



ERJU SYSTEM PILLAR

52 System Interface Description SCI-CMD



System Interface Description SCI-CMD

DRAFT

Approval by reviewers

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Type of Approval	 Document Approval
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DRAFT

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1 Preamble

1.1 Purpose

This document describes the  SPMS-6308 - SCI_CMD interface between the  SPMS-5062 - European Trackside Protection System and the  SPMS-5060 - Plan Execution System as required per  SPPRAMSS-349 - [EN 50126-1:2017] phase 5 (architecture and apportionment of system requirements).

The interface is identified in  SPP-18075 - TCS_System Architecture Description Traffic CS_V0.4].


1.2 Intended Audience

Domain experts involved in the tendering, development, verification, validation or assessment of the system under consideration (e.g. System Engineers, RAMSS Engineers, Developer, Tester, Assessors, etc).

Note:

This documentation is not intended for a general audience. For a comprehensive understanding of Traffic CS, please refer to the Traffic CS System Concept  SPP-19049 - Traffic CS System Concept V1.0].

1.3 Document Context

 SPT2TRAFFIC-16650 below shows the context of the document.

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ID	SPT2TRAFFIC-16650
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1.4 Glossary

1.4.1 Terms and definitions




Term	Definition
Movement Permission	<p>A Movement Permission is a discrete domain object within the ETPS that defines and secures the operational path of a train. It replaces the traditional split between route setting, signalling, and train control by integrating them into one unified concept.</p> <p>Key characteristics:</p> <ul style="list-style-type: none"> · Geometric Extent: The MP specifies a linear, contiguous section of track (running path) that a train is permitted to occupy, including mandatory safety margins (Risk Buffers, Risk Paths) to prevent collisions. · Basis for Movement Authority: An MP provides the trackside foundation from which an ETCS Movement Authority (MA) is derived and transmitted to the train. · Dynamic & Risk-Based: Unlike fixed interlocking routes, an MP can start and end at any topological point and is defined according to operational needs and real-time safety checks rather than static rules. · Lifecycle: MPs are created upon request, checked against topology and safety conditions, granted, supervised, and continuously updated (extended, shortened, upgraded, or removed). · Integration: By merging route protection and movement granting, the MP enables efficient infrastructure use, reduces unnecessary locking of track elements, and supports flexible, automated operations. <p>Movement Permission is not just an “allowance to proceed” but a dynamic, safety-checked allocation of infrastructure to a specific train movement, forming the essential prerequisite for issuing a Movement Authority in ETCS.</p>
Movement Permission Extent	<p>A <i>Movement Permission Extent</i> is a linear contiguous stretch of track that is reserved for the movement of a train. The Movement Permission Extent and the available Risk Buffer are translated to an authorisation (e.g. Movement Authority) according to the /ETCS/ - SUBSET-026 that is transmitted to the train.</p> <p>The Movement Permission Extent is part of the Movement Permission.</p>
Operating State	<p>The Operating State is the logical real-time representation of the actual state of the physical railway system in the Area of Control (e.g. information about the currently operating Train Units, the occupation of tracks, or the settings of Field Elements).</p> <p>The knowledge about the Operating State enables TMS to keep itself current with the operational situation in the Area of Control and to recognise deviations from an Operational Plan during execution. Further, it</p>

Term	Definition
	allows for identifying upcoming or existing conflicts between Operational Plans and developing appropriate countermeasures.
Risk Buffer	The <i>Risk Buffer</i> is a linear contiguous stretch of track that serves as the overrun protection to avoid an accident e.g. if the train brakes do not perform as well as expected and as a safety buffer in the event of a rollback of a chased train. It is part of a Movement Permission. A <i>Risk Buffer</i> exists if there is a Danger Point or project-specific safety margin greater than zero.
Risk Path	A <i>Risk Path</i> is one potential path (a linear contiguous stretch of track) by which a non-permitted vehicle movement could result in a flank collision with a vehicle moving along the <i>Movement Permission Extent</i> . A Movement Permission can contain zero or more <i>Risk Paths</i> .
Safe Train Extent	<p>The Safe Train Extent represents the extent of the track that may be occupied by a connected train. It is calculated from train-side information (Confirmed Rear End and Max Safe Front End derived from the ETCS Position Report) and track-side information (track vacancy proving sections like track circuits or axle counters), taking into account the most recent information available from these train- and track-side information sources.</p> <p>Remarks:</p> <ul style="list-style-type: none"> • The Safe Train Extent for a train will be updated when new information becomes available. • For a moving train, it is likely that the train will move outside the Safe Train Extent between update

1.4.2 Abbreviations

Abbreviation	Definition
MP	Movement Permission
STE	Safe Train Extent

2 Interface Overview

The interface  SPMS-6308 - SCI_CMD connects  SPMS-5062 - European Trackside Protection System with  SPMS-5060 - Plan Execution System.

See: [\[SPP-18094 - System Interface Description SCI-CMD\]](#).



In the following chapters, the interface partners are further described.

2-3 - European Trackside Protection System

Implements the safety-critical functionality within Traffic CS to control all trackside elements connected to ETPS, for example points, level crossings, and to manage movement permissions for trains, whilst maintaining the safety of the railway.

ETPS acts as a gate keeper and evaluates if the commands received via SCI_CMD interface can be implemented safely. Only if they can be implemented safely, the received commands are forwarded to the corresponding trackside element or the corresponding train.

In order to do this, ETPS maintains the Operating State for its area of control, containing all track occupancies and Movement Permissions within the area of control.

ID	SPMS-5062
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2-4 - Plan Execution System

The Plan Execution System (PES) is the bridge between Traffic Management System (TMS) and the European Trackside Protection System (ETPS). It processes the Operational Plans provided by the TMS by deriving time-optimised Trackside Assets states and Movement Permission requests towards the ETPS and provides the Operating State within the area of control received from the ETPS to the TMS.

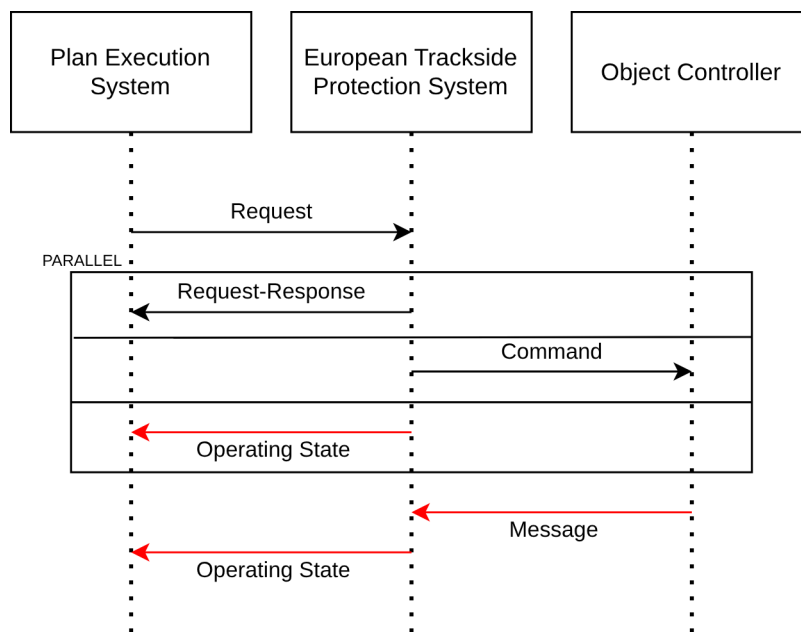
It has the following characteristics:

- implements Basic Safety Integrity Level functionalities

ID	SPMS-5060
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2.1 Communication patterns


The interface supports two complementary communication patterns depending on the type of information exchanged. Examples are shown in Figure  SPT2TRAFFIC-16008.



ID	SPT2TRAFFIC-16008
----	-------------------


2.1.1 Request-Response Pattern (used for commands)

Commands initiated by the PES are transmitted using a request message. Each command request message triggers a processing action on the ETPS side. ETPS confirms the execution by returning a corresponding request-response message that includes either "successful", or "code of first failed safety check".

The example in  SPT2TRAFFIC-16008 above shows a command request from PES which is confirmed by ETPS via a request-response message. Due to this command, ETPS sends a command to an Object Controller.

2.1.2 Push-based Publish/Subscribe Pattern (used for Operating State update)

Operating State updates are distributed using a push-based publish/subscribe pattern. The server (in our case ETPS) automatically publishes Operating State updates to subscribed clients (here e.g. PES) whenever a relevant change occurs. This decouples information flow from client polling and ensures that subscribers receive timely updates without explicitly requesting them.

The example in  SPT2TRAFFIC-16008 above shows a message that is received by ETPS which triggers an Operating State update.

3 Interface Description

3.1 Messages

This chapter contains the messages exchanged via the  SPMS-6308 - SCI_CMD interface.

3.1.1 Commands


3.1.1.1 Switchable Trackside Asset

3.1.1.1-1 - switchable_trackside_asset_request

Request to change the driveability of a switchable trackside asset.

The exchange item "switchable_trackside_asset_request" is composed of the following elements:

- **requestedSwitchableTracksideAsset** :

 SPMS-7781 - Draft_SwitchableTracksideAssetRequest

It has the following additional attributes:

Property	Value
type	Request

ID	SPMS-7746
----	-----------

3.1.1.1-2 - switchable_trackside_asset_request_response

Response to a switchable trackside asset request message.

