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# SLOVENSKI STANDARD
# SIST-TS CEN/TS 16157-9:2020

## 01-julij-2020

**Inteligentni transportni sistemi - Specifikacije za izmenjavo podatkov DATEX II pri upravljanju prometa in informiranju - 9. del: Publikacije za upravljanje prometnih signalov, namenjene mestnemu okolju**

Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 9: Traffic signal management publications dedicated to the urban environment

Intelligente Verkehrssysteme - Intelligente Verkehrssysteme - DATEX II Datenaustauschspezifikationen für Verkehrsmanagement und Verkehrsinformationen - Teil 9: Lichtsignalanlagen-Management-Publikationen für das städtische Umfeld

Systèmes de transport intelligents - Spécification DATEX II d'échange de données pour la gestion du trafic et l'information routière - Partie 9 : Publications pour la gestion des feux de circulation dédiées à l'environnement urbain

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TECHNICAL SPECIFICATION

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TECHNISCHE SPEZIFIKATION

# CEN/TS 16157-9

April 2020

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English Version

# Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 9: Traffic signal management publications dedicated to the urban environment

Systèmes de transport intelligents - Spécification DATEX II d'échange de données pour la gestion du trafic et l'information routière - Partie 9 : Publications pour la gestion des feux de circulation dédiées à l'environnement urbain

Intelligente Verkehrssysteme - Intelligente Verkehrssysteme - DATEX II Datenaustauschspezifikationen für Verkehrsmanagement und Verkehrsinformationen - Teil 9: Lichtsignalanlagen-Management-Publikationen für das städtische Umfeld

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The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

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## European foreword

This document (CEN/TS 16157-9:2020) has been prepared by Technical Committee CEN/TC 278 "Intelligent transport systems", the secretariat of which is held by NEN.

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 has been prepared under a standardization request given to CEN by the European Commission and the European Free Trade Association.

As a user of this document, attention is drawn to the resources of www.datex2.eu < http://www.datex2.eu/>. This website contains related software tools and software resources that aid the implementation of EN 16157 DATEX II.

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to announce this Technical Specification: 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, Turkey and the United Kingdom.

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## Introduction

This document defines a common set of data exchange specifications to support the vision of a seamless interoperable exchange of traffic and travel information across boundaries, including national, urban, interurban, road administrations, infrastructure providers and service providers.

Standardization in this context is a vital constituent to ensure that interoperability, reduction of risk, reduction of the cost base and promotion of open marketplace objectives are achieved that will lead to many social, economic and community benefits as a result of more informed travellers, network managers and transport operators.

With the aim to support sustainable mobility in Europe, the European Commission has been supporting the development of information exchange mainly between the actors of the road traffic management domain for a number of years. In the road sector, DATEX II has been long in fruition, with the European Commission being fundamental to its development through an initial contract and subsequent cofounding through the Euro-Regional projects, and well as support for Programme Support Action activities.

DATEX II is referenced within European regulations:

— EU Commission Delegated Regulation, (EU) 2013/885 of 15 May 2013 regarding the provision of information services for safe and secure parking places for trucks and commercial vehicles,

— EU Commission Delegated Regulation, (EU) 2013/886 of 15 May 2013 regarding data and procedures for the provision, where possible, of road safety-related minimum universal traffic information free of charge to users,

— EU Commission Delegated Regulation, (EU) 2015/962 of 18 December 2014 regarding the provision of EU-wide real-time traffic information services,

— EU Commission Delegated Regulation, (EU) 1926/2017 of 31 May 2017 regarding the provision of EU-wide multimodal travel information services.

This document includes the framework, context and specification for exchanges, the modelling approach, data content, data structure and relationships.

This document supports a methodology that is extensible.

This document, which is Part 9 of the CEN 16157 series, deals with the publication of traffic signal related information that is most relevant in the urban environment. It specifies the structures and definitions of information that may be exchanged within two publications:

— The Map Data publication conveys static information related to the intersections and road segments belonging to a road network, related to traffic signal-controlled intersections. The Map Data Publication is the translation in UML of the MapData message (MAP) as it is defined in CEN ISO/TS 19091 and its European profile.

