

TCCS SD1 - Data Model - ETCS Engineering

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2 References

 [TCCS SD1 - Data Model_12_SS026](#)

3 Package "Engineering"

3.1 Package Header

SPT2TS-122300 - Package specification



```
{  
  "$schema": "ERJU meta-model.json",  
  "isDefinedBy": "http://ERJU/datamodel/0.4/eng",  
  "name": "ETCSEngineering",  
  "containerStruct": "ETCSEngineering",  
  "prefix": "eng",  
  "intId": 3,  
  "version": "1.0",  
  "info": "Engineering Data for the ETCS Level 2/3 use case",  
  "enums": [],   "structs": []  
}
```

3.2 Buffer Stop

Note: details and need of buffer stop type etc. is under discussion.

SPT2TS-122292 - The modeling of buffer stops as linear objects allows for more precise safety assessments. It enables the evaluation of factors such as the required stopping distance, potential overruns, and the interaction between the buffer stop and the train in various scenarios. This information is crucial for designing appropriate safety measures while planning and ensuring compliance with safety regulations.

From the engineering point of view, buffer stop should be modelled as a linear object, rather than just a point, as it facilitates a more realistic representation of their physical characteristics, collision dynamics, structural integrity, and safety assessments. It enhances the accuracy of engineering analyses and supports the design and evaluation of effective buffer stop systems.

For base definition of the object see  [SPT2TS-93278 - Buffer Stop](#)  Content to be approved

]

SPT2TS-122285 - BufferStop

```
{  
  "structs": [  
    {  
      "name": "BufferStop",  
      "info": "object buffer stop on the track",  
      "attrs": [  



```

```

    { "intId": 1, "name": "id", "dataType": "string", "key": "global", "sameKeyAs": "infra.BufferStop",
      "info": "Identity of the object; used for referencing"},
    { "intId": 2, "name": "dangerPoints", "reference": "DangerPoint", "multiplicity": "0..*", "info":
      "refers to danger points"},
    { "intId": 3, "name": "trackEdgeSections", "composition": "infra.TrackEdgeSection",
      "multiplicity": "1..*", "info": "composes of track edge sections"},
    { "intId": 4, "name": "bsType", "enumType": "BufferStopType", "info": "defines buffer stop
      types"}
  ]
},
"enums": [
  {
    "name": "BufferStopType",
    "enumLiterals": [
      { "intId": 0, "name": "friction", "info": "is of type friction"},
      { "intId": 1, "name": "hydraulic", "info": "is of type hydraulic"},
      { "intId": 2, "name": "fixated", "info": "is of type fixated"},
      { "intId": 3, "name": "other", "info": "is of type other"}
    ]
  }
]
}

```

3.3 Point and Crossing

SPT2TS-127354 - For base definition of the object see  [SPT2TS-49047 - Point, Crossing, Derailer](#)  Content to be approved]

SPT2TS-122284 - Simple Point

```

{
  "structs": [
    {
      "name": "SimplePoint",
      "info": "Defines the physical track asset Simple Point",
      "attrs": [
        { "intId": 1, "name": "id", "dataType": "string", "key": "global", "sameKeyAs":
          "infra.SimplePoint", "info": "Identity of the object; used for referencing"},
        { "intId": 2, "name": "foulingPoints", "reference": "FoulingPoint", "multiplicity": "1..*", "info":
          "refers to fouling points"},
        { "intId": 3, "name": "tipShift", "dataType": "double", "info": "the tip distance from the start of
          the simple point on main and branching tracks"},

```



```
{ "intId": 4, "name": "bladeLength", "dataType": "double", "info": "the length of the blade of
simple point along main and branching tracks"}
```

```
]
}}
}
```

SPT2TS-125472 - Crossing

```
{
  "structs": [
    {
      "name": "Crossing",
      "info": "Defines the physical track asset Crossing without possibility to switch between two track
edges",
      "attrs": [
        { "intId": 1, "name": "id", "dataType": "string", "key": "global", "sameKeyAs": "infra.Crossing", "i
nfo": "Identity of the object; used for referencing"},
        { "intId": 2, "name": "foulingPoints", "reference": "FoulingPoint", "multiplicity": "1..*", "info":
"refers to fouling points"}
      ]
    }
  ]
}
```



