BS EN 12896-10:2022



BSI Standards Publication

Public transport — Reference data model

Part 10: Alternative Modes

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National foreword

This British Standard is the UK implementation of EN 12896-10:2022. It supersedes PD CEN/TS 17413:2020, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/278, Intelligent transport systems.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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European foreword

This document (EN 12896-10:2022) has been prepared by Technical Committee CEN/TC 278 “Intelligent Transport Systems”, 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of an identical text or by endorsement, at the latest by May 2023, and conflicting national standards shall be withdrawn at the latest by May 2023.

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 supersedes CEN/TS 17413:2019.

In comparison with the previous edition, the following technical modifications have been made:

This new publication takes into account the revision of the conceptual model by the project team TC278 PT0303 working on the implementation of the 'alternative modes' model.

EN12896-10, complementing the series of EN12896-x, establishes the semantic reference for the alternative modes data domain and thus facilitates the integration of these modes into the overall mobility environment, in particular into multimodal travel services (e.g., trip planning systems).

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

The European Delegated Regulation EU 1926/2017 requires the publication of information related to the alternative modes of transport, in particular by means of data exchange standards derived from Transmodel (EN12896). Based on the conceptual data model published by CEN TS 17413 (already based upon Transmodel) a data exchange format is elaborated as NeTEx – Part 5. Transmodel – Part 10 concerns the alternative modes aspects and completes the Transmodel eco-system ensuring coherence between the semantic model (Transmodel) and its implementation (as NeTEx/SIRI).

Public Transport Reference Data Model (EN12896) - Part 10 introduces extensions of Transmodel v6.

Most of them have been elaborated within CEN TC278 WG17 and published as CEN TS 17413:2019.The implementation of this model as NeTEx-Part 5 generates further refinements of the conceptual model.

EN12896-10 includes both achievements and creates a coherent set of standards (Transmodel-NeTEx-SIRI).

The series is 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 & statistics*; and

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— *Public transport – Reference data model – Part 9: Informative documentation* [CEN/TR].

Together these create version 6 of the European Standard EN 12896, known as “Transmodel”.

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

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Introduction

This document 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 Part 1 are generic patterns that are referenced by different other parts.

Part 2 of this European Standard presents space-related data structures.

Part 3 presents time-related data structures referring to the time-related Tactical Planning Components and to Vehicle Scheduling.

Part 4 presents data referring to daily operations (i.e., to operational days), different from those planned for day types (space-related data structures and tactical planning components) and including operational raw data referring to operations follow-up.

Part 5 presents fares structures including sales, validation and control.

Part 6 presents Passenger Information (planned and real-time).

Part 7 presents Driver Management including Driver Scheduling (day-type related driver schedules), Rostering (ordering of driver duties into sequences according to some chosen methods) and Driving Personnel Disposition (assignment of logical drivers to physical drivers and recording of driver performance).

Part 8 presents Management Information and Statistics.

Part 9 presents the Informative documentation.

Part 10 (this part) presents the data structures for alternative modes.

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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, EN12896, known as Transmodel V6,

incorporating the requirements of

- EN 15531-1 to -3 and TS 15531-4 and -5: Service interface for real-time information relating to public transport operations (SIRI),
- TS 16614-1 to 5: Network and Timetable Exchange (NeTEx).

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.

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).

This part corresponds to the Transmodel V6.0 Alternative Modes

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

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

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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.

The functional domains related to the present document are described in chapter 5 below.

1.3 Particular Scope of this Document

This document defines new modes in a reference data model, in order to allow integration of these modes into urban multimodal travel services (e.g., trip planning systems).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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, *Public transport - Reference data model - Part 1: Common concepts*

EN 12896-2, *Public transport - Reference data model - Part 2: Public transport network*

EN 12896-3, *Public Transport — Reference Data Model — Part 3: Timing Information and Vehicle Scheduling*

EN 12896-4, *Public Transport — Reference Data Model — Part 4: Operations Monitoring and Control*

EN 12896-5, *Public Transport — Reference Data Model — Part 5: Fare Management*

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3 Terms and definitions

3.1 General Terms and definitions

The following generic terms (extract based on Transmodel) are used.

3.1.1
attribute
property of an entity.

3.1.2
conceptual data model
description of a real-world domain in terms of entities, relationships and attributes in an implementation independent manner in order to provide a structure on which the rest of the development of an application system can be based.

3.1.3
conceptual level
in the context of data modelling, the conceptual data model.

3.1.4
database
collection of data; often used in the sense of the physical implementation of a data model.

3.1.5
data domain
data structure made up of data related to each other, through the fact that there is a functional area or group of functions using this data set as a whole.

3.1.6
data model
description of a real-world domain in terms of data and relationships.

3.1.7
entity
object (data) that has its own existence (as opposed to an attribute).

3.1.8
fare management
all activities related to the collection of money from passengers.

3.1.9
function
activity.

3.1.10
functional area
arbitrarily defined set of activities used to define the objectives and limits of the data model.

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3.1.11

interoperability

ability of (sub)systems to interact with other (sub)systems according to a set of predefined rules (interface).

3.1.12

logical data model

data design that takes into account the type of database to be used but which does not consider means of utilisation of space or access.

3.1.13

logical level

in the context of data modelling, the logical data model.

3.1.14

object-oriented data model

data structure expressed according to principles that allow for a direct implementation as an object-oriented database, where information is represented in form of objects, i.e., respecting the principle of encapsulation meaning in particular that each data is accessed or modified through operations (methods) belonging to it.

3.2 Domain specific terms and definitions

3.2.1

access mode

a characterisation of the traveller movement (e.g., walking, cycling, etc) enabling the traveller to reach public transport or to carry out a whole trip.

3.2.2

alternative mode

any publicly advertised mode of operation different from the conventional mode of operation, in particular vehicle sharing, vehicle rental and vehicle pooling.

3.2.3

car pooling

- vehicle pooling applied to cars, consisting in sharing a privately owned car for a trip between a defined driver who is already engaged in the trip and at least another traveller.

3.2.4

car rental

vehicle rental applied to cars, consisting in making car(s) available at specified agencies with the constraint to bring them back at specified agencies.

3.2.5

car sharing

vehicle sharing applied to cars consisting, the short-term use of a vehicle for a specific journey or time where the car might be taken from and parked at different places in the urban area.

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3.2.6

conventional mode

legacy mode of operation which is provided as a scheduled and/or flexible publicly advertised transport offer relying on a set of features: drivers are employees; the fleet is owned by an operator or an authority; the network topology is defined well in advance and is based on lines and journey patterns.

Note 1 to entry: the distinction between alternative and conventional mode of operation relies on the fact that one or more of the conditions as above may not be fulfilled. Moreover, the difference is in the mode of operation rather than the way the traveller is served.

3.2.7

cycle rental

vehicle rental applied to cycles, consisting in making cycle(s) available at specified agencies with the constraint to bring them back at specified agencies.

3.2.8

cycle sharing

vehicle sharing applied to cycles consisting of short-term cycle rental where the cycle can be taken from and parked at different places in the urban area.

3.2.9

flexible transport mode

passenger transport operation linked to a fixed network/schedule but offering flexibility, in order for instance, to optimise the service or to satisfy passenger demand.

3.2.10

mobility service

alternative mode of transport service available over a widespread area, for example car-pooling, rental, etc..

3.2.11

operational service

activities performed by actors in charge of operation of a service.

3.2.12

park and ride

activity allowing travellers to transfer between personal/alternative mode and conventional mode.

3.2.13

park and ride facility

location dedicated to travellers allowing them a modal transfer, in particular to leave/pick up their personal vehicles before/after a trip on public transport.

3.2.14

personal mode

private mode of operation excluding any publicly advertised use.

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3.2.15
public transport
any means of transport advertised and available for use by the general public.

3.2.16
scheduled mode
passenger transport operation following a fixed schedule and fixed routes.

3.2.17
taxi
type of vehicle pooling operation where the vehicle is driven by a driver providing services to travellers for commercial reasons.

3.2.18
taxi stand
A set of spots where any taxi is able to safely stop for a short period of time to load passengers.

3.2.19
traveller information provision
activity consisting in the provision of information on the rules/conditions related to a traveller service and concerning the available transportation means.

3.2.20
traveller service
activity (in general, initiated by users) in view of facilitating/enabling a trip.

3.2.21
walking mode
walking is considered as access mode so the traveller walks to a stop to get to the transport option.

3.2.22
vehicle pooling
particular mode of operation of a privately-owned vehicle consisting in sharing the vehicle for a trip between a defined driver who is already engaged in the trip and at least another traveller.

3.2.23
vehicle rental
particular mode of operation of a vehicle fleet (in general privately owned) consisting in making it available at specified agencies with the constraint to bring them back at specified agencies.

3.2.24
vehicle sharing
short term vehicle rental where the vehicle can be taken from and parked at different places in the urban area, often without the constraint of bringing the vehicle back to a dedicated specific location.

3.2.25
vehicle with driver
vehicle operating on demand such as a taxi, chauffeured car or dispatched mini-cab.

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4 Abbreviations

CCAM	cooperative, connected and automated mobility
EU	European Union
GDF	geographic data files
GNSS	global navigation satellite system
INSPIRE	infrastructure for spatial information in Europe
ITS	intelligent transport systems
MaaS	mobility as a service
U-ITS	urban ITS

5 Functional description of the alternative modes

5.1 Introduction

This document describes an extension of the Public Transport Reference Data Model, known as Transmodel (EN12896), which provides definitions and a conceptual data model for the "conventional transport " domain. This clause provides a clarification as regards the "conventional transport mode" vs. "alternative transport mode".

5.2 Categorisation of modes of transport

'Mode' is any means of transport used or available. It is split into 'vehicle mode' and 'access mode'.

'Vehicle mode' is a characterisation of the public transport operation according to the means of transport, e.g., bus, tram, metro, train, ferry, ship, or bicycle.

'Access mode' (e.g., walking, cycling, private car driving, etc) is a characterisation of the traveller movement (e.g., walk, bicycle, etc) enabling them to reach the 'vehicle mode' or to carry out a whole trip.

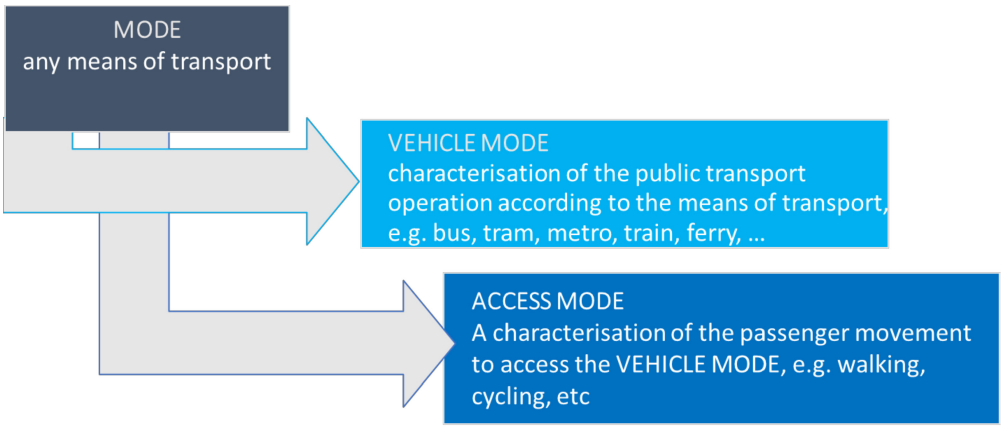


Figure 1 — Categorisation of transport modes

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A distinction is made between 'vehicle mode' and 'vehicle type'. Each 'vehicle mode' may correspond to a range of 'vehicle types' (e.g. to the 'vehicle mode' *'bus'* may correspond *'standard', 'articulated, minibus',' double-deck' buses*).

A further, finer categorisation of transport modes is provided by the concept of 'submode', which is a variant of a 'mode'. For example, for the mode '*rail'*, possible submodes are *'international rail'* or *'domestic rail'*; for the mode *'bus'*, the example of submode is *'regional bus',* for the mode *'car',* examples of submodes are *'electric car', 'conventional car', 'self-driven car'.*

This document takes over these normative definitions and provides a further clarification as regards the term 'public transport'.

For this document 'public transport' has to be understood as any means of transport, advertised and available for use by the general public.

5.2.1 Alternative mode of operation

5.2.1.1 Overview

Modes and submodes being defined as 'transport means' may be characterised in terms of types of operation, i.e., ways they are operated.

This document distinguishes the following types of 'mode of operation':

- conventional mode of operation: the legacy mode of operation which is provided as a scheduled and/or flexible *publicly advertised* flexible transport offer. This mode of operation is either following a fixed schedule and fixed routes or linked to a fixed network/schedule but offering flexibility, in order for instance, to optimise the service or to satisfy passenger demand;

- alternative mode of operation: any *publicly advertised mode of operation different from the conventional mode of operation*, in particular vehicle sharing, vehicle rental and vehicle pooling; and

- personal mode of operation: a private mode of transport *excluding any publicly advertised use*.

The scope of Transmodel is the conventional mode of operation, including both scheduled and flexible mode of operation. The distinction between alternative and conventional mode of operation relies on the fact that a conventional mode relies on a set of features: drivers are employees and the fleet is owned by an operator or an authority and the network topology is defined well in advance and is based on lines and journey patterns; whereas the alternative modes may not fulfil one or more of these features.

This document concerns the alternative mode of operation.

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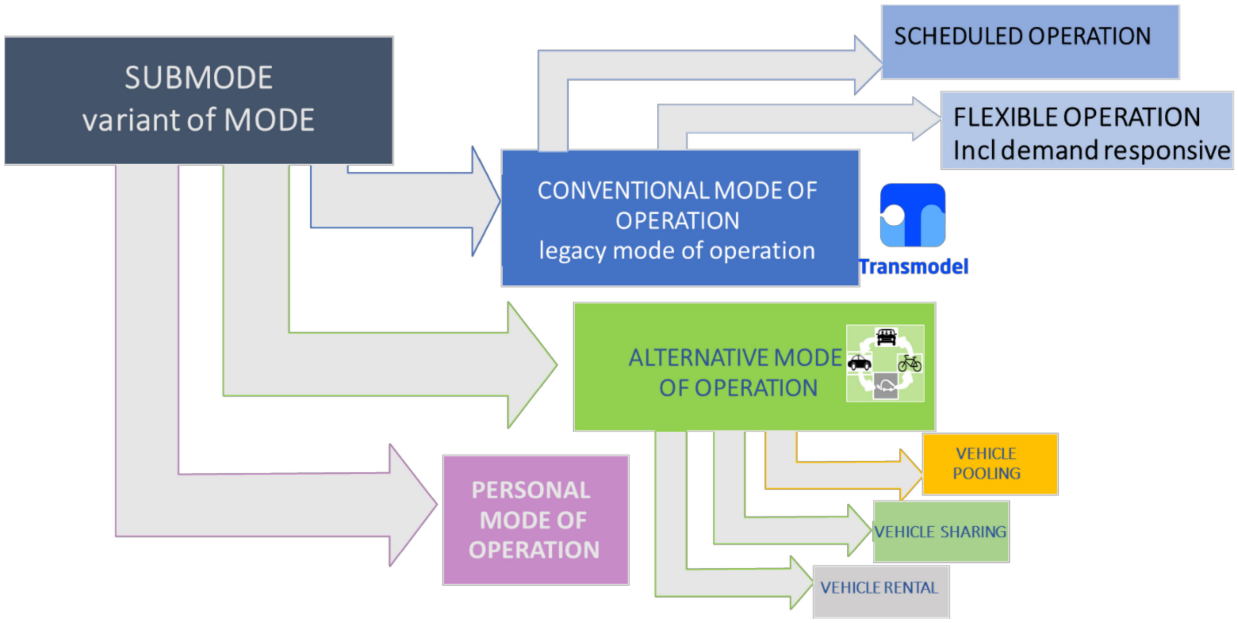


Figure 2 — Operation types for transportation modes

5.2.1.2 Wording convention

In this document, alternative mode of operation, alternative mode and new mode are used as synonyms (with a preference to alternative mode).

