



French C-ITS Deployment Coordination committee

# Common technical specifications for use cases

## Traffic Jam Ahead (I2V)

### 2.4.1.2 M E7

**Activity 2: Studies**

Sub Activity 2.4 > Specifications

Version 0.10 (validated)

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## Information on the document

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## Publishing history

Date	Version	Author(s)	Updates & changes	Diffusion
25/06/2020	0.01	A. AUDIGÉ	First draft, for review	COCSIC Studies
26/08/2020	0.10	A. AUDIGÉ	Remarks from review integrated. Contributions of O. Nalin, C. Lauquin, E. Petit, MC. Esposito <b>Validated by COCSIC 2020-07.</b>	Partners

Black highlighted text are problem with standards.

The following legend is used on the document tables :

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 (**N**) 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 behaviour 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 term certificate authority)

ZZZ > is the numeration of the requirement

ID	2.4.X.XX-YYYY-ZZZ
Component(s)	(e.g) ITSS-VU, ITSS-VRO, ITSS-R, PKI
Requirement	(e.g) An ITS station <b>SHALL</b> be able to request and get a Long term Certificate (LTC) from the SCOOP Public Key Infrastructure (PKI).
Acceptance	(e.g) CA1 : ITSS-VU sends a LTC request to the LTCA CA2 : ITSS-R relays the LTC request CA3 : The LTCA verifies the request and sends a response CA4 : The ITSS-R relays the response CA5 : The response is received by the ITSS-VU and is valid
Additional information	

## Acronyms & abbreviations

<b>C-ITS</b>	Cooperative Intelligent Transport Systems
<b>CA</b>	Condition of acceptance
<b>DENM</b>	Decentralized Environmental Notification Message
<b>DE</b>	Data Element
<b>DF</b>	Data Field
<b>HLN</b>	Harzadous Location Notification
<b>ITS</b>	Intelligent Transport Systems
<b>Nfr-ITS-S</b>	French National ITS Station
<b>N-ITS-S</b>	National ITS Station
<b>PF</b>	Platform
<b>R-ITS-S</b>	Roadside ITS Station
<b>RW</b>	Road Works
<b>TCC</b>	Traffic Control Center
<b>TJA</b>	Traffic Jam Ahead
<b>TMS</b>	Traffic Management System
<b>UC</b>	Use Case
<b>V-ITS-S</b>	Vehicular ITS Station

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# 1. Example of situation

The use-case E7 is functionally fully described in the « 2.2 C-ITS French Use Cases Catalogue – Functional Description ». We can recall (as a reminder only) :

- Summary : Within his TCC a road operator detects a traffic jam, and sends the information to the road user, mentioning the positions, the length of the traffic jam, the duration necessary to cross the traffic jam and the section/ lanes concerned if the information are available.
- Objective : The objective of this use-case is to inform about an increased duration of the trip caused by a traffic jam. The driver can react by changing his itinerary and by adapting his speed approaching the traffic jam.
- Situation : The traffic jam can be on : one specific lane (e.g. at an exit of a motorway ) of a road ; on the whole section. The warning message is sent out to road users approaching the traffic jam area.