3.4 Level Crossing

SPT2TS-122290 - For base definition of the object see  [SPT2TS-64030 - Level Crossing](#)  Content to be approved]

SPT2TS-122283 - LevelCrossing

```
{
  "structs": [
    {
      "name": "LevelCrossing",
      "info": "Defines the track asset level crossing",
      "attrs": [
        { "intId": 1, "name": "id", "dataType": "string", "key": "global", "sameKeyAs":
"infra.LevelCrossing", "info": "Identity of the object; used for referencing"},
        { "intId": 2, "name": "dangerPoints", "reference": "DangerPoint", "multiplicity": "1..*", "info":
"refers to danger points"}
      ]
    }
  ]
}
```

3.5 Balise(Group) and Balise Packet

SPT2TS-127353 - For base definition of the object see  SPT2TS-49051 - [Balise \(Group\)](#)  C
content to be approved]

SPT2TS-122282 - BaliseGroup

```
{
  "structs": [
    {
      "name": "BaliseGroup",
      "info": "Defines a technical device group on the railway trackbed.",
      "attrs": [
        { "intId": 1, "name": "id", "dataType": "string", "key": "global", "sameKeyAs":
"infra.BaliseGroup", "info": "Identity of the object; used for referencing"},
        { "intId": 2, "name": "m_version", "enumType": "ss026.ETCSVersion", "info": "Version of the
ERTMS/ETCS system" },
        { "intId": 3, "name": "q_link", "dataType": "boolean", "info": "true when the balise group is
linked, otherwise, false (unlinked)" },
        { "intId": 4, "name": "q_updown", "dataType": "boolean", "info": "This defines the direction of
information. True when it is Up-link (Track-to-Train) and false when it is Down-link (Train-to-
Track)"}
      ]
    }
  ]
}
```

SPT2TS-125473 - Balise

```
{
  "structs": [
    {
      "name": "Balise",
      "info": "Defines a technical device on the railway trackbed.",
      "attrs": [
        { "intId": 1, "name": "id", "dataType": "string", "key": "global", "sameKeyAs": "infra.Balise",
"info": "Identity of the object; used for referencing"},
        { "intId": 2, "name": "fixed", "dataType": "boolean", "info": "false when balise is of transparent
type" },
        { "intId": 3, "name": "m_dup", "enumType": "DuplicationType"},
        { "intId": 4, "name": "m_mcount", "dataType": "uint32", "range": "0..255", "info": "the purpose of
message counter is to make it possible for the ERTMS/ETCS on-board to detect which balise
group message the telegram belongs to."},
        { "intId": 5, "name": "n_pig", "dataType": "uint32", "range": "0..7", "info": "position in the group."
      ]
    }
  ]
}
```

Defines the position of the balise in the balise group."},

```
{ "intId": 6, "name": "verticallyOriented", "dataType": "boolean", "info": "false when oriented parallel to the sleepers" },
```

```
{ "intId": 7, "name": "standardSize", "dataType": "boolean", "info": "false when balise is of reduced size" },
```

```
{ "intId": 8, "name": "etcsPackets", "composition": "ss026.BalisePacket", "multiplicity": "0..*", "info": "Referring to the ss026 of this Data Model"},
```

```
{ "intId": 9, "name": "telegram", "dataType": "bytes", "info": "The telegram content of the Balise"},
```

```
{ "intId": 10, "name": "telegramChecksum", "dataType": "string", "info": "A checksum to verify the integrity of the stored telegram"},
```

```
{ "intId": 11, "name": "sleeperFastening", "dataType": "string", "info": "Indicates the fastening system used for the balise on the sleeper"},
```

```
{ "intId": 12, "name": "baliseMountingSystem", "dataType": "string", "info": "Indicates the mounting system used for the balise"},
```

```
{ "intId": 13, "name": "designType", "dataType": "string", "info": "Manufacturer type of that balise"},
```

```
{ "intId": 14, "name": "kmReferenceMarker", "reference": "KmSign", "info": "reference to the relevant reference marker"}
```

```
]
```

```
}
```

```
],
```

```
"enums": [
```

```
{
```

```
  "name": "DuplicationType",
```

```
  "info": "Flags to indicate whether the information of the balise is a duplicate of the balise before or after.",
```

```
  "enumLiterals": [
```

```
    { "intId": 0, "name": "noDuplicates", "info": " does not duplicate any balise"},
```

```
    { "intId": 1, "name": "duplicateNextBalise", "info": " duplicates next balise"},
```

```
    { "intId": 2, "name": "duplicatePreviousBalise", "info": "duplicates previous balise"}
```

```
  ]
```

```
}
```

```
]
```

```
}
```

