

## French C-ITS Deployment Coordination committee

# Common technical specifications for use cases - C2 - dynamic speed limit (I2V)

---

### Deliverable 2.4.1.2\_H\_C2

## Activity 2: Studies

### Sub Activity 2.4 > Specifications

Version 4.00

Publication Date: 14/11/2019



Co-financed by the Connecting Europe  
Facility of the European Union

*The contents of this publication are the sole responsibility of the the SCOOP@F project consortium, C-ROADS France project consortium and InterCor project consortium (French beneficiaries only) and do not necessarily reflect the opinion of the European Union.*

## Information on the document

Document: Common technical specifications for use cases SCooP, InterCor, C-Roads - C2 DynSpeedLimit

Date of publication: 14/11/2019

Responsible, Entity: Aymeric AUDIGE, Ministry of Ecology and Inclusive Transition (MTES)– Dir Atlantique

Status: Version 4.00 – Release 4

## Publication history

| Date     | Version | Author(s) | Updates & changes  | Diffusion |
|----------|---------|-----------|--|-----------|
| 14/11/19 | 4.00    | A. AUDIGÉ | <ul style="list-style-type: none"> <li>Consolidated version for release 4</li> </ul> | Release 4 |

Black highlighted texts are issues with standards.

Yellow highlighted texts are topics that need to be finalized.

The following legend is used on master document tables (next sub-chapters) and on profiles in each UC documents :

Standard / Field : if status is mandatory in standard : **bold**, If optional : *italic*.

Profile / Status :

- If mandatory : **I**
- If optional in standard :
  - Used (**U**) when always used
  - Not used (**I**) when never used.
  - Sometimes (**S**) when it depends.

Profile / Content : important settings or information are in ***bold italic pink underline***.

# Quality rules

## Reference to the version administration

Version number to be composed of 3 digits > vR.XY

- **R** corresponds to the release number : it is upgraded each time SC Studies validates the diffusion of a new release,

- **X** is the major version number: it is upgraded each time SC Studies validates the deliverable,

- **Y** is the minor version number: it is upgraded each time a contributor changes anything.

Once the deliverable is approved, its version number is upgraded from vR.XY to vR.(X+1)0

Once the deliverable is release, its version number is upgraded from vR.XY to v(R+1).00

As illustration :

0.03 > Work in progress version

0.10 > Del. Approved by SC Studies but not released

2.00 > Del. approved & released (in release 2)

2.05 > Del. Updated - in progress version

## Requirements identification & traceability

In this document, the following verbal forms are used to indicate requirements: **Shall / Shall not**

Recommendations shall be indicated by the verbal forms: **Should / Should not**

Permissions shall be indicated by the verbal forms: **May / May not**

Possibility and capability shall be indicated by the verbal forms: **Can / Cannot**

Inevitability used to describe behavior of systems beyond of the scope of this del. shall be indicated by: **Will / Will not**

Facts shall be indicated by the verbal forms: **Is / Is not**

In the table here below:

2.4.X.XX > is the number given to the deliverable (e.g. 2.4.4.8)

YYYY > for digit are given to identifying which component/entity the requirement is addressing (e.g. LTCA for long terme certificate authority)

