



## French C-ITS Deployment Coordination committee

# Common technical specifications for use cases: H4 - dynamic lane management - reserved lane (I2V)

## 2.4.1.2\_M\_H4

### Activity 2: Studies

### Sub Activity 2.4 > Specifications

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## Information on the document

Document: Common technical specifications for use case - H4 Dynamic Lane Management - Reserved Lane (I2V)

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Black highlighted text are problem with standards.

The following legend is used on the document ~~tables~~:tables:

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

Profile / Status :

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

Profile / ~~Content~~:Content: important settings or information are in ***~~bold italic~~ pink-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

<b>CAM</b>	<b>Cooperative Awareness Message</b>
<b>C-ITS</b>	Cooperative Intelligent Transport Systems
<b>Nfr-ITS-S</b>	National french central ITS Station (national ITS station)
<b>DENM</b>	<del>Decentralized Environmental Notification Message (réf. ETSI standard for C-ITS messages)</del>
<b>GPS</b>	<del>Global Positioning System</del>
<b>HOV</b>	High occupancy vehicle
<b>HMI</b>	<u>Human-Machine Interface</u>
<b>I2V</b>	<u>Infrastructure To Vehicle</u>
<b>ITS-G5</b>	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. In this document ITS-G5 stands for IEEE802.11p/ETSI ITS-G5.
<b>IVIM</b>	Infrastructure to Vehicle Information <u>Message</u> (réf. ETSI standard for C-ITS messages)
<b>MAPData</b>	<del>Geometric information for the intersection (réf. ETSI standard for C-ITS messages)</del>
<b>PF</b>	<u>Platform</u>
<b>PFro</b>	<u>Road Operator Platform</u>
<b>R-ITS-S</b>	Roadside ITS Station <del>(RSU or ITS-S-R in the French Terminology)</del>
<b>SPAT</b>	<del>Signal Phase and Timing (réf. ETSI standard for C-ITS messages)</del>
<b>TCC</b>	Traffic Control Centre (the place where road management measure are decided)
<b>TMS</b>	Traffic Management System (the usual system in which the road operator sets its road measures and events)
<b>V-ITS-S</b>	Vehicle ITS Station <del>(any vehicles)</del>
<b>Vro-ITS-S</b>	<del>Road operator vehicle ITS Station</del>
<b>Vru-ITS-S</b>	<del>User vehicle ITS Station (in that case, road operator vehicle are excluded when they are not in user mode)</del>
<b>N/A</b>	<i>Not Applicable</i>
<b>TBC</b>	<i>To Be Checked, with MS or associated partner</i>
<b>WIP</b>	<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

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

## 1.2 Applicable documents

<u>Id.</u>	<u>Reference</u>	<u>Version</u>	<u>Title / Content</u>
<u>[DA1]</u>	<u>2.4.1.2 M Master I2V</u>	<u>4.90</u>	<u>Master technical specifications for I2V use cases</u>

## 1.2. Figure and example of IVI message for dynamic lane management - reserved lane

In order to clarify the data elements description for the Dynamic Lane Management - Reserved Lane (DLM-RL) use case, we start by describing the scenario in the figure below and then the data elements associated in the table.

