



## French C-ITS Deployment Coordination committee

# TMS Specifications

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## Deliverable 2.4.3.1\_H

### Activity 2: Studies

### Sub Activity 2.4 > Specifications

Version 4.00

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# 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.) Vru-ITS-S, Vro-ITS-S, R-ITS-S, PKI
Requirement	(e.g.) An ITS station SHALL be able to request and get a Long-Term Certificate (LTC) from the SCOOP Public Key Infrastructure (PKI).
Acceptance	(e.g.) CA1: Vru-ITS-S sends a LTC request to the LTCA CA2: R-ITS-S relays the LTC request CA3: The LTCA verifies the request and sends a response CA4: The R-ITS-S relays the response CA5: The response is received by the Vru-ITS-S and is valid
Additional information	

## Acronyms & abbreviations

<b>CAM</b>	Cooperative Awareness Message
<b>C-ITS</b>	Cooperative Intelligent Transport Systems
<b>DENM</b>	Decentralized Environmental Notification Message
<b>e-VMS</b>	Embedded variable message sign
<b>GN</b>	Geo Networking
<b>GPS</b>	Global Positioning System
<b>ITS</b>	Intelligent Transport Systems
<b>IVI</b>	Infrastructure to Vehicle Information
<b>IVIM</b>	Infrastructure to Vehicle Information Message
<b>PFro</b>	Platform road operator
<b>POI</b>	Point of interest
<b>R-ITS-S</b>	Roadside ITS Station (RSU in the French Terminology)
<b>RIU</b>	Référentiel InterUrbain
<b>RWW</b>	Roadworks Warning
<b>s</b>	Seconds
<b>TCC</b>	Traffic control centre (old name for TMS)
<b>TMS</b>	Traffic Management System (new name for TCC)
<b>Virtual sensors</b>	Virtual sensors are created via R-ITS-S and are able to collect traffic information on defined superficies.
<b>VMS</b>	(Physical) Variable message sign
<b>Vru-ITS-S</b>	Vehicule road user – ITS Station
<b>Vro-ITS-S</b>	Vehicule road operator – ITS station

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# 1. Introduction

## 1.1 Presentation

This document specifies the requirements that TMS shall comply in order to achieve the different use cases in the French C-ITS projects.

In this document, TMS refers to all the software used by the road operator to manage his events, VMS, or traffic data. It can be one system or several. It can be his own, a local one, a distant one or TIPI.

PFro refers to the Local Platform for C-ITS specified in 2432H deliverable.

Deliverable 2414H specified the DATEX II messages.

## 1.2 Architecture

C-ITS projects components shall designate all physical components that enable users to produce or exchange the messages required in order to achieve the use cases. They are listed in the deliverable 2.4.1\_H.

The core components of the cooperative systems are the ITS stations (ITS-S) as defined in the standard ETSI EN 302 665.

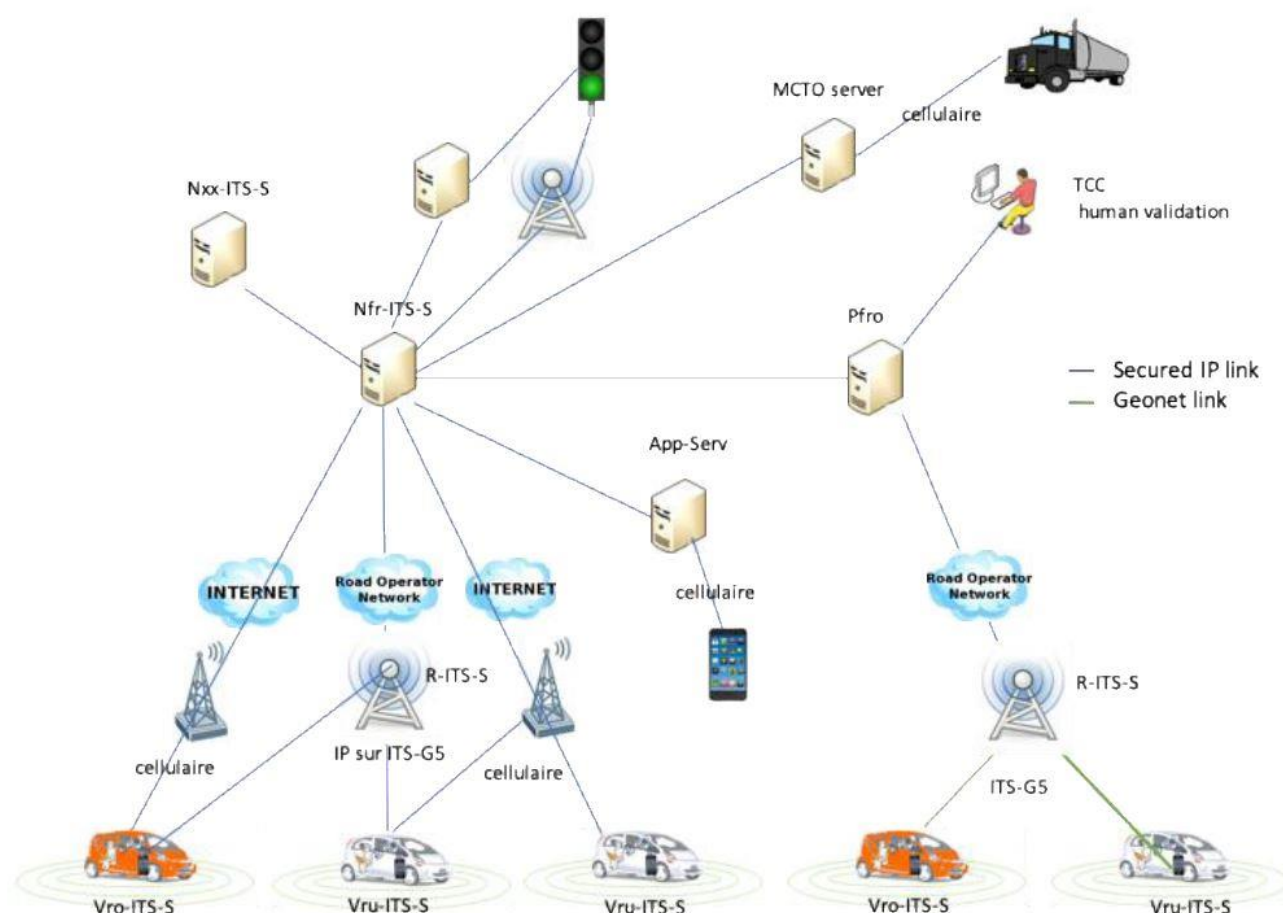


Figure 1 – General functional and communication architecture (extract from 2.4.1\_H)

## 1.3 Simplified communication architecture

This simplified diagram describes the exchange between the different information systems. It also indicates the exchange formats selected.

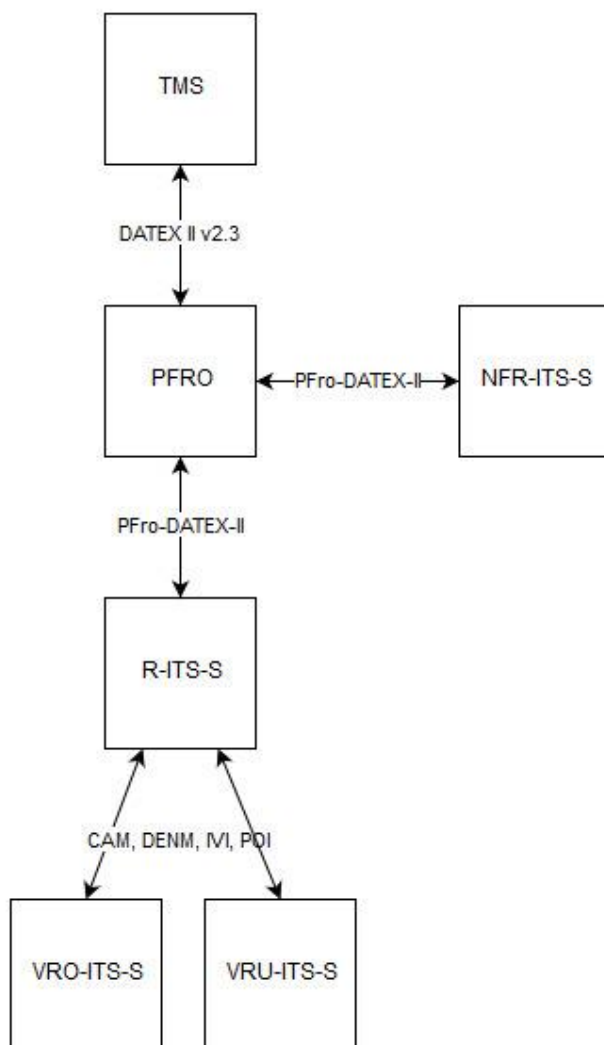


Figure 2 – Exchange

As specified below, exchange between TMS and PFro are done with web services forwarding DATEX II v2.3 files.

R-ITS stations and PFro exchange PFro-DATEX-II files defined through “DATEXIISchema\_2\_2\_3\_C-ITS-SDateX.xsd” file, which can be found in sixth annex of 2.4.1.4 deliverable.