— The Traffic Signal Phase and Timing Publication conveys the dynamic information related to traffic signal-controlled intersections belonging to a road network. Traffic Signal Phase and Timing Publication is the translation in UML of the SignalPhaseAndTiming message (SPAT) as it is defined in CEN ISO/TS 19091 and its European profile.

Both publications are specified as Level B Extensions to the DATEX II model.

The present document was developed by project team PT1709 funded by the European Commission under grant agreement SA/CEN/GROW/EFTA/546/2016-10 'Urban ITS - Traffic Management Data

Models and interfaces' (M/546 [1]). The focus of M/546 is Intelligent Transport Systems in the urban environment – but this does not preclude this document being used in the non-urban environment.

It is noted that the terms and concepts utilized in this document draw heavily on those defined in CEN ISO/TS 19091 and SAE J2735.

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## 1 Scope

This document constitutes a part of the CEN 16157 DATEX II series of standards and technical specifications. This series specifies and defines component facets supporting the exchange and shared use of data and information in the field of traffic and travel. The component facets include the framework and context for exchanges, the modelling approach, the data content, the data structure and relationships and the communications specification.

Part 9, this document, specifies additional data model structures that are applicable for traffic signal management applications in the urban environment. This part specifies data concepts to support the exchange of traffic signal status messaging, intersection geometry definition and attribution in a consistent way with existing C-ITS standards and technical specifications.

It establishes specifications for data exchange between any two instances of the following actors:

— Traffic Information Centres (TICs),

— Traffic Control Centres (TCCs),

— Service Providers (SPs).

Use of this document may be applicable for use by other actors.

## 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 16157-1:2018, *Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 1: Context and framework*

EN 16157-2, *Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 2: Location referencing*

EN 16157-7:2018, *Intelligent transport systems - DATEX II data exchange specifications for traffic management and information - Part 7: Common data elements*

CEN ISO/TS 19091:2017, *Intelligent transport systems – Cooperative ITS – Using V2I and I2V communications for applications related to signalized intersections*

SAE J2735:2016, *Dedicated Short Range Communications (DSRC) Message Set Dictionary*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 16157-1, EN 16157-2 and EN 16157-7 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

• ISO Online browsing platform: available at http://www.iso.org/obp

• IEC Electropedia: available at http://www.electropedia.org/

**3.1**
**bit string**
simple type whose distinguished values are an ordered sequence of zero, one or more bits

[SOURCE: ISO/IEC 8824-1:2015**]**

**3.2**
**egress path**
**egress**
flow of vehicular or other types of traffic leaving an intersection on one or more of the defined lanes of travel

[SOURCE: SAE J2735:2016]

**3.3**
**ingress path**
**ingress**
flow of vehicular or other types of traffic approaching an intersection on one or more of the defined lanes of travel

[SOURCE: SAE J2735:2016]

**3.4**
**lane**

strip of carriageway intended to accommodate a single line of moving vehicles, frequently defined by road markings

[SOURCE: ISO 6707-1:2017]

**3.5**
**link**
directed topological connection between two nodes, composed of an ordered sequence of one or more segments and represented by an ordered sequence of zero or more shape points

[SOURCE: ISO/TS 20452:2007]

**3.6**
**manoeuvre**
collection of related links and turns used in a route in combination

Note 1 to entry:     Manoeuvres are used to cluster turns into convenient and legal combinations. They could be as simple as a single turn, a combination of quick turns or very complex combinations consisting of entry, exit, and connecting roadways.

[SOURCE: EN ISO 19133:2007]

**3.7**
**node**
0-dimensional topological primitive

[SOURCE: EN ISO 19107:2005]

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**3.8**
**vehicle trajectory**
**trajectory**
path of a selected point on the vehicle in the earth-fixed coordinate system

|SOURCE: ISO 8855:2011]

## 4   Conformance

The Traffic Signals Namespace sub-model is a part of the DATEX II platform independent data model.  The Traffic Signals Namespace sub-model corresponds to a Level B extension as defined in EN 16157-1.

Conformance with this Part shall require platform independent models from which platform specific models are generated to comply with the UML modelling rules defined in EN 16157-1 and with the following requirements of this sub-model, which are expressed in this document:

— comply with all stipulated minimum and maximum multiplicity requirements for UML elements and relationships,

— comply with all definitions, types and ordering,

— employ optional elements as specified,

— comply with all expressed constraints.