3.6 Sleeper

SPT2TS-122293 - Sleepers are components on which the rails arranged with corresponding gauge. Depending on the sleeper type, balise holder is chosen to enable precise positioning and to transmit the safety critical data of the balise. Type of sleeper is also relevant for mounting of balises. In general, the area of the engineering structures can be of bad mounting conditions. Therefore, it is necessary to check the balise planning if it is possible to move the balises out of those areas.

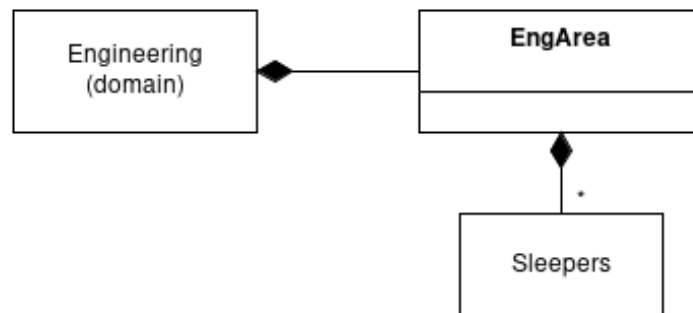


Figure 1 Class Diagram of Sleeper

Content to be approved]

SPT2TS-122278 - Sleepers

```

{
  "structs": [
    {
      "name": "Sleepers",
      "info": "Sleepers are components on which the rails arranged with corresponding gauge.",
      "attrs": [
        {"intId": 1, "name": "id", "dataType": "string", "key": "global", "info": "Identity of the object; used for referencing"},
        {"intId": 2, "name": "trackEdgeSection", "composition": "infra.TrackEdgeSection", "multiplicity": "1..*", "info": "composes of track edge sections"},
        {"intId": 3, "name": "sleepersType", "enumType": "SleepersType", "info": "defines sleeper types"}
      ]
    }
  ],
  "enums": [
    {
      "name": "SleepersType",
      "enumLiterals": [
        {"intId": 0, "name": "unknownSleepersType", "info": " sleeper type unknown"},
        {"intId": 1, "name": "composite", "info": " is of type composite"}
      ]
    }
  ]
}

```

```
{ "intId": 2, "name": "concrete", "info": "is of type concrete"},
{ "intId": 3, "name": "steel", "info": "is of type steel"},
{ "intId": 4, "name": "wood", "info": "is of type wood"}
]
}}
}
```

3.7 Danger Point

SPT2TS-122294 - The concept of a "danger point" is crucial for the implementation of the ETCS L2 w.Signal technology. The danger point refers to a specific location on the railway where a potential conflict or danger may arise between trains or between trains and other objects (such as road crossings or platforms). It is identified and managed in the context of ETCS Level 2 planning for the purposes Safety assurance, Balise placement, Movement authority, Signalling and intervention. Overall, in ETCS Level 2 *wosig* planning, the identification and management of danger points are vital for ensuring safe train operations, determining balise placements, calculating movement authorities, and facilitating appropriate signaling and intervention strategies to prevent potential conflicts and enhance railway safety.