## 1.4 List of relevant use cases

Use cases functionally described in the catalog	Vru-ITS-S → R-ITS-S → Pfro → TMS	Vro-ITS-S → R-ITS-S → Pfro → TMS	TMS → Pfro
<b>A – Probe Vehicule data</b>			
A1 – Traffic data collection	✓		
A2 – Data on detected events	✓	✓	
A3 – Data on declared events	✓	✓	
<b>B – Road Works Warning</b>			
B1a - Alert neutralization of part of a lane, whole lane, several lanes			✓
B1b – Alert planned closure of a road or a carriageway			✓
B1c – Alert planned road works – mobile			✓
B2a&b&c - road operator's intervention		✓	
B2d - Alert end of queue by a road operator vehicle		✓	
B3a&b&c – Winter maintenance		✓	
<b>B4, B5 – Dangerous Vehicle approaching a road works</b>			
B6 – Road works warning for automated vehicles			✓
<b>C – Signage applications</b>			
C2 – In-vehicle dynamic speed limit information			✓
C3 – In-vehicle signage			✓
<b>C4, C5, C6 – Toll station approaching</b>			
<b>D – Hazardous location notifications</b>			
D1 – Temporary slippery road	✓		✓
D2a&b – Animal or people on the road	✓		✓
D3 – Obstacle on the road	✓		✓
D4 – Alert stationary vehicle / breakdown	✓		✓
D5 – Alert accident area	✓		✓
D6 – Alert reduced visibility	✓		✓
D7 – Alert wrong way driving			✓
D8 – Unmanaged blockage of a road	✓		✓
D9 – Alert temporary mountain pass route closure			✓
D10 – Alert emergency brake	✓		
D11 – Alert end of queue	✓	✓	✓
D12 – Emergency vehicle approaching			
D13 – Longitudinal Collision risk warning			
<b>E - Traffic information and smart routig</b>			
E1 – Traffic information about snow on the road			✓
E2 – Rerouting			✓
E3 – Smart routing			
E4 – Smart POI			✓
E5 – Travel times of heavy goods vehicule			✓
E6 – Alert extreme weather conditions	✓		✓
<b>F – Parking, park and ride, multimodality</b>			
F1 – Information on parking lots location, availability and services			✓
F2 – Parking lots location and availability: break time indication			✓
F3 – Information about the schedule of the next public transport			
F4 – Information about the schedule of the next public transport			
F5 – Modal transfer advice			
F6 – Reservation of a parking space released by a user			

F7 – Information about a parking space releaser by a user			
<b>G – Intersection</b>			
G1 – GLOSA			✓
G2 – Traffic signal priority request by designated vehicles			
G3 – Intersection violation: Warning to the violator vehicle			
G4 – Intersection violation: Warning to approaching vehicle			
<b>H – Traffic management</b>			
H1 – Permanent traffic ban to specific vehicle			✓
H2 – Dynamic traffic ban to specific vehicles			✓
H3 – Dynamic lane management			✓
H4 – Dynamic lane management – reserved lane (I2V)			✓
H5 – Dynamic lane assignement			✓
H6 – Hover taking ban			✓
<b>I – Vulnerable users</b>			
I1 – Pedestrian at signalized intersection: warning to vehicle			
I1 – Pedestrian at signalized intersection: warning to pedestrian			
I3 – road workers in the field			
<b>J – Multimodal Cargo Transport Optimization</b>			
J1 – Truck ETA in the Terminal			
J2 – Assigning a slot to a given vehicle for cross-channel traffic	✓ <sup>1</sup>		
J3 – Information on the site-s access conditions			✓
J4 – Guide the truck in the port (Terminal or truck parking)			
<b>K – Level crossing</b>			
K1 – Level crossing out of order			
K2 – Level crossing approaching			
K3 – Level crossing in process of closing			
K4 – Detection of a vehicle in distress in a critical area			✓

In the French C-ITS projects, some use cases concern only vehicle-to-vehicle messages, automatic generated messages or messages not generated by the road operator. Consequently, there are not treat in this document.

New use cases could be added later. This table is based on the version 4.2 of the “C-ITS French Use Cases Catalog Functional descriptions” deliverable (March 7<sup>th</sup>, 2019). To get all use cases, look at the last version of “C-ITS French Use Cases Catalog Functional descriptions” deliverable.

<sup>1</sup> Message is forwarded by PFRO to TMS, but PFRO can have received this message from terminal operator or logistic hubs instead of usual Vru-ITS-S

## 2. Generalities for all the use cases

### 2.1 Technical considerations

The interfaces between TMS and the local PFro are developed outside the local PFro.

<b>ID</b>	<b>2.4.3.1_H-EXCHANGE-001</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	Exchange between TMS and PFro shall be done in DATEX II v2.3, according to the 2.4.1.4&co deliverables.
<b>Acceptance</b>	Analyse XML file with DATEX II v2.3 XSD dictionary.
<b>Additional information</b>	

*Rule 1 - 2.4.3.1\_H-EXCHANGE-001*

<b>ID</b>	<b>2.4.3.1_H-EXCHANGE-002</b>
<b>Component(s)</b>	TMS, PFro, ITS-S
<b>Requirement</b>	Name, nationalIdentifier, Id shall not change. TMS shall use the same identifiers during processes.
<b>Acceptance</b>	
<b>Additional information</b>	All road operator databases, including the local PRFRO, shall be consistent, when delivering messages to platform or ITS stations, especially about the identification (name, nationalIdentifier, Id ...) of the physical or logical components.

*Rule 2 - 2.4.3.1\_H-EXCHANGE-002*

<b>ID</b>	<b>2.4.3.1_H-COMMUNICATION-001</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	Concerning exchange between PFro and TMS, the web service with a SOAP envelope shall be used in push on occurrence with acknowledgement of receipt.
<b>Acceptance</b>	Check the pushed data are in the log.
<b>Additional information</b>	PFro should log requests and answers.

*Rule 3 - 2.4.3.1\_H-COMMUNICATION-001*

### 2.2 Time considerations

The time synchronization is a major factor for C-ITS exchange. Messages **will** be dropped out by platform, if their timestamp is considered as "out of date".

<b>ID</b>	<b>2.4.3.1_H-EXCHANGE-003</b>
<b>Component(s)</b>	TMS, PFro, ITS-S
<b>Requirement</b>	The time synchronization of all components, included TMS, shall be based on a timeserver through a NTP protocol.
<b>Acceptance</b>	Check time in the system log
<b>Additional information</b>	

*Rule 4 - 2.4.3.1\_H-EXCHANGE-003*

<b>ID</b>	<b>2.4.3.1_H-EXCHANGE-004</b>
<b>Component(s)</b>	TMS, PFro, ITS-S
<b>Requirement</b>	The time synchronization shall be periodic.
<b>Acceptance</b>	Check each synchronization in the system log
<b>Additional information</b>	If PFro is deployed on a network without internet access, TMS don't have to change its security strategy, but the PFro and TMS shall be synchronized regularly. As example, timeserver could be synchronized via GNSS.

*Rule 5 - 2.4.3.1\_H-EXCHANGE-004*

ID	2.4.3.1_H-EXCHANGE-005
Component(s)	TMS
Requirement	The TMS shall provide timestamps in the Universal Time Coordinated (UTC).
Acceptance	Check time in DATEX II message is in UTC (GMT +0)
Additional information	

#### Rule 6 - 2.4.3.1\_H-EXCHANGE-005

According its policies, TMS is free to accept DATEX II content from platform whatever the time between current timestamp and message timestamp.

PFro **can** ignore TMS Datex II v2.3 files when they are outdated. Admissible time between PFro and other systems are defined in 2.4.3.2\_H document.

## 2.3 Map consideration

The coordinate system is WGS84 in the C-ITS vehicle.

ID	2.4.3.1_H-MAP-001
Component(s)	TMS
Requirement	The TMS <b>shall</b> use WGS84 or ETRS89 (as for RIU).
Acceptance	Check coordinate system in DATEX files logged
Additional information	The coordinate system called "Lambert93" shall not be used in C-ITS projects. The points are too different. Translation software can be used by the TMS to send appropriate coordinates.

#### Rule 7 - 2.4.3.1\_H-MAP-001

*Note: the difference between one point in WGS84 and the same in ETRS89, in France, is up to 30 cm. This distance is acceptable for C-ITS project, as we consider that the GPS distance is up to 2m.*

*Note: TIPI software documentation mention EPSG:4326 which is equal to WGS84.*

*Note: DATEX II does not provide the name of the used coordinate system.*

The operator shall be aware of the gaps, when existing, between their input in HMI and the GPS localization.

## 2.4 About DATEX II messages

For the use cases using DATEX norm (most of them), the TMS **shall**<sup>2</sup> send messages in DATEX II v2.3 to the PFro.

<b>ID</b>	<b>2.4.3.1_H-EXCHANGE-006</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	Each DATEX II message from the TMS <b>shall</b> contain one and only one type of publication ( <i>situation of the same type</i> ). These publication can contain several classes ( <i>situationRecord</i> )
<b>Acceptance</b>	Inspect type unicity constraint in the system log
<b>Additional information</b>	These publications can contain several classes, but they shall all be of the same type: <ul style="list-style-type: none"> <li>Only situations, with several situation record, for DENM-based use cases,</li> <li>Only VMS messages for IVI-based use cases,</li> <li>Only Parking publication for Parking-based use cases.</li> </ul>

Rule 8 - 2.4.3.1\_H-EXCHANGE-006

Examples:

- a message can contain an accident, an obstruction, and an animal,
- a message can contain a VMS message about the speed limit, and a VMS message about pollution,
- but a message cannot contain an accident and a VMS message.

Currently, PFro **supports** an aggregation of "SituationRecord", but it **does not support** a message containing more than one situation, except for snapshots described in "2.5.2 - TMS snapshots page 16".

<b>Datex-II File</b>	<b>Content</b>	<b>Decision</b>
<b>Case A : 1 publication containing one class.</b>	<pre>&lt;situation1&gt;   &lt;situationRecord Type1/&gt; &lt;/situation1&gt;</pre>	Valid
<b>Case B1 : 1 publication containing multiple classes.</b>	<pre>&lt;situation1&gt;   &lt;situationRecord Type1/&gt;   &lt;situationRecord Type2/&gt;   &lt;situationRecord Type3/&gt; &lt;/situation1&gt;</pre>	Valid with restriction on location. (cf. §4.3 - Map consideration: Multiple location page 25)
<b>Case B2 : 1 type of publication containing multiple classes.</b>	<pre>&lt;situation1&gt;   &lt;situationRecord Type1/&gt;   &lt;situationRecord Type1/&gt;   &lt;situationRecord Type2/&gt; &lt;/situation1&gt;</pre>	Valid with restriction on location. (cf. §4.3 - Map consideration: Multiple location page 25)
<b>Case C: Multiple publications of the same type</b>	<pre>&lt;situation1 Type1/&gt; &lt;situation2 Type1/&gt; &lt;situation3 Type1/&gt;</pre>	Valid only for snapshots.

<sup>2</sup> See 2.4.3.1\_H-EXCHANGE-001 rule.