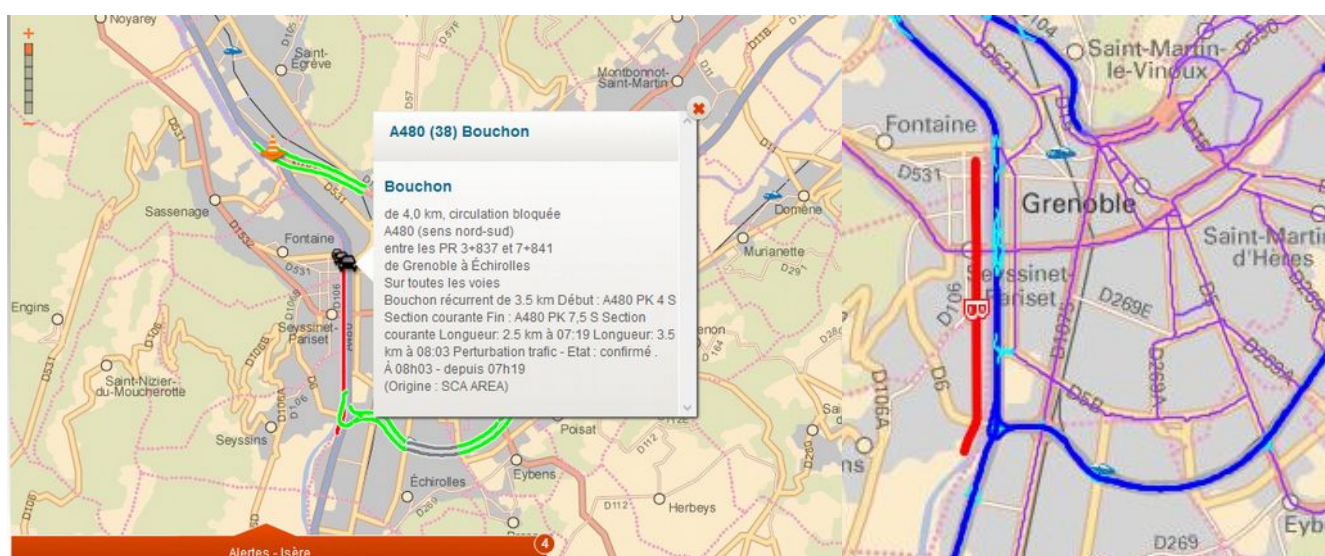
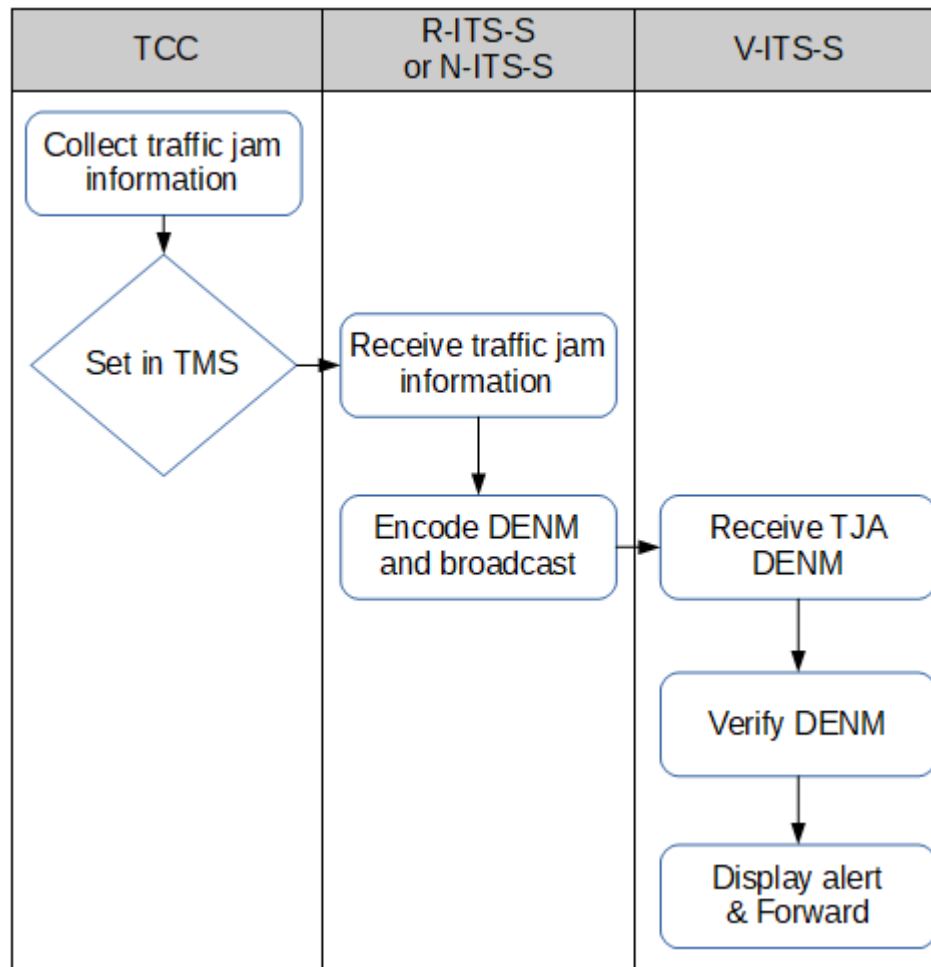