**Example by illustration (situation of lanes, not HMI proposals):**

	High occupancy vehicle	Bus lane
Activated		
Disabled		

*Figure 1: Examples by illustrations (situation of lanes, not HMI proposals)*

### Message associated with figure bus lane / activated

```
#Description of IVI for FR for DynLaneMgt-ReservedLane UC (I2V)
#Represents the example of bus lane from the figure 1 of the document
#Linked with a figure
#Commented by A. AUDIGE & J.DIEZ (DIR A & DGITM)(DIR-A)

header {
  protocolVersion=42, #currentVersion'
  messageID=6, #IVI
  stationID=4711
},
ivi {
  mandatory {
    serviceProviderId {
      countryCode=10110 01010, #means 'FR'
      issuerIdentifier=10033 #DIRA
    },
    iviIdentificationNumber=123456789,
    timeStamp=352425600000,
    validFrom=352447200000,
    validTo=352447200010,
    iviStatus=0, #new
  },
  optional {
    glc : { #GLC = geographic location container = description of reference point and zones (2 zones in this example)
      referencePosition {
        latitude =481540527, #latitude of point "0"; start point of the measure
        longitude=164801006, #longitude of point "0" ; start point of the measure
        positionConfidenceEllipse {
          semiMajorConfidence=0, #see-master_I2V
          semiMinorConfidence=0, #see-master_I2V
          semiMajorOrientation=0 #see-master_I2V
        },
        altitude {
          altitudeValue=800001, #unavailable, but can be provided if known by the system
          altitudeConfidence=unavailable(15)
        }
      },
      parts {
    }
```



```

zoneId=1, #description of a zone. Here, approach of referencePosition (similar to DENM/trace)
zoneHeading {
    headingValue=900, #Heading of the road at the referencePosition, here wgs84East
    headingConfidence=127, #unavailable
}
zone segment : {
    line deltaPositions : {
        {
            deltaLatitude=-6637,
            deltaLongitude=9289
        },
        {
            deltaLatitude=-5379,
            deltaLongitude=10567
        },
        {
            ... # number of points needs to be defined according to DA1 §2.3. line
        }
    }
}
}

zoneId=2, #description of a zone. Here, zone in which the IVI applies (similar to DENM/eventHistory)
zoneHeading {
    headingValue=900, #Heading of road at the referencePosition, here wgs84East
    headingConfidence=127, #unavailable
}
zone segment : {
    line deltaPositions : {
        {
            deltaLatitude=7591,
            deltaLongitude=-7420
        },
        {
            deltaLatitude=8278,
            deltaLongitude=-5379
        },
        {
            ... # number of points needs to be defined according to DA1 §2.3. line
        }
    }
}
}

gic : { #GIC = general lvi container = description of the traffic signs of the VMS
    { #First container = bus lane on hard shoulder
        detectionZoneIds {1},
        relevanceZoneIds {2},
        direction=0, #sameDirection
        applicableLanes {14}, #outer hard shoulder
        lviType=1, #regulatoryMessages
        roadSignCodes {
            {
                code iso14823 : {
                    pictogramCode {
                        serviceCategoryCode trafficSignPictogram : regulatory,
                        pictogramCategoryCode {
                            nature=1,
                            serialNumber=29
                        }
                    }
                }
            }
        }
    },
    { #Second container = 3 lanes of green arrow
        detectionZoneIds {1},
        relevanceZoneIds {2},
        direction=0, #sameDirection
        applicableLanes {1,2,3}, #all drivable lanes
        lviType=1, #regulatoryMessages,
        roadSignCodes {
            {
                code iso14823 : {
                    pictogramCode {
                        serviceCategoryCode trafficSignPictogram : informative,
                        pictogramCategoryCode {
                            nature=6,
                            serialNumber=60
                        }
                    }
                }
            }
        }
    }
}
}

```

">zone". Till 32 points possible (min 1 point)

">zone".

... # number of point needs to be defined. Till 32 points possible (min 1 point)

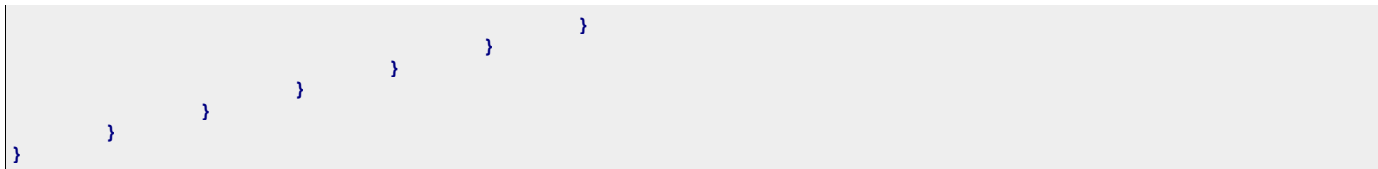
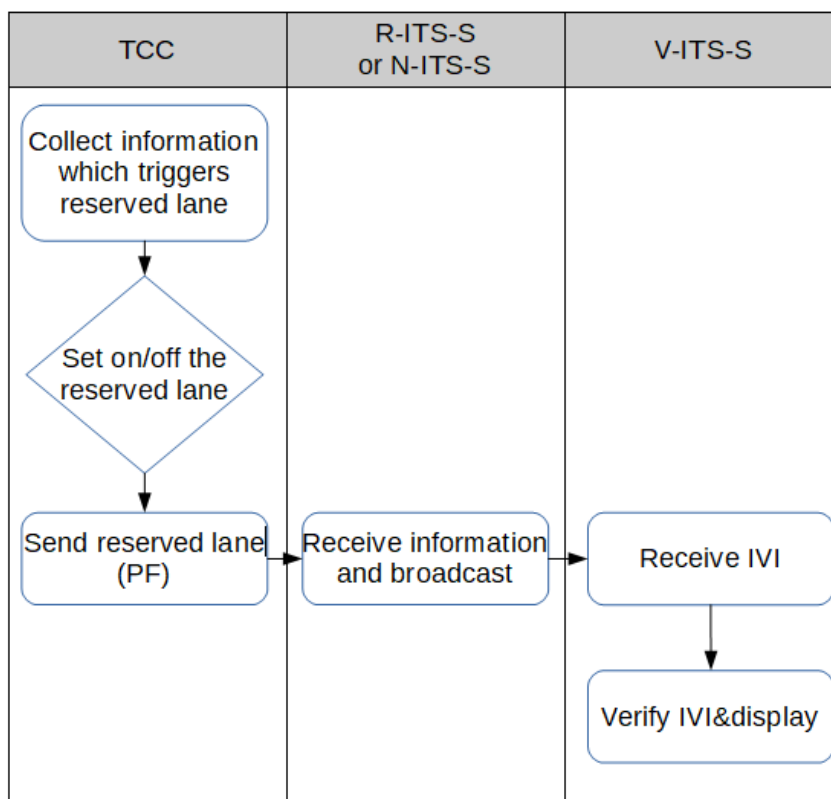


