



French C-ITS Deployment Coordination committee

Common technical specifications for use case - Dynamic speed limit (I2V)

2.4.1.2_M_C2

Activity 2: Studies

Sub Activity 2.4 > Specifications

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Document: Common technical specifications for use case – C2 DynSpeedLimit (I2V)

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Publication history

Date	Version	Author(s)	Updates & changes	Diffusion
14/11/2019	4.00	A. AUDIGÉ	<ul style="list-style-type: none"> Consolidated version for release 4 	Release 4
23/02/2020	4.10	A. AUDIGÉ	<ul style="list-style-type: none"> Spec post migration, validated by COCSIC 2020-02. 	COCSIC
13/10/2020	4.20	A. AUDIGÉ	<ul style="list-style-type: none"> Correction of the message associated to the figure to comply with the master_I2V post-migration (positionConfidenceEllipse) Validated by COCSIC 2020-09 	COCSIC
13/06/2022	4.21	J.DIEZ	<ul style="list-style-type: none"> New Master taken into account for IVI messages (inclusion of road configuration container and minor changes). Clarification of the process of the message & inclusion of requirement tables. References to DENM messages removed. Reference and applicable documents added. 	Small group of experts
21/06/2022	4.22	J.DIEZ	<ul style="list-style-type: none"> Small modifications from previous version. 	COCSIC Studies
19/07/2022 to 05/08/2022	4.30	J.DIEZ	<ul style="list-style-type: none"> Validated by COCSIC 2022-07 with minor changes. 	COCSIC Studies
07/02/2023	4.31	A.LE CALVEZ	<ul style="list-style-type: none"> COCSIC Action 1898: Adaptation of use case to urban areas Retroaction n°1486: Add PFro in diagram. Caption added to the diagram. Retroaction n°1550: No RCC if roadtype is not known and applicable lanes not present. Retroaction n°1587: IVI message not relayed. 	
09/02/2024	4.40	Thiwiza BELLACHE	<ul style="list-style-type: none"> Validated version 	CE
27/05/2024	4.41	Aymeric LE CALVEZ	<ul style="list-style-type: none"> Retroaction n°1623: trafficSign Pictogram in line with ASN1 	CE
24/06/2024	4.50	Younes BOUCHAALA AMO DMR	<ul style="list-style-type: none"> Diffusion COCSIC Studies. 	COCSIC Studies.

Black highlighted text are problem with standards.

The following legend is used on the document tables (next sub-chapters) and on:

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

Profile / Status :

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

Profile / Content: important settings or information are in ***bold italic red 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

HMI	Human-Machine Interface
I2V	Infrastructure To Vehicle
ITS-G5	<p>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.</p> <p>In this document ITS-G5 stands for IEEE802.11p/ETSI ITS-G5.</p>
IVIM	Infrastructure to Vehicle Information Message
Nfr-ITS-S	French National ITS Station
N-ITS-S	National ITS Station
PF	Platform
PFro	Road operator Platform
R-ITS-S	Roadside ITS Station
TCC	Traffic Control Centre
TMS	Traffic Management System
V-ITS-S	Vehicle ITS Station
<i>N/A</i>	<i>Not Applicable</i>
<i>TBC</i>	<i>To Be Checked, with MS or associated partner</i>
<i>WIP</i>	<i>Work in progress : when mentioned next to the version number, it means the document is an in-between version</i>

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1. Documents

1.1 Reference documents

Id.	Reference	Version	Title / Content
[DR1]	2.4.1_M Common specifications	0.30	Functional and technical hybrid architecture – Common specification

1.2 Applicable documents

Id.	Reference	Version	Title / Content
[DA1]	2.4.1.2_M_Master_I2V	4.90	Master technical specifications for I2V use cases