ZZZ > is the numeration of the requirement

# Acronyms & abbreviations

|           |  |
|-----------|--|
| CAM       | Cooperative Awareness Message  |
| C-ITS     | Cooperative Intelligent Transport Systems  |
| C-ITS-S   | Central ITS Station (national ITS station)   |
| DENM      | Decentralized Environmental Notification Message (réf. ETSI standard for C-ITS messages)   |
| GPS       | Global Positioning System  |
| ITS-G5    | ITS-G5 is a European standard for ad-hoc short-range communication of vehicles among each other (V2V) and with Road ITS Stations (V2I). ITS-G5 refers to the approved amendment of the IEEE 802.11 (standard IEEE 802.11p). This technology (possibly others) uses the 5.9 GHz frequency band to support safety- and non-safety ITS applications.<br>In this document ITS-G5 stands for IEEE802.11p/ETSI ITS-G5. |
| IVI       | Infrastructure to Vehicle Information (réf. ETSI standard for C-ITS messages)  |
| MAPData   | Geometric information for the intersection (réf. ETSI standard for C-ITS messages)   |
| R-ITS-S   | Roadside ITS Station (RSU or ITS-S R in the French Terminology)  |
| SPAT      | Signal Phase and Timing (réf. ETSI standard for C-ITS messages)  |
| TCC       | Traffic Control Centre (the place where road management measure are decided)   |
| TMS       | Traffic Management System (the usual system in which the road operator sets its road measures and events)  |
| V-ITS-S   | Vehicle ITS Station (any vehicles)   |
| Vro-ITS-S | Road operator vehicle ITS Station  |
| Vu-ITS-S  | User vehicle ITS Station (in that case, road operator vehicle are excluded when they are not in user mode)   |

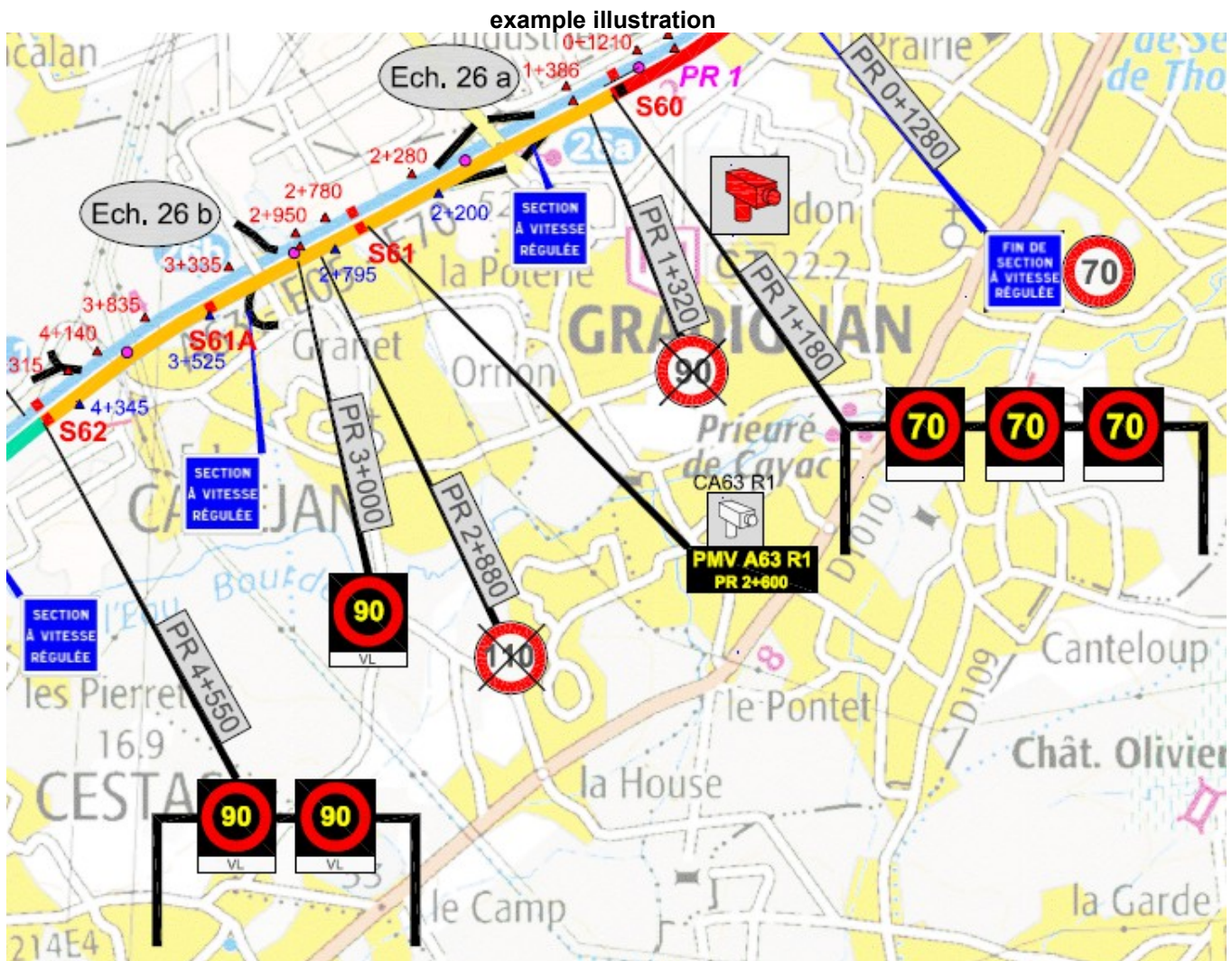
|     |   |
|-----|---|
| N/A | <i>Not Applicable</i>   |
| TBC | <i>To Be Checked, with MS or associated partner</i>   |
| WIP | <i>Work in progress : when mentioned next to the version number, it means the document is an in-between version</i> |