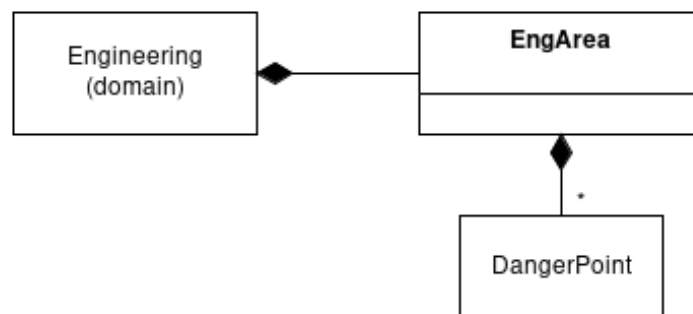


Figure 2 Class Diagram of Danger Point

[🔒 Content to be approved]

SPT2TS-122277 - DangerPoint

```
{
  "structs": [
    {
      "name": "DangerPoint",
      "info": "a specific location on the railway where a potential conflict or danger may arise
between trains or between trains and other object",
      "attrs": [
        {"intId": 1, "name": "id", "dataType": "string", "key": "global", "info": "Identity of the object;
used for referencing"},
        {"intId": 2, "name": "name", "dataType": "string", "info": "User-friendly name, only if different
from id"},
        {"intId": 3, "name": "spotLocation", "composition": "infra.TrackEdgePoint"}
      ]
    }
  ]
}
```



```
]
}
]
}
```

3.8 Fouling Point

SPT2TS-124158 - While danger point is a broad concept related to potential hazard throughout the network, fouling point (see Figure...) specifically deals with preventing trains from occupying the same track space as other objects, that is, fouling point refers to the point on a railway track beyond which a train is not allowed to proceed if another train or object is occupying that portion of the track.

Trains are not permitted to “foul” or occupy the beyond the fouling point to prevent collision, hence Clearance point (Fig ..) are defined for every fouling point.

A clearance point is a location on the diverging track that is positioned at a safe distance from the fouling point. This ensures that if a train is detected beyond the clearance point, it will consistently maintain a safe separation from another train moving on the adjacent track.

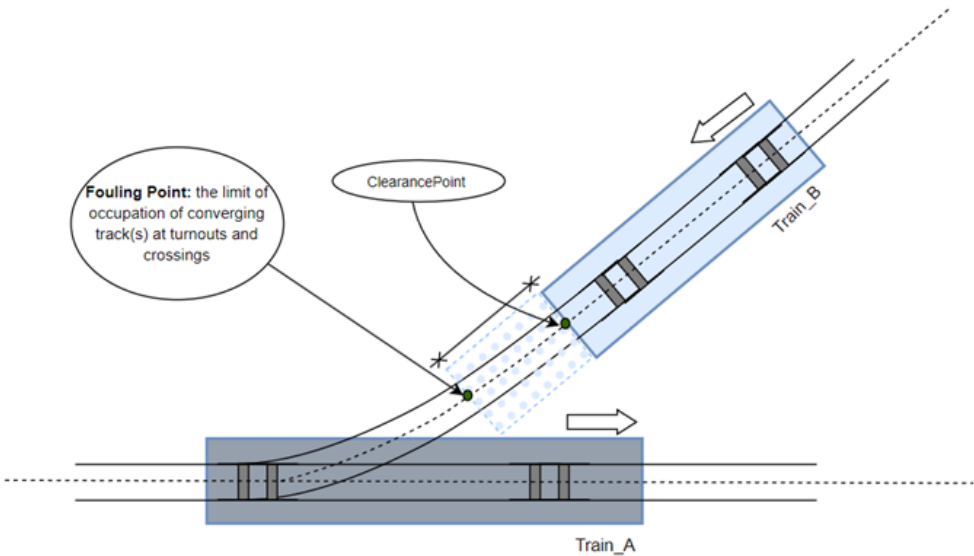


Figure 3 Fouling Point and Clearance Point

[🔒 Content to be approved]

SPT2TS-124160 - FoulingPoint

```
{
  "structs": [
    {
      "name": "FoulingPoint",
      "info": "the point on a railway track beyond which a train is not allowed to proceed if another
```

```

train or object is occupying that    portion of the track",
  "attrs": [
    {"intId": 1, "name": "id", "dataType": "string", "key": "global", "info": "Identity of the object;
used for referencing"},
    {"intId": 2, "name": "name", "dataType": "string", "info": "User-friendly name, only if different
from id", "multiplicity": "0..1" },
    {"intId": 3, "name": "spotLocation", "composition": "infra.TrackEdgePoint"},
    {"intId": 4, "name": "clearancePoint", "dataType": "uint32", "info": "location along the
TrackEdge from spotLocation, measured from start"}
  ]
}