2. Figure and example of IVI message for dynamic speed limit

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

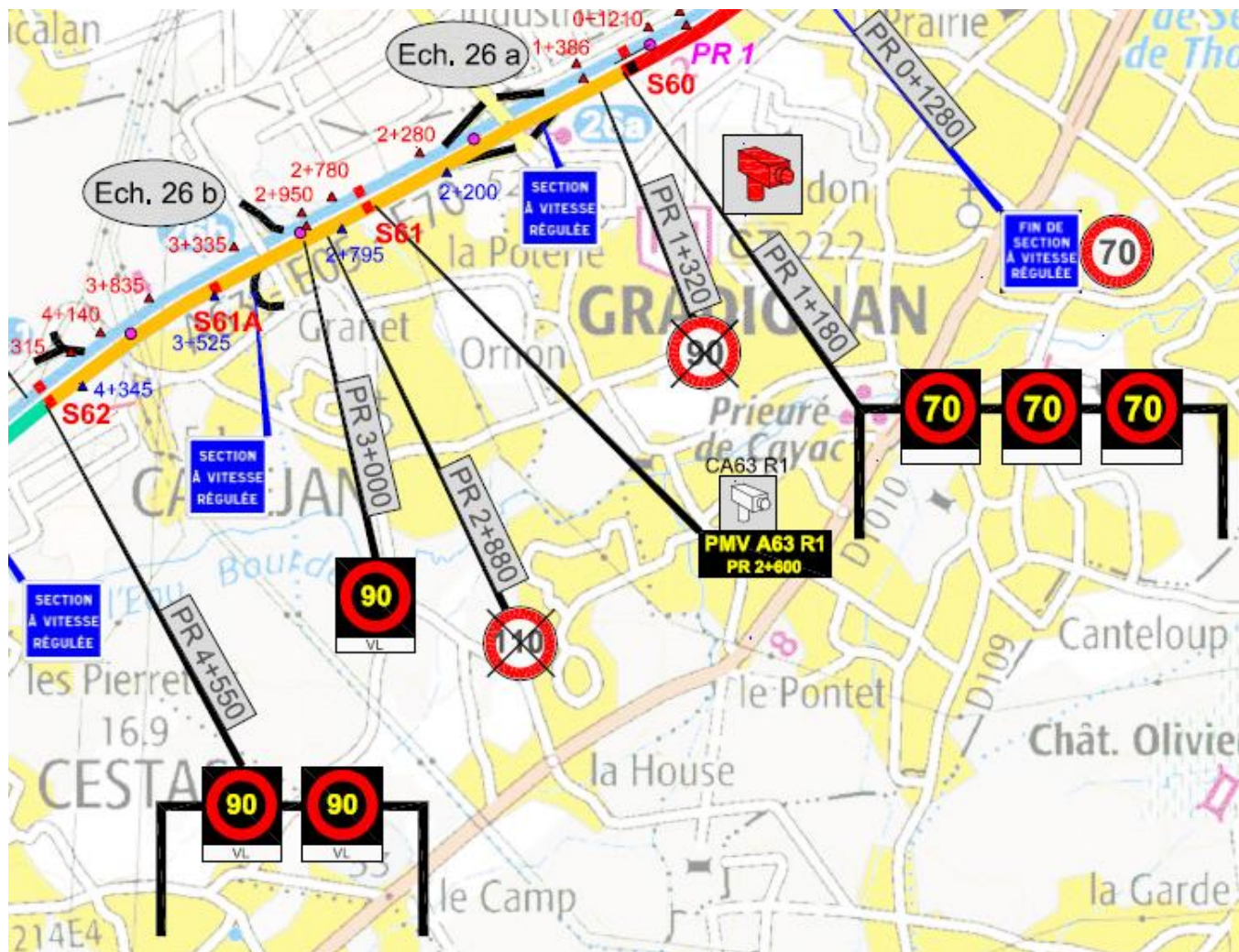


Figure 1: Example of dynamic speed limit situation

The use case is adapted for highways as well as urban zones.

For dynamic speed limit, the road is separated in sections. For each section, there are loops or similar systems to detect traffic flow and speed of vehicles. An algorithm analyses the data from the field and modulates the speed of each section to delay or avoid congestion. Speed limits **can** concern all vehicles or some categories of vehicles. Each sector has also to be separated in the IVI message built from the beginning to the end of the regulated sector at each entry ramp (as described in the profile table).

```
#Description of IVI for FR for DynSpeedLmit UC (I2V)
#Represents the example of the figure 1 of the document
#Commented by A. AUDIGE & J.DIEZ (DIR A & DGITM)
```

```
value1 IVI ::= {
    header {
```



```

protocolVersion currentVersion=2,
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=0,
          semiMinorConfidence unavailable=0,
          semiMajorOrientation unavailable=0
        },
        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, #example
                deltaLongitude 9289 #example
              },
              {
                deltaLatitude -5379, #example
                deltaLongitude 10567 #example
              },
              ... # number of points needs to be defined according to DA1 §2.3, line
            },
          }
        },
        {
          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, #example
                deltaLongitude -7420 #example
              },
              {
                deltaLatitude 8278, #example
                deltaLongitude -5379 #example
              },
              ... # number of points needs to be defined according to DA1 §2.3, line
            },
          }
        }
      }
    },
    gic : { #GIC = general Ivi container = description of the traffic sign representing the speed limit
      { #First container = speed limit for trucks (which is under the speed limit displayed on VMS)
        detectionZoneIds {