The exchange item "switchable_trackside_asset_request_response" is composed of the following elements:

- **respondedSwitchableTracksideAssetRequest** :  SPMS-7782 - Draft_SwitchableTracksideAssetRequestResponse

It has the following additional attributes:

Property	Value
type	Request-Response

ID	SPMS-5191
----	-----------

3.1.1.2 Movement Permission

3.1.1.2-1 - movement_permission_request

Request message for a movement permission.

The exchange item "movement_permission_request" is composed of the following elements:

- **requestedMovementPermission** :  SPMS-7183 - Draft_MovementPermissionRequest

It has the following additional attributes:

Property	Value
type	Request

ID	SPMS-4928
----	-----------

3.1.1.2-2 - movement_permission_request_response

Response to a movement permission request message.

The exchange item "movement_permission_request_response" is composed of the following elements:

- **RespondedMovementPermissionRequest** :  SPMS-7184 - Draft_MovementPermissionRequestResponse

It has the following additional attributes:

Property	Value
type	Request-Response


ID	SPMS-7783
----	-----------

3.1.1.3 Cooperative Shortening

3.1.1.3-1 - cooperative_shortening_request

Request for cooperative shortening of movement permission.

The exchange item "cooperative_shortening_request" is composed of the following elements:

- **cooperativeShorteningRequest** :  SPMS-7799 - Draft_CooperativeShorteningRequest

It has the following additional attributes:

Property	Value
type	Request

ID	SPMS-7786
----	-----------

3.1.1.3-2 - cooperative_shortening_request_response

Response to the request for the cooperative shortening of movement permission.

The exchange item "cooperative_shortening_request_response" is composed of the following elements:

- **respondedCooperativeShorteningRequest** :  SPMS-7797 - Draft_CooperativeShorteningRequestResponse

It has the following additional attributes:

Property	Value
type	Request-Response

ID	SPMS-7787
----	-----------

3.1.1.4 Restriction Area

3.1.1.4-1 - restriction_area_request

Request to activate or deactivate a usage restriction.

The exchange item "restriction_area_request" is composed of the following elements:

- **requestedUsageRestriction** :  SPMS-7730 - Draft_RestrictionAreaRequest

It has the following additional attributes:

Property	Value
type	Request

ID	SPMS-7754
----	-----------

3.1.1.4-2 - restriction_area_request_response

Response to a request to activate or deactivate a usage restriction.

The exchange item "restriction_area_request_response" is composed of the following elements:

- **RespondedURAResponse** :  SPMS-7837 - Draft_RestrictionAreaRequestResponse

It has the following additional attributes:

Property	Value
type	Request-Response

ID	SPMS-7801
----	-----------

3.1.2 Operating State

3.1.2-1 - switchable_trackside_asset_state

Status of switchable trackside asset.

The exchange item "switchable_trackside_asset_state" is composed of the following elements:

- **switchableTracksideAssetState** :  SPMS-7639 - SwitchableTracksideAssetState

It has the following additional attributes:

Property	Value
type	Operating State

ID	SPMS-7747
----	-----------

3.1.2-2 - train_object

Contains all known information about a train.

The exchange item "train_object" is composed of the following elements:

- **trainObject** :  SPMS-7625 - TrainObject

It has the following additional attributes:

Property	Value
type	Operating State

ID	SPMS-5119
----	-----------

3.1.2-3 - restriction_area

Status of restriction area.

The exchange item "restriction_area" is composed of the following elements:



- **restrictionAreaCMD** :  SPMS-7610 - RestrictionArea

It has the following additional attributes:

Property	Value
type	Operating State

ID	SPMS-7755
----	-----------


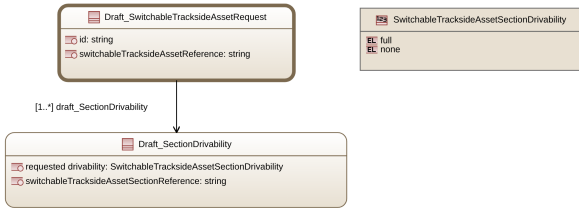
3.2 Data Description

This chapter contains the description of the data classes exchanged via the  SPMS-6308 - SCI_CMD interface. This data classes are part of the System Pillar CCS/TMS data model, see [ SPP-29096 - TCCS - Data Model_00_Guide v1.0].

3.2.1 Switchable Trackside Asset

3.2.1-1 - Draft_SwitchableTracksideAssetRequest

ID	SPMS-7781
----	-----------

Properties	<p>The object owns the properties listed below:</p> <p>id : string The unique identifier of a switchable trackside asset request.</p> <p>switchableTracksideAssetReference : string The unique identifier of a switchable trackside asset.</p> <p>draft_SectionDrivability :  SPMS-7975 - Draft_SectionDrivability [1 .. *] Requested drivabilities per switchable trackside asset section.</p>
Tree View Diagram	 <p>The diagram shows a tree structure. At the top is a box for Draft_SwitchableTracksideAssetRequest with properties: id : string and switchableTracksideAssetReference : string. Below it, connected by a line labeled [1..*] draft_SectionDrivability, is a box for Draft_SectionDrivability with properties: requested drivability : SwitchableTracksideAssetSectionDrivability and switchableTracksideAssetSectionReference : string. To the right of the top box is a box for SwitchableTracksideAssetSectionDrivability with properties: full and none.</p> <p><i>Figure 2 Tree View of Draft_SwitchableTracksideAssetRequest</i></p>

3.2.1-2 - Draft_SwitchableTracksideAssetRequestResponse

ID	SPMS-7782									
Properties	<p>The object owns the properties listed below:</p> <p>id : string Identification of request for referencing purpose (e.g. in response to request).</p> <p>switchableTracksideAssetResponseCode : Draft_SwitchableTracksideAssetResponseCode Response code to the request. Draft_SwitchableTracksideAssetResponseCode enumeration values:</p> <table><thead><tr><th>Value</th><th>Enumeration Literal</th><th>Description</th></tr></thead><tbody><tr><td>0</td><td>Accepted</td><td>Request was accepted.</td></tr><tr><td>1</td><td>Rejected</td><td>Request was rejected.</td></tr></tbody></table>	Value	Enumeration Literal	Description	0	Accepted	Request was accepted.	1	Rejected	Request was rejected.
Value	Enumeration Literal	Description								
0	Accepted	Request was accepted.								
1	Rejected	Request was rejected.								
Tree View Diagram	<div><div><div><div><div><div></div><div>Draft_SwitchableTracksideAssetRequestResponse</div></div><div><div>id : string</div><div>switchableTracksideAssetResponseCode: Draft_SwitchableTracksideAssetResponseCode</div></div></div></div><div><div><div></div><div>Draft_SwitchableTracksideAssetResponseCode</div></div><div><div>Accepted</div><div>Rejected</div></div></div></div><p>Figure 3 Tree View of Draft_SwitchableTracksideAssetRequestResponse</p></div>									


3.2.1-3 - SwitchableTracksideAssetState

represents available, requested and current states of the asset

ID	SPMS-7639
----	-----------

Properties

The object owns the properties listed below:

switchableTracksideAssetSectionState :  SPMS-7640 - SwitchableTracksideAssetSectionState [0 .. *]

Set of Switchable Trackside Asset Sections States that are part of the Switchable Trackside Asset

id : string

Reference to Switchable Trackside Asset

switchableTracksideAssetState : SwitchableTracksideAssetStateValue

Overall state of Switchable Trackside Asset

SwitchableTracksideAssetStateValue enumeration values:

Value	Enumeration Literal	Description
0	disturbed	
1	trailed	
2	processing	
3	ready	

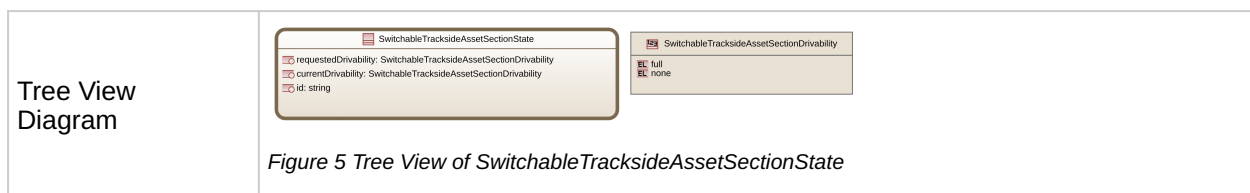
Tree View Diagram

```
classDiagram
    class SwitchableTracksideAssetState {
        id: string
        switchableTracksideAssetState: SwitchableTracksideAssetStateValue
    }
    class SwitchableTracksideAssetSectionState {
        requestedDrivability: SwitchableTracksideAssetSectionDrivability
        currentDrivability: SwitchableTracksideAssetSectionDrivability
        id: string
    }
    class SwitchableTracksideAssetStateValue {
        <<enumeration>>
        disturbed
        trailed
        processing
        ready
    }
    class SwitchableTracksideAssetSectionDrivability {
        <<enumeration>>
        full
        none
    }
    SwitchableTracksideAssetState "1" -- "*" SwitchableTracksideAssetSectionState
```