```

3.9 Container for Engineering Area

SPT2TS-122286 - EngineeringArea

```

{
  "structs": [
    {
      "name": "EngArea",
      "attrs": [
        {"intId": 1, "name": "id", "dataType": "string", "key": "global", "sameKeyAs":
"infra.FunctionalArea", "info": "Identity of the object; used for referencing"},
        {"intId": 2, "name": "defaultSleepersType", "enumType": "SleepersType"},
        {"intId": 3, "name": "simplePoints", "composition": "SimplePoint", "multiplicity": "0..*" },
        {"intId": 4, "name": "crossings", "composition": "Crossing", "multiplicity": "0..*" },
        {"intId": 5, "name": "levelCrossings", "composition": "LevelCrossing", "multiplicity": "0..*" },
        {"intId": 6, "name": "baliseGroup", "composition": "BaliseGroup", "multiplicity": "0..*" },
        {"intId": 7, "name": "balises", "composition": "Balise", "multiplicity": "0..*" },
        {"intId": 8, "name": "sleepers", "composition": "Sleepers", "multiplicity": "0..*" },
        {"intId": 9, "name": "dangerPoints", "composition": "DangerPoint", "multiplicity": "0..*" },
        {"intId": 10, "name": "foulingPoints", "composition": "FoulingPoint", "multiplicity": "0..*" },
        {"intId": 11, "name": "bufferStops", "composition": "BufferStop", "multiplicity": "0..*" }
      ]
    }
  ]
}

```

3.10 Location accuracy area

SPT2TS-125478 - LocationAccuracyArea

```
{
  "structs": [
    {
      "name": "LocationAccuracyArea",
      "attrs": [
        {"intId": 1, "name": "id", "dataType": "string", "key": "global", "sameKeyAs":
"infra.FunctionalArea", "info": "Identity of the object; used for referencing"},
        {"intId": 2, "name": "baliseAccuracies", "composition": "BaliseAccuracy", "multiplicity": "**",
"sortedByKey": true},
        {"intId": 3, "name": "etcsMarkerAccuracies", "composition": "EtcsMarkerAccuracy", "multiplicity":
"**, "sortedByKey": true},
        {"intId": 4, "name": "stopLocationAccuracies", "composition": "StopLocationAccuracy",
"multiplicity": "**", "sortedByKey": true},
        {"intId": 5, "name": "nationalBorderAccuracies", "composition": "NationalBorderAccuracy",
"multiplicity": "**", "sortedByKey": true},
        {"intId": 6, "name": "bufferStopAccuracies", "composition": "BufferStopAccuracy", "multiplicity":
"**, "sortedByKey": true}
      ]
    }
  ]
}
```

SPT2TS-125479 - BaliseAccuracy

```
{
  "structs": [
    {
      "name": "BaliseAccuracy",
      "attrs": [
        {"intId": 1, "name": "baliseId", "dataType": "string", "sameKeyAs": "infra.Balise", "info": "Identit
y of the object; used for referencing"},
        {"intId": 2, "name": "accuracy", "dataType": "uint32", "unit": "m", "exp": -3, "info": "defines
absolute deviation as 1sigma for balise"}
      ]
    }
  ]
}
```

SPT2TS-125480 - EtcMarkerAccuracy

```
{
  "structs": [
    {
      "name": "EtcMarkerAccuracy",
      "attrs": [
        {"intId": 1, "name": "markerId", "dataType": "string", "sameKeyAs": "infra.ETCSMarker", "info": "Identity of the object; used for referencing"},
        {"intId": 2, "name": "accuracy", "dataType": "uint32", "unit": "m", "exp": -3, "info": "defines absolute deviation as 1sigma for etcMarker"}
      ]
    }
  ]
}
```