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It should be noted that conformance of a publication service with all the structural requirements stated above does not necessarily ensure that the informational content of that service will be semantically comprehensible.

## 5   Symbols and abbreviations

DE       Data Element

DF       Data Frame

GUID   Globally Unique identifier

ITS      Intelligent Transport Systems

PIM     Platform Independent Model

SPaT   Signal Phase and Timing

UML    Unified Modelling Language

## 6   UML notation

The UML notation used in this document is as described in ISO/IEC 19505. An explanation of the UML notation used in this document is provided in EN 16157-1.

## 7   TheTrafficSignals model

### 7.1 Overview

The TrafficSignals model shall comprise the packages used in the SignalPhaseAndTiming Publication and the MapData Publication and the Classes and Enumerations specific for these publications. Figure 1 illustrates the sub-packages contained within the Traffic Signals package, which shall include the

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SignalPhaseAndTimingPublication package, the MapDataPublication package, the data types and the enumerations within the <<D2Namespace>> TrafficSignals.
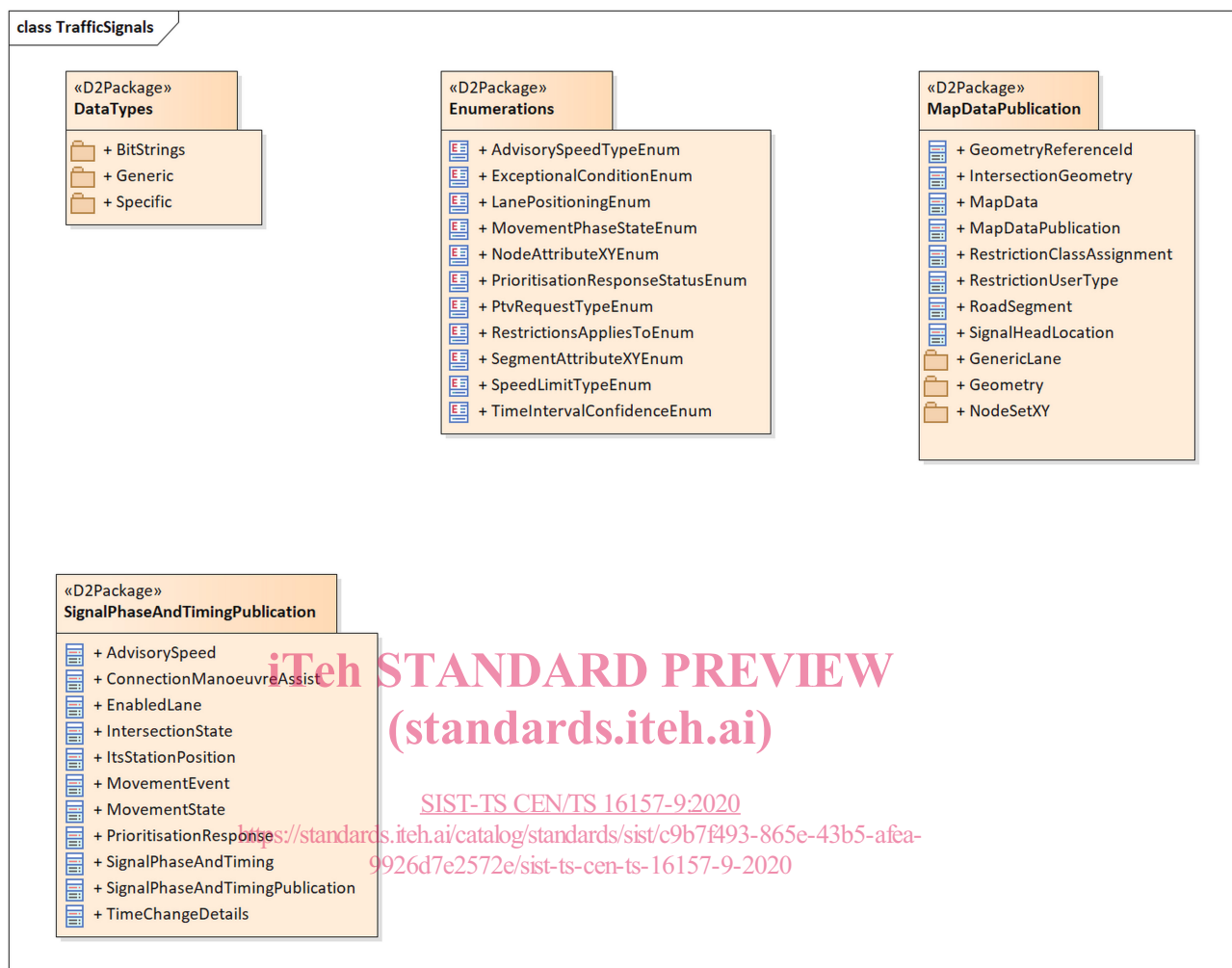