Conventional mode of operation is used as synonym of conventional mode, flexible mode of operation is synonymous to flexible mode, scheduled mode of operation as synonymous to scheduled mode.

5.2.1.3 Transport modes in Commission Delegated Regulation (EU) 2017/1926

The Commission Delegated Regulation (EU) 2017/1926), partitions the transport modes into Scheduled, Demand Responsive, and Personal. Rather than a definition, examples for these concepts are provided.

Scheduled modes: Air, rail including high speed rail, conventional rail, light rail, long-distance coach, maritime including ferry, metro, tram, bus, trolley-bus.

Demand-responsive modes: Shuttle bus, shuttle ferry, taxi, car-sharing, car-pooling, car-hire, bike-sharing, bike-hire.

Personal modes: Car, motorcycle, cycle.

The table below provides the correspondence of the different concepts and terms in use with the concepts of this document.

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Table 1 — Concepts and terms

Mode of operation	Type of mode of operation	Specification covering data requirements	*Type of mode according to the Commission Delegated Regulation (EU) 2017/1926*	The Commission Delegated Regulation (EU) 2017/1926: examples
Conventional mode of operation				
	Scheduled mode of operation	Transmodel	*Scheduled mode*	Air, rail including high speed rail, conventional rail, light rail, long-distance coach, maritime including ferry, metro, tram, bus, trolley-bus.
	Flexible mode of operation	Transmodel	*Demand-responsive mode*	Shuttle bus, shuttle ferry
Alternative mode of operation				
	Vehicle sharing (car sharing, cycle sharing)	This document	*Demand-responsive mode*	car-sharing, bike-sharing
	Vehicle pooling (carpooling)	This document	*Demand-responsive mode*	car-pooling, taxi
	Vehicle rental (car rental, cycle rental)	This document (partly)	*Demand-responsive mode*	car-hire, bike-hire.
Personal mode of operation			*Personal mode*	Car, motorcycle, cycle.

5.2.2 Limits of the specification

This document concentrates on data domains of use for the alternative modes of operation: vehicle sharing, vehicle pooling.

Vehicle rental and taxi are only partly considered.

The correspondence with the Commission Delegated Regulation (EU) 2017/1926 is provided in the table above.

This document does not cover Flexible Transport, as it is already covered by EN12896.

Two following types of usage as regards cycle sharing car sharing and car-pooling have been identified: the mobility of persons; and the transportation of goods. This document considers mobility of persons only.

Types of vehicles considered are referred to in clauses 5.5.1 and 5.6

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The data model focuses at the functional domain (Traveller) Information Provision mainly, in order to satisfy the requirements of the Delegated Regulation (EU) 2017/1926 mentioned above and covers partly data requirements of the functional domain Traveller Services (see figure 3).

Operational Services are not in scope of this document.

5.3 Links to Mobility as a service

5.3.1 Mobility as a service (MaaS)

Since the advent of the personal computer, the internet and more lately, the smartphone, consumer experiences have become increasingly integrated, and there has become an expectation of greater integration.

Increasingly, and especially in the urban setting, multiple modes of transport are used; and with the advent of car sharing, carpooling, cycle sharing, the number of modes, and mode combinations, have multiplied.

By applying the same 'integrated service' logic to the transport sector, because of technology change and the opening up and sharing of transport datasets, considerable 'value' can be added to the travellers experience by the provision of "mobility as a service" (MaaS), i.e. using a digital interface to source and manage the provision of transport related service(s) to meet the mobility requirements of a customer. A MaaS Provider offers its customer the travel experience using any, and probably multiple, types of transport service, public or private, in order to optimise the travel experience.

Tailored travel options can be provided using the fastest route, the lowest cost route, most direct route, most environmentally friendly, or most accessible service for persons with reduced mobility, or those travelling with children.

One MaaS possibility is the scenario where MaaS Providers offer consumers a service focussed on vehicle transport e.g., taxi, car sharing and carpooling services. The other possibility is a scenario where consumers are offered a fully intermodal service, i.e., combining different modes of transport.

The MaaS Provider uses data from multiple travel service providers to create a value proposition that comprises a 'bundle' of different mobility services to meet a travel requirement.

5.3.2 Cooperative, connected and automated mobility (CCAM)

The potential for MaaS is enhanced by changes in mobility consumption, the adoption of new mobility models (and this may lead to a move away from car ownership).

Modern vehicles are already connected devices, but the advent of Cooperative Intelligent Transport Systems (C-ITS), will allow road users and traffic managers to share information and use it to coordinate their actions.

Automated vehicles, and their full integration in the overall transport system (automated mobility), significantly advance the capabilities of, and desirability to the user, of MaaS, by assisting the MaaS provider to be able to offer options that are seen by the traveller to be better than their previous options.

5.3.3 Reference data model for alternative modes

In order to achieve MaaS, and utilise the associated capabilities of CCAM for MaaS, it is necessary to exchange and have access to relevant data. The Commission Delegated Regulation (EU) 2017/1926 requires that Member States facilitate the easy exchange and reuse of data for the provision of comprehensive travel information services. Transport authorities, transport operators, infrastructure managers or transport on demand service providers as appropriate need access to static data, corresponding metadata and information on the quality of the data accessible to users through a national or common access point.

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This document defines a reference data model, in order to allow integration of emerging transport modes into multimodal services (e.g., trip planning systems).

5.4 Functions and aspects related to the alternative modes

5.4.1 Introduction

As a result of an alternative mode of operation, new services are operated and proposed to travellers. This section describes new services through particular aspects and functions characterising these services.

The following 3 aspects are mostly relevant:

- types of vehicles: cycles, cars, cycle types, car types, etc, in particular characterised by their equipment,
- modes of operation: pooling, sharing, rental, personal,
- types of transportation: persons, goods.

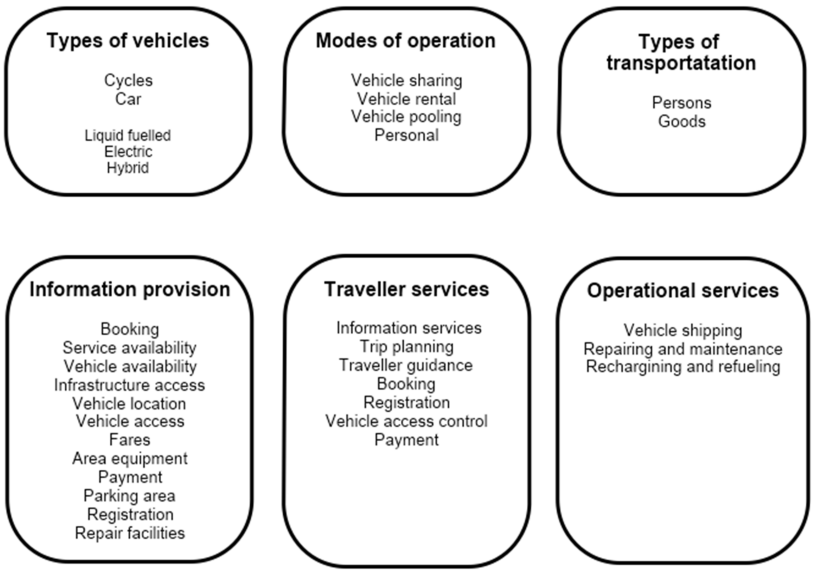


Figure 3 — Aspects and functions of related to alternative modes

The functional domains by which alternative modes are mostly concerned are grouped into the following categories;

- (traveller) information provision: activities consisting in the provision of information to the traveller on the rules/conditions related to a traveller service,
- traveller services: activities (in general initiated by users) in view of facilitating/enabling a trip,
- operational services: activities performed by actors in charge of operation of a service.
- The following sections describe the functional domains by functions (activities) in more detail, providing a short definition of each function. As mentioned above in 0 the primary goal of the following sections is to illustrate the scope of the developed conceptual data model mainly focusing at information provision.

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- Specifics of each particular mode of operation is described in the corresponding sections (cycle rental, cycle sharing, private cycling, car sharing, car rental, carpooling) in clauses 5.5, 5.6 and 5.7.

5.4.2 Information provision functions

5.4.2.1 Introduction

The following functions are dedicated to the provision of information to travellers. Some of the functions are applicable to the private modes of operation. In most of the cases, information provision may be general (referring to a whole area), or specific, related to a particular user query with specific parameters.

5.4.2.2 Booking information

This activity consists in the provision of information on booking rules and additional data allowing the user to take the decision to book a service. The following information is considered as relevant:

- booking methods: description how to book (by internet, through an agency, etc)
- booking conditions: information on how long in advance booking may take place, whether a guarantee is necessary, etc
- contact information: URL, address, etc. of the booking contact
- available number/type of vehicles per station; and,
- usage rules: this relates to the service that is going to be booked: time-related conditions, location of check in/out stations, penalties, user profile, etc. used in the booking operation.

There are two circumstances concerning booking access to a vehicle. Firstly, there is the occasion when the vehicle is required immediately due to unforeseen circumstances or the failure of other transport modes; in this case there might not be a vehicle available in an optimum location or indeed a vehicle available at all. Secondly, it should be possible to notify the service provider of the requirement for a car share; in this case a vehicle should be available of the required type and at the optimum location; however, it is likely that a different set of charges will apply.

5.4.2.3 Service availability information

This activity consists in the provision of information on the availability of a particular mode of operation, e.g., opening hours of agencies for vehicle rental, opening hours of off-street vehicle parking locations, etc. The information may be either static or dynamic.

5.4.2.4 Alternative mode vehicle availability information

This activity consists in the provision of either static or dynamic information on availability of vehicles at areas dedicated to the alternative modes. The static information corresponds to the capacity of areas (planned vehicle availability) dedicated to alternative modes.

The dynamic availability (actual presence of an available vehicle) may be derived from the information provided by vehicle location information (see 5.4.2.6) and the planned vehicle availability (capacity of a given area).

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5.4.2.5 Infrastructure access information

This activity consists of the provision of information describing where to find and how to access a dedicated location for an alternative mode, for example, vehicle sharing or rental, and the dedicated location where the vehicle can be released after use. The information is static.

5.4.2.6 Vehicle location information

This activity consists of the provision of dynamic information describing where to find a vehicle or where a vehicle has been dropped off. This information is also relevant to the Personal mode.

5.4.2.7 Vehicle access information

This activity consists in the provision of information describing how to unlock vehicle prior to use and secure it after use, in particular for vehicle sharing and rental. The information may be either static or dynamic.

5.4.2.8 Fares information

This activity consists in the provision of information on fare rules, pricing rules (hourly/weekly/monthly fee), discounts etc.. The information is in general static.

5.4.2.9 Payment information

This activity consists in the provision of information on payment means and methods, payment locations. The information is in general static.

This information involves:

- payment methods: cash, credit card, mobile payment, etc.;
- payment guarantees: credit card guarantee, banking, ID registration.

5.4.2.10 Alternative mode area equipment information

This activity consists in the provision of information on equipment present at locations dedicated to alternative modes, in particular secure storage facilities and battery recharging equipment, but also ticketing equipment, information desks, etc. The information may be static (planned presence of the equipment) or dynamic (status of the equipment).

5.4.2.11 Alternative modes parking area information

This activity consists in the provision of information about the alternative modes areas where a vehicle may be parked and left unattended (dropped off) and on the number of available parking slots for dropping-off alternative mode vehicles. This information is dynamic.

5.4.2.12 Registration information

This activity consists in the provision of information on the registration process to be accepted and recognised as a user.

The following information is of interest for the registration process:

- ID information: name, surname, date of birth, place of birth, address of residence

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- Contact information: e-mail address of the alternative mode service, mobile number of the user, e-mail addresses of the user;

- Additional information, such as payment information: credit card, bank account (this is mainly for payment guarantee).

5.4.2.13 Repair facility information

This activity consists in providing information about locations where repair and/or maintenance of vehicle is possible. A description of the possible type of repair may be provided, e.g., mending punctures, replacing chains and fixing lights. This information may be static or dynamic (availability status of such facilities).

5.4.3 Traveller Services

5.4.3.1 Introduction

The following sections provide examples of Traveller Services and this list is not exhaustive, and provides examples of functions typically encountered in the context of new modes; e.g., trip planning and traveller guidance functions are not described here as they are extensively described in standards related to conventional modes.

5.4.3.2 Booking

Booking is a traveller service which may be electronic and non-electronic dedicated to the reservation of a vehicle or a trip for users in specific dates and time as part of the urban mobility.

5.4.3.3 Registration

Registration is a traveller service considered as the virtual or physical first identification of users to access a traveller or transportation service. The registration process can be undertaken remotely using internet platform via PC or mobile access, or physically at specific locations.

5.4.3.4 Vehicle access control

Vehicle access control is a traveller service consisting in verifications and mechanisms to unlock and relock either an alternative vehicle mode.

5.4.3.5 Stopping place access control

Stopping place access control is an activity consisting in controlling and granting/denying access to a particular stopping place to vehicles operating as alternative or personal modes.

5.4.3.6 Payment

Payment is a traveller service of payment of a transport service. In the context of alternative modes, the process is mostly carried out using electronic payment procedures.

5.4.3.7 Trip planning

Modern computer-aided travel tools assist potential travellers in preparing their trips, particularly in answering specific TRIP REQUESTs. Such a trip planning function identifies the origin and destination places of an intended trip and proposes one or several trip solutions. The proposition takes into account the user's constraints or preferences, such as minimal trip duration, minimal number of interchanges, cheapest fare, etc., and involves an optimisation process using such parameters.

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After specification of the trip origin and destination, the system proposes a “trip pattern”, composed of access or connection walks/transfers to a number of public transport modes including alternative modes. Given a trip pattern proposal, it is possible to compute a precise duration of the trip (taking into account, for instance, the latest arrival time requested by the traveller) or a mean duration. It is also possible to calculate the corresponding costs, the suitability for a person of reduced mobility, etc..