# Table of Contents

|   |                           |
|---|---------------------------|
| 1. Figure and example of IVI message for dynamic speed limit..... | <a href="#"><u>6</u></a>  |
| 2. Step by step diagram.....                                      | <a href="#"><u>9</u></a>  |
| 3. Information profile - Message description (in details).....    | <a href="#"><u>11</u></a> |
| 4. Table for requirement.....                                     | <a href="#"><u>13</u></a> |

# 1. Figure and example of IVI message for dynamic speed limit

In order to clarify the data elements description for the eVMS use case, we start by describing the scenario in the figure below and then the data elements associated in the table.



For dynamic speed limit, road is cut in sections. For each section, there is loops or similar systems to detect traffic flow and speed of vehicles. An algorithm analyses the datas from the field and modulates the speed of each section to delay or avoid congestion. Speed limits can concern all vehicles or some category of vehicles.

Message associated with figure above (sector in orange)

```
#Description of IVI for FR for DynSpeedLimit UC (I2V)
#Linked with a figure 2412H-C2-DynSpeedLimit
#Commented by A. AUDIGE (DIR A)

value1 IVI ::= {
  header {
    protocolVersion currentVersion=1,
    messageID ivi=6,
```

```

stationID 4711
},
ivi {
  mandatory {
    serviceProviderId {
      countryCode 10110 01010, #means 'FR'
      issuerIdentifier 33 #DIRA
    },
    iviIdentificationNumber 123456789,
    timeStamp 352425600000,
    validFrom 352447200000,
    validTo 352447200010,
    iviStatus new=0
  },
  optional {
    glc : { #GLC = geographic location container = description of reference point and zones (2 zones in this example)
      referencePosition {
        latitude 481540527, #latitude of point "0" at the beginning of the orange section
        longitude 164801006, #longitude of point "0" at the beginning of the orange section
        positionConfidenceEllipse {
          semiMajorConfidence unavailable=4095,
          semiMinorConfidence unavailable=4095,
          semiMajorOrientation unavailable=3601
        },
        altitude {
          altitudeValue unavailable=800001, #But can be provided if known by the system
          altitudeConfidence unavailable=15
        }
      },
      parts {
        {
          zoneId 1, #description of a zone. Here, before the orange section, description of the approach.
          zoneHeading {
            headingValue wgs84East(900), #Heading of road at the referencePosition
            headingConfidence unavailable=127
          }
          zone segment : {
            line deltaPositions : {
              {
                deltaLatitude -6637, #exemple
                deltaLongitude 9289 #exemple
              },
              {
                deltaLatitude -5379, #exemple
                deltaLongitude 10567 #exemple
              },
              {
                ... # number of point needs to be defined. Till 32 points possible (min 1
              },
              {
            }
          },
          zoneId 2, #description of a zone. Here, the orange in which the speed limit applies.
          zoneHeading {
            headingValue wgs84East(900), #Heading of road at the referencePosition
            headingConfidence unavailable=127
          }
          zone segment : {
            line deltaPositions : {
              {
                deltaLatitude 7591, #exemple
                deltaLongitude -7420 #exemple
              },
              {
                deltaLatitude 8278, #exemple
                deltaLongitude -5379 #exemple
              },
              {
                ... # number of point needs to be defined. Till 32 points possible (min 1
              },
              {
            }
          }
        }
      },
      glc : { #GIC = general Ivi container = description of the VMS
        { #First container = speed limit for trucks (which is under the speed limit displayed on VMS)
          detectionZoneIds {
            1
          },
          relevanceZoneIds {
            2
          },
          direction sameDirection=0,
          iviType regulatoryMessages=1,
          vehicleCharacteristics {
            train {
              ranges {
                {
                  comparisonOperator
                }
              }
            }
          }
        }
      }
    }
  }
}
greaterThanOrEqualTo=1,
limits vehicleWeightLimits : {