Figure 4 Tree View of SwitchableTracksideAssetState

3.2.1-4 - SwitchableTracksideAssetSectionState

ID	SPMS-7640																		
Properties	<p>The object owns the properties listed below:</p> <p>requestedDrivability : SwitchableTracksideAssetSectionDrivability requested driveability ofSwitchable Trackisde Asset Section SwitchableTracksideAssetSectionDrivability enumeration values:</p> <table><tr><th>Value</th><th>Enumeration Literal</th><th>Description</th></tr><tr><td>0</td><td>full</td><td></td></tr><tr><td>1</td><td>none</td><td></td></tr></table> <p>currentDrivability : SwitchableTracksideAssetSectionDrivability current driveability ofSwitchable Trackisde Asset Section SwitchableTracksideAssetSectionDrivability enumeration values:</p> <table><tr><th>Value</th><th>Enumeration Literal</th><th>Description</th></tr><tr><td>0</td><td>full</td><td></td></tr><tr><td>1</td><td>none</td><td></td></tr></table> <p>id : string Reference to Switchable Trackside Asset Section</p>	Value	Enumeration Literal	Description	0	full		1	none		Value	Enumeration Literal	Description	0	full		1	none	
Value	Enumeration Literal	Description																	
0	full																		
1	none																		
Value	Enumeration Literal	Description																	
0	full																		
1	none																		



3.2.1-5 - Draft_SectionDrivability

ID	SPMS-7975									
Properties	<p>The object owns the properties listed below:</p> <p>requested drivability : SwitchableTracksideAssetSectionDrivability Requested driveability SwitchableTracksideAssetSectionDrivability enumeration values:</p> <table><thead><tr><th>Value</th><th>Enumeration Literal</th><th>Description</th></tr></thead><tbody><tr><td>0</td><td>full</td><td></td></tr><tr><td>1</td><td>none</td><td></td></tr></tbody></table> <p>switchableTracksideAssetSectionReference : string Id of switchable trackside asset section.</p>	Value	Enumeration Literal	Description	0	full		1	none	
Value	Enumeration Literal	Description								
0	full									
1	none									
Tree View Diagram	<div><div><div><div><div></div><div>Draft_SectionDrivability</div></div><div><div><div></div><div>requested drivability: SwitchableTracksideAssetSectionDrivability</div></div><div><div></div><div>switchableTracksideAssetSectionReference: string</div></div></div></div></div><div><div><div></div><div>SwitchableTracksideAssetSectionDrivability</div></div><div><div><div></div><div>full</div></div><div><div></div><div>none</div></div></div></div></div> <p>Figure 6 Tree View of Draft_SectionDrivability</p>									

3.2.2 Train Object


3.2.2-1 - TrainObject


Defines a train object as generated by ETPS including e.g. the validated train data and movement permission.


ID	SPMS-7625
----	-----------

Properties

The object owns the properties listed below:

safeTrainExtent :  SPMS-7468 - NetLinearReference
train extent starting with the train head (opposite to the train-movement-direction); defines the safe train extent as provided by ETPS

validatedTrainData :  SPMS-7597 - ValidatedTrainData
see ss026, 7.4.3.5 Packet Number 11: Validated train data

movementPermission :  SPMS-7626 - MovementPermission [0 .. 1]
Movement Permission associated to Train Object

onboardOperatingMode : OnboardOperatingMode
Defines the on-board operating mode of the train, see ss026, 7.5.1.72
M_MODE

OnboardOperatingMode enumeration values:

Value	Enumeration Literal	Description
0	fullSupervision	
1	onSight	
2	staffResponsible	
3	shunting	
4	unfitted	
5	sleeping	
6	standBy	
7	trip	
8	postTrip	
9	systemFailure	
10	isolation	
11	nonLeading	
12	limitedSupervision	
13	nationalSystem	
14	reversing	
15	passiveShunting	
16	automaticDriving	
17	supervisedManoeuvre	

speed : uint32

Defines current speed of the train, see ss026, 7.5.1.172V_TRAIN

unit: km/h

safeTrainLength : boolean

Defines if the trainLength-value is safe, see ss026, 7.5.1.112Q_LENGTH

communicationActive : boolean

Defines the communication state for the train object, see ss026, 7.5.1.127Q_RBC

maRequestedByTrain : MaRequestedByTrain

see ss026, 7.5.1.118.3Q_MARQSTREASON

MaRequestedByTrain enumeration values:

Value	Enumeration Literal	Description
0	startSelectedByDriver	

Value	Enumeration Literal	Description
1	timeBeforeReachingThePerturbationLocationReached	
2	timeBeforeASectionTimer_LoaSpeedTimerExpiresReached	
3	trackDescriptionDeleted	
4	tafUpToLevel2TransitionLocation	

obulIdentifier : string

Defines the onboard-unit identifier, see ss026, 7.5.1.88 NID_ENGINE

trainRunningNumber : string

see PhysicalTrainUnitIdentifier.trainRunningNumber; see ss026, 7.5.1.92 NID_OPERATIONAL

id : string

Id of Train Object generated by ETPS; used for referencing

runningDirection : RunningDirection

see ss026, 7.5.1.105Q_DIRTRAIN

RunningDirection enumeration values:

Value	Enumeration Literal	Description
0	reverse	
1	nominal	
2	unknown	

Tree View
Diagram

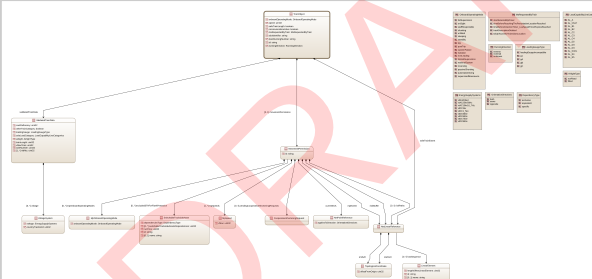


Figure 7 Tree View of TrainObject

3.2.2-2 - ValidatedTrainData

ID	SPMS-7597
----	-----------

Properties

The object owns the properties listed below:

cantDeficiency : uint32

No description available.

otherTrainCategory : boolean

see ss026, 7.5.1.84 NC_TRAIN

loadingGauge : LoadingGaugeType

No description available.

LoadingGaugeType enumeration values:

Value	Enumeration Literal	Description
0	loadingGaugeIncompatible	The train does not fit to any of the interoperable loading gauge profiles
1	g1	belongs to type g1
2	gA	belongs to type gA
3	gB	belongs to type gB
4	gC	belongs to type gC


axleLoadCategory : LoadCapabilityLineCategories

No description available.

LoadCapabilityLineCategories enumeration values:

Value	Enumeration Literal	Description
0	AL_A	Applicable for trains falling under axle load category A
1	AL_HS17	Applicable for trains falling under axle load category HS17
2	AL_B1	Applicable for trains falling under axle load category B1
3	AL_B2	Applicable for trains falling under axle load category B2
4	AL_C2	Applicable for trains falling under axle load category C2
5	AL_C3	Applicable for trains falling under axle load category C3
6	AL_C4	Applicable for trains falling under axle load category C4
7	AL_D2	Applicable for trains falling under axle load category D2
8	AL_D3	Applicable for trains falling under axle load category D3
9	AL_D4	Applicable for trains falling under axle load category D4
10	AL_D4XL	Applicable for trains falling under axle load category D4XL
11	AL_E4	Applicable for trains falling under axle load category E4

Value	Enumeration Literal	Description
12	AL_E5	Applicable for trains falling under axle load category E5

voltage :  SPMS-7833 - VoltageSystem [0 .. *]
No description available.

airtight : AirtightType
No description available.
AirtightType enumeration values:

Value	Enumeration Literal	Description
0	notFitted	
1	fitted	


trainLength : uint32


unit: m
vMaxTrain : uint32


unit: km/h
axleNumber : uint32
This gives the number of axles of the single unit (fixed train set or locomotive) in which the onboard equipment is fitted. See ss026,7.5.1.79.1 N_AXLE