The trip pattern components are explicitly linked to accessibility features; if such features are known they are populated ensuring that the trip pattern is suitable for the traveller according to specific needs.

If the request is made for a trip taking place on the same day, it is possible to take into account the monitored situation to refine the proposal. The trip pattern proposal will be influenced by service modifications due to control actions (e.g., service cancelled or shortened because of a protest) and the timing proposal will be based on actual (monitored) passing times.

5.4.4 Operational services

5.4.4.1 Vehicle shipping

Vehicle shipping is an activity consisting in cross-city vehicle shipping for any purpose, though particularly to ensure that vehicle sharing stations have sufficient vehicles for sharing and that the stations have sufficient spaces for vehicles to be released.

5.4.4.2 Repairing and maintenance

Repairing and maintenance is the provision of facilities for the repairing of all types of vehicles in dedicated areas with access to tools and spare parts.

5.4.4.3 Recharging and refuelling

Recharging and refuelling is the process of charging (possibly at a sharing station) of electric vehicles and the refuelling of liquid powered vehicles when required.

5.5 Cycling

5.5.1 Introduction

This section describes specific additional aspects of cycling.

Cycling is the operation of a cycle by a user to carry out a trip. Different modes of operation are described as: cycle rental; cycle-sharing; and private cycling.

The modelling of the information related to cycling can be used to provide traveller services; for instance, existing route planning algorithms may use cycling data to compute multi-modal trip plans including cycle rental and cycle sharing.

Cycle sharing, and cycle rental are both based on a commercial relationship between a user and an organisation making cycles available, which is not the case for private cycling.

The following types of cycles are considered in this document:

- Classical cycle: vehicle composed of wheels attached to a frame. It is powered by human muscles; and,
- Cycle with electric propulsion: vehicle with a low powered electric motor; falling in this category are: electric bikes; but also balancing scooter, hoverboard, motorised unicycles etc..

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5.5.2 Cycle rental

Cycle rental is applicable to any type of cycle. It provides a service which makes it possible to temporary (typically few hours or could be days) use a cycle for a time-based fee. In the context of multi-modal transportation systems cycle rental is a mode of operation enabling an alternative way of traveling across urban areas, in comparison to the conventional transport mode.

5.5.3 Cycle sharing

5.5.3.1 General

Cycle sharing is a mode of operation dedicated to (in general) short-term cycle rental in which the cycle can be taken and parked in different places anywhere in urban areas. One of the main differences between cycle sharing and cycle rental is the scheme in which they operate. Cycle sharing has a set of subscribed users who share the service, in general for short time or short distance rides for a fixed monthly or yearly fee. The fare depends on a range of parameters, for instance "frequent traveller profile" (see figure 38 concerning USAGE PARAMETERs). To be noted that the fares rely on a contract which may be implicit and anonymous (but in many cases the contract is personal) and this contract expresses the "membership" in a community of users of specific services (see 6.2.5.4.2 ‘Alternative Modes Fare Contract Information’).

5.5.3.2 Booking

Cycle sharing services offer a short-term booking in such a way that the users can check the closest available station, book a cycle and check-in within a short time. However, there is mostly no booking in advance; the user picks up one of the available cycles in the closest station.

5.5.3.3 Fares and payment

In cycle sharing operation, in most cases users pay for the service only once at the subscription and every time they have used the cycle longer than the free rental time.

5.5.3.4 Cycle network

Information about the cycling network is particularly important for trip planning. Parts of the cycling network may be shared (with other vehicle types) or dedicated to cycles. Dedicated lanes can be located on a part of the carriage way or sidewalks. Separation is provided using lane markings or permanent road equipment. The description of different characteristics of the cycling network, in particular of the sections dedicated for cycling, the slope, the type of surface, etc is standardised by ISO TC204 (GDF standard) and only partly by INSPIRE.

5.5.3.5 Cycling maps

Map of cycling infrastructure, comprising a map for the cycle network, cycle parking, cycle locker locations, publicly available lockers or private lockers, etc. represents a complement to the delivery of information concerning cycling-related infrastructure. According to the Delegated Regulation EU 2017/1926, INSPIRE data model has to be used to publish the cycle-lanes related information. However, there is a standardisation gap, as the INSPIRE data model is not complete in this domain.

5.5.3.6 Availability scenarios

The following scenarios are possible depending on the type of cycle sharing scheme:

- Docked: cycles are obtained from a specified predetermined location such as a cycle docking station where the station communicates the availability of a cycle and records when it has been taken and

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returned and by whom. The docking station will have systems to release a cycle to the potential traveller. A station may in fact have a higher capacity than the strict number of docks if it has attendant staff able to fetch additional vehicles to or from storage to balance demand – so called 'valet service'. It may be of equal importance to a user that there is an available empty dock to which to return their cycle at the end of their journey, otherwise they may face a time-consuming search and even a penalty fee for longer usage.

- Floating: For cycles in a dockless bike sharing system which typically feature immobilisation locks integrated into their frame, a station is not required. The cycle can be left at any safe location within the scheme zone and be immobilised or reactivated using a code.

5.5.4 Private cycling

Private cycling is a mode of operation consisting in using private cycles without any public advertisement. Travellers require access the entire infrastructure, in particular to cycle lanes, cycle parking areas and associated equipment (racks and lockers).

Data considered of interest for private cycling is:

- cycle network information: maps of urban infrastructure entirely or partly dedicated to cycling (dedicated or shared sections of the road network, dedicated lanes),
- parking availability information: availability of parking spots and lockers,
- pricing rules information (this is for parking or more general the use of the cycle infrastructure only).

This document does not focus on private cycling but most of the information modelled is useful for the above information provision.

5.5.5 Geofencing and areas of permitted use

- Most vehicle sharing systems (cycle, scooter, car, etc) operate only within a specific spatial area. This area may be indicated though maps or passenger information, or for vehicle with remote immobilisation systems, may even be enforced electronically by GNSS detection. Furthermore, certain areas with the operational zone may be restricted as to their use for operational, safety, or other reasons, for example to control environmental pollution. There may be financial penalties associated with violating the restricted boundaries at any time or at a particular time..
- The permitted areas may be described using mobility constraint zones, each expressing a spatial extent and the permitted uses.

5.6 Car sharing

5.6.1 Introduction

Car sharing is the use of a vehicle belonging to a commercial car sharing provider or a car sharing club for a specified pre-agreed time; it is similar to conventional vehicle renting but the time periods are shorter and there is less manual intervention at the beginning and end of the sharing period, and that the organisations involved are generally smaller than the large rental companies.

Car sharing is different to trip-sharing or carpooling in that it is the vehicle that is shared rather than a number of travellers using the same vehicle at the same time to complete a trip.

There are three main types of cars sharing:

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- provision of vehicles by an organisation (commercial cars sharing);
- peer to peer (car club) provision;
- conventional car rental.

The following types of cars are considered in this document for the different modes of operation:

- conventional cars: cars of different sizes, equipment, and gearbox type using conventional liquid fuel (gasoline or diesel); although hybrid cars which do not rely on being charged can also fall into this category;
- cars with electric propulsion: cars that need to be recharged after journeys or at the end of a sharing period;
- larger vehicles: vans that could carry up to 16 persons or goods.

5.6.2 Commercial car sharing

5.6.2.1 General description

Two different types of commercial car sharing are identified:

Business to Business - where an organisation makes available vehicles to another business (B to B) for the purpose of car sharing. The vehicles are only available to the staff of the business for the purpose of carrying out tasks for that business. Essentially, it is the contracting business that organises who, when and where an employee can use the vehicle. The car sharing organisation looks after all the charges and the provision and maintenance of the vehicle and possibly provides the systems for the logistical control of the vehicle.

Business to consumer – this is the conventional car sharing, where an organisation has a pool of vehicles that are available on a car sharing basis to registered consumers on an on-demand basis.

5.6.2.2 Registration

For the majority of the commercial services a user must register with the car sharing company. This registration will set up a payment method, the driver's credentials for use of the service and perhaps a deposit which will supply cover to the service provider in the event of damage or loss of the vehicle. This registration as well as setting up the account will also provide the applications for access and using the services.

5.6.2.3 Availability scenarios

Depending on the type of car sharing the vehicle could either be at a specified predetermined location (a car sharing slot) or where the vehicle was left after its last trip. There are a number of different scenarios around these two location conditions:

- Closed loop - this is where the car is accessed at a prescribed location and dropped off at the same location; this is also known as a station based round trip;
- One way - this is where the car accessed at a prescribed location and dropped off at another prescribed location; this is also known as free floating pool station;
- Free floating - this is where the car is picked up where it was dropped off after its previous use and drop off where the usage ends. The car sharing application will guide the potential user to the nearest

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or most accessible location of a suitable vehicle; this is also known as free floating operational area; or,

- Special docking facilities (for electric vehicles).

Some types of vehicles will require access locations that are suitable for their fuel type. Electric vehicles will require a parking location with charging facilities where the vehicle can be recharged between uses. Hence the free-floating option will not be applicable.

Car sharing parking lots might be quite large, such as at airports or other transport nodes. It might be necessary to give more detailed guidance to find the allocated vehicle.

It may not be practical to access a vehicle with a conventional key or key fob system so that other methods are used. In most cases it is a telematics system is utilised where the car-share application on a mobile device is used to scan an identification on the vehicle which in turn is automatically unlocks the vehicle and enables its use.

5.6.2.4 Fares and payment

There are a number of models for payment for the service:

- A subscription-based service where for a fee the vehicle can be used on an agreed number of occasions and an agreed distance travelled;
- A per distance service where the number of km travelled are charged on a metered basis;
- A per time basis when the time the vehicle is in use and therefore not available to others is charged; or,
- a combination of time and distance used.

5.6.3 Car sharing clubs (peer to peer)

5.6.3.1 General description

Peer to peer car sharing is publicly advertised service where a vehicle is owned by an individual, or a collective of individuals to make it available to others when it is not being used with a view to realising the best use of the investment in the vehicle. Peer- to-peer schemes are similar to commercial car sharing schemes in that an income from the vehicle is expected to offset the cost of the vehicle provision but differs in that it is not the prime purpose of the peer to peer or car club to make it a significant commercial business.

Peer-to-peer schemes are likely to operate on a semi-formal basis, but it is also likely that a peer to peer operator may join with others to for a car club in order to enjoy the benefits of an operating model, legal advice and insurance discounts. These benefits can be instantiated in a customisable commercially available software that can provide a smartphone app to make the booking and use of a vehicle seamlessly. Car sharing clubs are covered in this document as it is possible that the clubs could be federated into an overall car sharing offer.

5.6.3.2 Registration

Individuals wishing to use a car share vehicle will need to register and present their credentials and payment details before a vehicle is used.

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5.6.3.3 Access to the vehicle

At present most peer to peer systems will not use telematics-based access systems and will rely on the manual passing of a key or key-fob; however, this is likely to change as vehicles become more and more connected. As the number of vehicles in a peer to peer or car club scheme are likely to be low and that a closed loop system will be used, there are few logistical issues, save handling faults and damage.

5.6.3.4 Fares and Payment

Payment for the service will generally be by credit or debit card facilities. Payment will generally be handled by a car-club app.

Charges for the services can be based on any of the methods described in 5.6.2.4.

5.6.4 Car rental

Car rental is the provision of a vehicle for a specified time from a car rental company. Conventionally the transactions can be face to face with an agent in an office (adjoining the parking place) or by the car being delivered to, or, collected from an agreed location by the rental company's agent after the car has been booked and financed using web services. Increasingly, services are being introduced where access to the vehicle is undertaken by a telematics system. For instance, many large retail outlets have vans hireable by the hour which are booked and paid for using a terminal in the store or via a smartphone application. Users do have to register for the services, but again this can be done on the application or at the instore terminal. Access to the vehicle is via a code which is keyed into the vehicle which releases the door locks. The keys for the vehicle are left inside along with a fuel charge card. Any damage (before or after the hire period) to the vehicle is reported back to the operator by phone, smartphone application or using the in-vehicle terminal. The vehicle is generally returned back to the parking place it was retrieved from.

The main differences between car sharing and the more automated car rental are:

- with car rental the vehicle is normally booked in advance and for a specified time period rather than on an ad-hoc basis;
- with car rental the vehicle has to be returned to an agreed specified location.

5.7 Carpooling

5.7.1 Introduction

Carpooling is sharing personal cars (or possibly other types of vehicles or modes) between travellers for particular journeys or part of journeys (most often drivers and passengers do not share the same origin or destination).

Informal sharing has always taken place, particularly between family members, but also through citizens helping others out, including hitchhiking.

Carpooling in this document is considered to be planned and organised, rather than informal.

Carpooling may not always be arranged for the whole length of a journey. Especially on long journeys, it is common for passengers to only join for parts of the journey, and give a contribution based on the distance that they travel.

In some countries carpooling charges can only cover prescribed costs and a profit cannot be made by the provider of a carpooled journey.

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5.7.2 Generic Carpooling

Drivers offer a place for specific journeys on a specific date and time through an online service (usually web site or app) and passengers browse through these offers and select the one that suits them.

Different offer-request matching algorithms are available. Once the passenger has found a suitable offer (which can be a part of the proposed journey or may require a small change in the journey), a contact is established between the driver and the passenger to agree the detail of the journey.

The final booking (once all the details have been agreed) and payment may vary depending on the carpooling service used.

Most tools also provide a feedback feature to collect opinions and comments about drivers, but also about passengers; both may be banned from the service in case of inappropriate behaviour or conditions.

5.7.3 Dynamic Carpooling

Dynamic carpooling is similar to conventional carpooling but allows for ride-matching once a journey has commenced and is mainly suitable in the urban context (as opposed to long distance which is generally inter-urban and pre-arranged).

Dynamic carpooling usually but not necessarily requires:

- a smartphone with a dedicated app (for both driver and passenger);
- a continuous Internet connection;
- GPS availability, and associated map (road/pedestrian network) information: for users to locate each other, for guidance (walking to join a meeting point, or driving), etc.;
- a ride matching algorithm;
- social networks (usually inside the carpooling app) to establish trust and accountability between drivers and passengers.

Note that the organisation of dynamic carpooling is strongly linked to the evolution of technologies and is very different from what it was 10 years ago and is very likely to be very different again 10 years from now.

Data shall be shared taking account of user safety and security.

5.7.4 Carpooling organised by specific companies

Companies, and large organisations like universities can also provide a dedicated carpooling service to their employees, customers, students etc.. Organisational carpooling is mainly dedicated to home-to-work carpooling but can also be used in a broader context (business trips, etc.).

The operating methodology is similar to long distance carpooling but with added features as potential users are already known to the organisation operating the service: addresses and destinations (company, university) are already known allowing spontaneous incentive on journeys.

When the fleet of vehicles of the company in used, the service can be a combination of carpooling and car sharing.

More and more carpooling schemes are proposed by public transport organisations to help travellers when there is maintenance work on the network, to provide an alternative in case of cancellation or strike, or to cover last miles when public transport is not.

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This type of service is usually based on an "off the shelf" solution from a software company, purchased by the organisation willing to set up a carpooling service, and configured for its specific use.