Figure : example of a traffic jam in A480

## 2. Step by step Diagram



**Collect traffic jam information:** information can be given to TCC by loops or radar detection, camera survey, patrol agent, ...

**Set information in TMS:** the queue of a traffic jam is moving. So, a zone in which the congestion is present shall be set in TMS (traffic management system of the traffic control center).

This zone starts upstream from the last known position of the queue. For example, the start of this linear event can be set before the previous road connector if this is relevant. So that other vehicles can choose to follow another route. This zone, set in the TMS, ends at the location where the vehicles can drive freely again at the legal speed. Both positions have to be set in TMS.

TMS provides data in Datex II to the PF.

**Receive traffic jam information (R-ITS-S or Nfr-ITS-S):** information incoming from PF is CITS-Datex II.

**Encode DENM and broadcast:** CITS-Datex II to DENM translation should be done in R-ITS-S and Nfr-ITS-S. Canals CCH for 100%-G5 scenario and SCH for hybrid scenario should be used (see 2.4.1\_M for more details). GeoNetwork dissemination and forwarding are described in 2.4.1.2\_M\_Master\_I2V.

**Receive TJA information (vehicle):** Architecture options are not treated in this document (see 2.4.1\_M). Anyway, whatever route G5 or cellular the information has followed, **DENM of an event shall have the same *actionID* and the same *detectionTime***. So that vehicle treats one message or the other, but not both of them.

**Verify DENM and display alert:** an alert should warn the driver he may encounter a traffic jam vehicle soon. The process of vehicle-receiver can be as followed:

1. The vehicle checks actionID and detectionTime to verify if event is already known, if it is a new event or if it is an update.
2. The vehicle checks validityDuration to know if event is still active.
3. The vehicle checks eventPosition to determine how far from its position the event is and calculate its time-to-event.
4. The vehicle checks causeCode / subCauseCode and relevanceTrafficDirection : it's a 1/0 (trafficCondition / unavailable) so the UC is TJA (E7).
5. The event is upstreamTrafficDirection. The vehicle checks traces. If vehicle is following one of traces, it is concerned by event. If not, the vehicle can also compare eventPositionHeading with its own heading and the way it is approaching the eventPosition (by rear) to determine if concerned or not (difference between headings should be more or less about +/- 30°).
6. If concerned, the vehicle displays the event before eventPosition to alert the driver (proper moment is car manufacturer domain) that he is going to encounter a traffic jam in the eventHistory zone.



### 3. Message profile

ID	2.4.1.2_M_E7-Infrastructure-DENMProfile
Component(s)	R-ITS-S and Nfr-ITS-S (for emission), V-ITS-S (for reception)
Requirement	The DENM transmitted by the infrastructure <b>SHALL</b> respect what's expected in the following table (DENM profile for E7).
Acceptance	Referring to the "Status for the UC" column in the table : CA1 : All mandatory <span style="color: green;">v</span> DE and used <span style="color: green;">u</span> DE shall be present in the message emitted, with the defined values. CA2 : All optional <span style="color: yellow;">s</span> DE can be present in the message emitted. See expected values in the table when defined. CA3 : All not used <span style="color: red;">x</span> DE shall be absent in the message emitted,
Additional information	At reception, V-ITS-S receiving a message with not used <span style="color: red;">x</span> DE shall not discard the message.