nidNtc : uint32 [1 .. *]
see ss026, 7.5.1.98 NID_NTC


Tree View Diagram


 ValidatedTrainData


 cantDeficiency: uint32


 otherTrainCategory: boolean


 loadingGauge: LoadingGaugeType


 axleLoadCategory: LoadCapabilityLineCategories


 airtight: AirtightType


 trainLength: uint32


 vMaxTrain: uint32


 axleNumber: uint32


 [1..*] nidNtc: uint32


 VoltageSystem


 voltage: EnergySupplySystems


 countryTractionId: uint32


 LoadingGaugeType


 loadingGaugeIncompatible


 g1


 gA


 gB


 gC


 LoadCapabilityLineCategories


 AL_A


 AL_HS17


 AL_B1


 AL_B2


 AL_C2


 AL_C3


 AL_C4


 AL_D2


 AL_D3


 AL_D4


 AL_D4XL


 AL_E4


 AL_E5


 EnergySupplySystems


 vNotFitted


 vAC25kv50Hz


 vAC15kv16_7Hz


 vDC3kv


 vDC1_5kv


 vDC600v


 vDC650v

 vDC750v

 vDC850v

 AirtightType

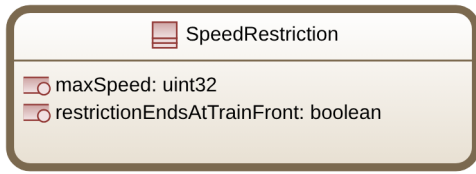
 notFitted

 fitted

</

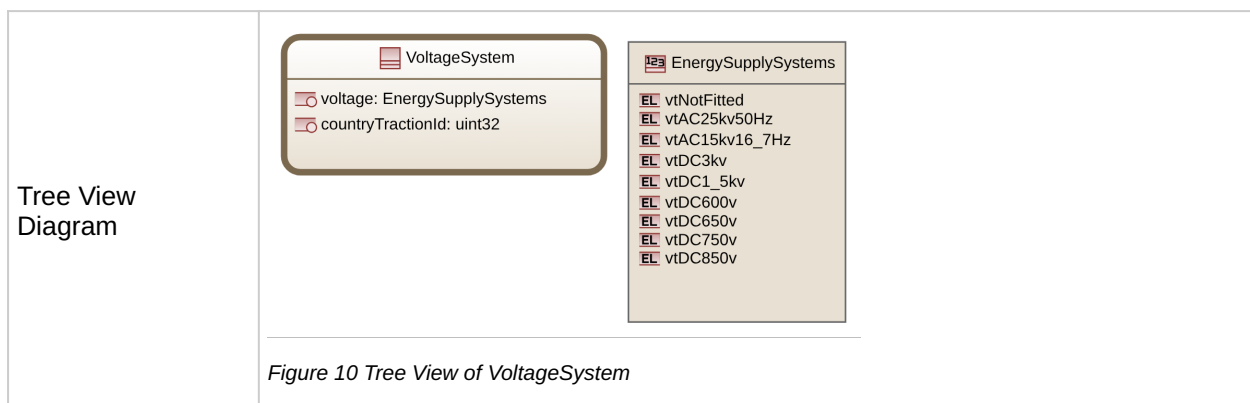
3.2.2-3 - SpeedRestriction

ID	SPMS-7959
----	-----------

Properties	<p>The object owns the properties listed below:</p> <p>maxSpeed : uint32 defines maximum speed unit: km/h</p> <p>restrictionEndsAtTrainFront : boolean normally false, but for disturbed level crossings, the train can accelerate as soon as the train-front passed the level crossing. In this case should be true</p>
Tree View Diagram	 <p>The diagram shows a box labeled 'SpeedRestriction' containing two properties: 'maxSpeed: uint32' and 'restrictionEndsAtTrainFront: boolean'.</p> <p><i>Figure 9 Tree View of SpeedRestriction</i></p>

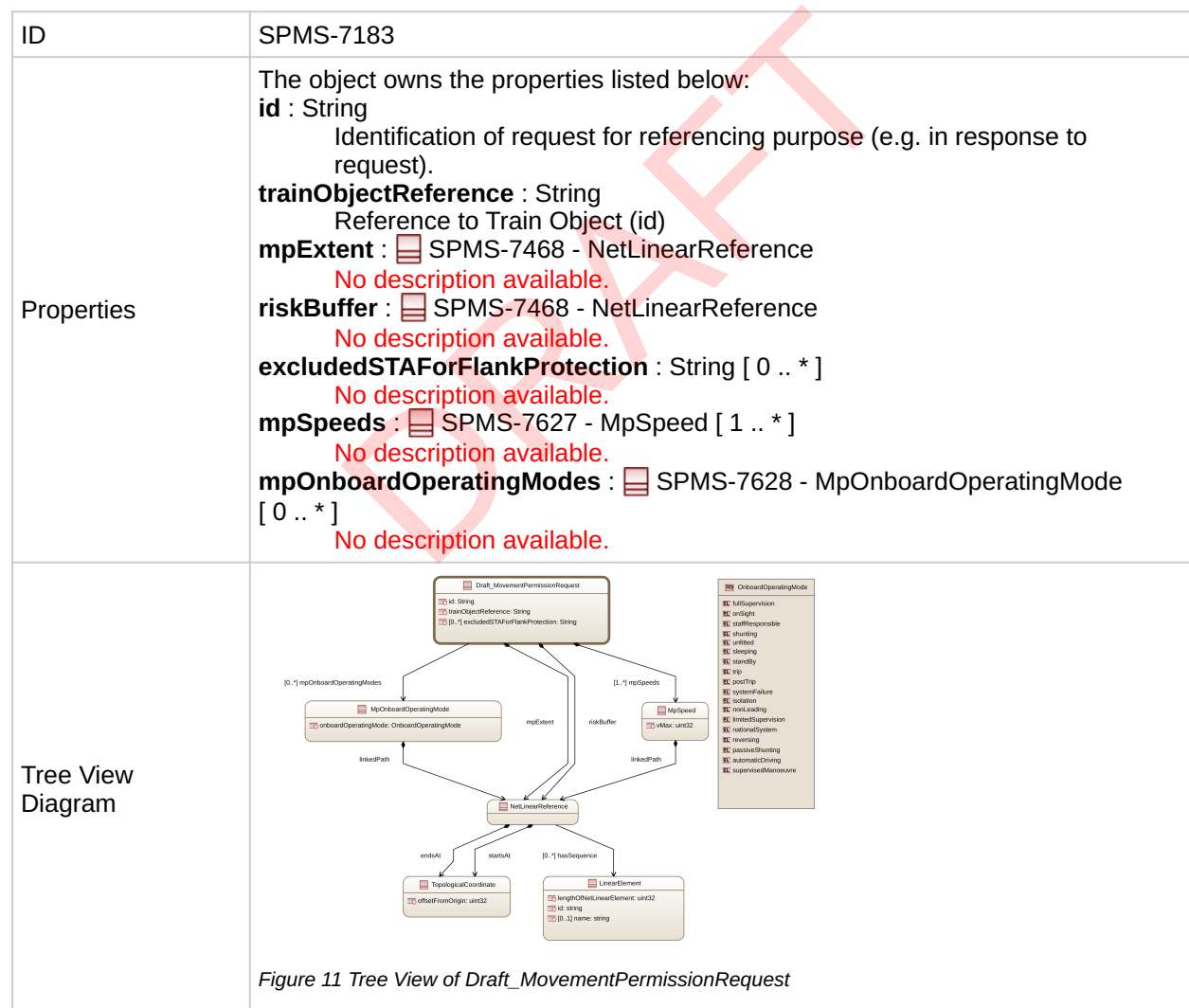
3.2.2-4 - VoltageSystem

ID	SPMS-7833																														
Properties	<p>The object owns the properties listed below: voltage : EnergySupplySystems see ss026, 7.5.1.78 M_VOLTAGE EnergySupplySystems enumeration values:</p> <table><tr><th>Value</th><th>Enumeration Literal</th><th>Description</th></tr><tr><td>0</td><td>vtNotFitted</td><td>Line not fitted (not electrified) with any traction system</td></tr><tr><td>1</td><td>vtAC25kv50Hz</td><td>AC 25kV 50Hz</td></tr><tr><td>2</td><td>vtAC15kv16_7Hz</td><td>AC 15kV 16.7Hz</td></tr><tr><td>3</td><td>vtDC3kv</td><td>DC 3kV</td></tr><tr><td>4</td><td>vtDC1_5kv</td><td>DC 1.5kV</td></tr><tr><td>5</td><td>vtDC600v</td><td>DC 600V</td></tr><tr><td>6</td><td>vtDC650v</td><td>DC 650V</td></tr><tr><td>7</td><td>vtDC750v</td><td>DC 750V</td></tr><tr><td>8</td><td>vtDC850v</td><td>DC 850V</td></tr></table> <p>countryTractionId : uint32 see ss026, 7.5.1.86.1 NID_CTRACTION</p>	Value	Enumeration Literal	Description	0	vtNotFitted	Line not fitted (not electrified) with any traction system	1	vtAC25kv50Hz	AC 25kV 50Hz	2	vtAC15kv16_7Hz	AC 15kV 16.7Hz	3	vtDC3kv	DC 3kV	4	vtDC1_5kv	DC 1.5kV	5	vtDC600v	DC 600V	6	vtDC650v	DC 650V	7	vtDC750v	DC 750V	8	vtDC850v	DC 850V
Value	Enumeration Literal	Description																													
0	vtNotFitted	Line not fitted (not electrified) with any traction system																													
1	vtAC25kv50Hz	AC 25kV 50Hz																													
2	vtAC15kv16_7Hz	AC 15kV 16.7Hz																													
3	vtDC3kv	DC 3kV																													
4	vtDC1_5kv	DC 1.5kV																													
5	vtDC600v	DC 600V																													
6	vtDC650v	DC 650V																													
7	vtDC750v	DC 750V																													
8	vtDC850v	DC 850V																													



3.2.3 Movement Permission



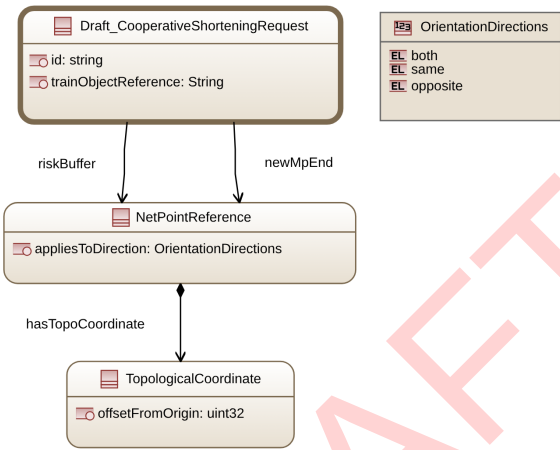
3.2.3-1 - Draft_MovementPermissionRequest