5.7.5 Carpooling functions

5.7.5.1 General

The following clauses describe functions for the carpooling excluding taxi and chauffeured car (cf. 5.6.7)

5.7.5.2 Pricing

The price the passenger has to pay for his carpooling journey is expected to cover a part of the driver's costs (fuel, car costs, etc.) but is never a way for the driver to make money (as opposed to taxis and chauffeured cars).

The basic principle for the price is to calculate it by dividing the sum of the fuel, possible tolls, calculation of the depreciation of the vehicle purchase and maintenance, insurance and taxes paid by the driver, distributed across travellers in proportion to the distance travelled by the passenger and the number of people that shared the vehicle.

Distance based pricing has also been proposed by some carpooling services (independently from the number of travellers: based on the maximum number of travellers).

Note that pricing nearly always requires an agreement on the distance of the journey before the travel time (and the duration of the journey is not part of the price calculation). The detour of a driver to pick up a passenger should be taken into account as well.

Note that pricing does not always occur: in some cases, it can be an exchange of service, or an agreement to be driver for a future journey.

5.7.5.3 Proof of carpooling

To be paid, or to be able to use some advantages dedicated to carpooling drivers (for example free parking, high occupancy vehicle lanes) the driver may need a proof of carpooling.

This proof of carpooling may also be required for taxes for the driver (income control) or for the traveller (proof of purchase when reimbursement is possible, e.g., for company employees,).

It is not always possible to get proof of carpooling, there is no completely reliable method to get this proof. In practice this proof may be a personal declaration - where the car-pooler states he/she did in fact carpool that day. This can be verified, for example by checking the license plates or, on dedicated lanes, by checking the number of travellers inside the vehicle.

5.7.5.4 Registration

Since the carpooling is a person to person activity, services are expected to provide a very high level of trust and security (personal security, in addition to financial security).

Therefore, registration most often involved several levels of identity checking and validation related to:

- E-mail (provided to connect 2 users);
- Phone number (provided to connect 2 users);
- Social network link (so user may check what kind of activity you have on your Facebook account);
- ID/passport number (of course, only the fact that the check has been completed is provided to the other users);

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- Driving licence and insurance.

5.7.5.5 Travel matching and booking mechanisms

The travel matching mechanisms can be from very simple (matching of origin/destination and time window) to quite complex, possibly integrating features such as:

- Being based on a real road-based journey planning algorithm (others may just use geographic "corridors" or simple via point or city);
- Possible enlarging of the area around departure and arrival locations;
- Possible integration of multimodal journeys;
- Integration of carpooling areas (and possibly guidance to find them);
- Integrating possible detours;
- Integrating user profile matching;
- Integration possible connections with public transport (offering travellers to start or end their journey on public transport or, in certain case, offering to switch to carpooling in case of disruption in public transport.
- Register request and receive alerts when a matching offer is available (e.g., SMS push alerts, mail, in Apps, and other messaging formats).

5.7.5.6 Payment

Carpooling services integrate a secured payment mechanism, acting as middleman between the driver and the traveller. Most usual payment methods, as credit card, PayPal, bank transfer (for drivers), etc. are usually accepted.

There may be different scenarios and characteristics:

- There is no direct payment from the traveller to the driver;
- The traveller pays using the online service (web site or app) at the time of booking the journey;
- The payment usually includes the travel cost plus the service fees plus the possible taxes;
- Once the journey has completed and if no special event has been reported, the driver is paid usually a few days after the trip, so the traveller has sufficient time to report any issues;
- In case of issues or if for some reason the journey was not performed, the traveller may be reimbursed (usually under conditions and not always 100%, typically service costs aren't usually reimbursed);

5.7.5.7 Accessibility for persons with restricted mobility

Some carpooling services provide a vehicle description, and driver ability to be able to carry disabled travellers with wheelchair, etc.; however, this is not the most common situation and is usually specific to some carpooling services.

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5.7.5.8 Infrastructure

In addition to the road network itself, some more specific infrastructure may be used for carpooling.

- Carpooling areas are advertised areas where a driver can pick-up or drop passenger to start or end a carpooling journey. There is no predefined structure for a carpooling area:
  - it can just be an advertised area where the car can access from the road network;
  - it can be a part of a parking area;
  - it can be a dedicated area;
  - it can be a closed or open area;
  - accessing to the area can be free, controlled or regulated;
  - access for passengers can be only by foot, but the area can also offer parking places (under agreed conditions) for passengers to leave their own car, or their bike, and start a carpooling journey; or, an advertised carpooling area may also be used for other purpose (rest area, etc.).

Carpooling areas are not mandatory for carpooling: they mainly aim to facilitate carpooling, promote it and to ensure a safe pick-up and drop-off. In some countries there may be regulations on advertising and management of carpooling areas.

5.7.6 Carpooling users

5.7.6.1 General

Carpooling users' profiles are vital for users to trust the service. There are 2 main types of users' profiles:

- The driver's profile; and
- The traveller's profile.

To be able to provide a sufficient trust level, as much information as possible is expected by users (and therefore by carpooling services) but this raises potential privacy issues that have to be managed by carpooling services.

5.7.6.2 Drivers

There is generally more data collected for the driver than the traveller. The level of detail provided varies depending on the step in the booking process:

- Early stage of the ride matching process (list of available trips): minimum level of information;
- Selection of a trip: a little more detailed information (but driver's name and contact are not provided, the communication with the driver is usually done through the service);
- The driver has accepted the request: full details;

The following information concerning the driver is usually required:

- Name (usually partially hidden in the first steps of the booking process);
- Valid licence and insurance;
- Age;
- The verification level of the driver's account - e-mail address, phone number, ID Card, etc.;

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- The driver's account statistics - number of proposed trips, number of persons who have travelled with him, we he first registered, when was the last proposed trip, etc.;
- The driver's driving style - according to users;
- Whether the driver is talkative or quiet;
- Whether the driver is a smoker;
- Whether the driver has an animal that is sometimes in the car, even if not in the car during the specific journey;
- Traveller evaluation - mean ranking, number of evaluations, etc.;
- Traveller comments;
- The type of vehicle - possibly including vehicle details;
- Social network integration - number of friends on Facebook, etc..

Accepted passenger requirements:

- Whether bringing luggage is possible - with dimensions;
- Whether detours are possible (including time and distance);
- Whether taking an animal is possible;
- Facilities for disabled travellers;
- Companions for disabled travellers.

5.7.6.3 Travellers

The traveller's profile is received by the driver who may then accept the request, start discussing with the requesting traveller, of reject the request.

The traveller's profile is usually similar to the driver profile, except for the driver's specific information - type of car, etc..

Drivers can rank travellers as they can be ranked by them (they usually are both notified of any ranking or comment, as on any social network).

5.7.6.4 Priority

The vehicle pooling may be given priority in being able to use public transport lanes or priority at traffic signals with the permission of local traffic authorities. Information on these priorities via signage is necessary as well as a robust means of determining which vehicles are presently using vehicle pooling. Refer to Annex C for more information.

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5.7.7 Taxi Services

5.7.7.1 Introduction

Taxi services similar to vehicle pooling services in that the vehicle is operated by a driver and the traveller pays for the journey. The main differences between taxi services and carpooling are, firstly that taxi services will be operated on a commercial basis where the operator makes a profit over and above the costs of providing the service; and secondly that the driver of the vehicle is making the journey solely for the benefit of the traveller. Essentially, they are demand responsive service.

Taxi services can comprise one of three scenarios:

- Taxi services that can be hailed on street and can stop to pick up the traveller at the side of the road and commence charging (by distance and time) from the point of pick up and cease charging on drop off. This sort of taxi service can use taxi stands. In many cities this kind of taxi service is highly regulated and licenced, and the drivers regularly checked for competence and safety. Some taxi services can also be booked and paid for on account.

- Bookable chauffeur driven services (sometimes called minicabs) that need to be booked in advance and cannot be hailed from the roadside. Historically bookable chauffeur driven services were booked by telephone, but more recently services have been introduced where the booking is undertaken by a smartphone application that identifies and hails the nearest vehicle subscribed to that service. This service cannot normally use a taxi rank at the side of the road except where it is combined with a booking office.

- A taxi service which can operate more like a bus service where unrelated travellers can share the costs of part of a trip in a similar way to carpooling. This sort of service is generally operated on a pre-booked basis.

5.7.7.2 Taxi stands

Taxi stands are normally delineated by road signs and/or road markings. The stands can be in an area at the roadside or in a layby area. The purpose of the stand is to provide a place where taxi services can: wait whilst not cruising for business; can provide comfort facilities for the driver; or be a place where potential travellers can find a free taxi. Stands will have a location (address), potentially a telephone number and potentially the number and type of vehicles it can accommodate.

5.7.7.3 Booking

Both taxis and chauffeur driven vehicles can be booked by telephone or online.

5.7.7.4 Fares and payment

For taxis fares are normally based on a combination of distance and time, that means the fare can increase in heavy traffic. Chauffeur driven cars that are booked can be operated on an agreed cost per journey basis regardless of the time taken to complete the journey.

5.7.7.5 Priority

The taxis may be given priority in being able to use public transport lanes or priority at traffic signals. Information on these priorities via signage is necessary as well as a means of determining that a vehicle is eligible. The awarding of specific priorities will be part of the public authority policy.

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6 Data requirements

6.1 General

This chapter is the revision of CEN TS 17413 Data Requirements. It is an extension of the series EN12896-X (2016 & 2019). The data modelling conventions have been extended to show the additional concepts and relationships compared to CEN TS 17413 and EN12896-X and are described in Annex D.

6.2 Data model

6.2.1 Overview

The data model is modular and structured as follows:

a) Modules (packages) showing extensions of packages present in EN12896-1 &2.

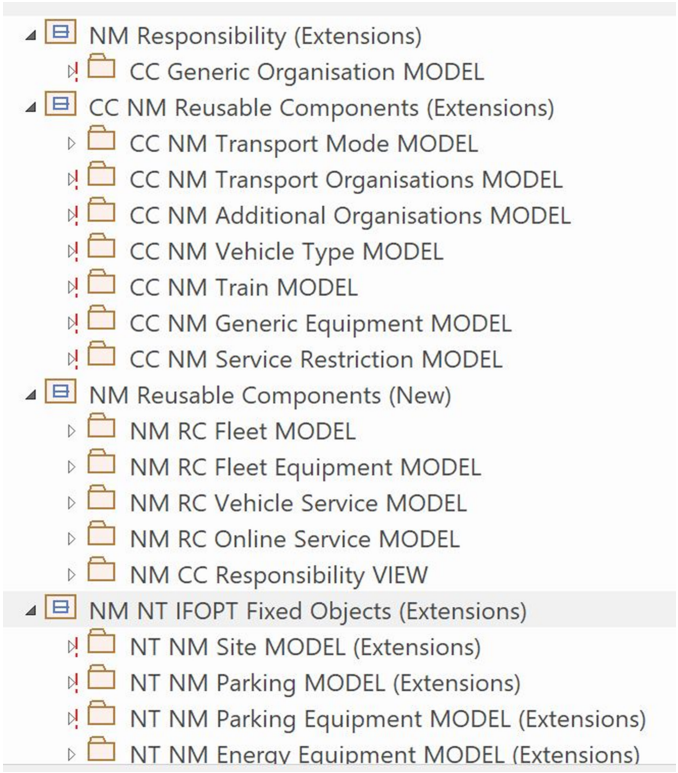


Figure 4 — Alternative Modes - Extensions Overview

b) New modules (packages) specific to Alternative Modes data structures:

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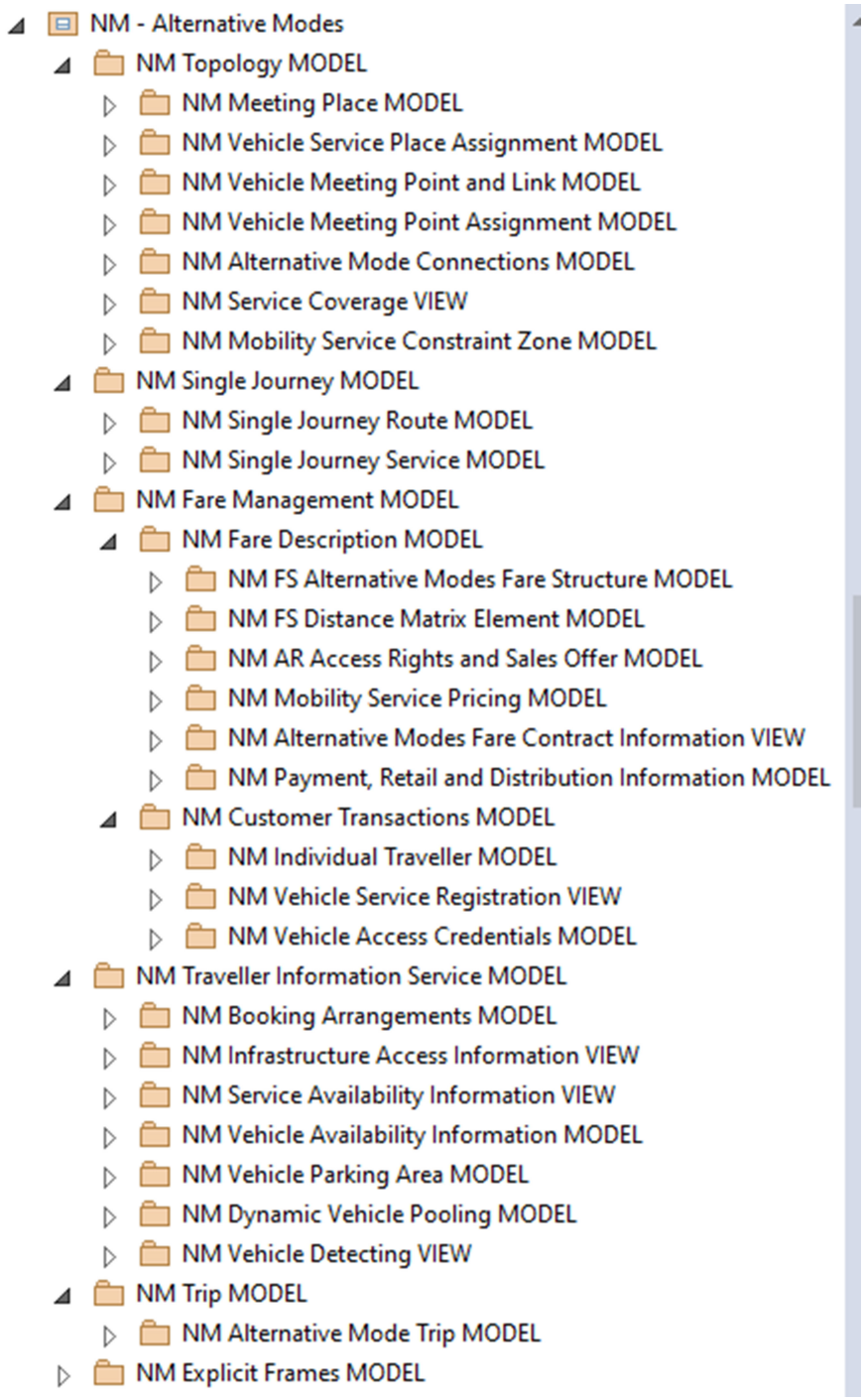


Figure 5 — Alternative Modes Model Overview

NM Topology MODEL: provides several models for spatial information linked to alternative modes of operation.

