**Control Route Suitability**

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**Reviewers:**

Reviewers of this document

**Date and version:**

24/10/2013 - v1 - creation

30/10/2013 - v2 - updated with requirements and variables

04/11/2013 - v3 - fixed author names

06/11/2013 - v4 - refactored modelisation to make functional view more centered on Control Route Suitability and kernel functions. Removed useless or internal variables. Added packets requirements and subset 23 definitions. Fixed previously stated issues.

**Input documents:**

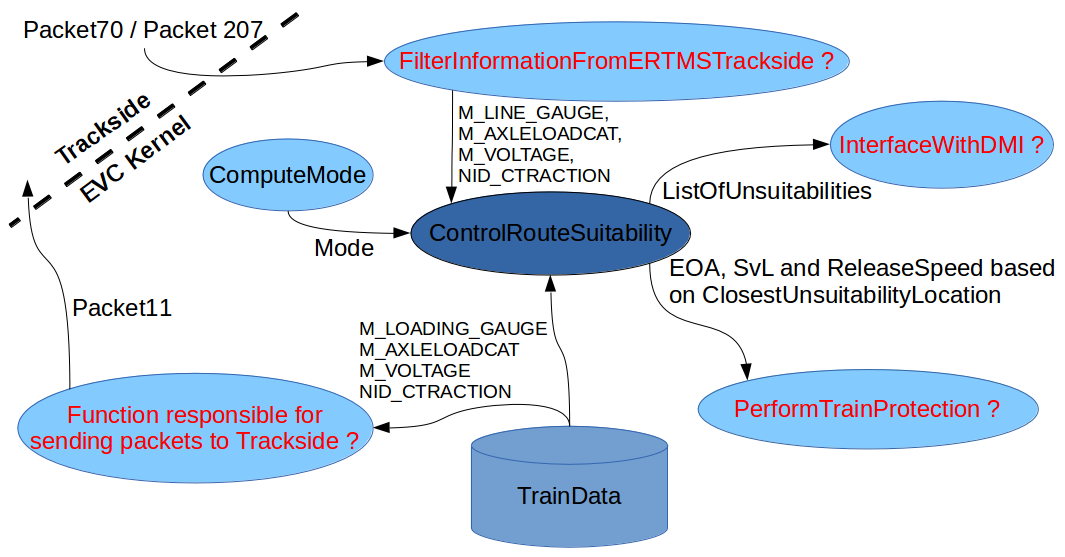
Subset 26 §3.12.2, §4.5.2, §7.4.2.21, §7.4.3.5

Subset 23

**Description**

This function manages route suitabilities where incompatibilities occur for this train which can be one of these :

* the loading gauge profile of the train is not accepted by trackside,
* the trackside traction system is not accepted by the engine,
* the train axle load category is higher than the maximum permitted by trackside.



#### Route suitability data defines which values concerning loading gauge, traction system and axle load category a train must meet to be allowed to enter the route (Subset-26-3.12.2.1).

Operational view ? Notably about Req. 3.12.2.8 of subset-26. On one hand, it requires that the train is tripped if it overpasses the location of the first unsuitability, which seems obvious as it means that either the train overpassed the end of authority, either the train has got no authority at all. On the other hand, it is ambiguous (« for any reasons »), and it must be taken in account the case when this point is overpassed by the minimum safe front end in L2/L3 or the minimum safe antenna in L1. That's why the function must send the RouteUnsuitabilityLocation to ATP function to update EOA/SvL. Possible case : the driver changes train data after a failure and before it enters a L1 zone.

Packet 70 :