Figure 1 — The "TrafficSignals" package class model

As illustrated in Figure 2, the "SignalPhaseAndTimingPublication" class and the "MapDataPublication" class shall be specializations of the GenericPublication class, as specified in CEN / EN16157-7, with the relationships defined as D2LevelBExtension. A dedicated namespace "TrafficSignals" has been created to host them, which uses the namespace prefix "tsi".

NOTE       For most applications using the TrafficSignals, model use of both the SignalPhaseAndTiming and MapData Publications can be expected due to the cross-referencing between the two Publications.
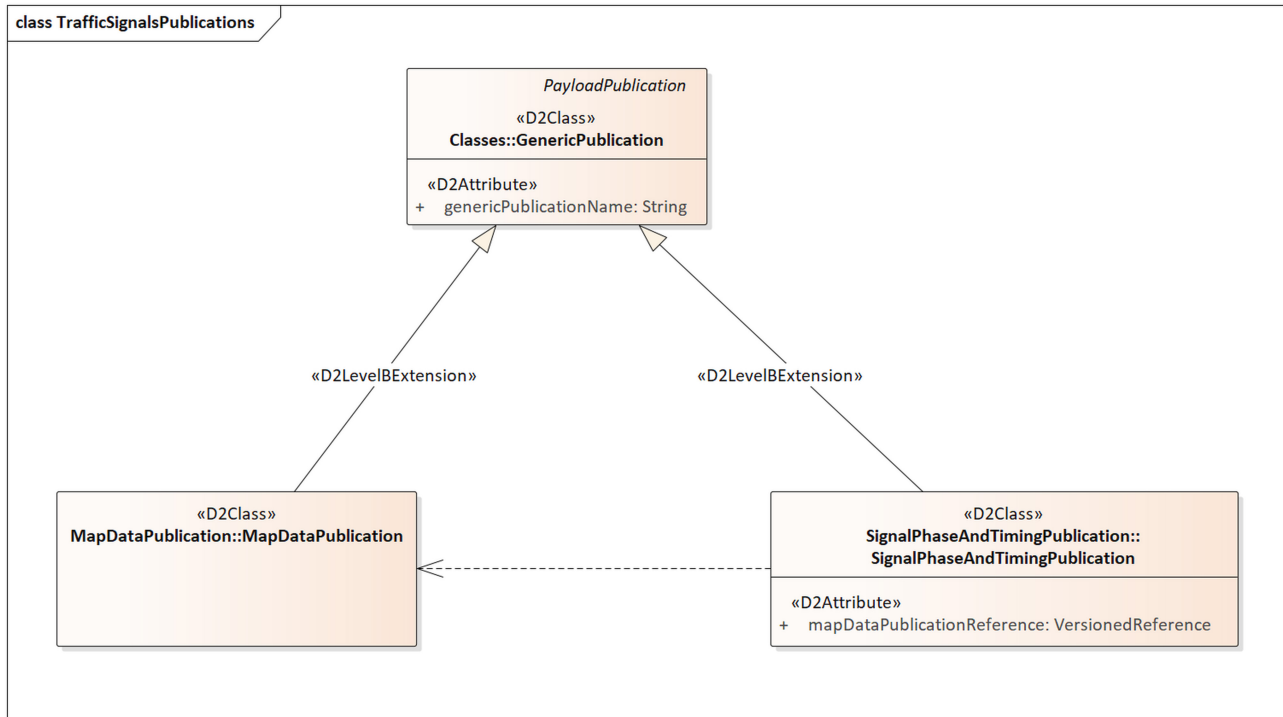
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class TrafficSignalsPublications