NM Single Journey MODEL: provides two submodels describing the routes and journeys defined for services such as vehicle pooling.

NM Fare Management Description MODEL provides submodels showing how the Transmodel Fare Management model may be used to describe products for alternative modes. It uses the same concepts of access rights, tariffs, products and prices as defined in Transmodel Part 5.

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NM Fare Management Customer Transaction MODEL provides submodels showing how the Transmodel Fare Management model may be used to describe the purchases and use of alternative mode services. It includes additional concepts to describe pooling service users, and to describe the registration and access credentials.

NM Traveller Information Service MODEL: provides sub-models representing data requirements for the traveller information services enumerated in 5.4.2 (and not covered by the models above).

NM Trip MODEL: provides the model of the trip where particular legs are made using alternative modes:

NM Explicit Frames provide information about the specific VERSION FRAMES to be used to organise the alternative modes data elements for exchange as a coherent data set.

6.2.2 Common Concepts extension for Alternative Modes

6.2.2.1 Generic Organisation

The Generic ORGANISATION Model defines abstract ORGANISATION elements that can be used wherever there is a need to describe an organisation. It is extended in the Reusable Components section with AUTHORITY, OPERATOR and other concrete organisation definitions specifically relevant for the transport domain.

6.2.2.2 Generic Organisation – MODEL

The entity ORGANISATION represents an organisation that is involved in the planning, collecting or provision of PT information. For example, a company providing a public transport information service, an authority, an operator, or a company providing an information collection service.

- Many organisations break down their operations into different organisation parts. This may be important not only from the operational point of view, but also for data administration, as different units may have different responsibilities. Some common data will be shared between them whereas some other will be managed by a specific part. The RESPONSIBILITY ROLE ASSIGNMENT can be used to describe these responsibilities.

- An ORGANISATION can consist of several DEPARTMENTs or ORGANISATIONAL UNITs. Those departments or units are modelled in the ORGANISATION PART.

- A DEPARTMENT can consist of one or more ORGANISATIONAL UNITs, which are in charge of operational functions. In a PTO context, a DEPARTMENT could comprise all ORGANISATIONAL UNITs responsible for the lines served by the same transport mode, or using the same type of operation (e.g., regular service, night service).

- In some cases, the organisational aspect of responsibilities for planning and operation need not necessarily to be present in a company data model. Therefore, the relationships to (and the existence of) these organisational entities are optional.

- The ADMINISTRATIVE ZONE represents a set of PT objects related to a district, a region, a city, a municipality, a traffic system, a set of lines or other subdivision for a specific purpose.

- An ORGANISATION may stand in a number of different types of relationships with other organisations; for example, as subsidiary, owner, contractor, collaborator, etc. Such relationships may be represented by a RELATED ORGANISATION, using a RESPONSIBILITY ROLE to indicate the nature of the relationship.

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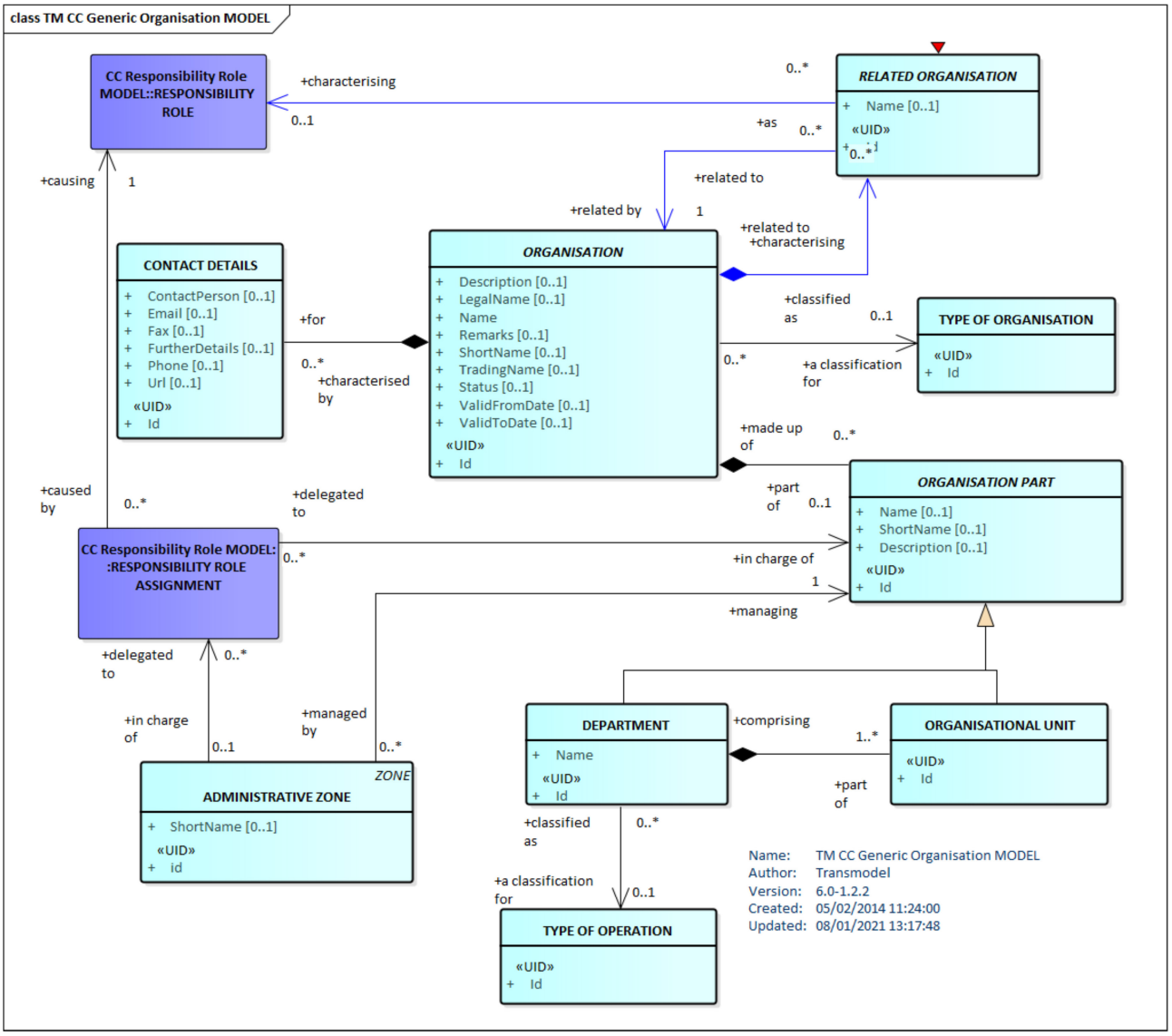


Figure 6 — Generic Organisation MODEL (UML)

6.2.3 Reusable components extension for Alternative Modes

6.2.3.1 Transport Organisation (extension)

6.2.3.1.1 General

The TRANSPORT ORGANISATION model defines organisations who run transport, specifically OPERATORs of Public Transport and the AUTHORITY. OPERATORs may be divided into OPERATING DEPARTMENTs.

The generic term OPERATOR expresses a rather general responsibility for a concessionary contract for public transport, where the operational responsibility for the execution of this contract may be handed to a specific OPERATING DEPARTMENT of the ORGANISATIONAL UNIT. The OPERATOR acts as an alias for the ORGANISATIONAL UNIT. Part of the contract-execution can be subcontracted to another OPERATOR. Or even the public transport for a whole area can be divided into several contracts, where a GROUP OF OPERATORs are actually the executers of the public transport timetables for a whole area.

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6.2.3.1.2 Transport Organisation – MODEL

A TRANSPORT ORGANISATION is a specialisation of ORGANISATION providing transport services related to particular modes of operation. Both an AUTHORITY and an OPERATOR are specialisations of TRANSPORT ORGANISATION that are specifically concerned with providing public transport.

An ORGANISATION PART of an ORGANISATION acts as an ORGANISATIONAL UNIT, responsible for the determination of the PT Services that need to be delivered in an OPERATIONAL CONTEXT often defined or limited to one TRANSPORT MODE or even to one VEHICLE MODE or SUBMODE that is the responsibility of one of its DEPARTMENTs. This defines the actual involved OPERATING DEPARTMENT that will act as the serving OPERATOR for the ordered services by the public transport AUTHORITY. The serving OPERATORs can be combined for executing this service in a GROUP OF OPERATORs.

It is possible to create a GROUP OF OPERATORs for a specific PURPOSE OF GROUPING, required for special functions or processes in public transport, e.g., CONTROL CENTREs, fare collection, passenger information, etc.

A CONTROL CENTRE is an organisational concept for where operational management takes place.

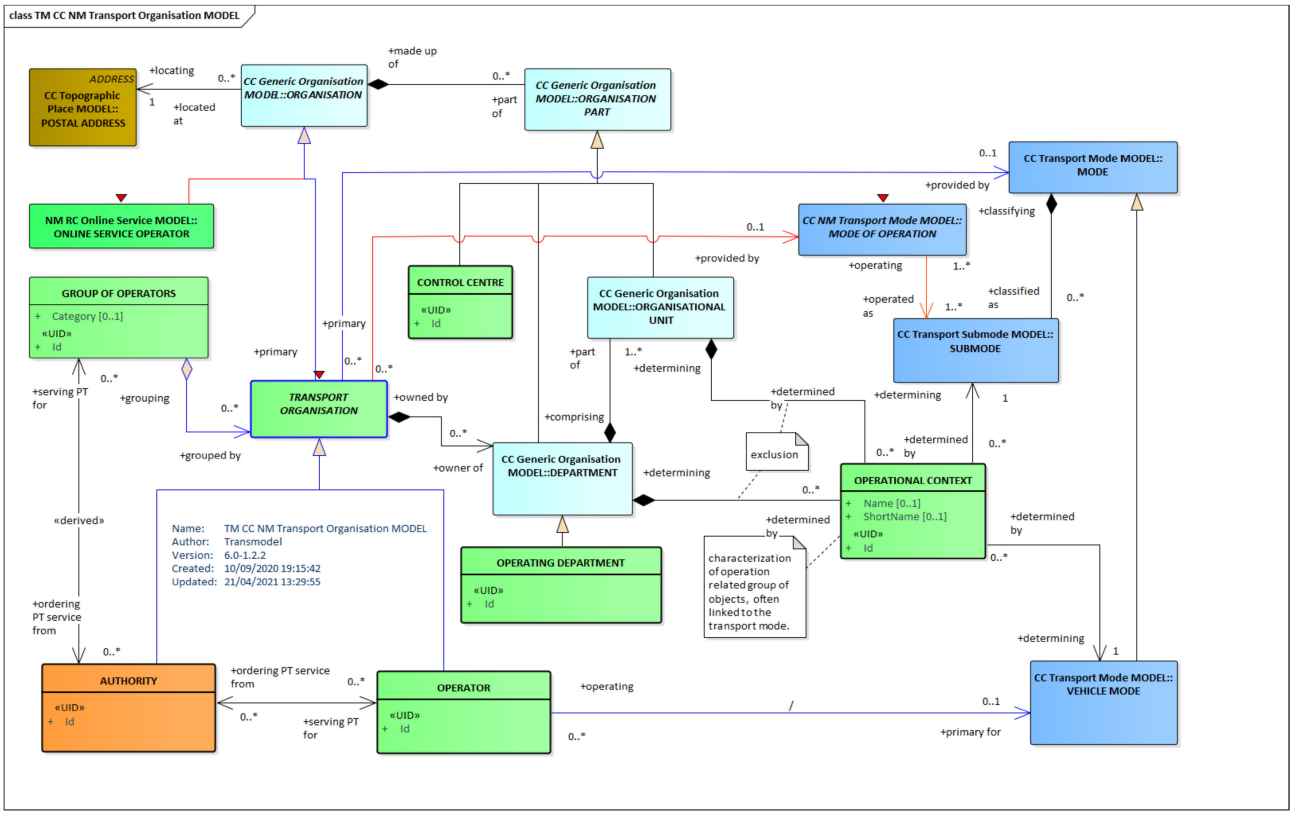


Figure 7 — Transport Organisations MODEL (UML)

6.2.3.1.3 Additional Organisations (extension)

6.2.3.1.4 General

Types of organisations other than the classically identified such as organisations regulating or performing transportation service are explicitly identified.

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6.2.3.1.5 Additional Organisation – MODEL

ONLINE SERVICE OPERATOR is an organisation that provides online access to an ONLINE SERVICE without necessarily operating transportation services for travellers (see ONLINE SERVICE -Conceptual MODEL).