|  |  |  |  |
| --- | --- | --- | --- |
| ***Description*** | The packet gives the characteristics needed to enter a route. | | |
| ***Transmitted by*** | Any | | |
| ***Content*** | **Variable** | Length | **Comment** |
|  | NID\_PACKET | 8 |  |
|  | Q\_DIR | 2 |  |
|  | L\_PACKET | 13 |  |
|  | Q\_SCALE | 2 |  |
|  | Q\_TRACKINIT | 1 |  |
|  | D\_TRACKINIT | 15 | Only if Q\_TRACKINIT = 1 |
|  | D\_SUITABILITY | 15 | Only If Q\_TRACKINIT = 0, D\_SUITABILITY and the following variables follows |
|  | Q\_SUITABILITY | 2 |  |
|  | M\_LINEGAUGE | 8 | If Q\_SUITABILITY= loading gauge |
|  | M\_AXLELOADCAT | 7 | If Q\_SUITABILITY= Max axle load. |
|  | M\_VOLTAGE | 4 | If Q\_SUITABILITY = traction system |
|  | NID\_CTRACTION | 10 | If Q\_SUITABILITY = traction system and M\_VOLTAGE ≠0 |
|  | N\_ITER | 5 |  |
|  | D\_SUITABILITY(k) | 15 |  |
|  | Q\_SUITABILITY(k) | 2 |  |
|  | M\_LINEGAUGE(k) | 8 | If Q\_SUITABILITY(k) = loading gauge |
|  | M\_AXLELOADCAT(k) | 7 | If Q\_SUITABILITY(k) = Max axle load. |
|  | M\_VOLTAGE(k) | 4 | If Q\_SUITABILITY(k) = traction system |
|  | NID\_CTRACTION(k) | 10 | If Q\_SUITABILITY(k) = traction system and M\_VOLTAGE(k) ≠0 |

Packet 207

|  |  |  |  |
| --- | --- | --- | --- |
| ***Description*** | The packet gives the characteristics needed to enter a route. | | |
| ***Transmitted by*** | Any | | |
| ***Content*** | **Variable** | **Length** | **Comment** |
|  | NID\_PACKET | 8 |  |
|  | Q\_DIR | 2 |  |
|  | L\_PACKET | 13 |  |
|  | Q\_SCALE | 2 |  |
|  | Q\_TRACKINIT | 1 |  |
|  | D\_TRACKINIT | 15 | Only if Q\_TRACKINIT = 1 |
|  | D\_SUITABILITY | 15 | Only If Q\_TRACKINIT = 0, D\_SUITABILITY and the following variables follows |
|  | Q\_SUITABILITY | 2 |  |
|  | M\_LINEGAUGE | 8 | If Q\_SUITABILITY = loading gauge |
|  | M\_AXLELOADCAT | 7 | If Q\_SUITABILITY = Max axle load. |
|  | M\_VOLTAGE | 4 | If Q\_SUITABILITY = traction system |
|  | NID\_CTRACTION | 10 | If Q\_SUITABILITY = traction system and M\_VOLTAGE ≠ 0 |
|  | N\_ITER | 5 |  |
|  | D\_SUITABILITY(k) | 15 |  |
|  | Q\_SUITABILITY(k) | 2 |  |
|  | M\_LINEGAUGE(k) | 8 | If Q\_SUITABILITY = loading gauge |
|  | M\_AXLELOADCAT(k) | 7 | If Q\_SUITABILITY = Max axle load. |
|  | M\_VOLTAGE(k) | 4 | If Q\_SUITABILITY = traction system |
|  | NID\_CTRACTION(k) | 10 | If Q\_SUITABILITY = traction system and M\_VOLTAGE ≠ 0 |

Packet 11

|  |  |  |  |
| --- | --- | --- | --- |
| ***Description*** | Validated train data. | | |
| ***Transmitted to*** | RBC | | |
| ***Content*** | **Variable** | Length | **Comment** |
|  | NID\_PACKET | 8 |  |
|  | L\_PACKET | 13 |  |
|  | NC\_CDTRAIN | 4 |  |
|  | NC\_TRAIN | 15 |  |
|  | L\_TRAIN | 12 |  |
|  | V\_MAXTRAIN | 7 |  |
|  | M\_LOADINGGAUGE | 8 |  |
|  | M\_AXLELOADCAT | 7 |  |
|  | M\_AIRTIGHT | 2 |  |
|  | N\_AXLE | 10 |  |
|  | N\_ITER | 5 |  |
|  | M\_VOLTAGE(k) | 4 | Identity of the traction system |
|  | NID\_CTRACTION(k) | 10 | NID\_CTRACTION(k) given only if M\_VOLTAGE(k) ≠ 0 |
|  | N\_ITER | 5 |  |
|  | NID\_NTC(k) | 8 | Type of National System available |