*PayloadPublication*
«D2Class»
**Classes::GenericPublication**

«D2Attribute»
+   genericPublicationName: String

«D2LevelBExtension»                 «D2LevelBExtension»

«D2Class»
**MapDataPublication::MapDataPublication**

«D2Class»
**SignalPhaseAndTimingPublication::**
**SignalPhaseAndTimingPublication**

«D2Attribute»
+   mapDataPublicationReference: VersionedReference

**Figure 2 — The "TrafficSignals" publications**

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## 7.2 <<D2Package>> MapDataPublication

### 7.2.1 Overview

The package "MapDataPublication" supplies classes and attributes for the static information related to the intersections and road segments belonging to a road network. The "MapDataPublication" class shall be defined as a Level B Extension to the "GenericPublication" class. The package "MapDataPublication" is the translation in UML of the MapData message (MAP) as specified in CEN ISO/TS 19091 and specifically its European profile (Annex G), which heavily relies upon terms, definitions and concepts from the standard SAE J2735. It is pictured including the relationships between the classes in Figure 3.

The MapDataPublication is used in combination with the second publication defined in this document, i.e. "SignalPhaseAndTimingPublication" which represents the dynamic content of the stages and phase of traffic signals. As both publications are DATEX II extensions they are located in the "Extension" namespace of the DATEX II tree structure, under the parent package "TrafficSignals".
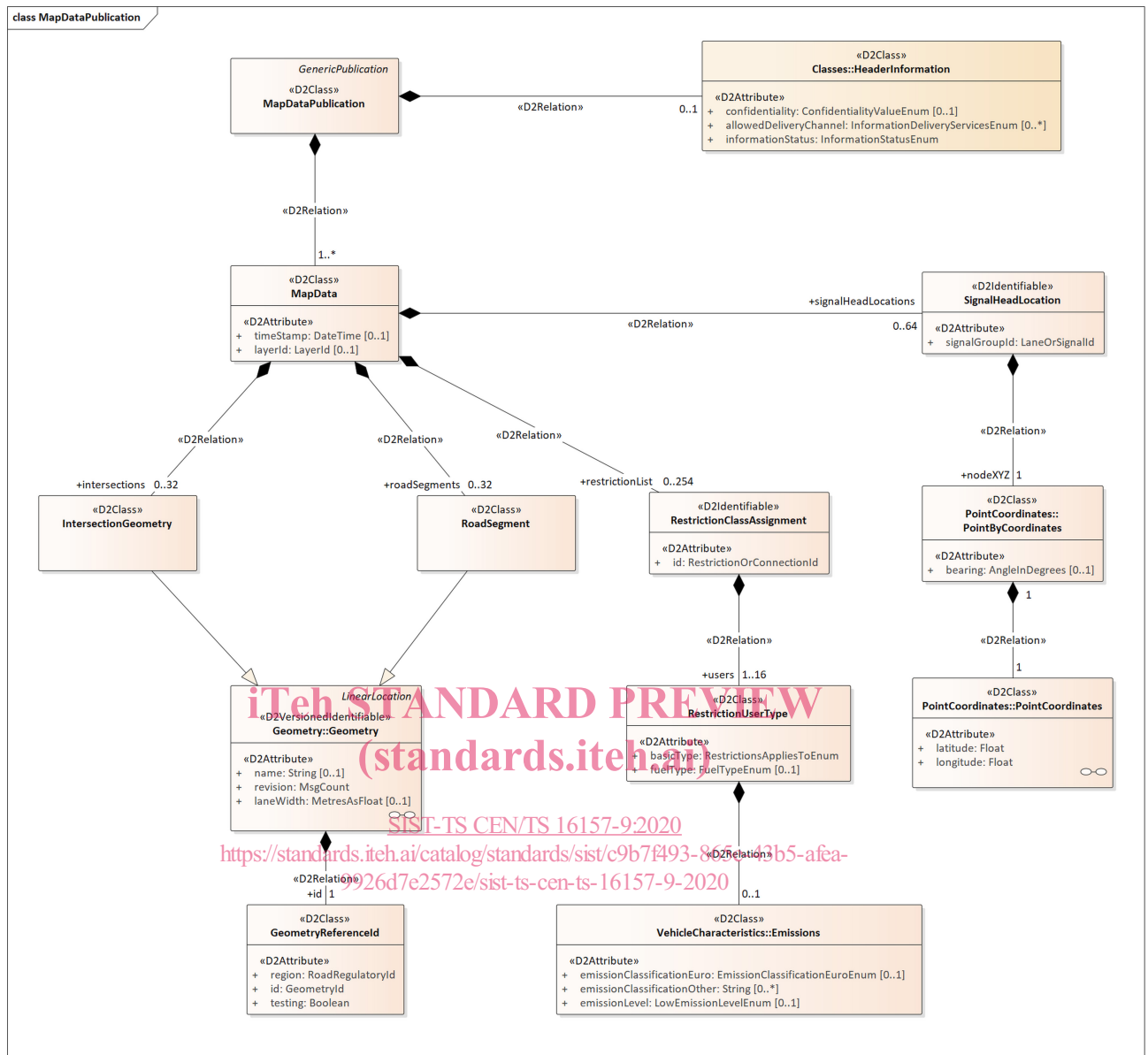
**Figure 3 — The MapPublication class model**