```

```

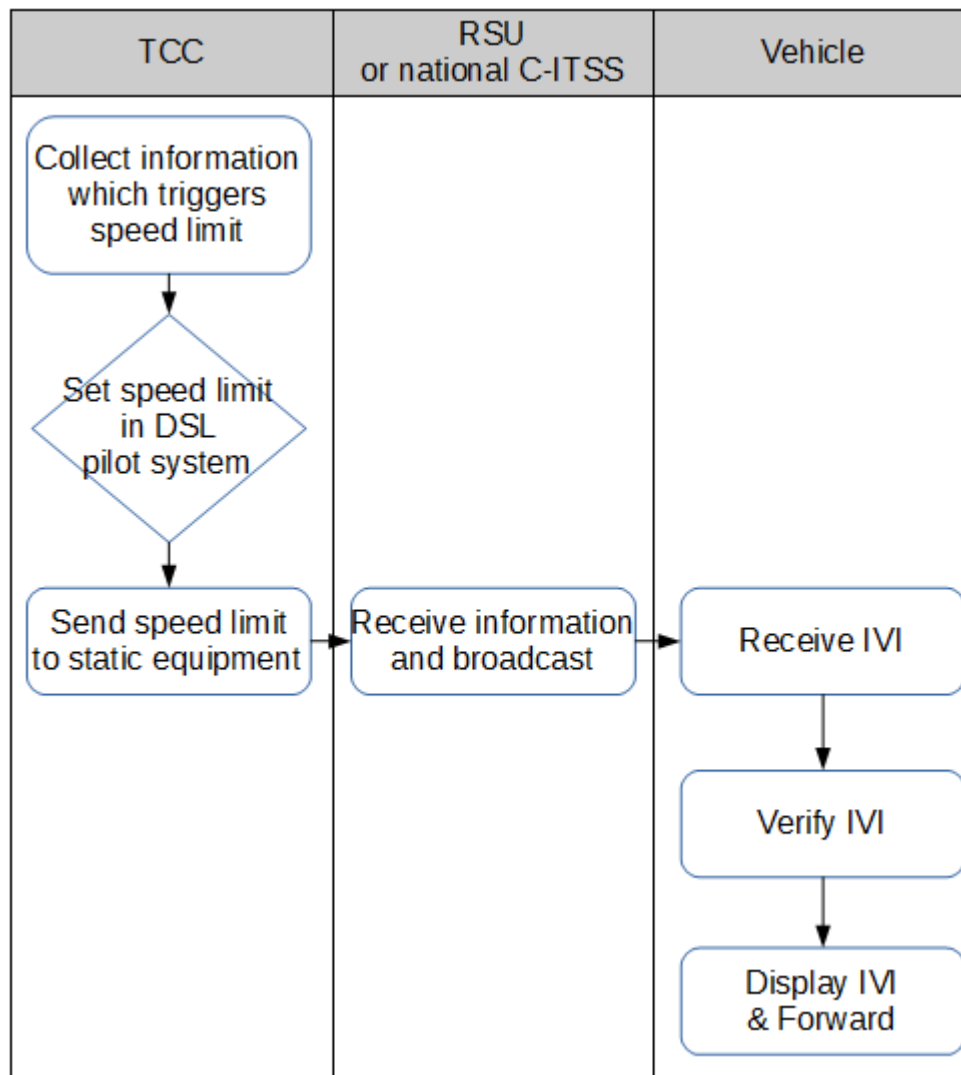
vehicleMaxLadenWeight 0,
3500,
vehicleWeightUnladen 0

TS14823 table
{
  roadSignCodes {
    code iso14823 : {
      pictogramCode {
        serviceCategoryCode trafficSignPictogram : regulatory=12, #See
        pictogramCategoryCode {
          nature 5,#See TS14823:2017 table
          serialNumber 57 #See TS14823:2017 table
        }
      },
      attributes {
        spe : {
          spm 80,
          unit kmperh=0
        }
      }
    }
  },
  { #Second container = default speed limit for other vehicles than trucks (through use of ranges only)
    detectionZonelds {
      1
    },
    relevanceZonelds {
      2
    },
    direction sameDirection=0,
    iviType regulatoryMessages=1,
    vehicleCharacteristics { #Due to following it applies to vehicles not over 3,5t.
      train {
        ranges {
          comparisonOperator lessThan=2,
          limits vehicleWeightLimits : {
            vehicleMaxLadenWeight 0,
            3500,
            vehicleWeightUnladen 0
          }
        }
      }
    }
  }
}

TS14823 table
{
  roadSignCodes {
    code iso14823 : {
      pictogramCode {
        serviceCategoryCode trafficSignPictogram : regulatory=12, #See
        pictogramCategoryCode {
          nature 5,#See TS14823:2017 table
          serialNumber 57 #See TS14823:2017 table
        }
      },
      attributes {
        spe : {
          spm 90,
          unit kmperh=0
        }
      }
    }
  }
}