## 2.5 Resumption of activity, synchronization and snapshots

### 2.5.1 Keep alive strategy

The PFro implements a keep alive strategy as described in 2.4.3.2\_H<sup>3</sup>.

The TMS **shall** implement keep alive strategies with PFro as described in the rules above.

#### Keep alive message pushed by TMS to PFro

ID	2.4.3.1_H-KEEP-ALIVE-001
Component(s)	TMS, PFro
Requirement	Regularly, TMS <b>should</b> emit keep-alive messages to verify connections between PFro and TMS.
Acceptance	Handle and inspect keep-alive messages in the system log
Additional information	

Rule 9 - 2.4.3.1\_H-KEEP-ALIVE-001

ID	2.4.3.1_H-KEEP-ALIVE-002
Component(s)	TMS, PFro
Requirement	Time between two pushed keep-alive messages <b>shall</b> be updatable.
Acceptance	Handle and inspect keep-alive messages in the system log
Additional information	

Rule 10 - 2.4.3.1\_H-KEEP-ALIVE-002

#### Keep alive message pushed by PFro to TMS

At any time, PFro send a keep alive message to TMS.

ID	2.4.3.1_H-KEEP-ALIVE-003
Component(s)	TMS, PFro
Requirement	TMS shall reply to each keep alive messages received from PFro.
Acceptance	Handle and inspect keep-alive messages in the system log
Additional information	

Rule 11 - 2.4.3.1\_H-KEEP-ALIVE-003

### 2.5.2 TMS snapshots requested by PFro

The PFro **will** ask the TMS for snapshots as described in 2.4.3.2\_H<sup>4</sup> deliverable. Each request sent by PFro will mention one of this kind of snapshot:

- "Events snapshot",
- "VMS snapshot",
- "POI snapshot".

ID	2.4.3.1_H-SNAPSHOTS-001
Component(s)	TMS, PFro
Requirement	When TMS received a request of "event snapshots" from the PFro, TMS <b>shall</b> reply with a DATEX file containing all current events.
Acceptance	Handle and inspect messages in the system log
Additional information	TMS should log requests and answers.

Rule 12 - 2.4.3.1\_H-SNAPSHOT-001

ID	2.4.3.1_H-SNAPSHOTS-002
Component(s)	TMS, PFro
Requirement	When TMS received a request of "VMS snapshot" (use case C2) from the PFro, TMS <b>shall</b> provide a VMS publication DATEX-II messages containing all current VMS publication ("VMSPublications" situation records).
Acceptance	Analyse PFro logs.

<sup>3</sup> Cf. rule: 2432\_H-COMMUNICATION-003

<sup>4</sup> Cf. rule: 2432\_H-COMMUNICATION-002



<b>Additional information</b>	TMS should log requests and answers. <i>Rule 13 - 2.4.3.1_H-SNAPSHOT-002</i>
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<b>ID</b>	<b>2.4.3.1_H-SNAPSHOTS-003</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	When TMS received a request of "VMS snapshot" (use case C2) from the PFro, TMS <b>shall</b> provide the VMS table publication too ("VMSTablePublication" situation records).
<b>Acceptance</b>	Handle and inspect messages in the system log
<b>Additional information</b>	TMS should log requests and answers. <i>Rule 14 - 2.4.3.1_H-SNAPSHOT-003</i>

<b>ID</b>	<b>2.4.3.1_H-SNAPSHOTS-004</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	When TMS received a request of "POI snapshot" (use case F) from the PFro, TMS <b>shall</b> provide a POI publication DATEX-II messages containing all current POI information ("VMSPublications" situation records).
<b>Acceptance</b>	Handle and inspect messages in the system log
<b>Additional information</b>	TMS should log requests and answers. <i>Rule 15 - 2.4.3.1_H-SNAPSHOT-004</i>

<b>ID</b>	<b>2.4.3.1_H-SNAPSHOTS-005</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	When TMS received a request of "POI snapshot" (use case F) from the PFro, TMS <b>shall</b> provide the main POI/parking table too..
<b>Acceptance</b>	Handle and inspect messages in the system log
<b>Additional information</b>	TMS should log requests and answers. <i>Rule 16 - 2.4.3.1_H-SNAPSHOT-005</i>

<b>ID</b>	<b>2.4.3.1_H- COMMUNICATIONS-002</b>
<b>Component(s)</b>	PFro, TMS
<b>Requirement</b>	Concerning exchange between PFro and TMS, the web service with a SOAP envelope shall be used in pull for snapshots asked by PFro
<b>Acceptance</b>	Check reception of snapshot in the log
<b>Additional information</b>	TMS should log requests and answers. <i>Rule 17 - 2.4.3.1_H - COMMUNICATIONS-002</i>

## 2.5.3PFro snapshots requested by TMS

To stay synchronised with PFro, the TMS **should** ask the PFro for snapshots for all events, operator action and traffic data.

<b>ID</b>	<b>2.4.3.1_H- SNAPSHOTS-006</b>
<b>Component(s)</b>	TMS
<b>Requirement</b>	When requiring snapshots, TMS shall sent one SOAP requests of a specified type of messages
<b>Acceptance</b>	Analyse snapshot requests and log type asked
<b>Additional information</b>	Specified type can be : <ul style="list-style-type: none"> <li>• a snapshot of events,</li> <li>• a snapshot of VMS<sup>5</sup>,</li> <li>• a snapshot of POI<sup>6</sup>,</li> <li>• a snapshot of virtual sensors<sup>7</sup>.</li> </ul> <i>Rule 18 - 2.4.3.1_H-SNAPSHOT-006</i>

<b>ID</b>	<b>2.4.3.1_H- COMMUNICATIONS-003</b>
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<sup>5</sup> PFro returns VMS publications, but does not return VMS table publications.

<sup>6</sup> PFro returns POI publications, but does not return POI table publications.

<sup>7</sup> PFro returns only sensor table publications. It does not return last aggregated data.

---

<b>Component(s)</b>	PFro, TMS
<b>Requirement</b>	The web-service with a SOAP envelope <b>shall</b> be used in push for snapshot.
<b>Acceptance</b>	Check reception of snapshot in the log
<b>Additional information</b>	PFro should log requests and answers.

*Rule 19 - 2.4.3.1\_H - COMMUNICATIONS-003*

The PFro **will** reply to each snapshot request sent by TMS as described in 2.4.3.2\_H deliverable.

### 3. Specificities for uplink messages from the platform

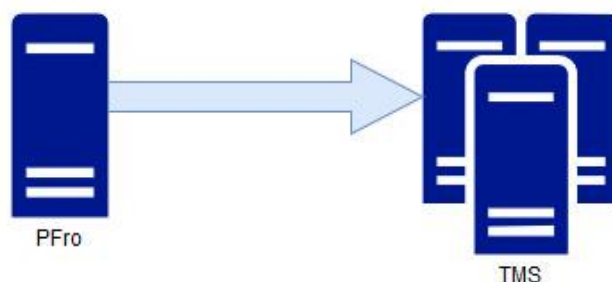


Figure 3 – Uplink messages

The PFro analyses PFro-DATEX-II messages received from the ITS stations and creates DATEX II v2.3 messages which are sent to the TMS. The PFro projects the location (X,Y) on the network of the road operator (Axe+PR+Sens<sup>8</sup>). PFro generates a DATEX II v2.3 message then PFro sends messages to the TMS.

#### 3.1 Lifecycle DATEX II files reception.

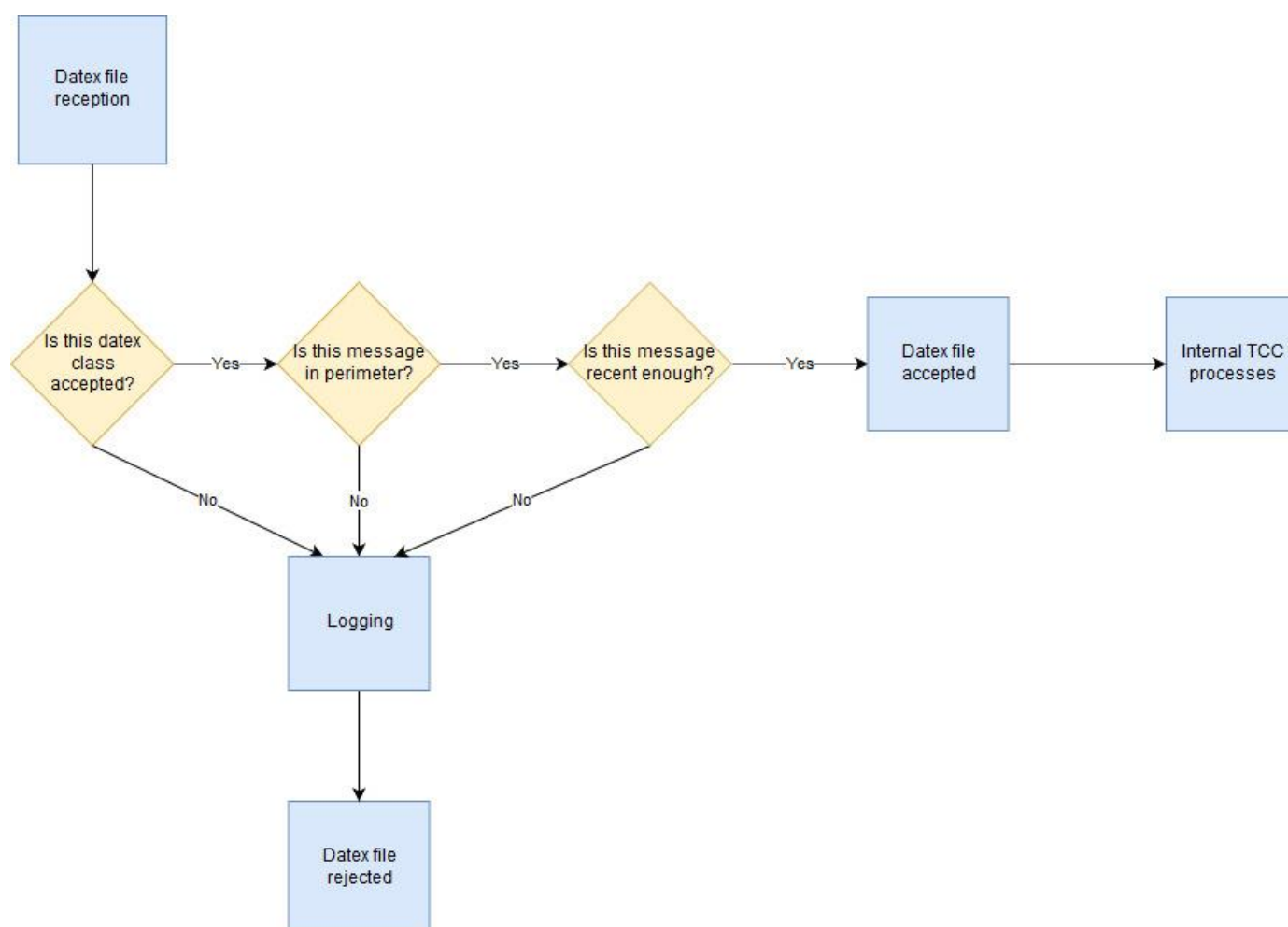


Figure 4 – Lifecycle DATEX II files reception

<sup>8</sup> AXE+PR+Sens : Axis, location point and cap (1, 2 or 3).