**Functions**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | **ControlRouteSuitability** |
| Definition | 1 | T\_Definition | compares RouteSuitabilityData (Packet70) from trackside with TrainData to determine the list of unsuitabilities  replaces movement authority data with the closest unsuitability location if there is some |
| *Input* | *0..n* | *T\_Variable* | *RouteSuitabilityData (Packet70), TrainData* |
| *Output* | *0..n* | *T\_Variable* | *ListOfUnsuitabilities* |
| *Local* | *0..n* | *T\_Variable* |  |
| *Parameter* | *0..n* | *T\_Constant* |  |
| *Requirement* | *0..n* | *T\_Requirement* | SA-1, SA-2, SA-3, SA-4, SA-5 |
| *Block* | *1 (optional)* | *T\_FunctionalBlock* |  |
| *Parent* | *0..1* | *T\_Function* |  |
| *Allocation* | *1* | *T\_System* | Kernel |
| Safety | 1 | Boolean |  |

**Variables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | RouteSuitabilityData |
| Definition | 1 | T\_Definition | Data transmitted to the ERTMS/ETCS on-board equipment to allow it to check its ability to run on the track as indicated by the movement authority. It includes data related to loading gauge, traction system and axle load category. |
| Source | 1 | T\_SourceDocument | Subset-23, Subset-26-3 |
| Nature | 1 | T\_VariableNature | Packet70 |
| MinimalValue | 0..1 | T\_Text |  |
| MaximalValue | 0..1 | T\_Text |  |
| SpecialValue | 0..n | T\_Text |  |
| Allocation | 1 | * Interface * Packet * Internal |  |
| *Requirement* | *1..n* | *T\_Requirement* | *SRS-3.12.2.1,* |
| Store | 0..1 | T\_Variable |  |
| Resolution | 0..1 | T\_VariableNature |  |
| Safety | 1 | Boolean |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | TrainData |
| Definition | 1 | T\_Definition | Defined set of data which gives information about the train. Data that characterises a train and which is required by ERTMS/ETCS in order to supervise a train movement. |
| Source | 1 | T\_SourceDocument | Subset-23, Subset-26-3 |
| Nature | 1 | T\_VariableNature |  |
| MinimalValue | 0..1 | T\_Text |  |
| MaximalValue | 0..1 | T\_Text |  |
| SpecialValue | 0..n | T\_Text |  |
| Allocation | 1 | * Interface * Packet * Internal |  |
| *Requirement* | *1..n* | *T\_Requirement* | *SA-1, SA-2, SA-3, SA-4* |
| Store | 0..1 | T\_Variable |  |
| Resolution | 0..1 | T\_VariableNature |  |
| Safety | 1 | Boolean |  |

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| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | ListOfUnsuitabilities |
| Definition | 1 | T\_Definition | List of route suitabilities where incompatibilities occur for this train. |
| Source | 1 | T\_SourceDocument | Subset-26-3 |
| Nature | 1 | T\_VariableNature |  |
| MinimalValue | 0..1 | T\_Text |  |
| MaximalValue | 0..1 | T\_Text |  |
| SpecialValue | 0..n | T\_Text |  |
| Allocation | 1 | * Interface * Packet * Internal |  |
| *Requirement* | *1..n* | *T\_Requirement* | *SA-1, SA-2, SA-3, SA-4* |
| Store | 0..1 | T\_Variable |  |
| Resolution | 0..1 | T\_VariableNature |  |
| Safety | 1 | Boolean |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | ClosestUnsuitabilityLocation |
| Definition | 1 | T\_Definition | The closest location (from the train location) corresponding to the unsuitabilities of ListOfUnsuitabilities |
| Source | 1 | T\_SourceDocument | Subset-26-3 |
| Nature | 1 | T\_VariableNature |  |
| MinimalValue | 0..1 | T\_Text |  |
| MaximalValue | 0..1 | T\_Text |  |
| SpecialValue | 0..n | T\_Text |  |
| Allocation | 1 | * Interface * Packet * Internal |  |
| *Requirement* | *1..n* | *T\_Requirement* | *SA-1, SA-2, SA-3, SA-4* |
| Store | 0..1 | T\_Variable |  |
| Resolution | 0..1 | T\_VariableNature |  |
| Safety | 1 | Boolean |  |