```

## 2. Step by step diagram



### Collect information from field which triggers dynamic speed limit :

Generally, information as current speed of users and flow of carriageways are used and proceed to determin the proper dynamic speed limit for a section of road. Then a speed limit is proposed to the road operator.

### Set speed limit in DSL pilot system :

A calculated speed limit can be proposed to the operator for validation or it is validated automatically.

### Send speed limit to static equipment :

The speed limit pilot system drives the field equipments. It is at this stage that speed limit, lane information and vehicle characteristics information have to be extracted from the pilot system for the C-ITS service.

**Beforehand, different section of road in which the speed limit by section applies should be set (as relevance zone of e-VMS) and an interface should collect current speed information in DSL pilot system.**

**Receive information and broadcast (RSU or national C-ITSS) :** information incoming from PF is IVI.

Channel CCH for 100%-G5 scenario and SCH1 for hybrid scenario should be used (see 241H for more details). Geonetwork dissemination and forwarding for 100%-G5 would be similar to SCooP1 use-cases (10km area and ten hops ; see 241H also).

**Receive IVI (vehicle)** : through architecture. Architecture options are not treated in this document (see 241H). Anyway, whatever route the information has followed, **IVI must have same serviceProviderId+iviIdentificationNumber and same timeStamp (as presented below in profile)**. So that vehicle treats one message or the other, but not both of them.

**Verify IVI and display IVI** : message is displayed on HMI from **referencePosition** (start of regulated section) or before it (pre-awareness). The information is displayed all the **relevanceZonelds** long. To classify and prioritize the information between several VMS messages, the receiving vehicle may use the data element IviType (see below for further details), that provides the message category.