3.2.3-2 - Draft_MovementPermissionRequestResponse

ID	SPMS-7184															
Properties	<p>The object owns the properties listed below:</p> <p>id : string Identification of request corresponding to the request.</p> <p>MovementPermissionResponseCode : Draft_MovementPermissionResponseCode Extent of the movement permission. Draft_MovementPermissionResponseCode enumeration values:</p> <table><tr><th>Value</th><th>Enumeration Literal</th><th>Description</th></tr><tr><td>0</td><td>Accepted</td><td>Request was accepted.</td></tr><tr><td>1</td><td>Rejected</td><td>Request was rejected.</td></tr><tr><td>2</td><td>Forwarded</td><td></td></tr><tr><td>3</td><td>Invalid</td><td></td></tr></table>	Value	Enumeration Literal	Description	0	Accepted	Request was accepted.	1	Rejected	Request was rejected.	2	Forwarded		3	Invalid	
Value	Enumeration Literal	Description														
0	Accepted	Request was accepted.														
1	Rejected	Request was rejected.														
2	Forwarded															
3	Invalid															
Tree View Diagram	<div><div><div>Draft_MovementPermissionRequestResponse</div><div>id: string</div><div>MovementPermissionResponseCode: Draft_MovementPermissionResponseCode</div></div><div><div>Draft_MovementPermissionResponseCode</div><div>Accepted</div><div>Rejected</div><div>Forwarded</div><div>Invalid</div></div></div> <p>Figure 12 Tree View of Draft_MovementPermissionRequestResponse</p>															

3.2.3-3 - Draft_CooperativeShorteningRequest









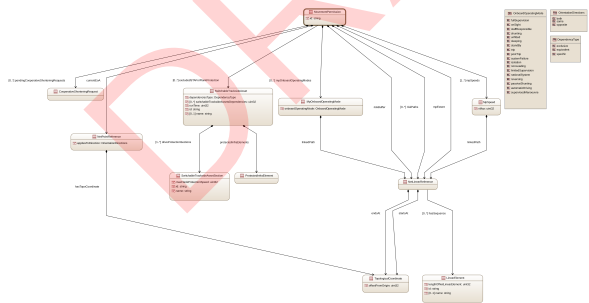
ID	SPMS-7799
Properties	<p>The object owns the properties listed below:</p> <p>id : string Identification of request for referencing purpose (e.g. in response to request).</p> <p>trainObjectReference : String Reference to train object (id).</p> <p>newMpEnd :  SPMS-7466 - NetPointReference Shortened end of movement permission.</p> <p>riskBuffer :  SPMS-7466 - NetPointReference Extent of the risk buffer.</p>
Tree View Diagram	 <p><i>Figure 13 Tree View of Draft_CooperativeShorteningRequest</i></p>

3.2.3-4 - Draft_CooperativeShorteningRequestResponse

ID	SPMS-7797									
Properties	<p>The object owns the properties listed below:</p> <p>id : string Identification of request for referencing purpose (e.g. in response to request).</p> <p>cooperativeShorteningResponseCode : Draft_CooperativeShorteningResponseCode Response code to the request. Draft_CooperativeShorteningResponseCode enumeration values:</p> <table><tr><th>Value</th><th>Enumeration Literal</th><th>Description</th></tr><tr><td>0</td><td>Accepted</td><td>Request was accepted.</td></tr><tr><td>1</td><td>Rejected</td><td>Request was rejected.</td></tr></table>	Value	Enumeration Literal	Description	0	Accepted	Request was accepted.	1	Rejected	Request was rejected.
Value	Enumeration Literal	Description								
0	Accepted	Request was accepted.								
1	Rejected	Request was rejected.								
Tree View Diagram	<div><div><div>Draft_CooperativeShorteningRequestResponse</div><div>id: string</div><div>cooperativeShorteningResponseCode: Draft_CooperativeShorteningResponseCode</div></div><div><div>Draft_CooperativeShorteningResponseCode</div><div>Accepted</div><div>Rejected</div></div></div> <p>Figure 14 Tree View of Draft_CooperativeShorteningRequestResponse</p>									


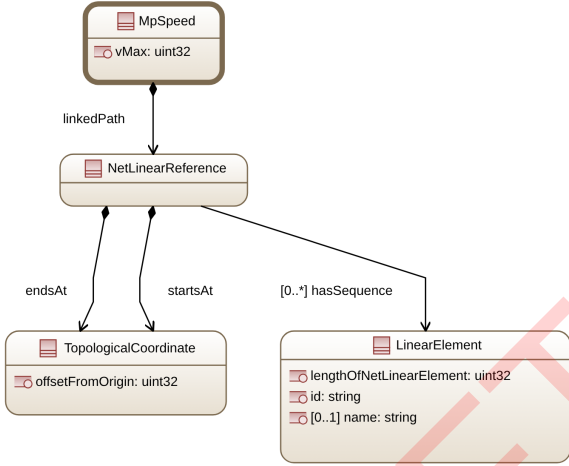
3.2.3-5 - MovementPermission

Defines path and speed profiles assigned to a train for its next movement.

ID	SPMS-7626
Properties	<p>The object owns the properties listed below:</p> <p>riskBuffer :  SPMS-7468 - NetLinearReference Defines the risk buffer for a movement permission =overlap after MP. Extent risk buffer for a Movement Permission.</p> <p>riskPaths :  SPMS-7468 - NetLinearReference [0 .. *] Defines flank protection area on the neighbouring tracks.Collection of applied Risk Paths of Movement Permission</p> <p>mpExtent :  SPMS-7468 - NetLinearReference Extent of the Movement Permission</p> <p>mpSpeeds :  SPMS-7627 - MpSpeed [1 .. *] Applied speed profile</p> <p>mpOnboardOperatingModes :  SPMS-7628 - MpOnboardOperatingMode [0 .. *] Applied mode profile</p> <p>id : string Defines the Identity of the object; used for referencing</p> <p>currentEoA :  SPMS-7466 - NetPointReference Current End of Authority of associated Movement Authority</p> <p>pendingCooperativeShorteningRequests :  SPMS-7641 - CooperativeShorteningRequest [0 .. *] Pending requests for cooperative shortening of Movement Authority</p> <p>excludedSTAFForFlankProtection :  SPMS-7644 - SwitchableTracksideAsset [0 .. *] Set of Switchable Trackside Assets excluded from flank protection</p>
Tree View Diagram	 <p>Figure 15 Tree View of MovementPermission</p>

3.2.3-6 - MpSpeed

Defines speed-restriction section of the path defined in a movement permission.

ID	SPMS-7627
Properties	<p>The object owns the properties listed below:</p> <p>linkedPath :  SPMS-7468 - NetLinearReference refers the applicable path</p> <p>vMax : uint32 Defines the maximum applicable speed for movement permission along the assigned path unit: km/h</p>
Tree View Diagram	 <pre> graph TD MpSpeed[MpSpeed] -- linkedPath --> NetLinearReference[NetLinearReference] NetLinearReference -- endsAt --> TopologicalCoordinate[TopologicalCoordinate] NetLinearReference -- startsAt --> TopologicalCoordinate NetLinearReference -- "[0..*] hasSequence" --> LinearElement[LinearElement] style MpSpeed fill:#f9f9f9,stroke:#ccc,stroke-width:1px style NetLinearReference fill:#f9f9f9,stroke:#ccc,stroke-width:1px style TopologicalCoordinate fill:#f9f9f9,stroke:#ccc,stroke-width:1px style LinearElement fill:#f9f9f9,stroke:#ccc,stroke-width:1px </pre> <p><i>Figure 16 Tree View of MpSpeed</i></p>


3.2.3-7 - MpOnboardOperatingMode

Defines inside of a movement permission, which parts of the reserved path can be driven in which ETCS mode.

ID	SPMS-7628
----	-----------

Properties

The object owns the properties listed below:

linkedPath :  SPMS-7468 - NetLinearReference

refers the applicable path

onboardOperatingMode : OnboardOperatingMode

Defines the applicable driving mode along the associated path

OnboardOperatingMode enumeration values:

Value	Enumeration Literal	Description
0	fullSupervision	
1	onSight	
2	staffResponsible	
3	shunting	
4	unfitted	
5	sleeping	
6	standBy	
7	trip	
8	postTrip	
9	systemFailure	
10	isolation	
11	nonLeading	
12	limitedSupervision	
13	nationalSystem	
14	reversing	
15	passiveShunting	
16	automaticDriving	
17	supervisedManoeuvre	

Tree View Diagram

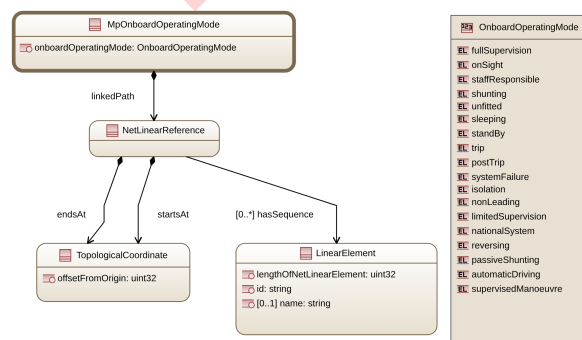


Figure 17 Tree View of MpOnboardOperatingMode

3.2.3-8 - CooperativeShorteningRequest


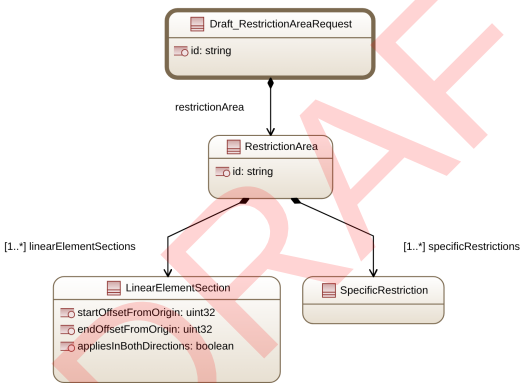
ID

SPMS-7641

Properties	No properties are owned by this object.
Tree View Diagram	 <p>Figure 18 Tree View of CooperativeShorteningRequest</p>