TMS dispatches a web service as described in 2.4.3.2\_H to receive information submitted by PFro. When TMS is receiving an event:

- TMS **should** check that the situation record is accepted (depending its own policies),
- TMS **should** check that the event is in the perimeter<sup>9</sup> of the road operator,
- TMS **should** check that the event is not outdated,

If DATEX II message is not accepted by TMS, TMS **should** log data about the reject as:

- the reason of the reject,
- the content of the rejected DATEX II file.

If use case is accepted, TMS **should** analyse data and launch internal processes, like operator notification, automatic action plan, etc.

ID	2.4.3.1_H-UPDATE-001
Component(s)	TMS
Requirement	If a DATEX file is rejected, the TMS <b>shall not</b> forward event modification to the PFro nor forward DATEX II file to close the event.
Acceptance	
Additional information	

*Rule 20 - 2.4.3.1\_H-UPDATE-001*

<sup>9</sup> Some TMS shall test the perimeter because PFRO can provide DATEX II messages for a pool of TMS, like in DIR-Ouest TMS. There is two operators connected to the platform.

## 4. Specificities for downlink messages (from TMS)

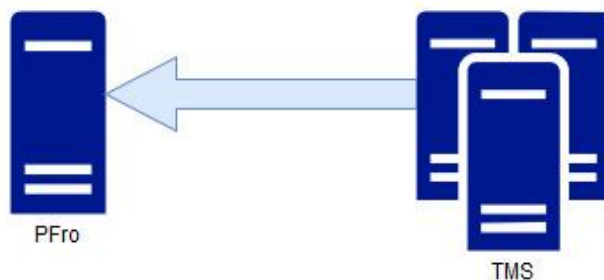


Figure 5 – Downlink messages

Downlink messages concern messages from the TMS to the PFro. Here is an example for DATEX-II events which are transformed into DENM messages.

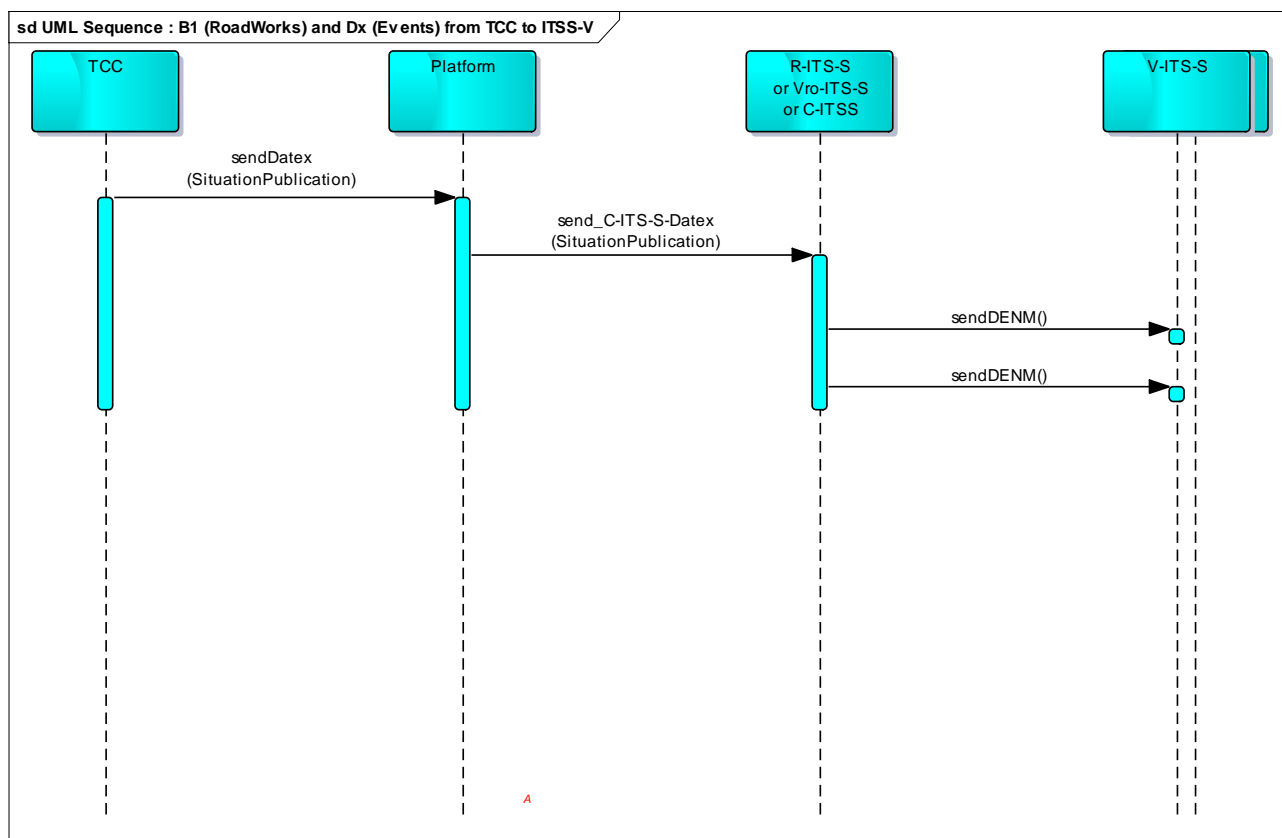


Figure 6 – Downlink full flow for DENM messages translated by R-ITS-S (from 2.4.1.4\_H deliverable)

The construction of DATEX II v2.3 message of event data is described in 2.4.1.4\_H deliverable.

## 4.1 Lifecycle for events

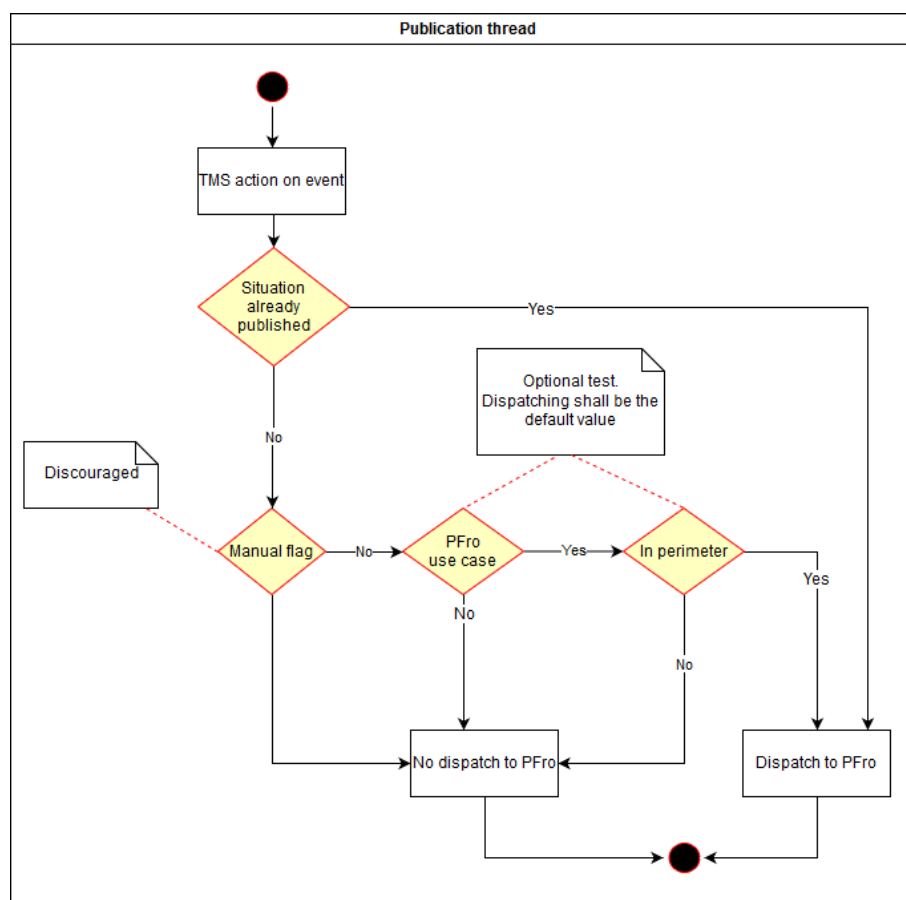


Figure 7 – Lifecycle for events

According to TMS policy, the TMS **should** implement settings to define which use case are sent to the PFro. Operator is able to select which kind of event are forwarding, especially during qualification process or just after a TMS production update or a PFro update.

According to TMS policy, the TMS **should** implement settings to define its perimeter of publication. So, depending event location, TMS can decide to publish or not DATEX-II file to the PFro.

According to TMS policy, the TMS **should** implement a parameter to decide which event are sent or not. Therefore, depending the situation, operator can force to push or block the Datex-II file to the PFro.