The process of vehicle-receiver can be as followed :

1. The vehicle checks serviceProviderID+iviIdentificationNumber and timestamp to verify if event already known, new event or is an update.
2. The vehicle checks validFrom and validTo to determine if active.
3. The vehicle checks referencePosition to determine if near of far of its position and calculate its time-to-event.
4. The vehicle checks detectionZone. If vehicle is following the linear described by zone(s), it is concerned by event (which is upstream). If not, the vehicle compares referencePositionHeading with its own current heading and the way it is approaching the referencePosition by rear to know if concerned or not (difference between headings should be more or less about +/- 30°).
5. The vehicle checks presence of extraText container which is untrue, it's not an eVMS.
6. The vehicle checks trafficSignPictogram, nature and serialNumber which are **regulatory, nature 5, serial 57**. By the way, the ITSS-V knows that the UC is a dynamic speed limit.
7. HMI displays the message from referencePosition point or before (pre-awareness) and displays it it all relevanceZone long. If vehicleCharacteristics are given by IVI, the information should be processed by the vehicle-receiver. If conditions are not checked (involved the receiver know its own characteristics), message should not be displayed.

Forward : see before and 241H.

### 3. Information profile - Message description (in details)

| IVI transverse state                 |                         | Profile DSL       |   |           |
|--------------------------------------|-------------------------|-------------------|---|-----------|
| Field                                | Status from transverse] | Status For the UC | Comments  | Value set |
| <b>Header</b>                        |                         |                   |   |           |
| protocolVersion                      |                         |                   | See Master document / IVI   |           |
| messageID                            |                         |                   | See Master document / IVI   | (is 6)    |
| stationID                            |                         |                   | See Master document / IVI   |           |
| <b>Management container</b>          |                         |                   |   |           |
| serviceProviderId                    |                         |                   | See Master document / IVI   |           |
| iviIdentificationNumber              |                         |                   | See Master document / IVI   |           |
| timestamp                            |                         |                   | See Master document / IVI   |           |
| validFrom                            |                         |                   | See Master document / IVI   |           |
| validTo                              |                         |                   | See Master document / IVI   |           |
| connectedIviStructures               |                         |                   |   |           |
| iviStatus                            |                         |                   | See Master document / IVI   |           |
| <b>Geographic Location Container</b> |                         |                   |   |           |
| referencePosition                    |                         |                   | Position of the start of the speed limit zone. Transverse position is in the <b>middle of the carriageway</b> . (which is conform with ISO TS 17426 standard) | by PF     |
| referencePositionTime                |                         |                   |   |           |
| referencePositionHeading             |                         |                   |   |           |
| referencePositionSpeed               |                         |                   |   |           |
| parts                                |                         |                   | See 5 next lines  |           |