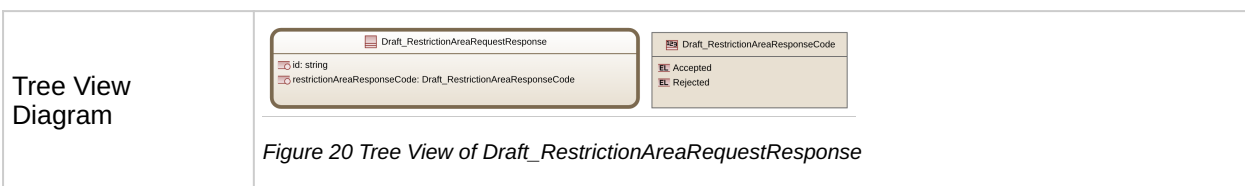
3.2.4 Restriction Area

3.2.4-1 - Draft_RestrictionAreaRequest

ID	SPMS-7730
Properties	<p>The object owns the properties listed below:</p> <p>id : string Identification of request for referencing purpose (e.g. in response to request).</p> <p>restrictionArea :  SPMS-7610 - RestrictionArea Restriction Area.</p>
Tree View Diagram	 <p>Figure 19 Tree View of Draft_RestrictionAreaRequest</p>

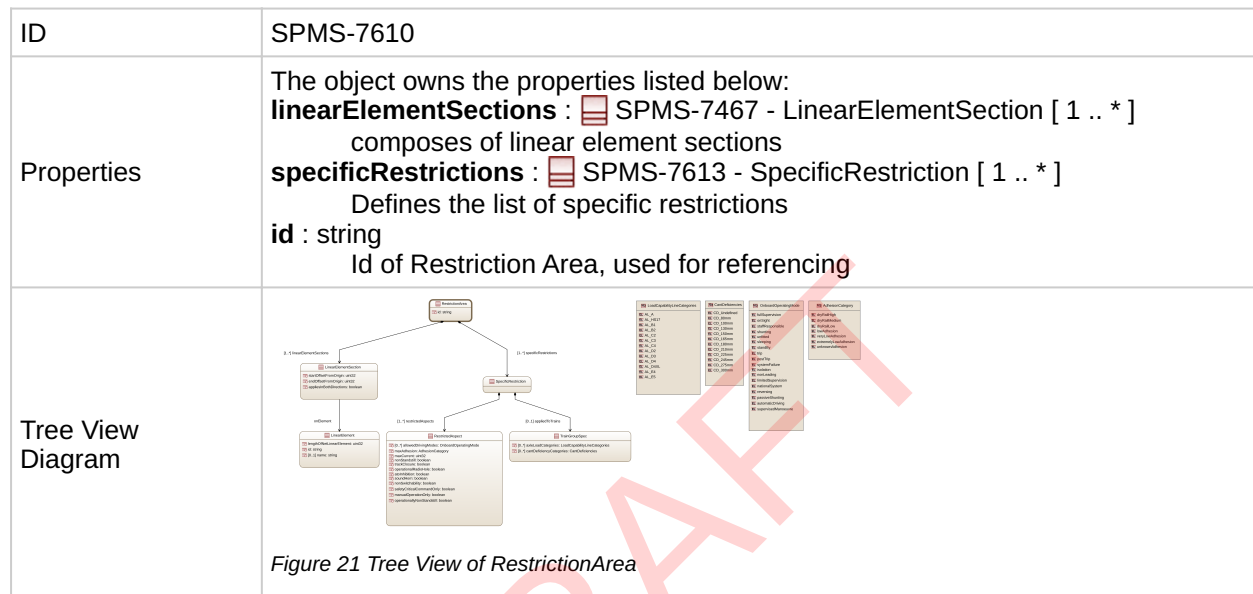
3.2.4-2 - Draft_RestrictionAreaRequestResponse

ID	SPMS-7837									
Properties	<p>The object owns the properties listed below:</p> <p>id : string Identification of the request corresponding to the request.</p> <p>restrictionAreaResponseCode : Draft_RestrictionAreaResponseCode No description available.</p> <p>Draft_RestrictionAreaResponseCode enumeration values:</p> <table><tr><th>Value</th><th>Enumeration Literal</th><th>Description</th></tr><tr><td>0</td><td>Accepted</td><td>Request was accepted.</td></tr><tr><td>1</td><td>Rejected</td><td>Request was rejected.</td></tr></table>	Value	Enumeration Literal	Description	0	Accepted	Request was accepted.	1	Rejected	Request was rejected.
Value	Enumeration Literal	Description								
0	Accepted	Request was accepted.								
1	Rejected	Request was rejected.								



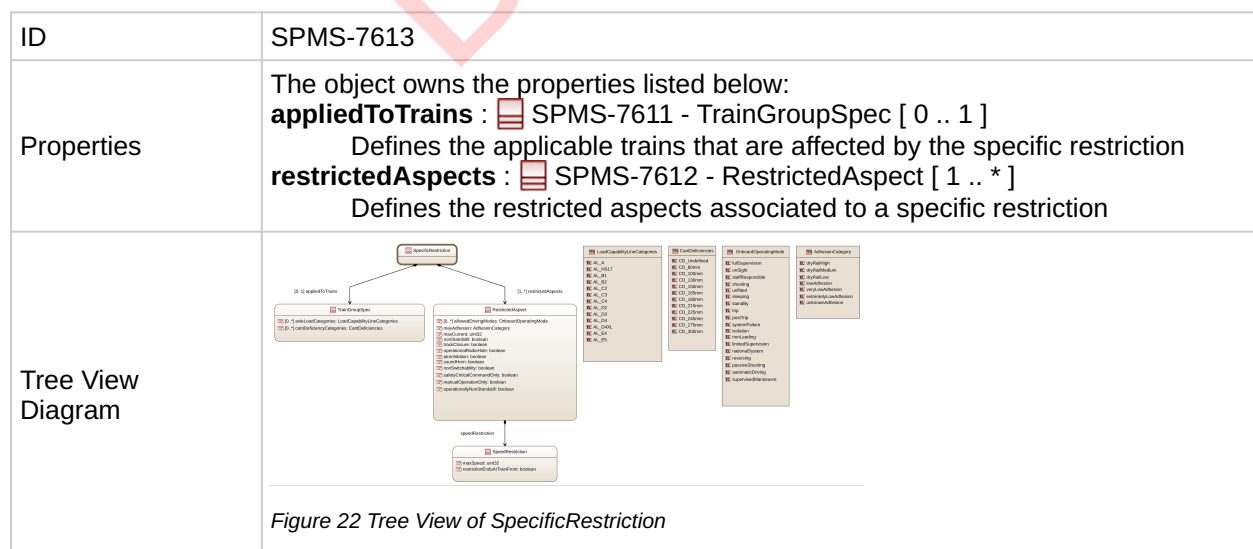
3.2.4-3 - RestrictionArea

Defines a topological area, in which the restrictions must be applied.



3.2.4-4 - SpecificRestriction

Defines single aspect of the infrastructure restriction.



3.2.4-5 - RestrictedAspect

Defines single aspects of the infrastructure restriction

ID	SPMS-7612
----	-----------

DRAFT

Properties

The object owns the properties listed below:

speedRestriction :  SPMS-7959 - SpeedRestriction

Defines the allowed speed

allowedDrivingModes : OnboardOperatingMode [0 .. *]

Defines the allowed driving modes

OnboardOperatingMode enumeration values:

Value	Enumeration Literal	Description
0	fullSupervision	
1	onSight	
2	staffResponsible	
3	shunting	
4	unfitted	
5	sleeping	
6	standBy	
7	trip	
8	postTrip	
9	systemFailure	
10	isolation	
11	nonLeading	
12	limitedSupervision	
13	nationalSystem	
14	reversing	
15	passiveShunting	
16	automaticDriving	
17	supervisedManoeuvre	

maxAdhesion : AdhesionCategory

Defines the maximum adhesion

AdhesionCategory enumeration values:

Value	Enumeration Literal	Description
0	dryRailHigh	Conditions where 100% of the brake force of the vehicle can be applied with no axle sliding of more than 2% (adhesion level typically above 0.15μ)
1	dryRailMedium	Conditions where the wheel/rail adhesion is in the range 0.15 à 0.10 (Damp rails with some contamination)
2	dryRailLow	Conditions where the wheel/rail adhesion is in the range 0.10 à 0.08 (Typical autumn mornings due to dew/dampness often combined with light overnight rust)

Value	Enumeration Literal	Description
3	lowAdhesion	Conditions where the wheel/rail adhesion is in the range 0.08 to 0.05
4	veryLowAdhesion	Conditions where the wheel/rail adhesion is in the range 0.05-0.03
5	extremelyLowAdhesion	Conditions where the wheel/rail adhesion is below 0.03
255	unknownAdhesion	

maxCurrent : uint32

Defines max current value. For ATO, SS126. Ignored by TrafficCS

unit: A

nonStandstill : boolean

Defines the non stopping area. If true, the trains defined in trainGroupSpec shall not stop within restriction area.

trackClosure : boolean

Defines track closure information. If true, the trains defined in trainGroupSpec shall not enter restriction area

operationalRadioHole : boolean

Defines the presence of operational radio holes. If true radio communication is restricted within restriction area

atoInhibition : boolean

Defined the ato inhibition zones. Examples: train section is not constantly monitored, or stimulate driver's attention, or approaching overcrowded station

soundHorn : boolean

Defines that approaching trains need to sound horn

nonSwitchability : boolean

Defines that Switchable Trackside Asset cannot be switched. To be clarified.

safetyCriticalCommandOnly : boolean

Defines that only safety critical commands are allowed

manualOperationOnly : boolean

Defines that only manual operation by operator or maintainer is allowed (no automatic operation by PES)

operationallyNonStandstill : boolean

Defines the operationally non stopping area. If true, the trains defined in trainGroupSpec should not stop within restriction area due to operational reasons.

