

## French C-ITS Deployment Coordination committee

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

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### Activity 2: Studies

### Sub Activity 2.4 > Specifications

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## Information on the document

Document: Common technical specifications for use cases SCooP, InterCor, C-Roads - H4 Dynamic Lane Management - Reserved Lane

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## 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
Nfr-ITS-S	National french central ITS Station (national ITS station)
DENM	Decentralized Environmental Notification Message (réf. ETSI standard for C-ITS messages)
GPS	Global Positioning System
HOV	High occupancy vehicle
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. 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
Vru-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>

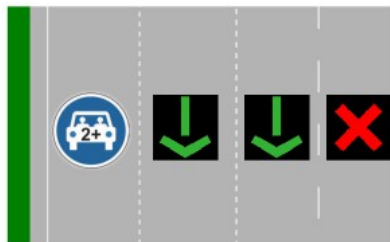
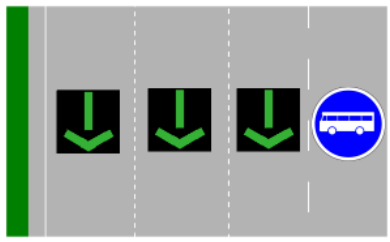
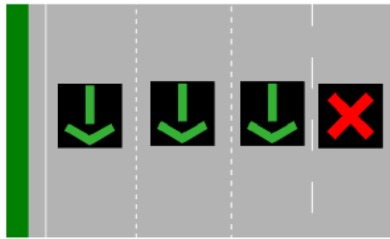
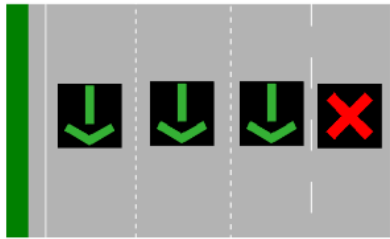
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# 1. Figure and example of IVI message for dynamic lane management - reserved lane

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

	High occupancy vehicle	Bus lane
Activated		
Disabled		

Message associated with figure bus lane / activated

```
#Description of IVI for FR for DynLaneMgt-ReservedLane UC (I2V)
#Linked with a figure
#Commented by A. AUDIGE (DIR A)

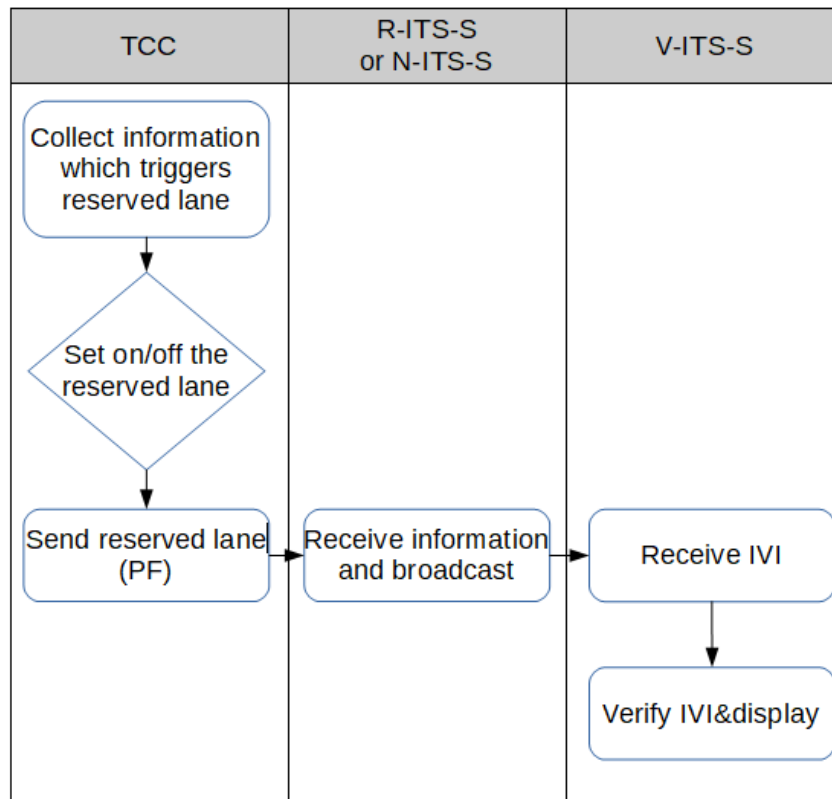
header {
  protocolVersion=1, #currentVersion'
  messageId=6, #IVI
  stationID=4711
},
ivi {
  mandatory {
    serviceProviderId {
      countryCode=10110 01010, #means 'FR'
      issuerIdentifier=10033 #DIRA
    },
    iviIdentificationNumber=123456789,
    timeStamp=352425600000,
    validFrom=352447200000,
    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=4095, #unavailable in the example
          semiMinorConfidence=4095, #unavailable in the example
          semiMajorOrientation=3601#unavailable in the example
        },
        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 road at the referencePosition, here wgs84East
  headingConfidence=127#unavailable
}
zone segment : {
  line deltaPositions : {
    {
      deltaLatitude=-6637,
      deltaLongitude=9289
    },
    {
      deltaLatitude=-5379,
      deltaLongitude=10567
    },
    {
      ... # number of point needs to be defined.Till 32 points possible (min 1 point)
    }
  }
}
},
{
  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 point needs to be defined.Till 32 points possible (min 1 point)
      }
    }
  }
}
},
},
gic : { #GIC = general Ivi container = description of the VMS
  { #First container = bus lane on hard shoulder
    detectionZonelds {1},
    relevanceZonelds {2},
    direction=0, #sameDirection
    applicableLanes {0},
    iviType=1, #regulatoryMessages
    roadSignCodes {
      {
        code iso14823 : {
          pictogramCode {
            serviceCategoryCode trafficSignPictogram : regulatory,
            pictogramCategoryCode {
              nature=1,
              serialNumber=29
            }
          }
        }
      }
    }
  },
  { #Second container = 3 lanes of green arrow
    detectionZonelds {1},
    relevanceZonelds {2},
    direction=0, #sameDirection
    applicableLanes {1,2,3},
    iviType=1, #regulatoryMessages,
    roadSignCodes {
      {
        code iso14823 : {
          pictogramCode {
            serviceCategoryCode trafficSignPictogram : informative,
            pictogramCategoryCode {
              nature=6,
              serialNumber=60
            }
          }
        }
      }
    }
  }
}
}
}