DENM Master_I2V status		Profile WWD		
Field	Status (Master)	Status For the UC	Comments	Value set
<b>Header</b>				
protocolVersion	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_I2V document / DENM	
messageID	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_I2V document / DENM	(is 1)
stationID	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_I2V document / DENM	
<b>Management container</b>				
actionID	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_I2V document / DENM	
detectionTime	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_I2V document / DENM	
referenceTime	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_I2V document / DENM	
termination	<span style="color: yellow;">s</span>	<span style="color: yellow;">s</span>	See Master_I2V document / DENM. Note that for this UC, as for many HLN, it is important that TCC close the event as soon as road operator knows it's ended.	
eventPosition >	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See 4 next lines and Master_I2V document / DENM <b>The road operator SHALL place the end point of the traffic jam zone sufficiently upstream to avoid that a queue occurs outside the declared zone.</b>	
>latitude	<span style="color: green;">v</span>	<span style="color: green;">v</span>	<b>Latitude of the end point of the traffic jam, placed upstream the zone in which vehicles can be stopped.</b>	
>longitude	<span style="color: green;">v</span>	<span style="color: green;">v</span>	<b>Longitude of the end point of the traffic jam, placed upstream the zone in which vehicles can be stopped.</b>	
>confidencePositionElipse	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_I2V document / DENM	
>altitude	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_I2V document / DENM	
relevanceDistance	<span style="color: red;">x</span>			
relevanceTrafficDirection	<span style="color: green;">u</span>	<span style="color: green;">u</span>	Is upstream the zone in which encountering a queue of traffic <span style="color: blue;">may</span> happen	is 1 (upStreamTraffic).
validityDuration	<span style="color: green;">v</span>	<span style="color: green;">v</span>	Generally, no end time is set on TMS for a TJA. See Master_I2V document / DENM for the implication. With a default value of 3600s (1 hour) for this UC.	
transmissionInterval	<span style="color: red;">x</span>			
stationType	<span style="color: green;">v</span>	<span style="color: green;">v</span>	See Master_I2V document / DENM	(is 15)

DENM Master_I2V status		Profile WWD		
Field	Status (Master)	Status For the UC	Comments	Value set
<b>Situation container</b>				
informationQuality	V	V	See Master_I2V document / DENM.  informationQuality should be set to 4 (probable) to take in account the fact that the road operator is not going to follow the traffic jam minute by minute. However, if the detection of congestion rely on an automatic system with high confidence rate, the informationQuality can be set to 6 (certain).	by RSU is 4 or 6
eventType	V	V	<b>The causeCode is set to 1 (trafficCondition).</b> <b>The subCauseCode is set to 0 (unavailable)</b>	is 1/0
linkedCause	S	S	If the traffic jam is related to an event (e.g stationary vehicle or breakdown or an accident), it can be interesting to have this information here.	
eventHistory	U	U	See Master_I2V document / DENM  The eventHistory covers the zone in which there is a traffic jam, from somewhere upstream the queue point (i.e eventPosition) to the head of the congestion zone (i.e location where the vehicles can progress freely at the legal speed)	
<b>Location container</b>				
eventSpeed	X			
eventPositionHeading	S	S	<b>When given, set as the drive direction at eventPosition.</b> See Master_I2V document / DENM	from TMS
traces	V	V	Sequence of delta position from event position to "start" of each trace. See Master_I2V document / DENM	by PF
roadType	S	S	See Master_I2V document / DENM	
<b>À la carte container</b>				
lanePosition	S	S	Given if relevant (i.e the congestion is not on all lanes) and doable	
impact	X			
Reduction (DF)	X			
external	X			
Temperature	X			
roadWorks (DF)	S	X	Not needed for this UC, not appropriate (not a RW UC)	
positioning	X			
Solution	X			
stationary	X			
Vehicle (DF)	X			