Tree View Diagram

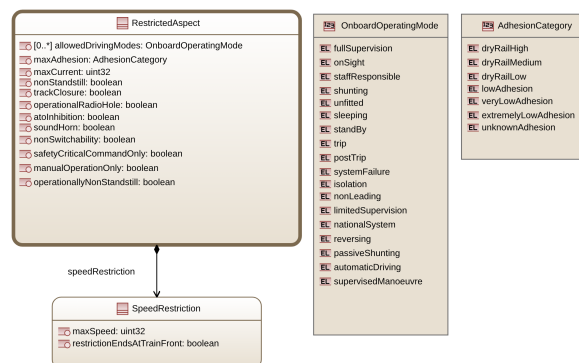


Figure 23 Tree View of RestrictedAspect

3.2.4-6 - TrainGroupSpec

Defines the train aspects, which define if the train belongs to the restricted group.

ID	SPMS-7611
----	-----------

DRAFT

Properties

The object owns the properties listed below:

axleLoadCategories : LoadCapabilityLineCategories [0 .. *]

Trains with the listed Axle-Load-Category belong to the TrainGroup.

LoadCapabilityLineCategories enumeration values:

Value	Enumeration Literal	Description
0	AL_A	Applicable for trains falling under axle load category A
1	AL_HS17	Applicable for trains falling under axle load category HS17
2	AL_B1	Applicable for trains falling under axle load category B1
3	AL_B2	Applicable for trains falling under axle load category B2
4	AL_C2	Applicable for trains falling under axle load category C2
5	AL_C3	Applicable for trains falling under axle load category C3
6	AL_C4	Applicable for trains falling under axle load category C4
7	AL_D2	Applicable for trains falling under axle load category D2
8	AL_D3	Applicable for trains falling under axle load category D3
9	AL_D4	Applicable for trains falling under axle load category D4
10	AL_D4XL	Applicable for trains falling under axle load category D4XL
11	AL_E4	Applicable for trains falling under axle load category E4
12	AL_E5	Applicable for trains falling under axle load category E5

cantDeficiencyCategories : CantDeficiencies [0 .. *]

Trains with the listed Cant Deficiency Category belong to the TrainGroup.

CantDeficiencies enumeration values:

Value	Enumeration Literal	Description
0	CD_Undefined	annotates inactive cant deficiency
1	CD_80mm	Applicable for trains capable of compensating cant deficiency of 80mm
2	CD_100mm	Applicable for trains capable of compensating cant deficiency of 100mm
3	CD_130mm	Applicable for trains capable of compensating cant deficiency of 130mm

	<table><tr><th>Value</th><th>Enumeration Literal</th><th>Description</th></tr><tr><td>4</td><td>CD_150mm</td><td>Applicable for trains capable of compensating cant deficiency of 150mm</td></tr><tr><td>5</td><td>CD_165mm</td><td>Applicable for trains capable of compensating cant deficiency of 165mm</td></tr><tr><td>6</td><td>CD_180mm</td><td>Applicable for trains capable of compensating cant deficiency of 180mm</td></tr><tr><td>7</td><td>CD_210mm</td><td>Applicable for trains capable of compensating cant deficiency of 210mm</td></tr><tr><td>8</td><td>CD_225mm</td><td>Applicable for trains capable of compensating cant deficiency of 225mm</td></tr><tr><td>9</td><td>CD_245mm</td><td>Applicable for trains capable of compensating cant deficiency of 245mm</td></tr><tr><td>10</td><td>CD_275mm</td><td>Applicable for trains capable of compensating cant deficiency of 275mm</td></tr><tr><td>11</td><td>CD_300mm</td><td>Applicable for trains capable of compensating cant deficiency of 300mm</td></tr></table>	Value	Enumeration Literal	Description	4	CD_150mm	Applicable for trains capable of compensating cant deficiency of 150mm	5	CD_165mm	Applicable for trains capable of compensating cant deficiency of 165mm	6	CD_180mm	Applicable for trains capable of compensating cant deficiency of 180mm	7	CD_210mm	Applicable for trains capable of compensating cant deficiency of 210mm	8	CD_225mm	Applicable for trains capable of compensating cant deficiency of 225mm	9	CD_245mm	Applicable for trains capable of compensating cant deficiency of 245mm	10	CD_275mm	Applicable for trains capable of compensating cant deficiency of 275mm	11	CD_300mm	Applicable for trains capable of compensating cant deficiency of 300mm
Value	Enumeration Literal	Description																										
4	CD_150mm	Applicable for trains capable of compensating cant deficiency of 150mm																										
5	CD_165mm	Applicable for trains capable of compensating cant deficiency of 165mm																										
6	CD_180mm	Applicable for trains capable of compensating cant deficiency of 180mm																										
7	CD_210mm	Applicable for trains capable of compensating cant deficiency of 210mm																										
8	CD_225mm	Applicable for trains capable of compensating cant deficiency of 225mm																										
9	CD_245mm	Applicable for trains capable of compensating cant deficiency of 245mm																										
10	CD_275mm	Applicable for trains capable of compensating cant deficiency of 275mm																										
11	CD_300mm	Applicable for trains capable of compensating cant deficiency of 300mm																										
Tree View Diagram	<div><div><div>TrainGroupSpec</div><div><div>[0..*] axleLoadCategories: LoadCapabilityLineCategories</div><div>[0..*] cantDeficiencyCategories: CantDeficiencies</div></div></div><div><div>LoadCapabilityLineCategories</div><div>AL_A AL_HS17 AL_B1 AL_B2 AL_C2 AL_C3 AL_C4 AL_D2 AL_D3 AL_D4 AL_D4XL AL_E4 AL_E5</div></div><div><div>CantDeficiencies</div><div>CD_undefined CD_80mm CD_100mm CD_130mm CD_150mm CD_165mm CD_180mm CD_210mm CD_225mm CD_245mm CD_275mm CD_300mm</div></div></div>																											

Figure 24 Tree View of TrainGroupSpec

3.2.5 Infrastructure

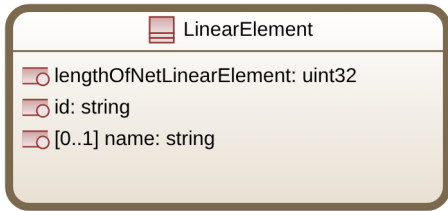
Note:

The infrastructure data classes are part of the definition of [SPP-29097 - TCCS - Data Model_10_INFRA v1.0].

3.2.5-2 - LinearElement


A linear element is an uninterrupted stretch of railway track, without divergence or convergence.

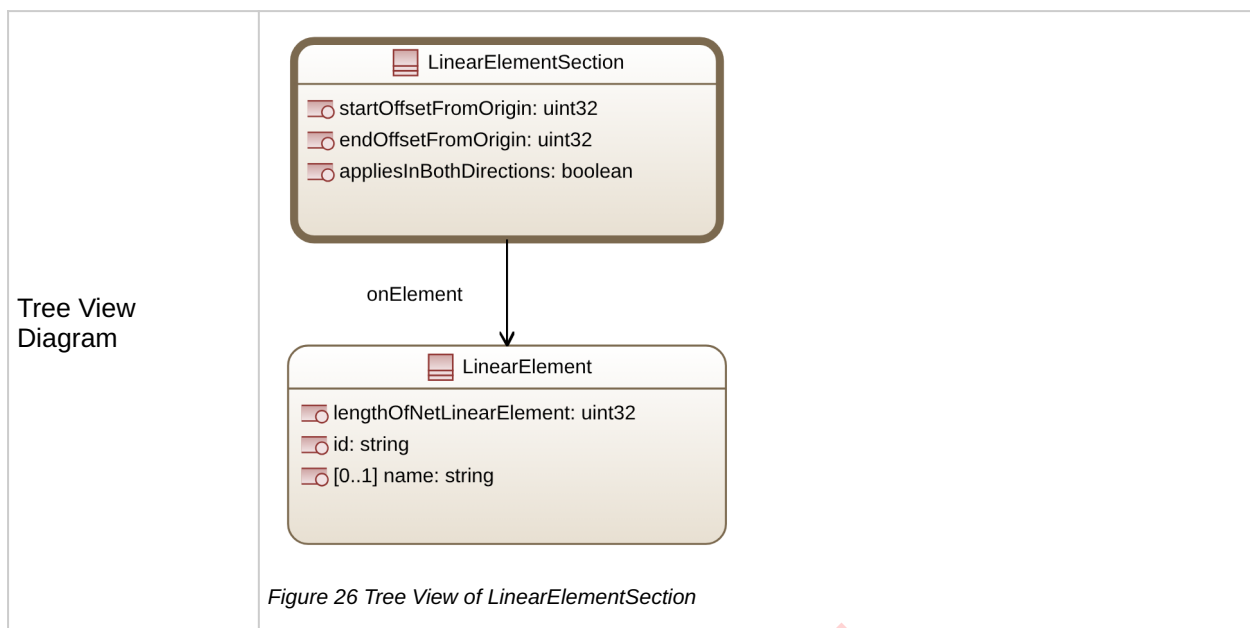
ID	SPMS-7463
----	-----------

Properties	<p>The object owns the properties listed below:</p> <p>lengthOfNetLinearElement : uint32 Defines the distance along the LinearElement's track centre line. exp: -3 unit: m</p> <p>id : string Identity of the object; used for referencing</p> <p>name : string [0 .. 1] User-friendly name, only if different from id</p>
Tree View Diagram	 <p>Figure 25 Tree View of LinearElement</p>