Figure 2: IVI message associated with bus lane example from figure 1

## 2.3. Step by step diagram



### Collect information which triggers reserved lane:

Generally, information on flow congestion of the carriageway is used to activate or inactivate the reserved lane. It **can** also be a fixed scheduled program (for example during the peak hours every day). The activation or inactivation of a reserved lane is proposed to the road operator, but it **can** also be automated.

The geometry of the reserved lane is fixed **and has to shall** be preset in the system (which lane of which section of the carriageway, start point and end point, especially situation at the intersections).

### Set on/off the reserved lane:

Activation or inactivation, manually or automatically.

The PF needs the geometry of the reserved lane, the current status of the lane (activation/inactivation) and the type of road users concerned by the reserved lane (HOV, bus). All these parameters need to be defined through the DATEX II message that enters the PF.

### Send reserved lane (by the PF):

<b>ID</b>	<b>2.4.1.2_M_H4-SendeReservedLaneFromTCC (1)</b>
<b>Component(s)</b>	<b>TMS</b>
<b>Requirement</b>	As the PFro will admit only Datex II format in entrance, road operators <b>shall</b> develop an appropriate interface between their existing tool and the PFro, if needed.
<b>Acceptance</b>	
<b>Additional information</b>	

The SCOOP PF<sub>ro</sub> adapts the Datex II coming from the TMS for the R-ITS-S and Nfr-ITS-S.

~~The data for IVI/detectionZone (similar to DENM/trace) and for IVI/relevanceZone (similar to DENM/eventHistory) are calculated as usual. The event received by the PF is a linear. If this linear includes interchange, the message should be cut in several events - one for each section from beginning of measure to the next ramp of entrance until the end of the measure.~~

### 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 PF<sub>ro</sub>.

<b>ID</b>	<b>2.4.1.2 M_H4-ReceiveAndBroadcast (1)</b>
<b>Component(s)</b>	R-ITS-S or Nfr-ITS-S
<b>Requirement</b>	Canal CCH should be used (see DR1 for more details).
<b>Acceptance</b>	
<b>Additional information</b>	GeoNetwork dissemination and forwarding are described in DA1.

~~Chanel 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 are described in 2.4.1.3 M\_Master-IVI.~~

### Receive IVI (vehicle)->:

<b>ID</b>	<b>2.4.1.2 M_H4-ReceiveIVI (1)</b>
<b>Component(s)</b>	V-ITS-S
<b>Requirement</b>	Architecture options are not treated in this document (see DR1).  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): <ul style="list-style-type: none"><li>- <u>serviceProviderId+ivIdentificationNumber</u></li><li>- <u>timestamp</u></li></ul> Those elements are the key to identify an IVI from another.
<b>Acceptance</b>	CA1: <u>serviceProviderId+ivIdentificationNumber and timestamp do not differ when the same IVIM is following G5 and cellular paths.</u>
<b>Additional information</b>	<u>That allows the vehicle to treat one message or the other, but not both of them as they contain the exact same information.</u>