```

```

    },
    relevanceZonelds {
      1
      2
    },
    direction sameDirection=0,
    iviType regulatoryMessages=1,
    vehicleCharacteristics {
      train {
        ranges {
          {
            comparisonOperator
            limits vehicleWeightLimits : {
              vehicleMaxLadenWeight 0,
              vehicleWeightUnladen 0
            }
          }
        }
      }
    },
    roadSignCodes {
      {
        code iso14823 : {
          pictogramCode {
            serviceCategoryCode trafficSignPictogram = regulatory, #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
        2
      },
      relevanceZonelds {
        1
        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,
                vehicleWeightUnladen 0
              }
            }
          }
        }
      }
    },
    roadSignCodes {
      {
        code iso14823 : {
          pictogramCode {
            serviceCategoryCode trafficSignPictogram = regulatory, #See
            pictogramCategoryCode {
              nature 5, #See TS14823:2017 table
              serialNumber 57 #See TS14823:2017 table
            }
          },
          attributes {
            spe : {

```

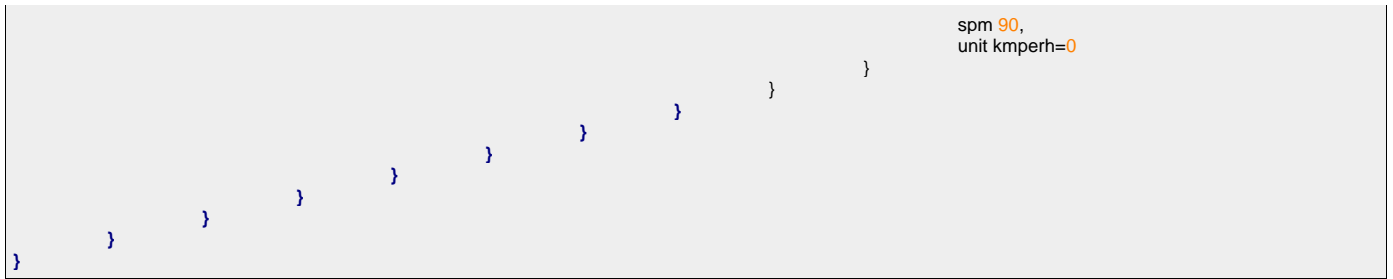


Table 1: IVI Message associated with part of the figure above

3. Step by step diagram

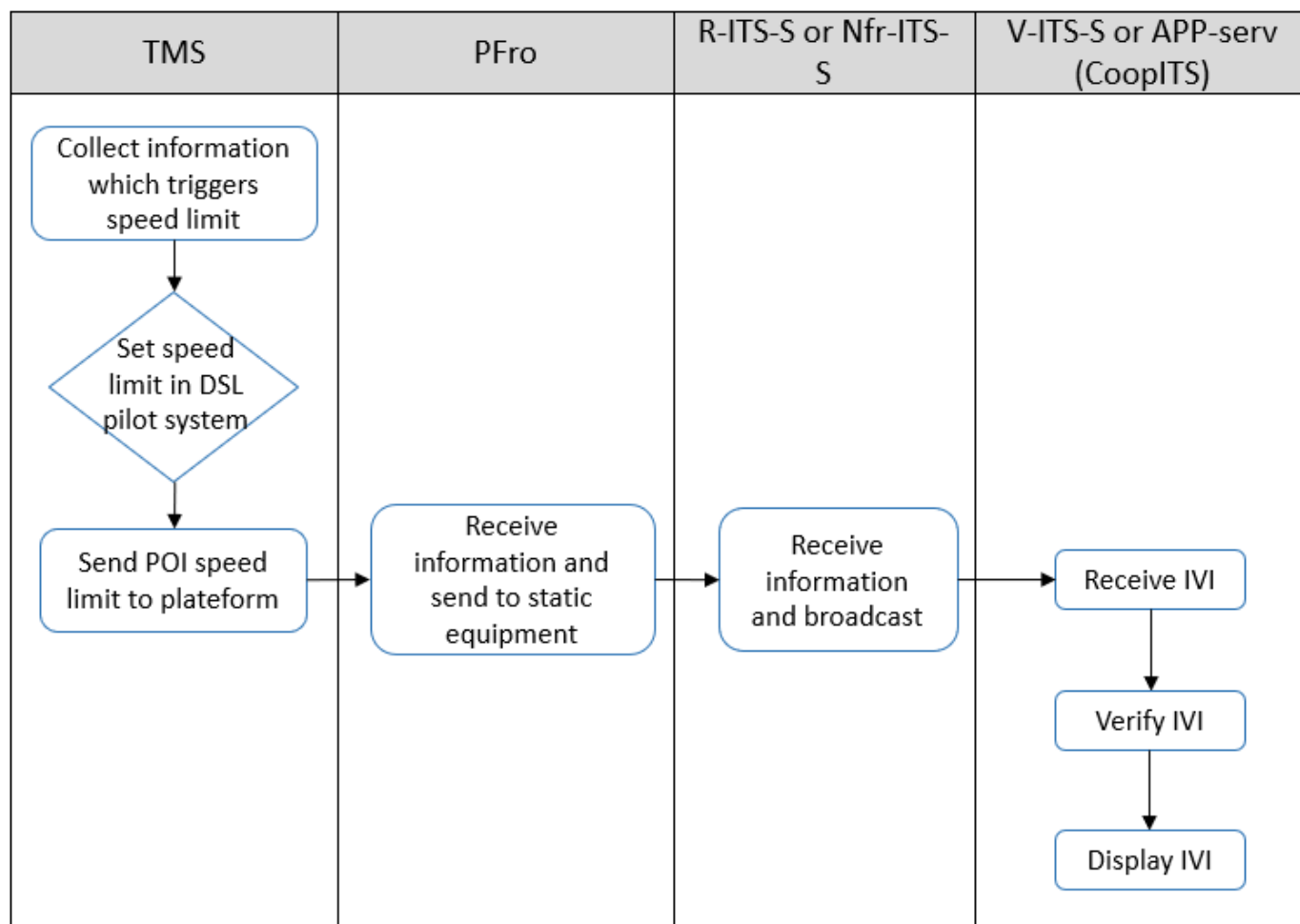


Figure 2: C2 use case diagram

Collect information from the field which triggers dynamic speed limit:

Generally, information as current speed of users and flow of carriageways are used and proceed to determine 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 equipment. It is at this stage that speed limit, lane information (if the carriageway is separated in different lanes) 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.

ID	2.4.1.2_M_C2-SendDSLfromTCC (1)
Component(s)	TMS
Requirement	As the PFro will admit only Datex II format in entrance, road operators shall develop an appropriate interface between their existing tool and the PFro, if needed.
Acceptance	
Additional information	

Receive information and broadcast (R-ITS-S or Nfr-ITS-S):

The R-ITS-S or Nfr-ITS-S constructs an IVI with the DATEX II data given by the PFro.

ID	2.4.1.2_M_C2-ReceiveAndBroadcast (1)