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| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | EndOfAuthority |
| Definition | 1 | T\_Definition | Location to which the train is permitted to proceed and where target speed = zero. |
| Source | 1 | T\_SourceDocument | Subset-23, Subset-26-3 |
| Nature | 1 | T\_VariableNature |  |
| MinimalValue | 0..1 | T\_Text |  |
| MaximalValue | 0..1 | T\_Text |  |
| SpecialValue | 0..n | T\_Text |  |
| Allocation | 1 | * Interface * Packet * Internal |  |
| *Requirement* | *1..n* | *T\_Requirement* | *SA-5, SA-8* |
| Store | 0..1 | T\_Variable |  |
| Resolution | 0..1 | T\_VariableNature |  |
| Safety | 1 | Boolean |  |

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| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SupervisedLocation |
| Definition | 1 | T\_Definition | Supervised location |
| Source | 1 | T\_SourceDocument | Subset-26-3 |
| Nature | 1 | T\_VariableNature |  |
| MinimalValue | 0..1 | T\_Text |  |
| MaximalValue | 0..1 | T\_Text |  |
| SpecialValue | 0..n | T\_Text |  |
| Allocation | 1 | * Interface * Packet * Internal |  |
| *Requirement* | *1..n* | *T\_Requirement* | *SA-5, SA-8* |
| Store | 0..1 | T\_Variable |  |
| Resolution | 0..1 | T\_VariableNature |  |
| Safety | 1 | Boolean |  |

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| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | ReleaseSpeed |
| Definition | 1 | T\_Definition | A speed value to allow a train to approach the end of its movement authority. Needed for intermittent transmission to enable the train to approach a signal that has cleared in order to reach the information point at the signal. |
| Source | 1 | T\_SourceDocument | Subset-23, Subset-26-3 |
| Nature | 1 | T\_VariableNature |  |
| MinimalValue | 0..1 | T\_Text |  |
| MaximalValue | 0..1 | T\_Text |  |
| SpecialValue | 0..n | T\_Text |  |
| Allocation | 1 | * Interface * Packet * Internal |  |
| *Requirement* | *1..n* | *T\_Requirement* | *SA-5* |
| Store | 0..1 | T\_Variable |  |
| Resolution | 0..1 | T\_VariableNature |  |
| Safety | 1 | Boolean |  |

**Requirements**

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| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SA-1 |
| Definition | 1 | T\_Definition | The Kernel shall compare RouteSuitabilityData with TrainData, and build the list of unsuitabilities (if any). |
| Nature | 1 | * Structural * Functional * Definition |  |
| Source | 1 | T\_SourceDocument | subset-26 |
| Discussion | 1 (Optional) | T\_Text |  |
| Parent | 0..1 | T\_Requirement | SRS-3.12.2.3 |
| Allocation | 0..1 | T\_System | Kernel |
| Safety | 1 | Boolean |  |

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| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SA-2 |
| Definition | 1 | T\_Definition | a) The Kernel shall add an unsuitability to the list of unsuitabilities if TrainData.M\_LOADINGGAUGE is not in the list indicated by RouteSuitabilityData.M\_LINEGAUGE. |
| Nature | 1 | * Structural * Functional * Definition |  |
| Source | 1 | T\_SourceDocument | subset-26 |
| Discussion | 1 (Optional) | T\_Text |  |
| Parent | 0..1 | T\_Requirement | SRS-3.12.2.3, SRS-7.4.2.21 |
| Allocation | 0..1 | T\_System | Kernel |
| Safety | 1 | Boolean |  |

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| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SA-3 |
| Definition | 1 | T\_Definition | b) The Kernel shall add an unsuitability to the list of unsuitabilities if the traction system indicated by RouteSuitabilityData.M\_VOLTAGE and RouteSuitabilityData.NID\_CTRACTION is not in TrainData.ListOfAcceptedTractionSystems |
| Nature | 1 | * Structural * Functional * Definition |  |
| Source | 1 | T\_SourceDocument | subset-26 |
| Discussion | 1 (Optional) | T\_Text |  |
| Parent | 0..1 | T\_Requirement | SRS-3.12.2.3, SRS-7.4.2.21 |
| Allocation | 0..1 | T\_System | Kernel |
| Safety | 1 | Boolean |  |

