domain**	
5.1	**Introduction**	
5.2	**Overview**	
5.2.1	Model and document structure	new
5.3	**Journey and Journey Times**	
5.3.1	Vehicle journey	TM and NeTEx
5.3.2	Service journey	TM and NeTEx
5.3.3	Time demand times	TM and NeTEx
5.3.4	Journey timing	TM and NeTEx
5.3.5	Journey pattern times	TM and NeTEx
5.3.6	Vehicle journey times	TM and NeTEx
5.3.7	Interchange	TM and NeTEx
5.3.8	Interchange rule	NeTEx
5.3.9	Coupled journey	TM and NeTEx
5.3.10	Flexible service	NeTEx
5.3.11	Journey accounting	NeTEx
5.4	**Dated journey**	
5.4.1	Dated journey	TM
5.5	**Passing times**	
5.5.1	Passing times	TM
5.6	**Vehicle scheduling**	
5.6.1	Tactical resource planning	TM
5.6.2	Resources for tactical planning	TM
5.6.3	Vehicle service	TM and NeTEx
5.7	**Vehicle journey assignments**	
5.7.1	Train component label assignment	new
5.7.2	Stopping position assignment	new
5.8	**Explicit frames**	
5.8.1	Timetable frame	new
5.8.2	Vehicle schedule frame	new

Table B.2 — Status of diagrams and figures compared to NeTEx

Part 3 figure	**Main Package**	**Part 3 diagram/figure title**	**status compared to NeTEx**
1	Journeyandjourneytimes model	Vehicle journey basic model	copied
2		Vehicle journey model	copied
3		Vehicle journey notice assignment model	added
4		Basic service journey model	added
5		Service journey model	copied
6		Time demand times model	modified
7		Journey timings model	corrected
8		Journey pattern times model	corrected
9		Vehicle journey times model	simplified
10		Frequency based service model	corrected
11		Interchange model	modified
12		Interchange rule model	modified
13		Coupled journey model	added and corrected
14		*Example – joining and splitting trains*	*copied*
15		*Example – joining and splitting: Amsterdam to Warsaw*	*copied*
16		*Example – journeys: Amsterdam to Warsaw*	*copied*
17		*Example – journey parts: Amsterdam to Warsaw*	*copied*
18		*Example – six journey meetings: Amsterdam to Warsaw*	*copied*
19		*Example – journey meetings: Amsterdam to Warsaw*	*copied*
20		Flexible service model	copied
21		Flexible service example: Tisseo tad 118 with courtesy of Tisseo	copied
22	Journey accounting model	Journey accounting model	copied
23	Dated journey model	Dated journey model	modified
24	Passing times model	Passing times model	copied
25	Vehicle service model	Vehicle service model	modified

Part 3 figure	**Main Package**	**Part 3 diagram/figure title**	**status compared to NeTEx**
26		Train coupling and block view	added and modified
27		Coupled journey and block view	added and modified

Part 3 figure	**Main Package**	**Part 3 diagram/figure title**	**status compared to NeTEx**
28		*Train block parts and journey part couples: amsterdam to warsaw*	*copied*
29		*Train block parts and journey part couples: amsterdam to copenhagen*	*copied*
30		*Example of label assignment*	*added*
31	Vehicle journey assignment model	Train component label assignment model	added
32		Stopping position assignment model	added
33	Explicit frames model	Timetable frame model	added
34		Vehicle schedule frame model	added

Copied: means “copied from NeTEx” with no change except layout, and adaptation of the stereotype PK – > UID.

Corrected: means “corrected from NeTEx” where the correction refers to the type of association (composition < – > aggregation), cardinality, scope of ID (private– > public), label naming.

Modified: means “modified from NeTEx” if it includes any change other than the above ones.

Added means “added compared to NeTEx” with possible substantial changes.

New: means “not considered within NeTEx” (but considered in Transmodel)

Bibliography

[1] EN 15531-1, *Public transport - Service interface for real-time information relating to public transport operations - Part 1: Context and framework*

[2] EN 15531-2, *Public transport - Service interface for real-time information relating to public transport operations - Part 2: Communications*

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[6] CEN/TS 16614-1, *Public transport - Network and Timetable Exchange (NeTEx) - Part 1: Public transport network topology exchange format*

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