Component(s)	R-ITS-S or Nfr-ITS-S
Requirement	Canal CCH should be used (see DR1 for more details).
Acceptance	
Additional information	GeoNetwork dissemination and forwarding are described in DA1 .

Receive IVI (vehicle):

ID	2.4.1.2_M_C2-ReceiveIVI (1)
Component(s)	V-ITS-S
Requirement	<p>Architecture options are not treated in this document (see DR1).</p> <p>Whatever route taken by the message, duplicates of the same IVI messages shall be recognizable thanks to the couple of elements, which should be identical for all duplicates (as presented below in profile):</p> <ul style="list-style-type: none"> - serviceProviderId+ivIdentificationNumber - timestamp <p>Those elements are the key to identify an IVI from another.</p>
Acceptance	CA1: serviceProviderId+ivIdentificationNumber and timestamp do not differ when the same IVIM is following G5 and cellular paths.
Additional information	That allows the vehicle to treat one message or the other, but not both of them as they contain the exact same information.

Verify IVI and display IVI: message is displayed on HMI from **referencePosition** (start of regulated section) or before it (pre-awareness is possible). 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+ivIdentificationNumber and timestamp to verify if the information is already known, if it is new or if it is an update.
2. The vehicle checks validFrom and validTo to determine if the information is currently applicable.
3. The vehicle checks referencePosition to determine how far from its position the speed limit is.
4. The vehicle checks the zones described in the message to determine whether it is concerned by the information. It can do this analysis by different means (using detectionZones, relevanceZone or zoneHeading for example) depending on the OEM's implementation.
5. The vehicle checks presence of Text container which is absent, it is not an eVMS.
6. The vehicle checks trafficSignPictogram, nature and serialNumber which are **regulatory, nature 5, serial 57**. This way, the V-ITS-S knows that the use case is a dynamic speed limit.

7. HMI displays the message from referencePosition point or before (pre-awareness) and displays 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.

Forwarding: see [DR1](#).