### 7.2.2 Semantics

The entry point of this package is the class "MapDataPublication". Being an extension, it is derived from the "GenericPublication" class defined in EN 16157-7. It shall contain at least a set of data defining different road geographic features (class "MapData"). As every publication in DATEX II it is associated with general information (class "HeaderInformation") representing among others its status (e.g. if it is "real" or for "test"). This latter class in defined in EN 16157-7.

This set of road geographic features may include data related to:

— Complex intersections description (class "IntersectionGeometry") (up to 32 different instances);

— Road segments description (class "RoadSegment") (up to 32 instances);

— Restrictions applicable to a road user category (class "RestrictionClassAssignment") (up to 254 instances);

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— The position of traffic signal heads (class "SignalHeadLocation") (up to 64 instances).

Each occurrence of map data may be timestamped.

Every intersection description and every road segment description are based on a common geometrical description realized by the "Geometry" class. Each occurrence of the class is identified through the identification mechanism of DATEX II as specified in EN 16157-7 (stereotype "D2VersionedIdentifiable"). It shall own a revision number (between 0 and 127) incremented at each revision to communicate the valid release of the geometry description for the same publisher. If there is no change in the deployed geometry description, the same revision counter is transmitted. If a revised deployment of the geometry description (e.g. new lane added, identifiers changed, etc.), the revision number is increased by one. This number shall be reinitialised, when the publisher changes, or when the value 127 is reached.

Every occurrence of geometry may be given a name and/or a lane width, which is used as a default value for all the described lanes unless a new lane width is provided. It shall be given a unique external reference identification (class "GeometryReferenceId") which shall be composed of an identifier (integer number between 256 and 65535). In case of testing usage, the corresponding flag ("testing") shall be set to "true". The "region" attribute may be used to identify a local road authority assigning generic reference identification for intersection geometries or road segments.

NOTE    The usage of such an external reference identification is only of interest for creating MAP and SPAT messages. It is not used internally.

Every position of traffic signal head is defined by a geographic point defined by coordinates (according to CEN ISO/TS 19091:2017,G.5.2.7, this definition shall be tridimensional).