ID	2.4.3.1_H-PUBLICATION-001
Component(s)	TMS, PFro
Requirement	Anyway, if an event has been sent to the PFro by TMS, this TMS <b>shall</b> dispatch each updating and closing messages to the PFro.
Acceptance	
Additional information	

Rule 21 - 2.4.3.1\_H- PUBLICATION-001

## 4.2 Lifecycle for VMS and POI messages

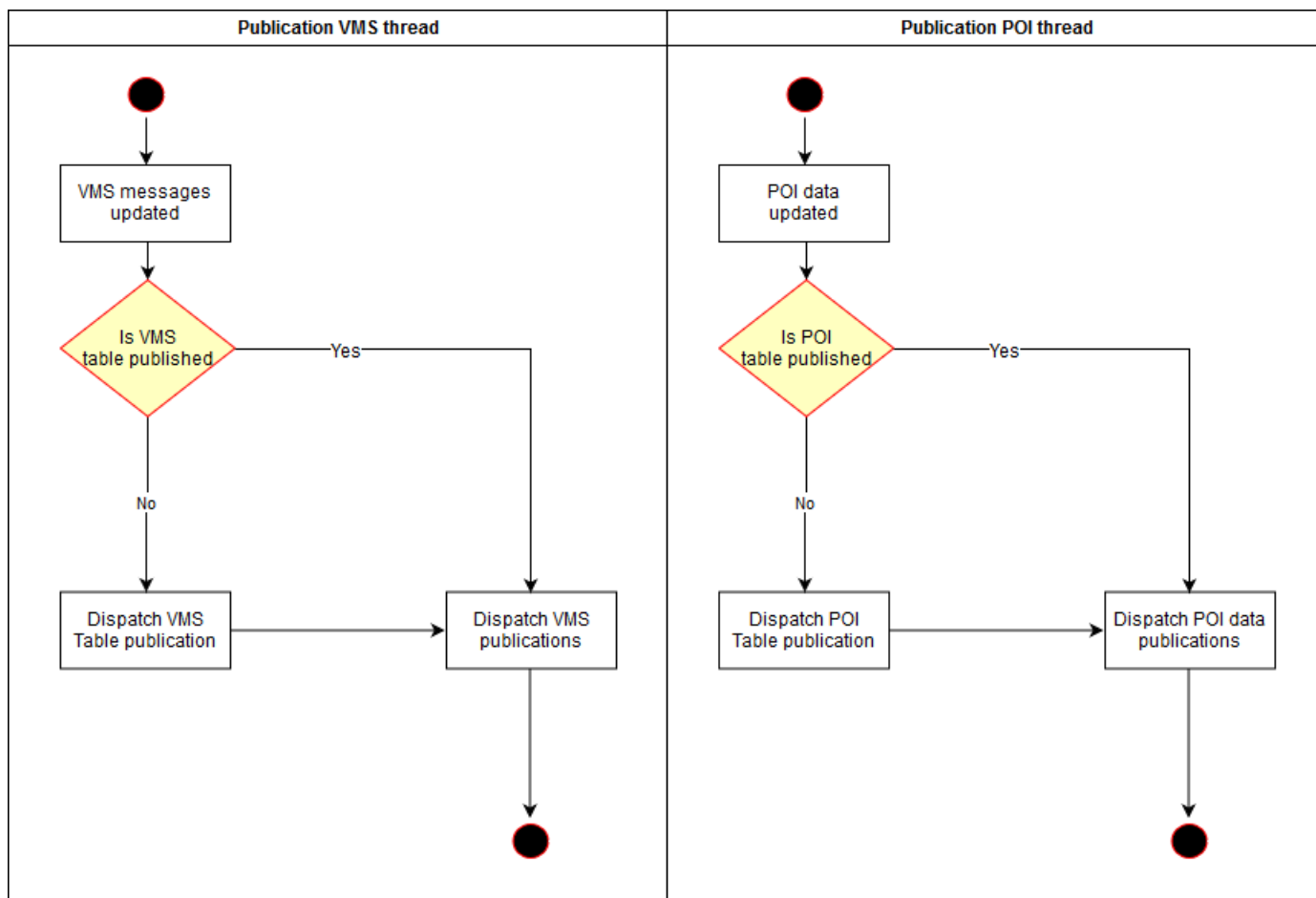


Figure 8 – Lifecycle for VMS and POI messages sent to PFr

According to the §0 -

C3 use case – e-VMS use case page 38 and §9 - Specificities for parking use case (Use cases F) page 39, TMS shall send POI/VMS table publication before sending POI/VMS publications. These two paragraphs described rules.



## 4.3 Map consideration: Multiple location

Multiple location is possible in DATEX II v2.3 and in some TMS. In the uplink (from PFro to TMS), no use case are using "multilocation". But in downlink (from TMS to PFro), "multilocation" event could happen like a road work on multiple axes.

For example:

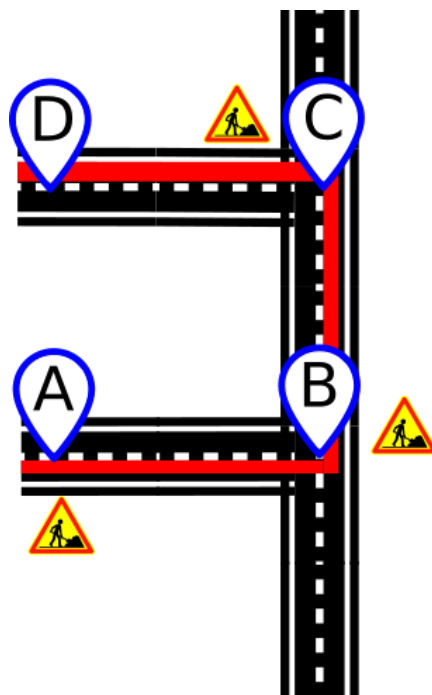


Figure 9 – Multiple location in a roadworks

The PFro **cannot** handle this multiple location. In this example, DatexII v2.3 norm **recommends** to use one situation, containing one situationRecord containing three localisations.

```
<situation>
  <situationRecord>
    <location1> <!-- From A to B -->
    <location2> <!-- From B to C -->
    <location3> <!-- From C to D -->
  </situationRecord>
</situation>
```

Currently, PFro **is not able to** understand multiple locations, TIPI neither. DatexII-France discourages to use the above example.

<b>ID</b>	<b>2.4.3.1_H-MULTILOCATION-001</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	The TMS <b>shall</b> construct a DATEX II message containing as many situation records as locations.
<b>Acceptance</b>	
<b>Additional information</b>	If it is impossible, TMS shall respect the 2.4.3.1_H-MULTILOCATION-002 rule.

Rule 22 - 2.4.3.1\_H-LOCATION-001

For the above example, TIPI and some TMS are sending a DATEXII file containing multiple situation records, like the below truncated XML node:

```
<situation>
```

```

<situationRecord1>
  <location1> <!-- From A to B -->
</situationRecord1>
<situationRecord2>
  <location2> <!-- From B to C -->
</situationRecord2>
<situationRecord3>
  <location3> <!-- From C to D -->
</situationRecord3>
</situation>

```

With the below DATEX-II file, PFro will create only one DENM which eventCode is equal to the situationRecord1 type. PFro will use information in situationRecord2, but will ignore localisation2. Currently, TMS shall order situation record in DATEX-II file. The first segment shall be the first on the driver way. In the above example, the location from A to B shall be the first situation record in the XML Datex-II file.

<b>ID</b>	<b>2.4.3.1_H-MULTILOCATION-002</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	When TMS is sending a Datex II file containing multiple situation records of the same type, TMS shall order situation record. The situation record containing the first point on the driver way shall be the first in list.
<b>Acceptance</b>	
<b>Additional information</b>	

#### Rule 23 - 2.4.3.1\_H-LOCATION-002

*This solution is temporary, because drivers coming from the south will never be alerted about roadworks.*

It implies that the ITS-stations can receive up to three messages for the illustrated roadworks.

Note: when receiving a multi-location, or a non-understandable location, the PFro removes the non-managed location and sends a light message of type "roadworks" to the ITS-station (only a linear event to provide a basic Roadwork DENM).

<b>ID</b>	<b>2.4.3.1_H-MULTILOCATION-003</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	The TMS <b>should</b> send one Datex-II file for each location
<b>Acceptance</b>	
<b>Additional information</b>	

#### Rule 24 - 2.4.3.1\_H-LOCATION-003

Currently, to avoid this unavailable functionality, the TMS should send one Datex-II file for each location like in this example:

File1:

```
<situation1><situationRecord1><location1></situationRecord1></situation1>
```

File2:

```
<situation2><situationRecord2><location2></situationRecord2></situation2>
```

File3:

```
<situation3><situationRecord3><location3></situationRecord3></situation3>
```

This situation is temporary. PFRO **will** accept multilocation.

## 4.4 Complementary information in DATEX-II File

Depending from TMS policy, the emitted DATEX-II messages often contains complementary information. For example, they can contain a press book about the roadworks, the official act of the roadworks or an information like "Suspendable roadworks". ITS-Stations **will ignore** this information.

So, TMS **can** omit complementary information. PFRO **will ignore** this information.

## 5. Specificities for exchange messages

PFro forwards event to TMS. They are coming from Vru-ITS-S (Vehicule road user – ITS Station) or from Vro-ITS-S (Vehicule road operator – ITS Station).

### 5.1 Message initially created by Vru-ITS-S

ID	2.4.3.1_H-UPDATE-002
Component(s)	TMS
Requirement	The TMS <b>shall not</b> update the initial DATEX II message nor forward it to the PFro nor close it when this message was initially created by Vru-ITS-S.
Acceptance	
Additional information	When TMS want to confirm a message, it <b>shall</b> send a new message with a different ID to the PFro. If the received a message seems to be wrong, TMS shall not update the initial message. TMS <b>shall</b> send a new message (more precise), with a different ID.

Rule 25 - 2.4.3.1\_H-UPDATE-002

*For example, a passenger declare through its V-ITS-S an accident at a position. The DENM is sent to the R-ITS-S. The R-ITS-S forward a DATEX II C-ITS message to the PFro. PFro forward a DATEX II message to the TMS. The TMS creates a new accident event and the operator is notified. After a search with the cameras, the declared accident seems to have a bad localization. The operator updates event on its own TMS.*

So, other V-ITS-S **will** received two messages :

- An accident with a position declared by a passenger,
- Another accident with a position declared by the TMS.