Note: an ONLINE SERVICE can be operated by any OPERATOR, but an ONLINE SERVICE OPERATOR only operates ONLINE SERVICE

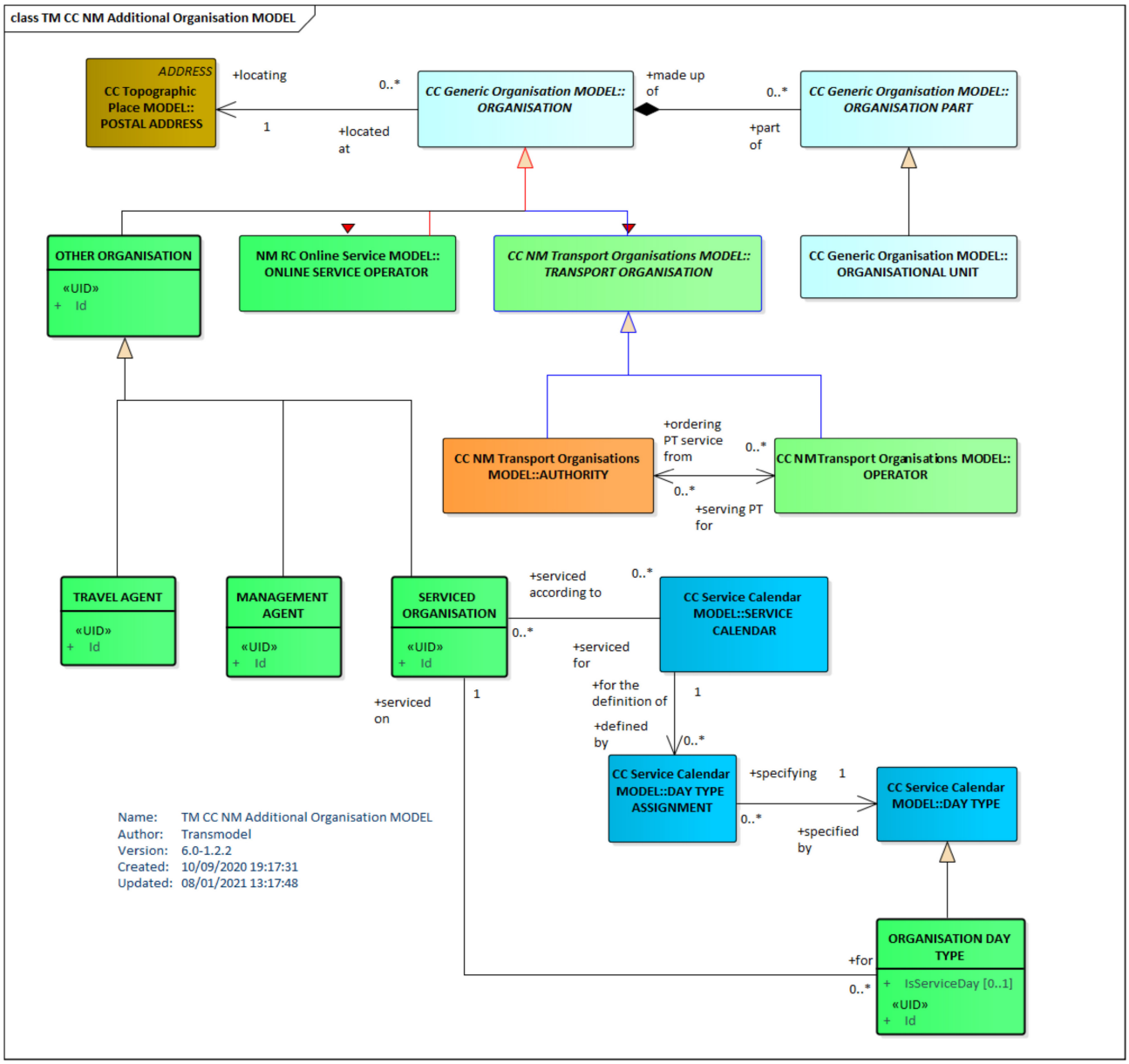


Figure 8 — Additional Organisations MODEL

6.2.3.2 Transport Mode (extension)

6.2.3.2.1 General

The diagram below intends to clarify the distinction between, on one hand

- the concept of MODE, defined as any means of transport, or SUBMODE, defined as a variant of a MODE, linked to VEHICLE TYPE (see EN12896-1); and the other,

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- the concept of MODE OF OPERATION which represents the way the MODE or SUBMODE is operated.

6.2.3.2.2 Transport Mode – MODEL

- Three specialisations of MODE OF OPERATION are identified:

- CONVENTIONAL MODE OF OPERATION: Legacy mode of operation which is provided as a scheduled and/or flexible publicly advertised transport offer.

- ALTERNATIVE MODE OF OPERATION: Any publicly advertised mode of operation different from the CONVENTIONAL MODE OF OPERATION, for example: VEHICLE SHARING, VEHICLE RENTAL and VEHICLE POOLING.

    - VEHICLE RENTAL: An ALTERNATIVE MODE OF OPERATION of a vehicle, part of a FLEET (in general privately owned), available for use for a certain period of time and fee, with the constraint to bring it back at specified agencies.

    - VEHICLE SHARING: Short term vehicle rental where the vehicle can be taken from and parked at different places in the urban area, possibly without the constraint to bring back the vehicle to a specific location.

    - VEHICLE POOLING: An ALTERNATIVE MODE OF OPERATION of a privately-owned vehicle consisting in sharing the vehicle for a trip between the driver who is at the same time performing a trip and at least another traveller.

    - NOTE: Chauffeured Car and Taxi are special types of VEHICLE POOLING (with a dedicated TYPE OF OPERATION).

- PERSONAL MODE OF OPERATION: Not advertised mode of operation of private persons using their own vehicle.

Diagram "NM Mode MODEL" shows that any SUBMODE may be assigned one or several MODEs OF OPERATION. For instance, a "local bus" may be operated as a CONVENTIONAL MODE, scheduled or flexible. A "mini-bus" may be operated using a CONVENTIONAL MODE OF OPERATION (scheduled or flexible), or as an ALTERNATIVE MODE, for instance, dedicated to VEHICLE SHARING. TYPE OF MODE OF OPERATION characterises more precisely possible ways of operation, for a given a SUBMODE.

This particular specification concerns ALTERNATIVE MODES OF OPERATION, but many similarities to the CONVENTIONAL MODE exist, in particular, as regards types of data structures and for this reason, many models for the new modes take advantage of existing Transmodel data structures.

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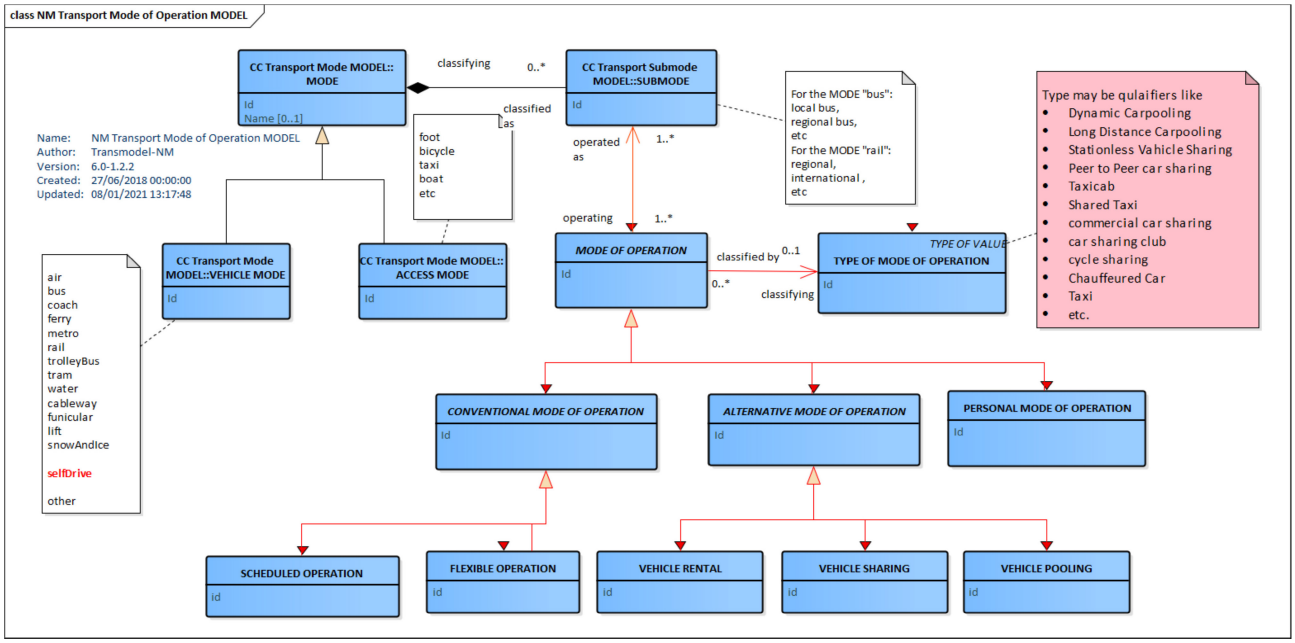


Figure 9 — Mode MODEL

6.2.3.3 Vehicle Type (extension)

6.2.3.3.1 General

The VEHICLE TYPE MODEL represents VEHICLEs and their properties.

VEHICLEs may be classified according to the vehicle scheduling requirements as to model and capacity and on board facilities (e.g., standard bus, double-deck, etc.). These same requirements may be attached to a SERVICE JOURNEY to indicate that it should be satisfied by a vehicle of that type.

6.2.3.3.2 Vehicle Type – MODEL

A TRANSPORT TYPE characterises the properties of any form of VEHICLE, public or personal. It is specialised as a VEHICLE TYPE and a SIMPLE VEHICLE TYPE.

A VEHICLE TYPE specifies the requirements for a passenger carrying scheduled public transport vehicle. These may include various types of VEHICLE REQUIREMENT.

- A PASSENGER CARRYING requirement, specify a PASSENGER CAPACITY for different categories of PASSENGER.
- A MANOEUVRING REQUIREMENT specifying the constraints on manoeuvrability of the vehicle
- A FACILITY REQUIREMENT specifying facilities required on the VEHICLE.

A SIMPLE VEHICLE TYPE specifies the requirements for a VEHICLE being used to provide alternative mode services and can include characteristics of other types of vehicles such as cycles, scooters, etc.

A TRANSPORT TYPE may belong to a VEHICLE MODEL, specifying a set of properties satisfying a VEHICLE EQUIPMENT PROFILE.

A given VEHICLE will have a TRANSPORT TYPE and a VEHICLE MODEL.

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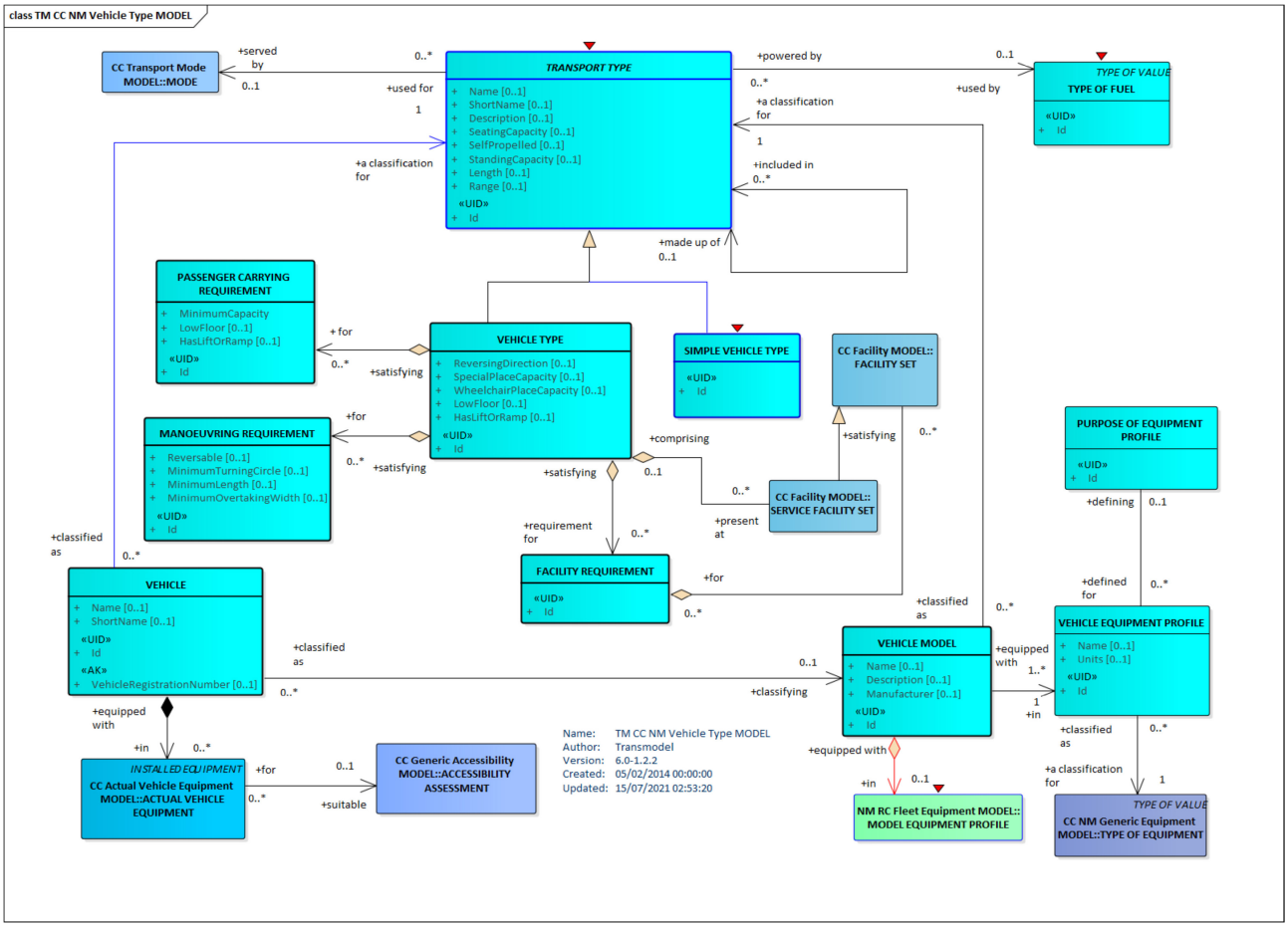


Figure 10 — Vehicle Type MODEL

6.2.3.3.3 Train – MODEL

As a consequence of the extension of the VEHICLE TYPE model, the TRAIN model is structured as follows:

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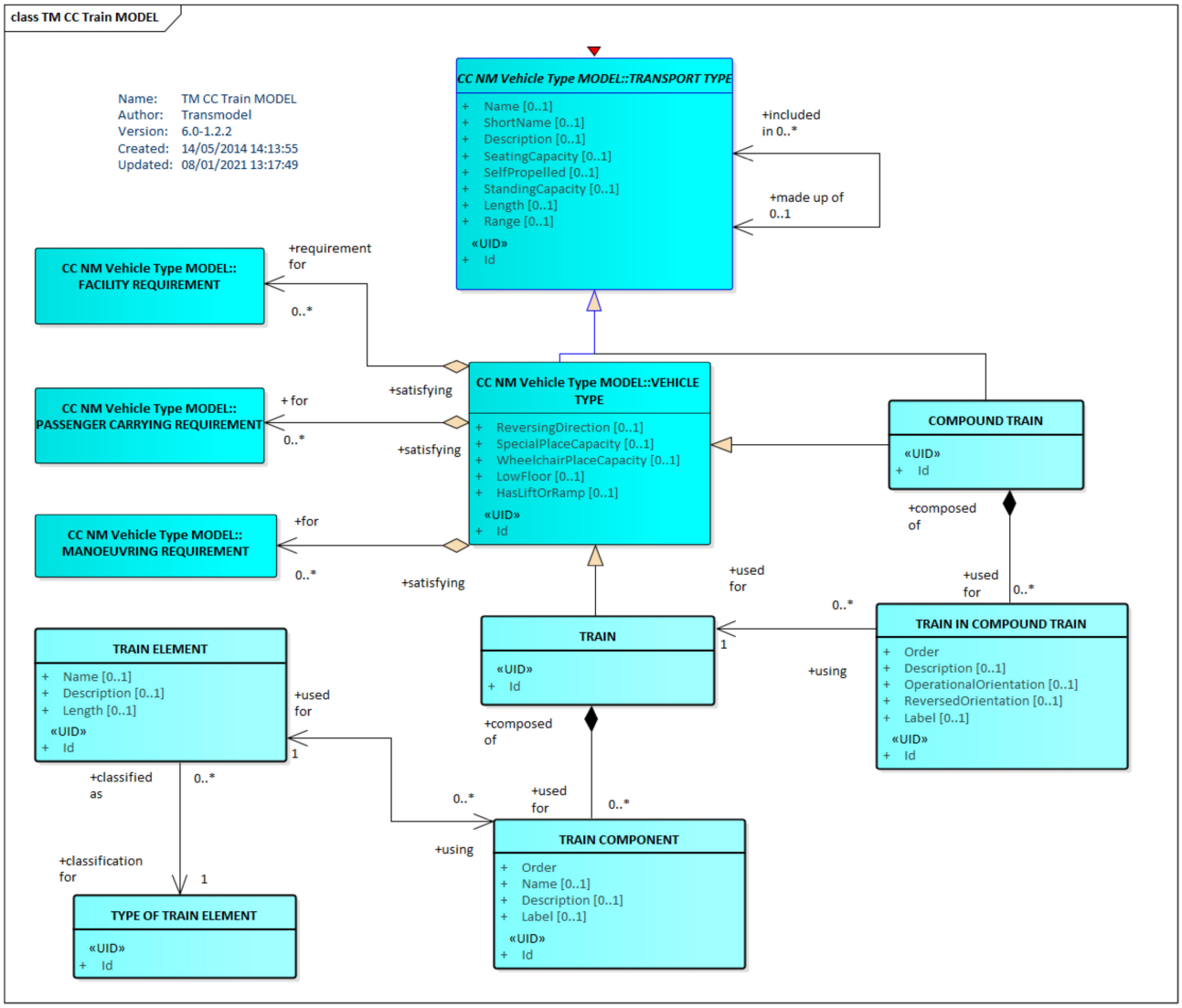


Figure 11 — Train MODEL

6.2.3.4 Generic Equipment (extension)

6.2.3.4.1 General

The Equipment Model for the alternative modes relies on the generic Transmodel representation of EQUIPMENT, specialising in INSTALLED EQUIPMENT, LOCAL SERVICE and MOBILITY SERVICE.