```

## 2. 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 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 message 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) :

The SCOOP PF 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 (ITSS-R or national ITSS-C) :

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

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 would be the same that for SCooP1 use-cases (10km area and ten hops).

**Receive IVI (vehicle) :** 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 **relevanceZone**ds long. To classify and prioritize the information between several IVI messages, the receiving vehicle may 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 :

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 by the fact that direction DE of IVI is "0" (sameDirection)).
5. **The vehicle checks the presence of applicableLanes in the general IVI container. It proves the IVI provide regulatory information by lanes.**
6. **Lane with trafficSignPictogram corresponding to green arrow or red cross are non specific lanes (no reserved lane).**  
**Whereas, Lane with trafficSignPictogram not corresponding to green arrow or red cross are specific lanes (reserved lane).**
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.

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

IVI transverse state		Profile DLM-RL		
Field	Status from transverse]	Status For the UC	Comments	Value set
<b>Header</b>				
<b>protocolVersion</b>			See Master document / IVI	
<b>messageID</b>			See Master document / IVI	(is 6)
<b>stationID</b>			See Master document / IVI	
<b>Management container</b>				
<b>serviceProviderId</b>			See Master document / IVI	
<b>iviIdentification Number</b>			See Master document / IVI	
<b>timestamp</b>			See Master document / IVI	
<b>validFrom</b>			See Master document / IVI	
<b>validTo</b>			See Master document / IVI	
<b>connectedIviStructures</b>				
<b>iviStatus</b>			See Master document / IVI	
<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>referencePositionSpeed</b>				
<b>parts</b>			See 5 next lines	

IVI transverse state		Profile DLM-RL		
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 regulated zone (similar to traces in DENM). Then, next zone Ids may be used to define "relevance zone(s)" in which the regulated situation 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) or at the next regulated section, where an other IVI should be generated to continue the same regulation or an other one.</b> Minimum is 2 zone an zone Id (e.g. one trace / detection zone and one eventHistory / relevance zone)	by PF
>laneNumber				
>zoneExtension				
>zoneHeading			<b>Heading direction of the carriageway at the point of referencePosition.</b> If unknown, the confidence is set to unavailable (127)	by PF
>zone			See Master document / IVI	
General IVI Application Container				
detectionZoneIds			See Master document / IVI	
its-rrid				
revelanceZoneIds			See Master document / IVI	
direction			See Master document / IVI	
driverAwareness ZoneIds				
minimumAwareness Time				
applicableLanes			Reserved lane is lane specific and all lanes shall be described one time through the whole IVI message.	
iviType			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				
laneStatus				
vehicleCharacteristics			<b>Not used because the information concerns all the lanes and so all vehicles. Some lanes are authorized, some not but not to all kind of vehicles (HOV or bus). It's interesting for common vehicles to know why they can see vehicles on the lane they are not authorized to take.</b>	
driverCharacteristics				
layoutId				
preStoredLayoutId				

IVI transverse state		Profile DLM-RL		
Field	Status from transverse]	Status For the UC	Comments	Value set
roadSignCodes	I	I	<p><i>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.</i></p> <p><i>- ServiceCategoryCode shall be informative, nature shall be 6 and serialNumber shall be 59 for a red cross (lane is closed).</i></p>  <p><i>- ServiceCategoryCode shall be informative, nature shall be 6 and serialNumber shall be 60 for a green arrow (lane is open).</i></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><i>For HOV, ServiceCategoryCode shall be regulatory, nature shall be 1 and serialNumber shall be 34. (i.e "High occupancy vehicle lane" in TS14823)</i></p>  <p>(Réf. not in IISR, proposed by Guide "Aménagement des voies réservées" (Certu, october 2013)</p> <p><i>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)</i></p>  <p>(Réf. B27a in IISR4 FR)</p>	
extraText	S	S	<p><i>Presence of extraText without "/" shall not be done.</i></p> <p><i>Presence of extraTex 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, ...).</i></p>	
Road Configuration Container	I			
Text Container	I			
Layout Container	I			