The V-ITS-S internal process choose which DENM is the more pertinent due to its “informationQuality” data.

### 5.2 Message initially created by Vro-ITS-S

When creator of message is a Vro-ITS-S depending from current TMS, this TMS is allowed to update the initial DATEX-II message and forward modifications to PFro. TMS **shall** update it when new information are available, according to 2.4.3.1\_H-PUBLICATION-001 rule defined page 22.

### 5.3 Message initially created by PFro

When a message was initially created by the PFro, its TMS is allowed to update the initial DATEX-II message and forward modifications to PFro. TMS **shall** update it when new information are available, according to 2.4.3.1\_H-PUBLICATION-001 rule defined page 22.

## 6. Specificities for A1 messages – Traffic data collection

### 6.1 Overview of A1 use case

The service is the automatic collection of road traffic data from the vehicle to the road manager. Objective of this service is to collect data from vehicles. Data can be used for real time traffic information and management, but also to build statistical information.

The vehicle regularly generates CAM messages indicating its speed, position, direction and other data. These data are collected by R-ITS-S via “virtual sensors” as described in figure below. R-ITS-S creates and defines location of virtual sensors in its range.

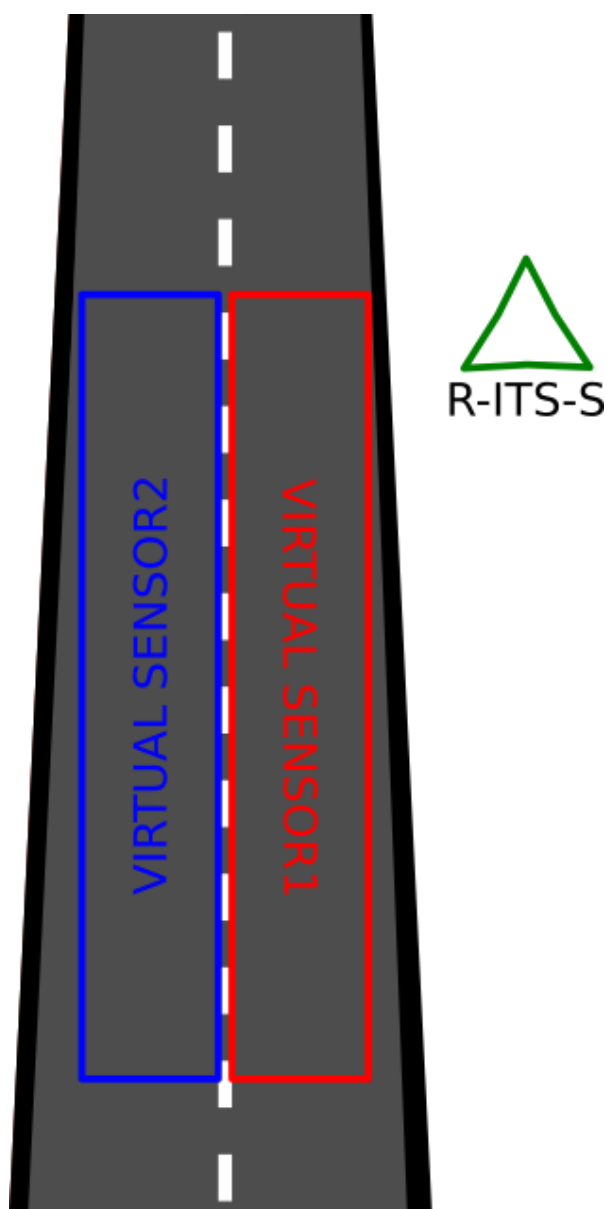


Figure 10 – Virtual sensors declared via R-ITS-S

R-ITS-S collect CAM from vehicle passing through virtual sensors. PFro and R-ITS-S will configure virtual sensors (cf. 2.4.3.2\_H deliverable).

## 6.2 Data forwarded to TMS from PFro

PFro **will** forward one DATEX-II file containing metadata about virtual sensors and PFro **will** forward DATEX-II files containing traffic data. (Cf 2.4.2.1 and 2.4.1.4 deliverable).

According to its policy, when a TCC is implementing the A1 use case, TMS **should** use data received from virtual sensor to improve its traffic knowledge.

<b>ID</b>	<b>2.4.3.1_H- VIRTUAL-SENSOR -001</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	When TMS receives traffic data from an unknown virtual sensor, TMS <b>shall</b> ask a "sensor snapshot".
<b>Acceptance</b>	
<b>Additional information</b>	PFro will answer to the request by the meta-data of all current virtual sensors.

*Rule 26 - 2.4.3.1\_H-VIRTUAL-SENSOR-001*

## 7. Specificities for B “RoadWorks” use case

### 7.1 Overview of PFro use case

#### 7.1.1 Simple B1 fixed and mobile roadworks

This uses case is specified in 2.4.1 SCOOP Deliverable and in “C-ITS French Use Cases Catalog Function descriptions” deliverable.

The road operator wants to inform the driver about a stationary or mobile linear roadwork:

- B1a – Alert closure of part of a lane, whole lane or several lanes,
- B1b – Alert planned closure of a road or a carriageway,
- B1c – Alert planned road works (mobile).

ID	2.4.3.1_H-ROADWORK-001
Component(s)	TMS, PFro
Requirement	The DATEX II message sent by the TMS <b>shall</b> contains at least one Roadwork situation, with the start point and the end of the Roadwork.
Acceptance	
Additional information	

Rule 27 - 2.4.3.1\_H-ROADWORK-001

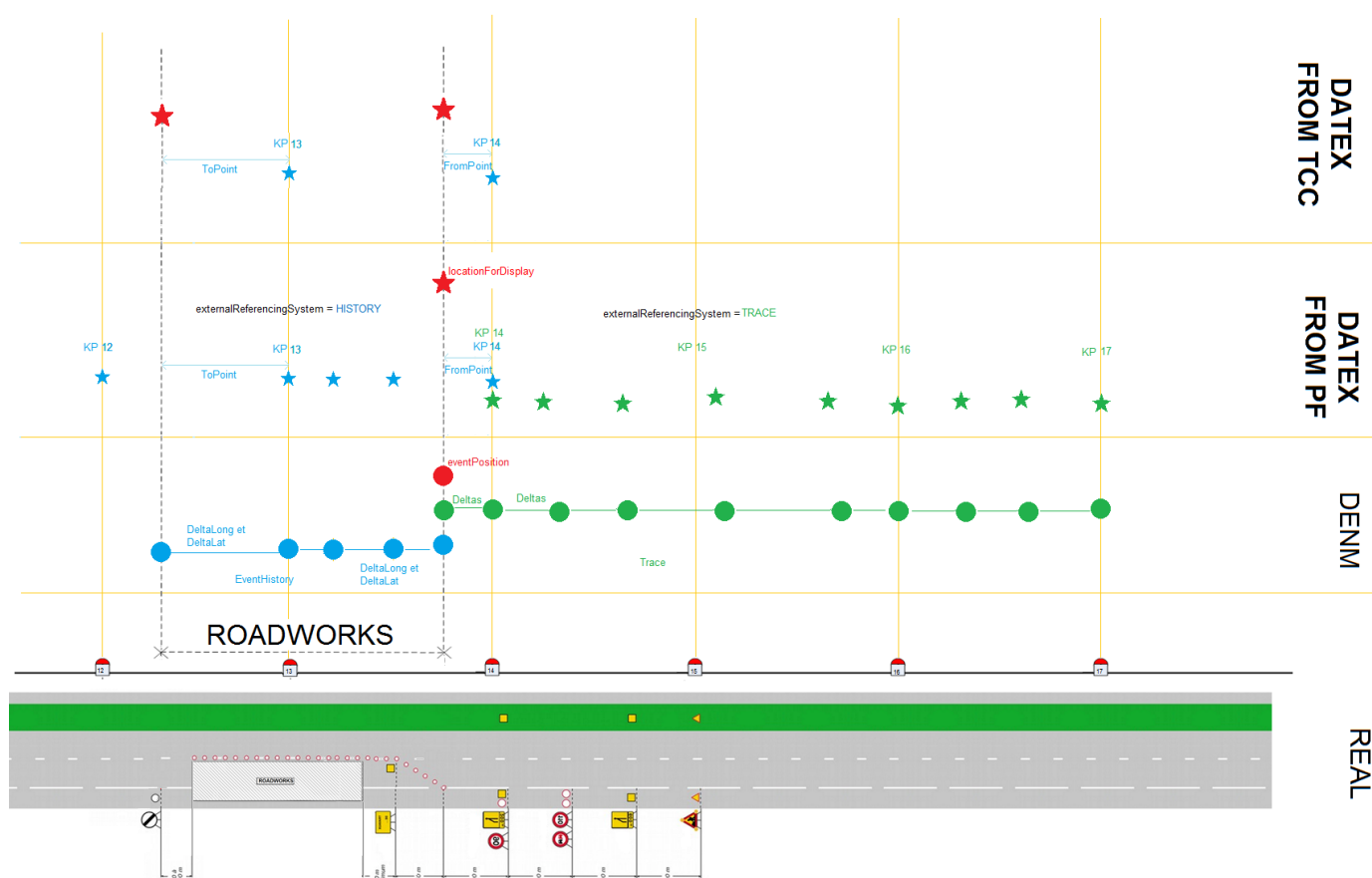
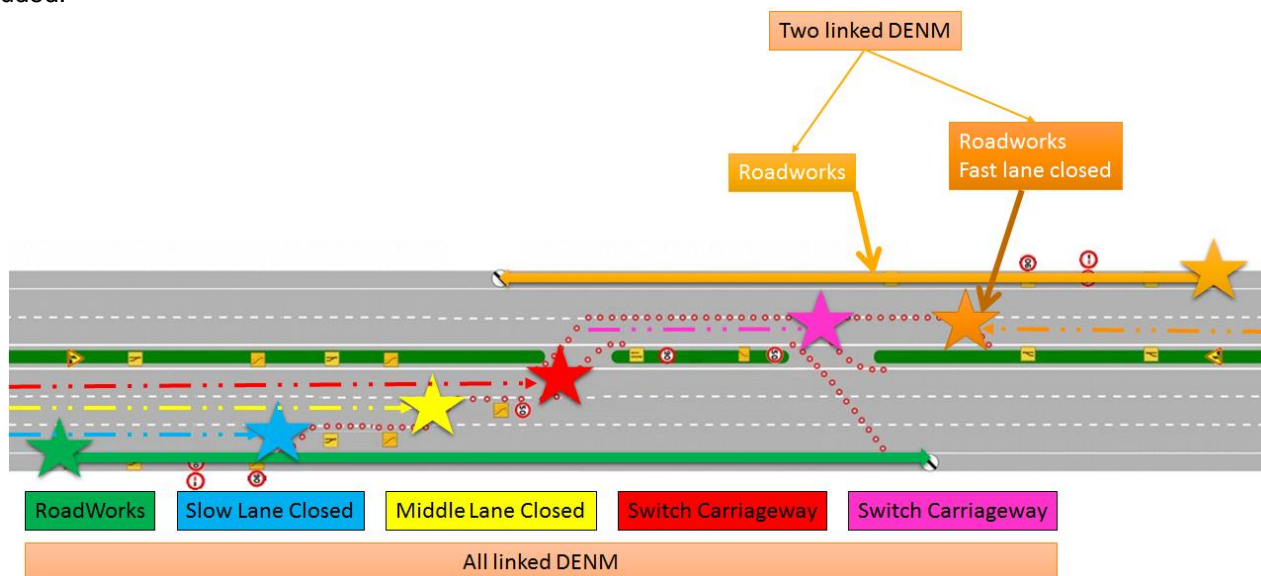