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| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SA-4 |
| Definition | 1 | T\_Definition | c) The Kernel shall add an unsuitability to the list of unsuitabilities if TrainData.AxleLoadCategory > RouteSuitabilityData.M\_AXLELOADCAT |
| Nature | 1 | * Structural * Functional * Definition |  |
| Source | 1 | T\_SourceDocument | subset-26 |
| Discussion | 1 (Optional) | T\_Text |  |
| Parent | 0..1 | T\_Requirement | SRS-3.12.2.3, SRS-7.4.2.21 |
| Allocation | 0..1 | T\_System | Kernel |
| Safety | 1 | Boolean |  |

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| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SA-5 |
| Definition | 1 | T\_Definition | If ListOfUnsuitabilities contains at least one unsuitability, the Kernel shall set ClosestUnsuitabilityLocation with the closest location corresponding to the unsuitabilities of the list, and replace both EndOfAuthority and SupervisedLocation with ClosestUnsuitabilityLocation, and set ReleaseSpeed to a NO\_RELEASE\_SPEED value. |
| Nature | 1 | * Structural * Functional * Definition |  |
| Source | 1 | T\_SourceDocument | subset-26 |
| Discussion | 1 (Optional) | T\_Text |  |
| Parent | 0..1 | T\_Requirement | SRS-3.12.2.4 |
| Allocation | 0..1 | T\_System | Kernel |
| Safety | 1 | Boolean |  |

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| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SRS-4.5.2 |
| Definition | 1 | T\_Definition | Function RouteSuitability shall be active in FS, LS and OS modes. |
| Nature | 1 | * Structural * Functional * Definition |  |
| Source | 1 | T\_SourceDocument | subset-26 |
| Discussion | 1 (Optional) | T\_Text |  |
| Parent | 0..1 | T\_Requirement |  |
| Allocation | 0..1 | T\_System | Kernel |
| Safety | 1 | Boolean |  |

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| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SRS-3.12.2.10 |
| Definition | 1 | T\_Definition | The train is permitted to run without any route suitability data given from the track. No default values shall be used or supervised by the on-board equipment, i.e. the initial state is that no restrictions related to route suitability exists. |
| Nature | 1 | * Structural * Functional * Definition |  |
| Source | 1 | T\_SourceDocument | subset-26 |
| Discussion | 1 (Optional) | T\_Text |  |
| Parent | 0..1 | T\_Requirement |  |
| Allocation | 0..1 | T\_System | Kernel |
| Safety | 1 | Boolean |  |

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| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SRS-4.10.1.3 |
| Definition | 1 | T\_Definition | When entering mode FS, LS, OS or PT, stored route suitability data shall remain unchanged.When entering any other mode (except non-relevant modes SF and IS), it shall be deleted. |
| Nature | 1 | * Structural * Functional * Definition |  |
| Source | 1 | T\_SourceDocument | subset-26 |
| Discussion | 1 (Optional) | T\_Text |  |
| Parent | 0..1 | T\_Requirement |  |
| Allocation | 0..1 | T\_System | Kernel |
| Safety | 1 | Boolean |  |

**Exported Requirements :**

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| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SRS-3.12.2.2 |
| Definition | 1 | T\_Definition | The trackside shall send the route suitability data as location data when needed. |
| Source | 1 | T\_SourceDocument | subset-26 |
| Allocation | 0..1 | T\_System | Trackside |
| Safety | 1 | Boolean |  |

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| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SA-6 |
| Definition | 1 | T\_Definition | The DMI shall inform the driver about all unsuitabilities from ListOfUnsuitabilities. |
| Source | 1 | T\_SourceDocument | subset-26 |
| Allocation | 0..1 | T\_System | DMI |
| Safety | 1 | Boolean |  |

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| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SA-7 |
| Definition | 1 | T\_Definition | The Kernel shall send route suitability parts of TrainData through Packet11 to the RBC. |
| Source | 1 | T\_SourceDocument | subset-26 |
| Allocation | 0..1 | T\_System | Kernel but other function |
| Safety | 1 | Boolean |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Occurrence** | **Type** | **Description** |
| Name | 1 | T\_Text | SRS-3.12.2.9.1 |
| Definition | 1 | T\_Definition | Note: This allows for route suitability supervision to be used in systems external to the ERTMS/ETCS system. |
| Source | 1 | T\_SourceDocument | subset-26 |
| Allocation | 0..1 | T\_System | Trackside |
| Safety | 1 | Boolean |  |