## 7.3 <<D2Package>> Geometry

### 7.3.1 Overview

The package "Geometry" supplies classes and attributes for the definition of a geometry usable when defining geometric features of an intersection or a road segment including the relevant attributive items of these features. It is pictured including the relationships between the classes in Figure 4.
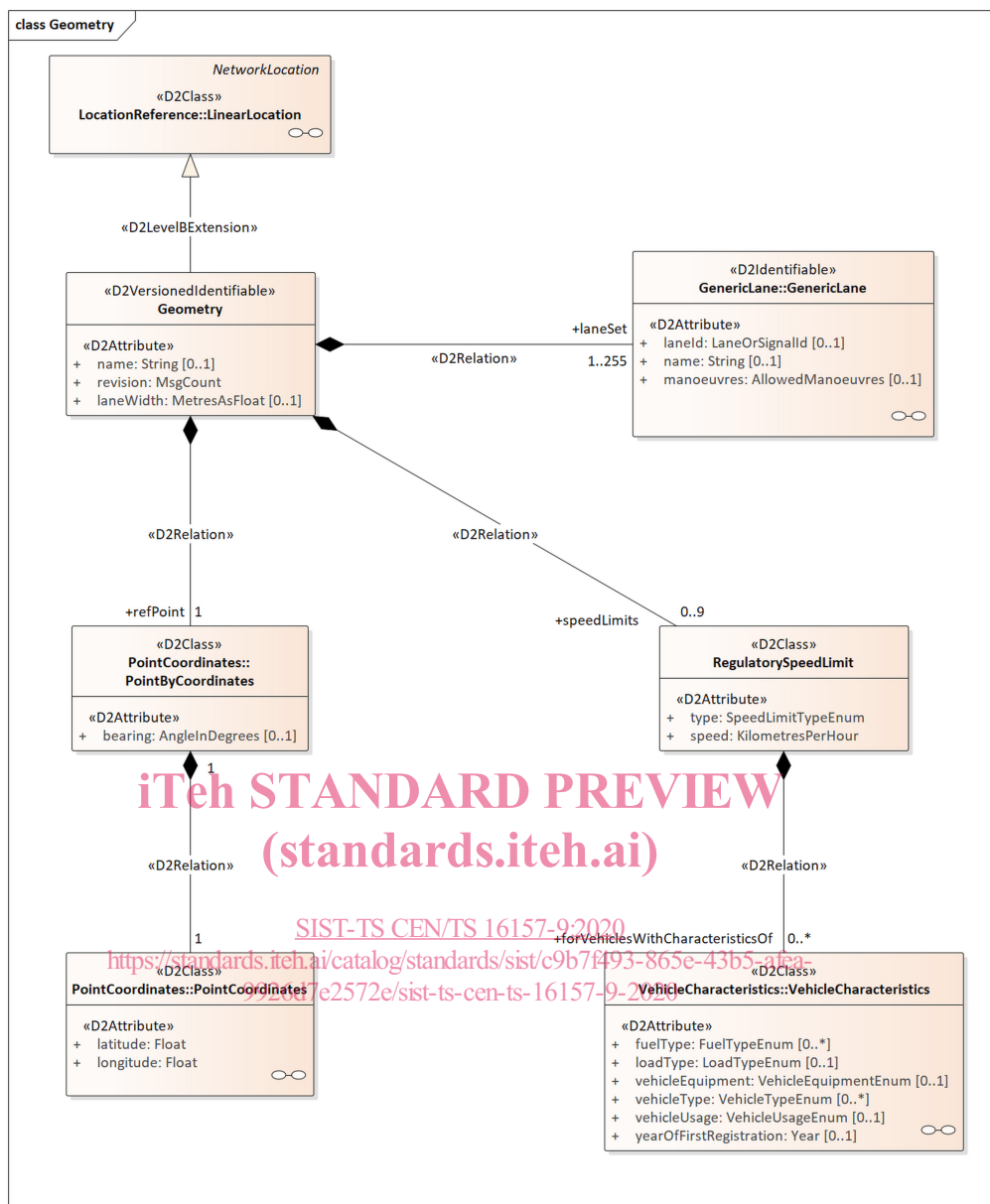
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**Figure 4 — "Geometry" package class model**

## 7.3.2 Semantics

The common geometry description is defined by the class "Geometry" which is already defined in 7.2.2. To this geometry are associated:

— One point location (class "PointByCoordinates" associated through "refPoint") which represents a reference of this intersection of this road segment (e.g. for representational purpose). According to CEN ISO/TS 19091 this point shall be defined in three dimensions. This point is defined as required in EN 16157-2. This point may be used for calculating the offsets of the other points belonging to the same geometry during the MAP message generation;

— A set of up to 9 speed limit values (class "RegulatorySpeedLimit") applicable to the whole geometric element and corresponding to certain types and to the vehicle type (class "VehicleCharacteristics"). This latter class is defined in EN 16157-7;