| IVI transverse state              |                         | Profile DSL       |  |           |
|-----------------------------------|-------------------------|-------------------|--|-----------|
| Field                             | Status from transverse] | Status For the UC | Comments   | Value set |
| >zoneId                           |                         |                   | First zone(s) Ids may be used to define the "detection zone(s)", approach of the speed limit zone (similar to traces in DENM). Then, next zone Ids may be used to define "relevance zone(s)" in which the dynamic speed limit is relevant (e.g. the display zone / eventHistory). <b>By default, the relevance zone should end at next point of exchange of the road (junction of an entry ramp), where an other IVI should be generated if the speed limit zone continue.</b> Minimum is 2 zone Id for Dynamic Speed Limit UC (e.g. one trace / detection zone and one eventHistory / relevance zone) | by PF     |
| >laneNumber                       |                         |                   |  |           |
| >zoneExtension                    |                         |                   |  |           |
| >zoneHeading                      | U                       | U                 | See Master document / IVI  |           |
| >zone                             | U                       | U                 | See Master document / IVI  |           |
| General IVI Application Container |                         |                   | <b>If the speed limit is vehicle specific, one part by group of vehicle. If the speed limit is lane specific, one part by group of lane(s).</b>  |           |
| detectionZoneIds                  | U                       | U                 | See Master document / IVI  |           |
| its-rrid                          | x                       |                   |  |           |
| relevanceZoneIds                  | U                       | U                 | See Master document / IVI  |           |
| direction                         | U                       | U                 | See Master document / IVI  |           |
| driverAwareness ZoneIds           | x                       |                   |  |           |
| minimumAwareness Time             | x                       |                   |  |           |
| applicableLanes                   | S                       | S                 | <b>Only present if speed limit is lane specific. In that case, each driving lane has to be described one time in a GicParts or an other so that all lanes are described.</b>   |           |
| iviType                           | ✓                       | ✓                 | As it is described in CS standard, Regulatory messages (1) is used for mandatory speed limit and Traffic-related information (2) is used for advisory speed limit. Thus, as FR UC gives mandatory speed limit, Regulatory messages is used.  | is 1      |
| iviPurpose                        | x                       |                   | (which is a difference with ISO TS 17426 standard)   |           |
| laneStatus                        | x                       |                   |  |           |
| vehicleCharacteristics            | S                       | S                 | <b>To be provided if speed limit is by type of vehicles. In that case, each group of vehicle has to be described one time in a GicParts or an other so that all type of vehicle(s) concerned are described.. (*)</b>   |           |
| driverCharacteristics             | x                       |                   |  |           |
| layoutId                          | x                       |                   |  |           |
| preStoredLayoutId                 | x                       |                   |  |           |
| roadSignCodes                     | ✓                       | ✓                 | <b>For the DSL, it is set to regulatory, nature 5, serial 57. attributes spm is provided to give the speed limit.</b>  |           |
| extraText                         | S                       | S                 | Only used if a text is associate with the speed limit roadsign. Most of time absent.   |           |
| Road Configuration Container      | x                       |                   |  |           |
| Text Container                    | x                       |                   |  |           |
| Layout Container                  | x                       |                   |  |           |

(\*) To describe vehicle characteristics, use of ranges and weight of train seems the simplest way to do so (by consequence, use of following lines in **bold** is recommended)

**TractorCharacteristics::=SEQUENCE{**  
 equalTo SEQUENCE (SIZE (1..4,...)) OF VehicleCharacteristicsFixValues OPTIONAL,  
 notEqualTo SEQUENCE (SIZE (1..4,...)) OF VehicleCharacteristicsFixValues OPTIONAL,  
**ranges SEQUENCE (SIZE (1..4,...)) OF VehicleCharacteristicsRanges OPTIONAL}**  
**VehicleCharacteristicsFixValues::= CHOICE{**  
 simpleVehicleType StationType,  
 euVehicleCategoryCode EuVehicleCategoryCode,  
 iso3833VehicleType Iso3833VehicleType,  
 euroAndCo2value EnvironmentalCharacteristics,

```

engineCharacteristics EngineCharacteristics,
loadType LoadType,
usage VehicleRole,...}
VehicleCharacteristicsRanges::= SEQUENCE{
  comparisonOperator ComparisonOperator,
  limits CHOICE{
    numberOfAxles INTEGER(0..7),
    vehicleDimensions VehicleDimensions,
    vehicleWeightLimits VehicleWeightLimits,
    axleWeightLimits AxleWeightLimits,
    passengerCapacity PassengerCapacity,
    exhaustEmissionValues ExhaustEmissionValues,
    dieselEmissionValues DieselEmissionValues,
    soundLevel SoundLevel,...}}
VehicleWeightLimits::= SEQUENCE {
  vehicleMaxLadenWeight Int2, #Optional
  vehicleTrainMaximumWeight Int2, #Optional
  vehicleWeightUnladen Int2 #Optional
}
ComparisonOperator::= INTEGER {
  greaterThan (0),
  greaterThanOrEqualTo (1),
  lessThan (2),
  lessThanOrEqualTo (3)} (0..3)

```