Figure 11 – Illustration of B1a Roadworks from TMS to and Vru-ITS-S

## 7.1.2 Enhanced B1 enhanced fixed roadworks

This use case is an alert neutralization of part of a lane, whole lane or several lanes, with alternate mode and closure excluded.



ID	2.4.3.1_H-ROADWORK-001
Component(s)	TMS, PFro
Requirement	The DATEX II message sent by the TMS shall contains at least one Roadwork situation, with the start point and the end of the Roadwork.
Acceptance	
Additional information	

Rule 28 - 2.4.3.1\_H-ROADWORK-002

Roadwork event **should** contains each point of blockage of a lane, including at the switch of carriageway.

## 7.2 Validity and time management of roadworks

### 7.2.1 Beginning of Roadworks

TMS **can** provide roadworks event to the platform before their validity period. Anyway, the PFro doesn't forward to R-ITS-S events which are not active at current time.

To be compliant with the information politic of the TMS, before validity period, TMS **can** send a VMS message as described in chapter 0 -



C3 use case – e-VMS use case page 38. So, TMS provide a non-linked Datex-II file using e-VMS message. This VMS can be virtual. Virtual VMS can be created on demand.

*For example, roadworks will happened tomorrow on the main bridge of highway. TMS **can** provide roadworks event before they have began. If TCC want to inform current drivers, TMS can provide information to discourage drivers to use this path tomorrow. Therefore, TMS can purpose another path using VMS messages (C3 use case). If there is no real VMS upstream to roadworks, TMS can create a temporary e-VMS, then forward its new e-VMS table to PFro (C3 use case) and then submit a new linked situation record to PFro.*

## 7.2.2 End of Roadworks

When end of roadwork is not mentioned in DATEX-II messages, PFro will never stop event while it do not receive a closing DATEX-II messages for the current situation. When mentioned, at the roadworks end time, even without end confirmation message, the PFro deletes the roadworks event in its database.

*Note: this is different in TIPI database. The event is deleted only the 15th day after their end time, in the case no end confirmation message or no update message is received before.*

So, in its event message, the TMS **should** provide the more pertinent end of roadworks date time according its internal politics. It **can** choose to provide the scheduled end of roadworks, it **can** add a default time to its scheduled end of roadworks. TMS **can** decide to leave blank the end of roadworks too, but it is discouraged.

## 7.2.3 Scheduled roadworks

TMS **should** inform PFro about roadworks event to the platform. TMS **can** provide non-begun roadworks event to the platform as described in §7.2.1 - Beginning of Roadworks page 32.

ID	2.4.3.1_H-SCHEDULED-ROADWORKS-001
Component(s)	TMS
Requirement	If the scheduled roadwork event has been sent to PFro, TMS <b>shall</b> emit a DATEX-II file to inform PFro each time the roadwork began or is interrupted.
Acceptance	
Additional information	

*Rule 29 - 2.4.3.1\_H- SCHEDULED-ROADWORKS-001*

*As example, if roadworks are scheduled for a month but are only active during weekend, the TMS shall only forward an event the Saturday morning and shall close event the Sunday evening.*

According to the TMS policy, these starting, stopping, interrupting, restarting DATEX-II file can be forwarded automatically or by a manual intervention of operator.

## 7.2.4 Comments for suspended roadworks.

When the roadworks **can be** stopped, TMS often add a non-public commentary associated to the DATEX II v2.3 message to explain the situation. As described in §4.4 - Complementary information in DATEX-II File page 27, PFro do not transmit this commentary to the ITS-stations by the PFro. So, TMS **should** omit this information.

*For example, the region prefect decides to stop the roadworks to prevent the traffic congestion on a special day. TMS often add "chantier levable" in a non-public commentary. PFro will never add this information to R-ITS-S. So, TMS can omit this commentary.*

## 7.3 Speed limit

The operator **should** set in the TMS the smallest speed limit of the roadwork for the linear event of the roadwork and the speed limit at each punctual event of a blockage of lane.

## 7.4 Lane restriction

Each new blockage of lane, including the switch of carriageway if relevant, **should** be set in the TMS.

## 8. Specificities for signage applications (Use case C)

### 8.1 C2 use case – in vehicle dynamic speed limit information

#### 8.1.1 Definition

The road user receives speed limit notification as he drives. The message subject is the dynamic speed limit given by the road manager, which is always mandatory. TMS is free to cover or not cover this use case. If TMS cover this use case, it shall respect these rules.

#### 8.1.2 General feature

ID	2.4.3.1_H-DYNAMIC-SPEED-LIMIT-001
Component(s)	TMS
Requirement	Datex-II file <b>shall</b> contain the current speed limit, the start point and the end point of the section.
Acceptance	
Additional information	

Rule 30 - 2.4.3.1\_H-DYNAMIC-SPEED-LIMIT-001

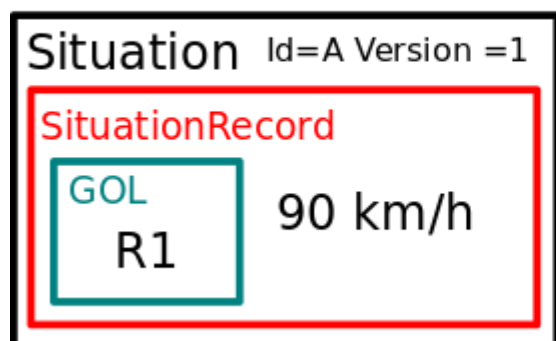
ID	2.4.3.1_H-DYNAMIC-SPEED-LIMIT-002
Component(s)	TMS
Requirement	Each time the speed limit is changing, TMS <b>shall</b> sent a new Datex-II file with the new speed limit.
Acceptance	
Additional information	

Rule 31 - 2.4.3.1\_H-DYNAMIC-SPEED-LIMIT-002

ID	2.4.3.1_H-DYNAMIC-SPEED-LIMIT-003
Component(s)	TMS
Requirement	For each section, Datex-II file <b>shall</b> preserve the "id" attribute of situation and increase the "version" attribute as displayed in the image.
Acceptance	
Additional information	

Rule 32 - 2.4.3.1\_H-DYNAMIC-SPEED-LIMIT-003

#### First DATEXII file



#### Second DATEXII file

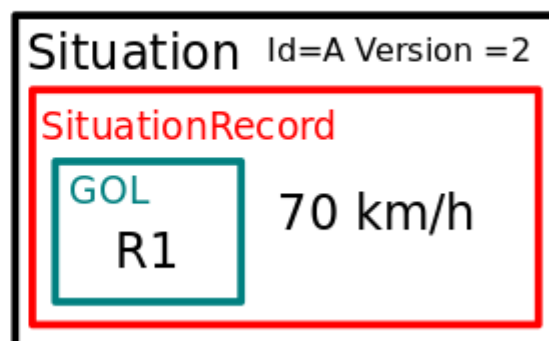


Figure 12 – Speed limit for R1 zone decreases from 90km/h to 70 km/h

In the figure above, situation "id" do not change, situation "version" is increase by one, group of location is not updated and speed limit can change as described in rule 2.4.3.1\_H-DYNAMIC-SPEED-LIMIT-003.

Here is the two corresponding Datex II files:

First file at t time:

```
<situation id="A" version="1">
  <situationRecord xsi:type="DynamicSpeedLimit" id="A-01" version="1">
    ...
    <groupOfLocations xsi:type="Linear">
      <!-- THE R1 location -->
    </groupOfLocations>
    <ComplianceOption>mandatory</ComplianceOption>
    <temporarySpeedLimit>90</temporarySpeedLimit>
    <speedManagementType>speedRestrictionInOperation</speedManagementType>
  </situationRecord>
</situation>
```

Second file at t+1 time:

```
<situation id="A" version="2">
  <situationRecord xsi:type="DynamicSpeedLimit" id="A-02" version="2">
    <groupOfLocations xsi:type="Linear">
      <!-- THE R1 location -->
    </groupOfLocations>
    <ComplianceOption>mandatory</ComplianceOption>
    <temporarySpeedLimit>70</temporarySpeedLimit>
    <speedManagementType>speedRestrictionInOperation</speedManagementType>
  </situationRecord>
</situation>
```

### 8.1.3 Specific feature: the covered zone is changing

ID	2.4.3.1_H-DYNAMIC-SPEED-LIMIT-004
Component(s)	TMS
Requirement	To avoid a situation with two different limitations on the same path, the dynamic speed limit can change in a segment, but the start and the end of the segment <b>shall</b> not change.
Acceptance	
Additional information	Currently, TMS defined segments with fixed start and end. The defined segment have a homogenous speed limit. Anyway, if the zone have to change, TMS shall close all opened dynamic speed limit events before sending the new zones.