SPT2TS-125481 - StopLocationAccuracy

```
{
  "structs": [
    {
      "name": "StopLocationAccuracy",
      "attrs": [
        {"intId": 1, "name": "stopLocationId", "dataType": "string", "sameKeyAs": "infra.StopLocation", "info": "Identity of the object; used for referencing"},
        {"intId": 2, "name": "accuracy", "dataType": "uint32", "unit": "m", "exp": -3, "info": "defines absolute deviation as 1sigma for stop location"}
      ]
    }
  ]
}
```

SPT2TS-125482 - NationalBorderAccuracy


```
{
  "structs": [
    {
      "name": "NationalBorderAccuracy",
      "attrs": [
        {"intId": 1, "name": "nationalBorderId", "dataType": "string", "sameKeyAs": "infra.NationalBorder", "info": "Identity of the object; used for referencing"},
        {"intId": 2, "name": "accuracy", "dataType": "uint32", "unit": "m", "exp": -3, "info": "defines
```

absolute deviation as 1sigma for stop location"}
]
 }
 }

SPT2TS-125483 - BufferStopAccuracy

```
{
  "structs": [
    {
      "name": "BufferStopAccuracy",
      "attrs": [
        {"intId": 1, "name": "bufferStopId", "dataType": "string", "sameKeyAs": "infra.BufferStop", "info": "Identity of the object; used for referencing"},
        {"intId": 2, "name": "accuracy", "dataType": "uint32", "unit": "m", "exp": -3, "info": "defines absolute deviation as 1sigma for stop location"}
      ]
    }
  ]
}
```

3.11 Kilometer Signs

SPT2TS-127376 - Kilometer Signs represent the actual signs boards along the track. The data model provides the track edge location as well as the track kilometer written on the sign e.g., 14.00. These are also called as Hectometer signs. This object is not suitable for track planning activities, rather is only used as visual aid or UI purposes for the system users.  Content to be approved]

SPT2TS-125614 - TrackEdgeKmSigns

```
{
  "structs": [
    {
      "name": "TrackEdgeKmSigns",
      "attrs": [
        {"intId": 1, "name": "id", "dataType": "string", "key": "global", "sameKeyAs": "infra.TrackEdge", "info": "Identity of the object; used for referencing"},
        {"intId": 2, "name": "kmSigns", "composition": "KmSign", "multiplicity": "**", "info": "sorted by pos from 0 to length"}
      ]
    }
  ]
}
```

```
}}}
```

SPT2TS-125615 - KmSign

```
{
  "structs": [
    {
      "name": "KmSign",
      "info": "An object that represent a physical sign that would be used to convey Kilometer
information at specific location on      a TrackEdge",
      "attrs": [
        {"intId": 1, "name": "pos", "dataType": "uint32", "unit": "m", "exp": -3, "info": "position on the
associated trackEdge"},
        {"intId": 2, "name": "label", "dataType": "string", "info": "example 44.50"}
      ]
    }
  ]
}
```

SPT2TS-125616 - KmArea

```
{
  "structs": [
    {
      "name": "KmArea",
      "attrs": [
        {"intId": 1, "name": "id", "dataType": "string", "sameKeyAs": "TopoArea", "info": "Identity of the
object; used for referencing"},
        {"intId": 2, "name": "trackEdgeKmSigns", "composition": "TrackEdgeKmSigns", "multiplicity":
"**, "sortedByKey": true, "info": "composes of track edge km signs"}
      ]
    }
  ]
}
```

3.12 Container for ETCS Engineering

SPT2TS-122311 - ETCSEngineering

```
{
  "structs": [
    {
      "name": "ETCSEngineering",
      "attrs": [
        {"intId": 1, "name": "engAreas", "composition": "EngArea", "multiplicity": "*", "sortedByKey":
true},
        {"intId": 2, "name": "locationAccuracyAreas", "composition": "LocationAccuracyArea",
"multiplicity": "*", "sortedByKey": true},
        {"intId": 3, "name": "kmAreas", "composition": "KmArea", "multiplicity": "*", "sortedByKey":
true}
      ]
    }
  ]
}
```