INSTALLED EQUIPMENT is defined as an item of equipment either fixed (PLACE EQUIPMENT) or on board i.e., associated with vehicles, or on-board the vehicle (VEHICLE EQUIPMENT).

INSTALLED EQUIPMENT is materialised as opposed to a service (LOCAL SERVICE) considered as an immaterial equipment.

A MOBILITY SERVICE parallels, **over a wider area**, a Transmodel LOCAL SERVICE, a named service relating to the use of a or transport services at **a particular location**, for example porterage, assistance for disabled users, booking offices etc. (see 6.2.3.8.2)

MOBILITY SERVICE is defined as an alternative mode transport service available over a widespread area, for example car-pooling, rental, etc. The service may be accessible at designated SITEs

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NOTE Transmodel also allows for locating the different types of equipment within a SITE: the EQUIPMENT PLACE, which, as a SITE COMPONENT containing EQUIPMENT, may be located by coordinates or by an address.

6.2.3.4.2 Generic Equipment – MODEL

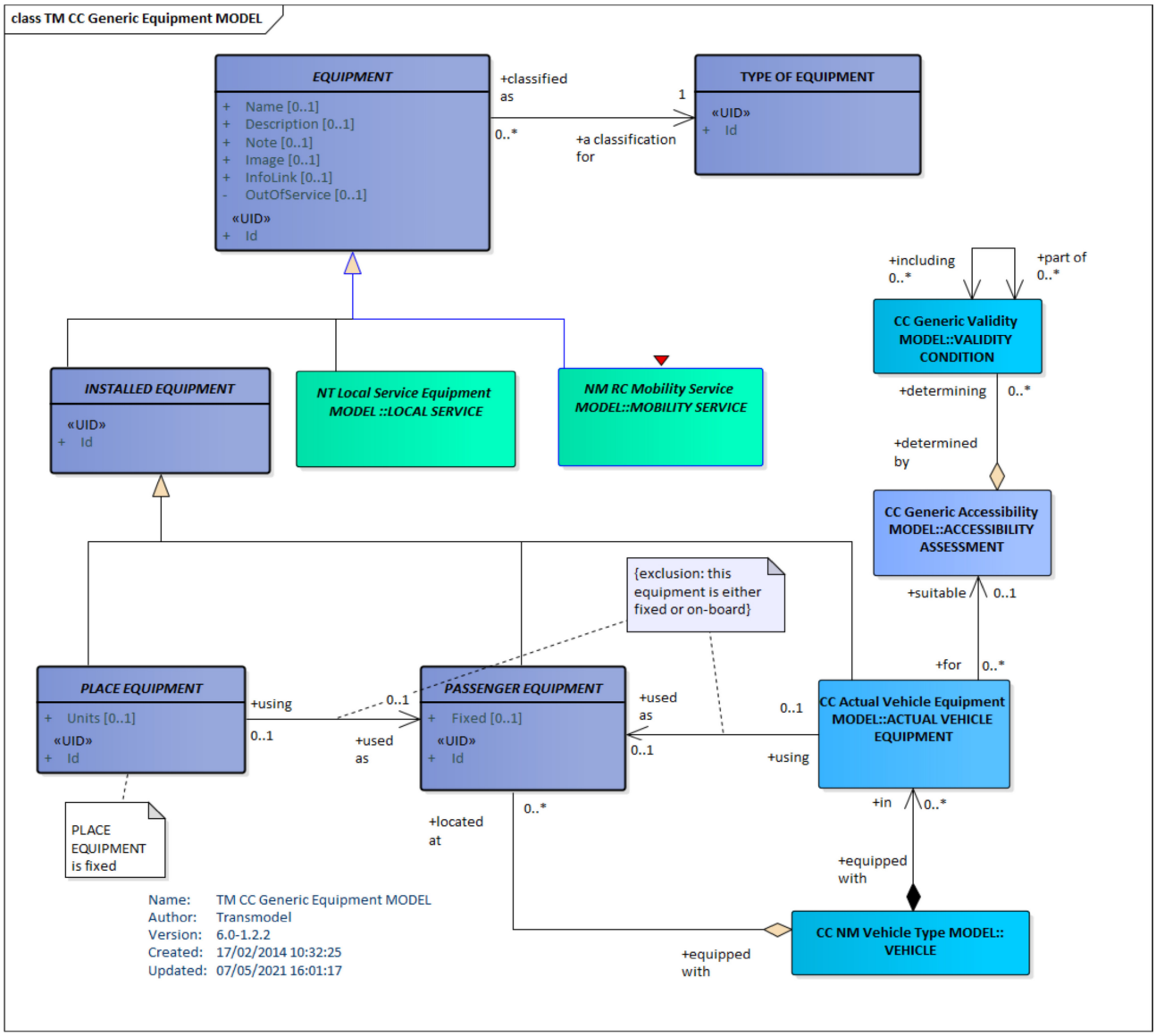


Figure 12 — Generic Equipment MODEL

6.2.3.5 Service Restriction (extension)

6.2.3.5.1 General

SERVICE RESTRICTION describes the limitations as regards the use of equipment or service.

The BOOKING ARRANGEMENTS describe the specific parameters of the booking rules for the services linked to the ALTERNATIVE MODE OF OPERATION, in particular VEHICLE RENTAL, VEHICLE SHARING, VEHICLE POOLING.

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6.2.3.5.2 Service Restriction – MODEL

SERVICE BOOKING ARRANGEMENTS PROVIDE information on booking rules and additional data allowing on how to book a LOCAL SERVICE or a MOBILITY SERVICE.

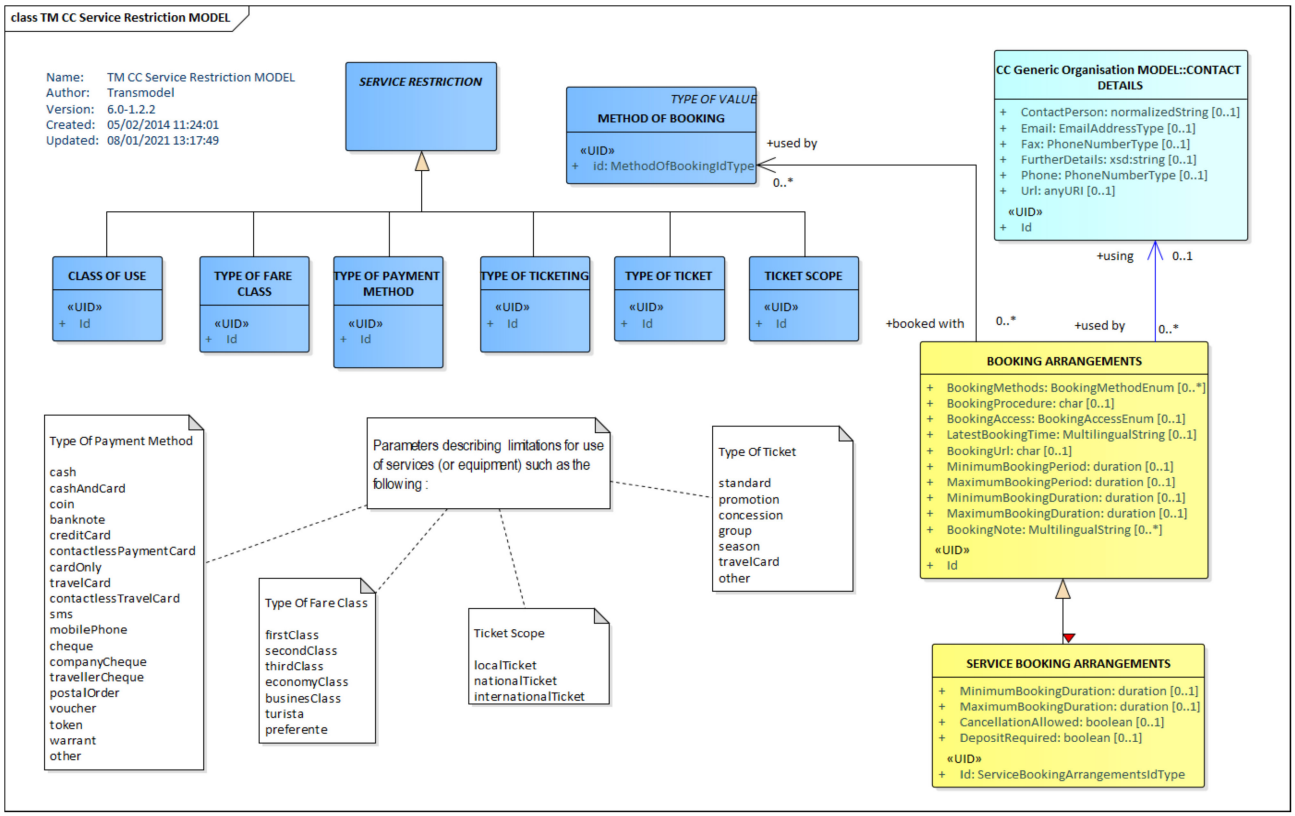


Figure 13 —Service Restriction MODEL

6.2.3.6 Fleet (extension)

6.2.3.6.1 General

The NM Fleet MODEL describes the vehicle FLEET, defined as a set of vehicles of any type. The concept of a FLEET is general, i.e., not dependent on MODE OF OPERATION, but is in particular of use in describing the services offered by some of the ALTERNATIVE MODES OF OPERATION.

6.2.3.6.2 Fleet – MODEL

A FLEET is owned by a TRANSPORT ORGANISATION, a legally incorporated body associated with any aspect of the transport system. A TRANSPORT ORGANISATION may own many FLEETs.

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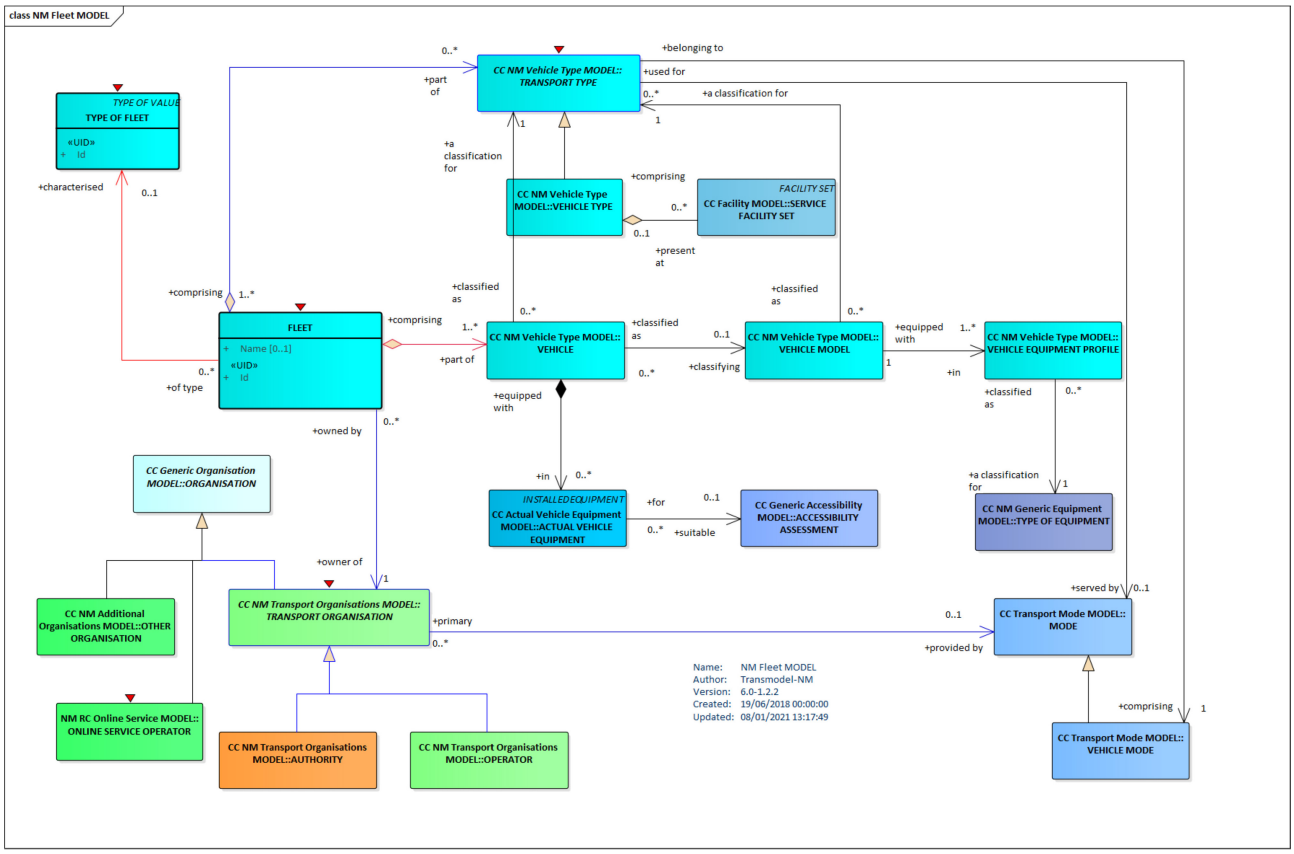


Figure 14 — Fleet MODEL

6.2.3.7 Fleet Equipment (extension)

6.2.3.7.1 General

The Fleet Equipment MODEL describes the equipment of any vehicle which is part of a fleet. The MODEL EQUIPMENT PROFILE describes the EQUIPMENT installed on board VEHICLEs of a specific VEHICLE MODEL. which includes general purpose attributes useful for any type of vehicles such as gears, lockers etc.. Some of the attributes are specifically added to further support cycle sharing and rental systems.