*Rule 33 - 2.4.3.1\_H-DYNAMIC-SPEED-LIMIT-004*

ID	2.4.3.1_H-DYNAMIC-SPEED-LIMIT-005
Component(s)	TMS
Requirement	Even if a speed limit concerns successive segments, TMS <b>shall</b> send one message per segment.
Acceptance	
Additional information	Currently, TMS defined segments with fixed start and end. On the defined segment speed limit is always homogenous.

*Rule 34 - 2.4.3.1\_H-DYNAMIC-SPEED-LIMIT-005*

### 8.1.4 Specific feature: different limitations for the same zone.

*In this example, car speed limit is 90km/h for and truck speed limit is 70km/h.*

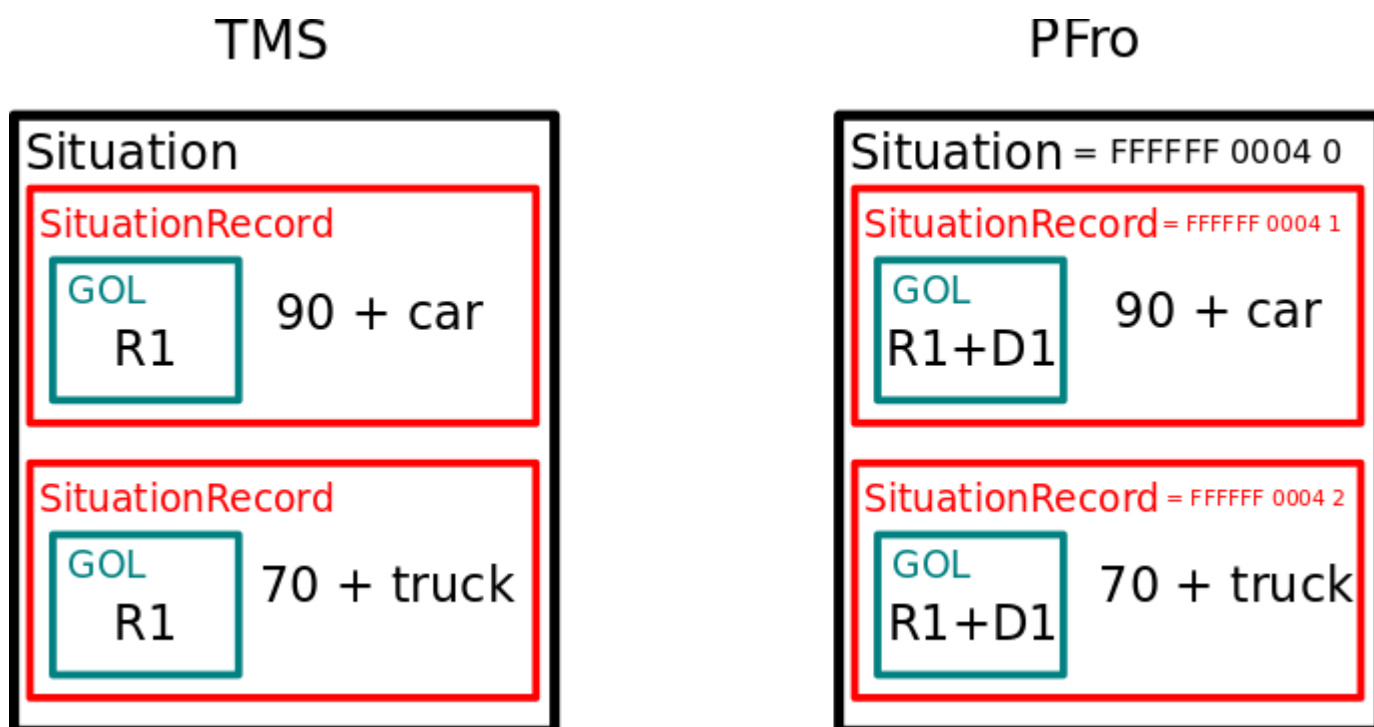


Figure 13 – Example of different dynamic speed limit on the same zone

<b>ID</b>	<b>2.4.3.1_H-DYNAMIC-SPEED-LIMIT-005</b>
<b>Component(s)</b>	TMS
<b>Requirement</b>	TMS shall send a Datex-II file containing one situation, with a situation record for each speed limit.
<b>Acceptance</b>	
<b>Additional information</b>	Group of location on each situationRecord shall be strictly identic. Anyway, if groups of location are different, PFro will reject them.

*Rule 35 - 2.4.3.1\_H-DYNAMIC-SPEED-LIMIT-005*

## 8.2 C3 use case – e-VMS use case

The service displays to the user an information of type “free text”. The information can reproduce a physical VMS or be displayed as a new virtual VMS.

According to its policies, the TMS **should** send the VMS publication to the PFro. TMS is free to cover or not cover this use case. If TMS cover this use case, it shall respect these rules.

<b>ID</b>	<b>2.4.3.1_H-eVMS-001</b>
<b>Component(s)</b>	TMS
<b>Requirement</b>	Before sending the “VMSPublications” messages linked to the VMS panel, TMS <b>shall</b> send at least one “VMSTablePublication” message to specify the VMS <sup>10</sup> .
<b>Acceptance</b>	
<b>Additional information</b>	The TMS <b>should</b> send all VMS messages.

*Rule 36 - 2.4.3.1\_H-eVMS-001*

<b>ID</b>	<b>2.4.3.1_H-eVMS-002</b>
<b>Component(s)</b>	TMS
<b>Requirement</b>	Each time the location of a VMS change, the TMS shall send a new table of location (VMSTablePublication).
<b>Acceptance</b>	
<b>Additional information</b>	

*Rule 37 - 2.4.3.1\_H-eVMS-002*

<b>ID</b>	<b>2.4.3.1_H-eVMS-003</b>
<b>Component(s)</b>	TMS, PFro
<b>Requirement</b>	In the DATEX II message, the TMS shall fill in: <ul style="list-style-type: none"> <li>• &lt;vmsMessageInformationType&gt;</li> <li>• roadsign int the TS 14823 references,</li> <li>• all string or text attributes in UTF8 (&lt;VMStext&gt; at least),</li> <li>• the language of the VMStext.</li> </ul>
<b>Acceptance</b>	
<b>Additional information</b>	

*Rule 38 - 2.4.3.1\_H-eVMS-003*

<b>ID</b>	<b>2.4.3.1_H-eVMS-004</b>
<b>Component(s)</b>	TMS
<b>Requirement</b>	In the DATEX II message, the TMS <b>shall</b> never send a message with more than two pages.
<b>Acceptance</b>	
<b>Additional information</b>	On a physical VMS, two messages can appear and alternate. This is a “two pages information”.

*Rule 39 - 2.4.3.1\_H-eVMS-004*

<sup>10</sup> see 2.4.2.1\_H deliverable for more details

## 9. Specificities for parking use case (Use cases F)

### 9.1 F1: Information on parking lots location, availability, services

The service provides to drivers of all vehicles information about parking solution, including :

- The location of parking lots,
- The number of their available spaces (or full or free information),
- Services provided in parkings.

The sender can be directly parking operators, but this could be the TMS too. In this case, the TMS **shall** publish regularly the parking table and the parking status.

ID	2.4.3.1_H-POI-001
Component(s)	TMS, PFro
Requirement	Before sending the first "ParkingStatusPublication" message, TMS <b>shall</b> send at least one "ParkingTablePublication" message to specify the POI.
Acceptance	
Additional information	

*Rule 40 - 2.4.3.1\_H-POI-001*

ID	2.4.3.1_H-POI-002
Component(s)	TMS, PFro
Requirement	TMS <b>shall</b> sent the "ParkingTablePublication" on each update.
Acceptance	
Additional information	

*Rule 41 - 2.4.3.1\_H-POI-002*

ID	2.4.3.1_H-POI-003
Component(s)	TMS, PFro
Requirement	When data are available, the TMS <b>shall</b> sent a Datex II file containing the "ParkingStatusPublication" to the PFro at a defined frequency.
Acceptance	
Additional information	TMS should define this frequency.

*Rule 42 - 2.4.3.1\_H-POI-003*

### 9.1 F2: Break time indication

This service displays at a defined frequency, the available parking spots along the way of driver. Some TMS are able to collect parking information and service, including available slots, provided by their own means or relationships. In this case, the TMS **should** publish regularly the parking table.

TMS **shall** send "ParkingTablePublication" message to specify the POI. Cf Rule 41 - 2.4.3.1\_H-POI-002 page 39.

## 10. Annex

### 10.1 List of known TMS

Table – List of TMS used by public road operator

Public road operator	City	TMS name	Connection with PFro
<b>DIR ATLANTIQUE</b>	BORDEAUX	SAGASE and TIPI	Connection established by TIPI
<b>DIR CENTRE-EST</b>	GENAS	SAGACITE	Connection planned in the course of February
	GENTIANE	SAGACUTE	Connection planned in the course of 2020
	Other cities	SAGACITE	No connection planned
<b>DIR CENTRE-OUEST</b>	LIMOGES	SAGACITE	Installation of Sagacite only planned after 2021
<b>DIR EST</b>	BESANÇON	VAUBAN	No connection planned
	METZ	SAGACITE	Sagacite installation planned in the course of 2019
	STRASBOURG	GUTEMBERG	No connection planned
<b>DIR ÎLE DE FRANCE</b>	PARIS	SIRIUS	Connected with PFro
<b>DIR MÉDITERRANÉE</b>	MARSEILLE	MARIUS	No information available
<b>DIR NORD</b>	LILLE	ALLEGRO	Connected with PFro
<b>DIR NORD-OUEST</b>	CAEN	SAGASE and TIPI	No connection planned
	ROUEN	SAGASE and TIPI	No connection planned
<b>DIR OUEST</b>		SAGACITE	Connected with PFro
<b>DIR SUD-OUEST</b>	TOULOUSE	SAGACITE	Sagacite installation planned in the course of 2019
<b>ITINISERE DPT 38</b>			