3.2.5-3 - LinearElementSection

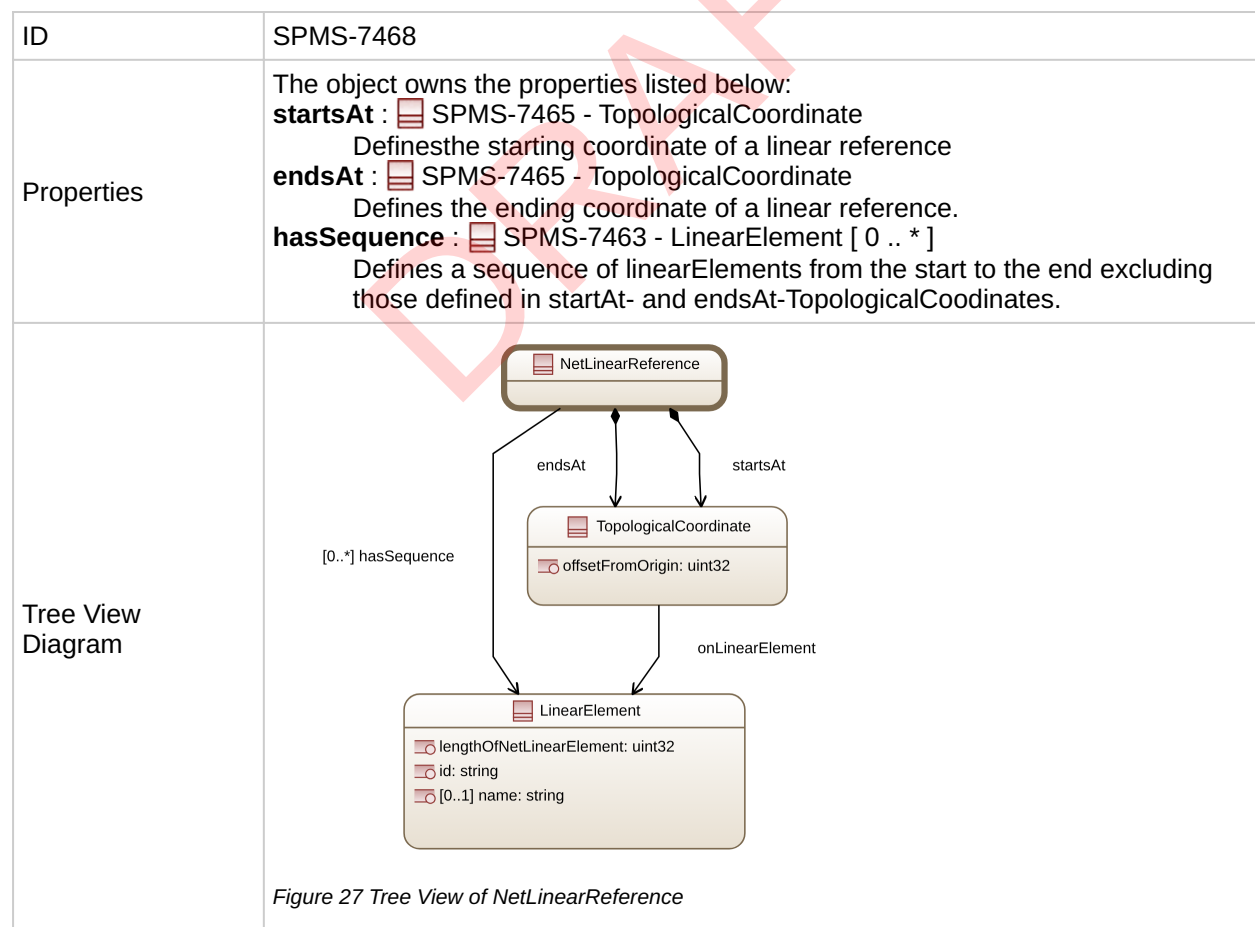
Defines a directed linear object (with a linear extension) located on a LinearElement

ID	SPMS-7467
Properties	<p>The object owns the properties listed below:</p> <p>onElement :  SPMS-7463 - LinearElement refers to linear element</p> <p>startOffsetFromOrigin : uint32 Defines the start offset from the origin exp: -3 unit: m</p> <p>endOffsetFromOrigin : uint32 Defines the end offset from the origin exp: -3 unit: m</p> <p>appliesInBothDirections : boolean Defines if the section applies in both directions</p>



3.2.5-4 - NetLinearReference

Defines a linked path on the topology



3.2.5-5 - NetPointReference

Represents a point reference in the network.


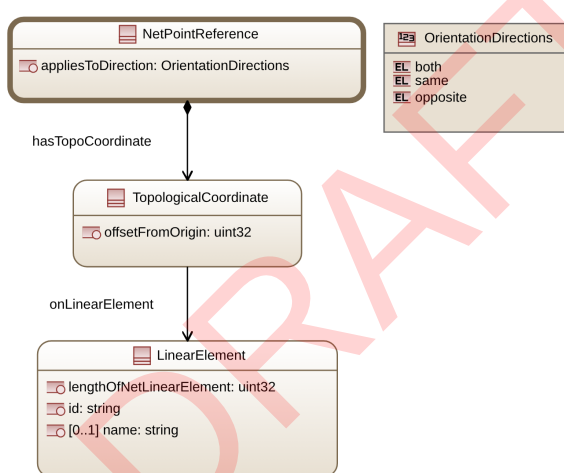

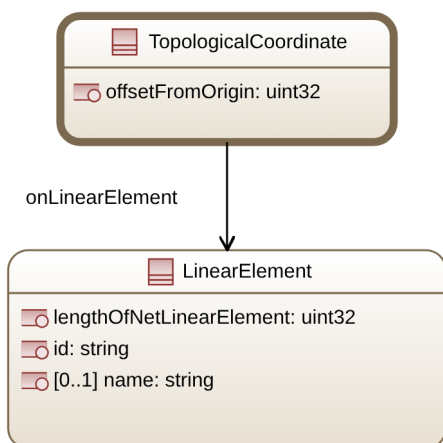
ID	SPMS-7466												
Properties	<p>The object owns the properties listed below:</p> <p>hasTopoCoordinate :  SPMS-7465 - TopologicalCoordinate Defines the topological coordinate of a network point reference</p> <p>appliesToDirection : OrientationDirections The direction relative to the origin of the linear element towards the point reference applies OrientationDirections enumeration values:</p> <table><thead><tr><th>Value</th><th>Enumeration Literal</th><th>Description</th></tr></thead><tbody><tr><td>0</td><td>both</td><td>active in both directions</td></tr><tr><td>1</td><td>same</td><td>in the same direction as the linearElement</td></tr><tr><td>2</td><td>opposite</td><td>in the opposite direction as the linearElement</td></tr></tbody></table>	Value	Enumeration Literal	Description	0	both	active in both directions	1	same	in the same direction as the linearElement	2	opposite	in the opposite direction as the linearElement
Value	Enumeration Literal	Description											
0	both	active in both directions											
1	same	in the same direction as the linearElement											
2	opposite	in the opposite direction as the linearElement											
Tree View Diagram	 <p>The diagram illustrates the hierarchical structure of the NetPointReference object. At the top is the NetPointReference object, which contains the appliesToDirection property of type OrientationDirections. Below it is the TopologicalCoordinate object, which contains the offsetFromOrigin property of type uint32. At the bottom is the LinearElement object, which contains the lengthOfNetLinearElement (uint32), id (string), and name (string, indexed 0..1) properties. Arrows indicate the relationships: NetPointReference hasTopoCoordinate TopologicalCoordinate, and TopologicalCoordinate is onLinearElement LinearElement. A separate box for OrientationDirections shows its enumeration values: EL both, EL same, and EL opposite.</p>												

Figure 28 Tree View of NetPointReference

3.2.5-6 - TopologicalCoordinate

Defines a topological coordinate on the track

ID	SPMS-7465
Properties	<p>The object owns the properties listed below:</p> <p>onLinearElement :  SPMS-7463 - LinearElement is positioned on linear element</p> <p>offsetFromOrigin : uint32 position on the associated NetElement exp: -3 unit: m</p>

Tree View
Diagram*Figure 29 Tree View of TopologicalCoordinate*

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4 Non-functional characteristics / non-functional requirements

Will be provided in a future release.

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5 Appendix

5.1 References

Id	Description	Reference
[ SPP-29096 - TCCS - Data Model_00_Guide v1.0]	The document gives guidance for CCS/TMS Data Model specified by SP TCCS SD1.	Link
[ SPP-29097 - TCCS - Data Model_10_INFRA v1.0]	This document delivers the infrastructure description as the base for the CCS/TMS data model (from TCCS SD1) for all relevant domains needing infrastructure data in System Pillar.	Link
[ SPP-18075 - TCS_System Architecture Description Traffic CS_V0.4]	System Architecture Description of the Traffic CS System according to.	Link
[ SPP-19049 - Traffic CS System Concept V1.0]	Traffic CS prepared this document to summarise the most important system requirements for Traffic CS and the solution concept how it is foreseen to fulfil these requirements. Furthermore, assumptions and expectations to external systems outside of Traffic CS are stated and roadmap is presented.	Link