6.2.3.7.2 Fleet Equipment – MODEL

The EQUIPMENT PROFILE is a set of characteristics of equipment installed on-board and characterising a VEHICLE MODEL.

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CYCLE EQUIPMENT PROFILE and CAR EQUIPMENT PROFILE describe specific characteristics according to the type of vehicle.

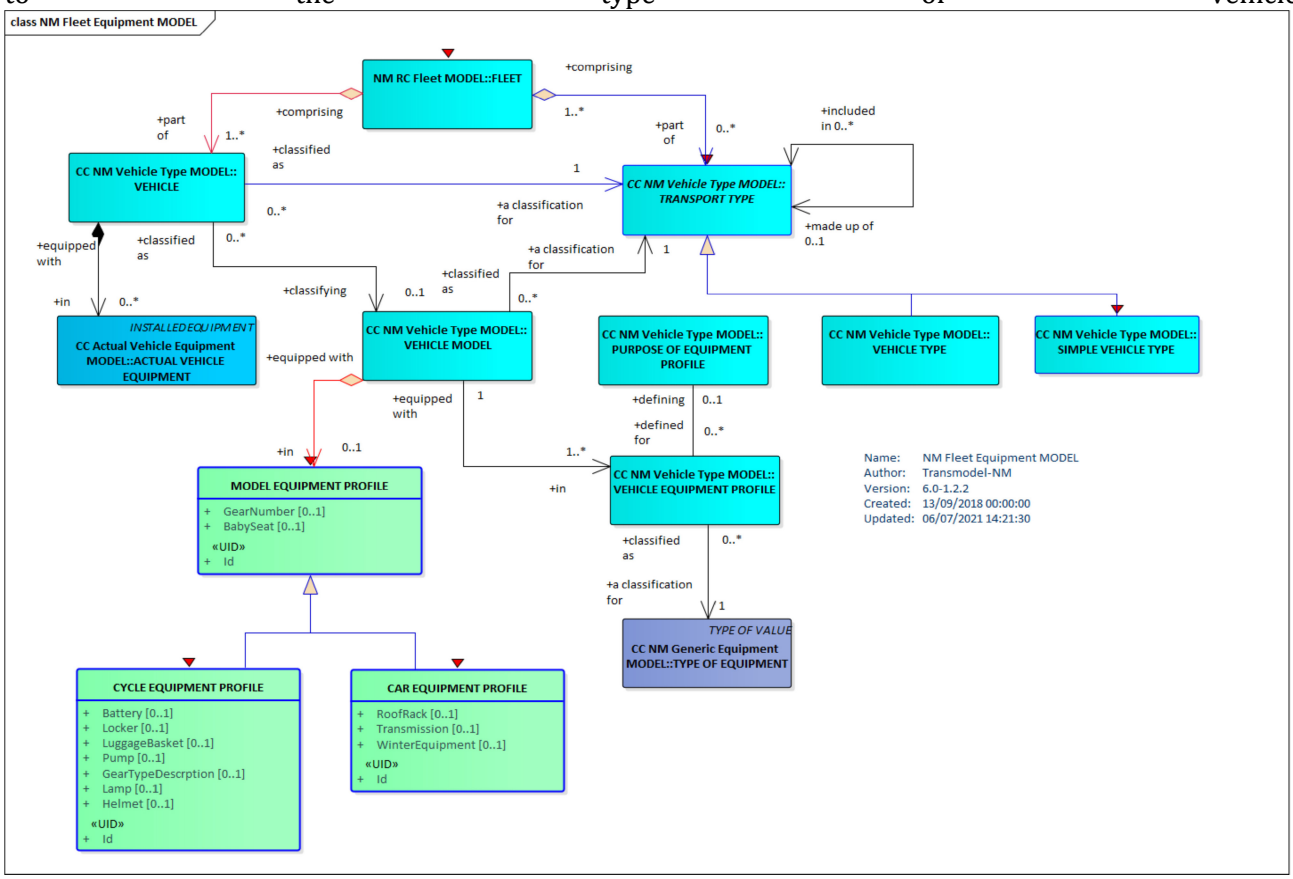


Figure 15 — Fleet Equipment MODEL (UML)

6.2.3.8 Mobility Services

6.2.3.8.1 General

The Mobility Service MODEL represents the transport service offer linked to the ALTERNATIVE MODE OF OPERATION.

A MOBILITY SERVICE is a transport service that may be available both at specific named SITEs (a SITE is a well-known geographic place of any type which may be specified as the origin or destination of a trip), and also more widely over a specified coverage area.

A MOBILITY SERVICE parallels, over a wider area, a Transmodel LOCAL SERVICE, a named service relating to the use of a or transport services at a particular location, for example porterage, assistance for disabled users, booking offices etc[1].

6.2.3.8.2 Mobility Service – MODEL

An AVAILABILITY CONDITION can be used to indicate the temporal availability of a MOBILITY SERVICE (e.g., hours or days of week when a service is available for use).

[1] Mobility service MODEL replaces the Vehicle Service MODEL from CEN TS 17413

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A MOBILITY SERVICE itself is abstract. A COMMON VEHICLE SERVICE is specialisation of a MOBILITY SERVICE involving VEHICLEs. Three specialisations of a COMMON VEHICLE SERVICE are considered:

- VEHICLE RENTAL SERVICE: A transport service offer related to VEHICLE RENTAL.
- VEHICLE SHARING SERVICE: A transport service offer related to VEHICLE SHARING.
- VEHICLE POOLING SERVICE: A transport service that connects (driver and passenger(s)) for carrying out trips. This may be further specialised into TAXI SERVICE, CHAUFFEURED VEHICLE SERVICE and GENERAL POOLING SERVICE.

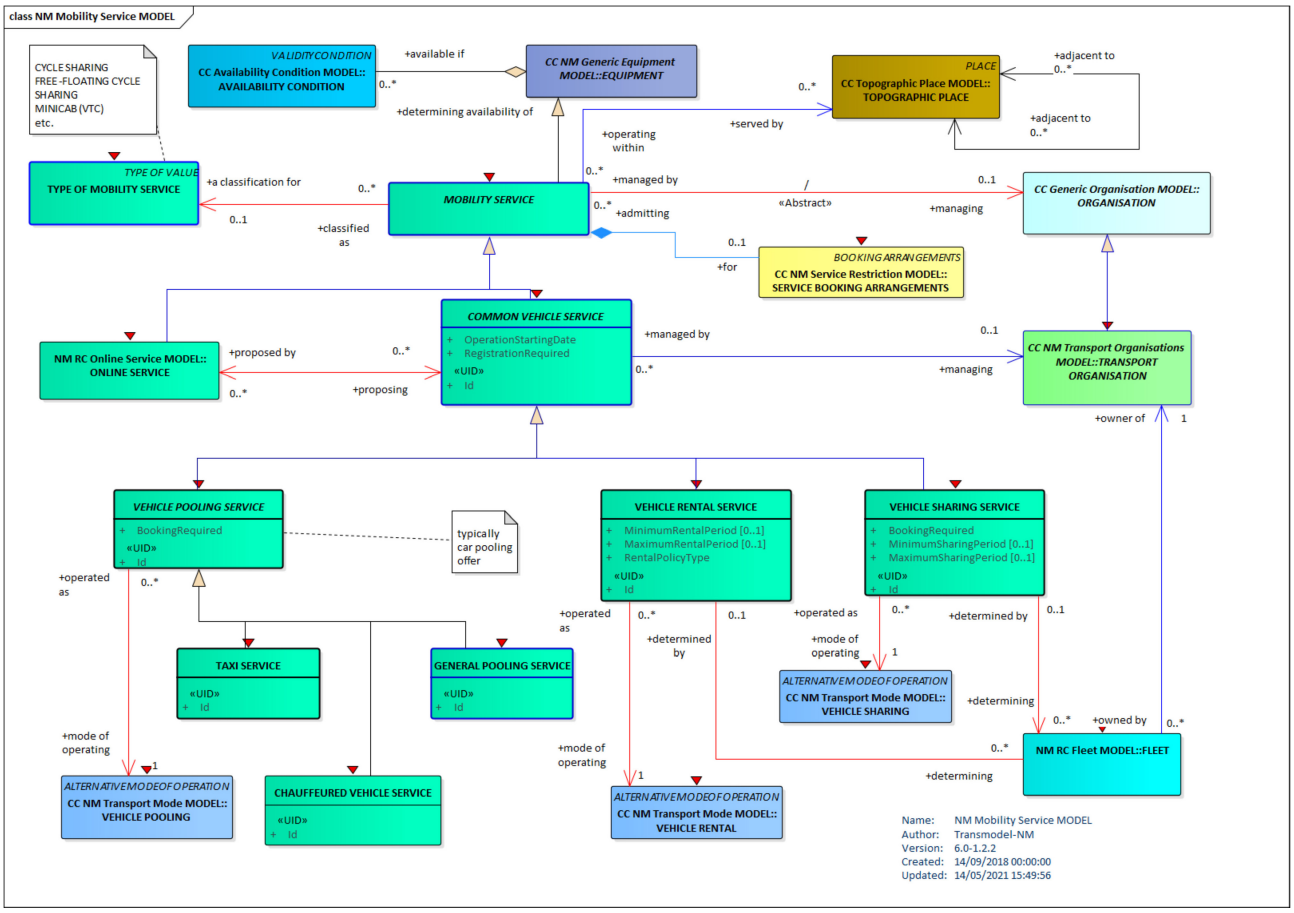


Figure 16 — Mobility Service MODEL (UML)

For VEHICLE RENTAL SERVICEs and/or VEHICLE SHARING SERVICEs, it is the FLEET which determines the transport service offer, characterised as regards the area of operation by a TOPOGRAPHIC PLACE and as regards the time of operation by an AVAILABILITY CONDITION. If there are further constraints on where the service may be used, these can be indicated by a separate additional model - see MOBILITY CONSTRAINT ZONE.

The VEHICLE POOLING SERVICE is also considered as a MOBILITY SERVICE but is based on a service offer determined by a set of SINGLE JOURNEYs rather than on a FLEET of vehicles.

The SERVICE is to be understood as service offer. For vehicle sharing/rental this offer is represented by the availability of a FLEET. For Vehicle pooling the service offer is represented by a set of SINGLE JOURNEYs.

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6.2.3.9 Online Services (extension)

6.2.3.9.1 Online Service – MODEL

The entity ONLINE SERVICE represents any remotely accessible service providing access to any mode of transportation and/or information related to transportation services.

An ONLINE SERVICE OPERATOR is in charge of managing an ONLINE SERVICE (but not the transportation itself, i.e., is different from a TRANSPORT OPERATOR), for instance, to provide information to a user of available/suitable carpooling offers, using a web application. The ONLINE SERVICE provides an interface between users or between users and operators.

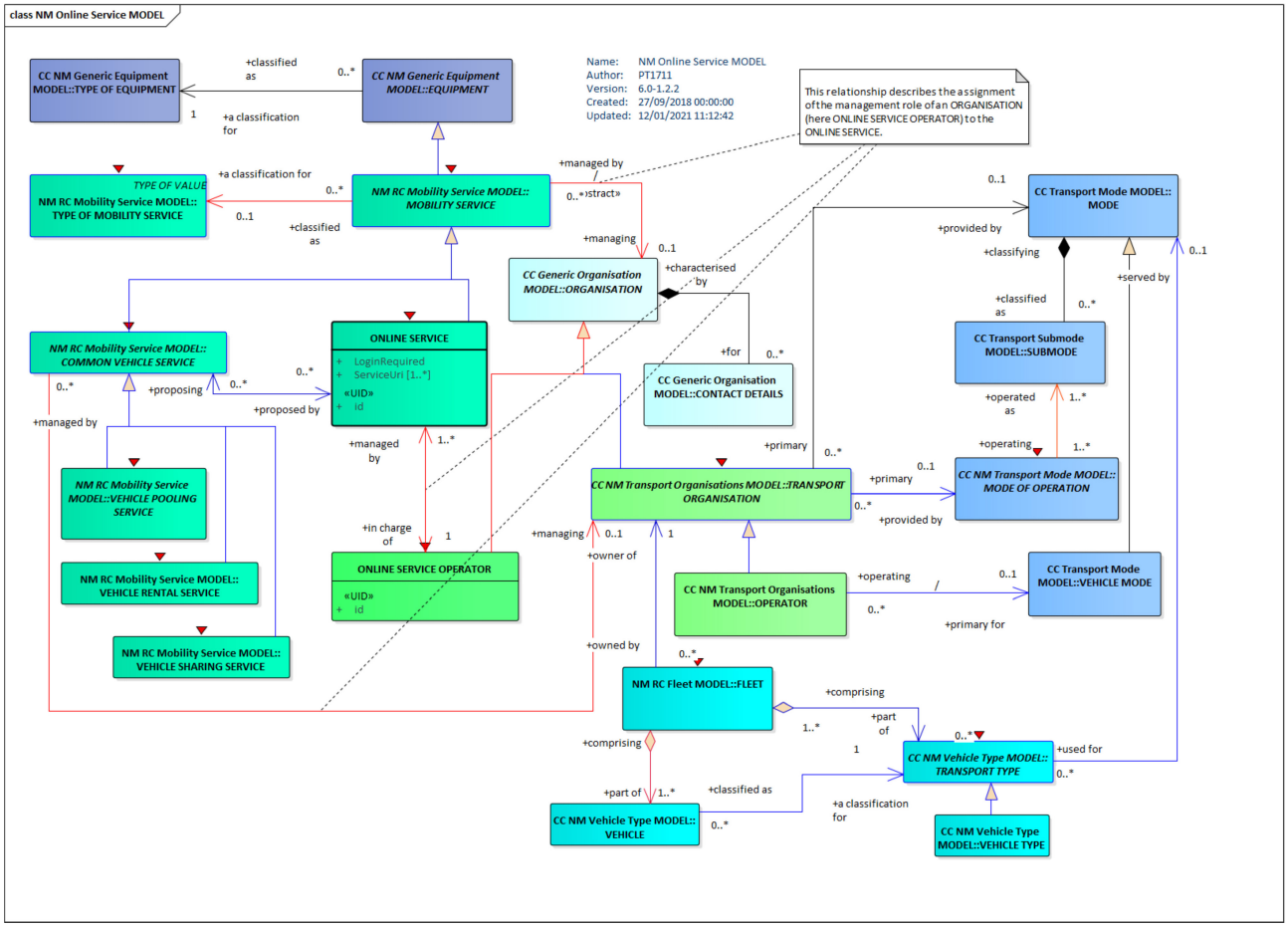


Figure 17 — Online Service MODEL (UML)

6.2.3.9.2 NM Organisation Role model – MODEL

ORGANISATIONs may undertake different roles.

The ONLINE SERVICE OPERATOR ROLE is the role of an organisation that provides an online service to the customer who uses a product.

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