4. Information profile - Message description (in details)

ID	2.4.1.2_M_C2 – IVIProfile (1)
Component(s)	R-ITS-S, Nfr-ITS-S
Requirement	The IVIM transmitted by the R-ITS-S or N-ITS-S shall respect what's expected in the following table (IVIM profile for C2).
Acceptance	Referring to the "Status for the UC" column in the table: CA1: All mandatory V DE and used U DE shall be present in the message emitted, with the defined values. CA2: All optional S DE can be present in the message emitted. See expected values in the table when defined. CA3: All not used X DE shall be absent in the message emitted.
Additional information	At reception, V-ITS-S receiving a message with not used X DE shall not discard the message.

IVI Master_I2V status		Profile DSL		
Field	Status (Master)	Status For the UC	Comments	Value set
Header				
protocolVersion	V	V	See Master_I2V document / IVI	(is 2)
messageID	V	V	See Master_I2V document / IVI	(is 6)
stationID	V	V	See Master_I2V document / IVI	
Management container				
serviceProviderId	V	V	See Master_I2V document / IVI	by PF
ivIdentification Number	V	V	See Master_I2V document / IVI	by PF
<i>timestamp</i>	U	U	See Master_I2V document / IVI	by PF
<i>validFrom</i>	S	S	See Master_I2V document / IVI	from TMS
<i>validTo</i>	U	U	See Master_I2V document / IVI	from TMS or by PF
<i>connectedIviStructures</i>	X			
iviStatus	V	V	See Master_I2V document / IVI	by PF
<i>connectedDenm</i>	X			
Geographic Location Container		V		
referencePosition	V	V	Position of the start of the speed limit zone. Transverse position is in the middle of the carriageway. (which is conform with ISO TS 17426 standard)	by PF
<i>referencePosition Time</i>	X			
<i>referencePosition Heading</i>	X			
<i>referencePositionSpeed</i>	X			
parts	V	V	See 5 next lines	by PF

IVI Master_I2V status		Profile DSL		
Field	Status (Master)	Status For the UC	Comments	Value set
>zoneld	✓	✓	First zone(s) Ids may be used to define the “detection zone(s)”, before entering the speed limit zone. Then, next zone Ids may be used to define “relevance zone(s)” in which the dynamic speed limit is relevant. At least one detection zone and one relevance zone shall be provided.	by PF
>laneNumber	✗			
>zoneExtension	✗			
>zoneHeading	✓	✓	See Master_I2V document / IVI	by PF
>zone	✓	✓	See Master_I2V document / IVI	by PF
General IVI Application Container		✓	If the speed limit is vehicle specific, one part by group of vehicle(s). If the speed limit is lane specific, one part by group of lane(s).	
detectionZonelds	✓	✓	See Master_I2V document / IVI	by PF
its-rrid	✗			
revelanceZonelds	✓	✓	See Master_I2V document / IVI	by TMS or PF
direction	✓	✓	See Master_I2V document / IVI	is 0
driverAwareness Zonelds	✗			
minimumAwareness Time	✗			
applicableLanes	✓	✓	Only present if there are different lanes on the carriageway and the 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. If present, the road configuration container should be provided.	by PF
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	✗			
laneStatus	✗			
vehicleCharacteristics	✓	✓	To be provided if speed limit is by type of vehicles.	by PF
driverCharacteristics	✗			
layoutId	✗			
preStoredLayoutId	✗			
roadSignCodes	✓	✓	For the DSL, it is set to regulatory, nature 5, serial 57. attributes spm is provided to give the speed limit	by PF
extraText	✓	✓	Only used if a text is associated with the speed limit roadsign. Most of time absent.	by PF
Road Configuration Container		✓	To be provided if applicableLanes is used and roadtype is known. Should not be provided otherwise.	
relevanceZoneIds	✓	✓	See Master_I2V document / IVI.	by PF
roadType	✓	✓	See Master_I2V document / IVI.	by PF
laneConfiguration	✓	✓	See next 6 lines	
>laneNumber	✓	✓	See Master_I2V document / IVI.	by PF
>direction	✓	✓	See Master_I2V document / IVI.	Is 0

IVI Master_I2V status		Profile DSL		
Field	Status (Master)	Status For the UC	Comments	Value set
>validity	S	X		
>laneType	V	V	See Master_I2V document / IVI.	by PF
>laneStatus	V	V	See Master_I2V document / IVI.	by PF
>laneWidth	S	S	See Master_I2V document / IVI. It is not necessary for the purpose of the use case but can be additional information if the sender is able to provide it.	by PF
Text Container		X		
Layout Container		X		