~~through architecture which options are not treated in this document (see 241H). Anyway, whatever the route the information has followed, IVI must have same serviceProviderId+ivIdentificationNumber 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 before referencePosition (pre-awareness is needed). The information is displayed all the relevanceZonelds long. To classify and prioritize the information between several IVI messages, the receiving vehicle may-shall use the data element IviType, that provides the message category. For this UC, iviType is regulatory (1).~~

The process of vehicle-receiver can be as followed->followed:

1. The vehicle checks serviceProviderID+ivIdentificationNumber and timestamp to verify if ~~event~~the information is already known, ~~if it is new event~~ or ~~if it is an update~~.
2. The vehicle checks validFrom and validTo to determine if information is currently applicable~~active~~.
3. The vehicle checks referencePosition to determine if the reserved lane is near of far ~~of from~~ its position ~~and calculate its time to event~~.
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.
- ~~4. The vehicle checks detectionZone. If vehicle is following the linear described by zone(s), it is concerned by event (which is upstream by the fact that direction DE of IVI is "0" (sameDirection)).~~
- 5. The vehicle checks ~~absence of Text container and~~ the presence of applicableLanes in the general IVI container. It proves the IVI provide regulatory information by lanes.**
- 6. Lane(s) with trafficSignPictogram corresponding to green arrow or red cross are non specific lanes (no reserved lane).  
Whereas Lane(s) with trafficSignPictogram not corresponding to green arrow or red cross are specific lanes (reserved lane(s)).**
7. HMI displays the message before referencePosition point (pre-awareness), when the vehicle is along the linear of detectionZone. Lane specific is fully applicable and **should** be displayed. However, when a red cross is associated **with the outer hard shoulder specifically** (i.e applicableLanes "14"), the lane **should not** be displayed on the HMI. If it is, the hard shoulder **should** appear clearly on the HMI as being the hard shoulder (and not a driving lane).





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

<b>ID</b>	<b>2.4.1.2 M_H4 – IVIProfile (1)</b>
<b>Component(s)</b>	R-ITS-S, Nfr-ITS-S
<b>Requirement</b>	The IVIM transmitted by the R-ITS-S or N-ITS-S <b>shall</b> respect what's expected in the following table (IVI profile for H4).
<b>Acceptance</b>	Referring to the "Status for the UC" column in the table-: CA1: All mandatory  DE and used  DE shall be present in the message emitted, with the defined values. CA2: All optional  DE can be present in the message emitted. See expected values in the table when defined. CA3: All not used  DE shall be absent in the message emitted.
<b>Additional information</b>	At reception, V-ITS-S receiving a message with not used  DE shall not discard the message.

IVI Master_I2V status/IVI transverse state		Profile <u>H4 (DLM-RL)</u>		
Field	Status from transverse set (Master)	Status For the UC	Comments	Value set
<b>Header</b>				
<b>protocolVersion</b>			See Master_I2V document / IVI	(is 2)
<b>messageID</b>			See Master_I2V document / IVI	(is 6)
<b>stationID</b>			See Master_I2V document / IVI	
<b>Management container</b>				
<b>serviceProviderId</b>			See Master_I2V document / IVI	by PF
<b>iviIdentification Number</b>			See Master_I2V document / IVI	by PF
<b>timestamp</b>			See Master_I2V document / IVI	by PF
<b>validFrom</b>			See Master_I2V document / IVI	From TMS
<b>validTo</b>			See Master_I2V document / IVI	From TMS or by PF
<b>connectedIviStructures</b>				
<b>iviStatus</b>			See Master_I2V document / IVI	by PF
<b>connectedDenms</b>				
<b>Geographic Location Container</b>				
<b>referencePosition</b>			Position of the start of the regulated zone. Transverse position is in the <b>middle of the carriageway</b> .	by PF
<b>referencePosition Time</b>				
<b>referencePosition Heading</b>				
<b>referencePosition Speed</b>				
<b>parts</b>			See 5 next lines	
<b>&gt;zoneId</b>			First zone(s) Ids <b>may</b> be used to define the "detection zone(s)", approach of the regulated zone <del>(similar to traces in DENM)</del> . Then, next zone Ids <b>may</b> be used to define "relevance zone(s)" in which the regulated situation is relevant <del>(e.g. the display zone / eventHistory)</del> . <del>By default, the relevance zone should end at next point of exchange of the road (junction of an entry-ramp) or at the next regulated section, where an other IVI should be generated to continue the same regulation or an other one.</del> At least one detection zone and one relevance zone <b>shall</b> be provided. Minimum is 2 zone an zone Id (e.g. one trace / detection zone and one eventHistory / relevance zone)	by PF

## 2.4.1.2\_M\_H4 (Dynamic Lane Management - Reserved Lane)

IVI Master_I2V statusIVI-transverse state		Profile <b>H4 (DLM-RL)</b>		
Field	Status from transverse set (Master)	Status For the UC	Comments	Value set
>laneNumber	X			
>zoneExtension	X			
>zoneHeading	U	U	Heading direction of the carriageway at the point of referencePosition. If unknown, the confidence is set to unavailable (127)	by PFby PF
>zone	U	U	See Master_I2V document / IVI	by PF
General IVI Application Container		U		
detectionZoneIds	U	U	See Master_I2V document / IVI	by PF
its-rrid	X			
revelanceZoneIds	U	U	See Master_I2V document / IVI	by TMS or PF
direction	U	U	See Master_I2V document / IVI	Is 0
driverAwareness ZoneIds	X			
minimumAwareness Time	X			
applicableLanes	S	U	<b>Reserved lane is lane specific and all lanes shall be described exactly one time through the whole IVI message.</b>	by PF
iviType	V	V	Even if arrow or red cross roadsign correspond to informative section of TS14823, reserved lane panels (as bus lane for exemple) correspond to regulatory section. By consequence, iviType is regulatory for this UC.	is 1
iviPurpose	X			
laneStatus	X			
vehicleCharacteristics	S	X	Not used because the information concerns <del>all the lanes and so all vehicles</del> . <del>Some lanes are authorized, some not but not to all kind of vehicles (HOV or bus).</del> <del>It is</del> interesting for common vehicles to know why they can see vehicles on the lane they are not authorized to take.	
driverCharacteristics	X			
layoutId	X			
preStoredLayoutId	X			

IVI Master I2V statusIVI-transverse state		Profile H4 (DLM-RL)		
Field	Status from transverse set (Master)	Status For the UC	Comments	Value set
roadSignCodes	✓	✓	<p>For the lanes non specific to particular user (bus, hov or critt'air, or else) or for inactivated lanes, red cross or green arrow are provided.</p> <p>- ServiceCategoryCode shall be informative, nature shall be 6 and serialNumber shall be 59 for a red cross (lane is closed).</p>  <p>- ServiceCategoryCode shall be informative, nature shall be 6 and serialNumber shall be 60 for a green arrow (lane is open).</p>  <p>Pre-informative section should not be coded by road operator with informative-6-61 (merge to the left arrow) or informative-6-62 (merge to the right arrow), because the roadsign do not handle the exception for authorized vehicle in the reserved lane (furthermore, concerning the merge to the left, the bus lane is on the hardshoulder so that there is no need to ask other user to merge to the left).</p> <p>For HOV, ServiceCategoryCode shall be regulatory, nature shall be 1 and serialNumber shall be 34. (i.e "High occupancy vehicle lane" in TS14823)</p>  <p>(Réf. not in IISR, proposed by Guide "Aménagement des voies réservées" (Certu, october 2013))</p> <p>For bus lane, ServiceCategoryCode shall be regulatory, nature shall be 1 and serialNumber shall be 29. (i.e "Exclusive lane for route bus" in TS14823)</p>  <p>(Réf. B27a in IISR4 FR)</p>	by PF
extraText	S	S	<p>See Master I2V document / IVI. Presence of extraText without "/" shall not be done.</p> <p>Presence of extraText with "/" (subpanel of roadsign) is optional. It can complete the information give by the roadsign (e.g number of passenger required in HOV, text information "bus lane" for the bus lane, ...).</p>	by PF
Road Configuration Container		✓		
relevanceZoneIds	✓	✓	Each Rcc part is used for all zones in an IVIM that have the same characteristics. All those zones are listed here.	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
>validity	S	S	It may be provided if the hard shoulder is opened for a specific known duration for some vehicles for example.	by PF
>laneType	✓	✓	See Master I2V document / IVI.	by PF
>laneStatus	✓	✓	See Master I2V document / IVI.	by PF



IVI Master I2V statusIVI-transverse state		Profile <u>H4</u> (DLM-RL)		
Field	Status from transverse set (Master)	Status For the UC	Comments	Value set
<u>&gt;laneWidth</u>	<u>S</u>	<u>S</u>	<u>See Master I2V document / IVI.</u>	
<del>Road Configuration Container</del>				
<del>Text Container</del>			<u>Not used, it allows the receiver to distinguish between eVMS use case and this use case.</u>	
<del>Layout Container</del>				