



# **C-ITS SERVICE AND USE CASE DEFINITIONS**

**PROBE VEHICLE DATA (PVD)  
[C-ROADS SUD10]**

**VERSION 3.1.0**

C-Roads Platform

Working Group 2 Technical Aspects

Taskforce 2 Service Harmonisation

Vienna, 01.11.2025



Co-funded by  
the European Union

## Publication History

*Note: The publication history of releases 1.x and 2.x can be found in the release 2.3.0 documentation.*

Version	Date	Description, updates and changes	Status
3.0.0	01.09.2025	Extracting the service categories into separate documents	Final
3.1.0	01.11.2025	Created new version without any further changes	Final

# Table of Contents

Introduction.....	4
10. Probe Vehicle Data (PVD) .....	5
10.1 PVD: Service introduction.....	5
10.2 PVD: Use Cases .....	7
10.2.1 PVD – Vehicle Data Collection (PVD-VDC).....	7
10.2.2 PVD – Event Data Collection (PVD-EDC).....	14
Annex PVD .....	18
Annex PVD-VDC .....	18
Annex PVD-EDC .....	21

# Introduction

The document ‘Service and Use Case Descriptions 01 Intro Document’ [C-Roads SUD01] explains the structure of the service and use case descriptions harmonized in C-Roads. Also, it gives an overview of all harmonized service and use cases and in which document they are described. Each service and its use cases are described in a separate chapter in a separate document. Together, these documents form the integral deliverable of the service and use case descriptions.

All References (in square brackets) refer to the global reference document [WG2 REF], which is part of the whole set of documents of a specific C-Roads release.

# 10. Probe Vehicle Data (PVD)

## 10.1 PVD: Service introduction

Service introduction	
Summary	<p>Probe Vehicle Data (PVD) is a C-ITS service that provides vehicle or event data from a vehicle to other vehicles (V2V service) and also to the road traffic management infrastructure (V2I service). The PVD service can either be an automatic collection by the in-vehicle system (i.e., vehicle C-ITS station) or a manual reporting by the drivers via the in-vehicle system.</p> <p>This service description specifies the requirements of V2I PVD service <b>from the perspective of the road operators and the service providers active in C-Roads</b>. V2V service requirements are out of the scope of this description.</p> <p>Since the PVD service provides data that can be related to vehicles/drivers (e.g., location data), it creates concerns about the traceability of the vehicles/drivers when this service is used by road operators and service providers. Therefore, appropriate measures need to be taken for the implementation and use of the PVD service to protect the privacy of both the drivers using the service and the other drivers concerned by the data in compliance with the GDPR. This specification adopts the current view of C-Roads as detailed in [C-ITS Privacy – Concluding Memo] by C-Roads WG1.</p>
Background	<p>Today's vehicles know at any time their own position, speed, direction, vehicle type, length, etc. Moreover, sensors/embedded technologies in the vehicles can detect and report specific events affecting driving performance, road conditions etc. For events (e.g., animal on the road) that may be not detected by the vehicle itself, the driver may visually detect and report them. This data can be used by the road operators to get a more comprehensive knowledge of the road network (especially in areas not equipped with road sensors, such as loop detectors, CCTV etc.). It can also be used to enhance the road operator's knowledge of events, complementing road sensors, patrol and other existing sources.</p>
Objective	<p>The objective of this service is to collect data from vehicles and/or drivers on public road networks for improving road traffic management and safety operations. The PVD service will provide data:</p> <ul style="list-style-type: none"> <li>○ to improve knowledge of traffic conditions, traffic flow and incidents,</li> <li>○ to improve knowledge of road and weather conditions,</li> <li>○ to improve existing traffic management operations,</li> <li>○ to enable innovations in traffic management and safety operations,</li> <li>○ to improve or enable I2V use cases,</li> <li>○ to improve traffic management strategies and policies (e. g., through exploitation of new information), and</li> <li>○ for statistical and modelling purposes (e.g., digital twin).</li> </ul>
Expected benefits	<p>Expected benefits of the PVD service include, but are not limited to:</p>

	<ul style="list-style-type: none"> <li>○ faster, more accurate and more efficient event detection on the road network,</li> <li>○ improved network operations and event management,</li> <li>○ improved safety of public drivers,</li> <li>○ improved air quality and environmental performance,</li> <li>○ enhanced road network and event impact knowledge,</li> <li>○ a possible cost reduction of the installation and maintenance of event detection infrastructure, and</li> <li>○ new or enhanced C-ITS services: <ul style="list-style-type: none"> <li>○ Location-based provisioning of C-ITS messages/services by service providers</li> <li>○ (Centralised) collision risk warning or signal violation warning</li> <li>○ Optimisation of signalised intersections</li> <li>○ (Dangerous) End of queue warning</li> <li>○ Extreme weather warning</li> <li>○ Travel time estimation and information</li> <li>○ Hazardous Location Notification</li> </ul> </li> </ul>
Use cases	<ul style="list-style-type: none"> <li>○ Vehicle Data Collection (PVD-VDC)</li> <li>○ Event Data Collection (PVD-EDC)</li> </ul> <p><i>NOTE: the current description reflects the view and requirements of C-Roads members and probably will be updated/enhanced following the discussion with other stakeholders e.g., C2C-CC.</i></p>

## 10.2 PVD: Use Cases

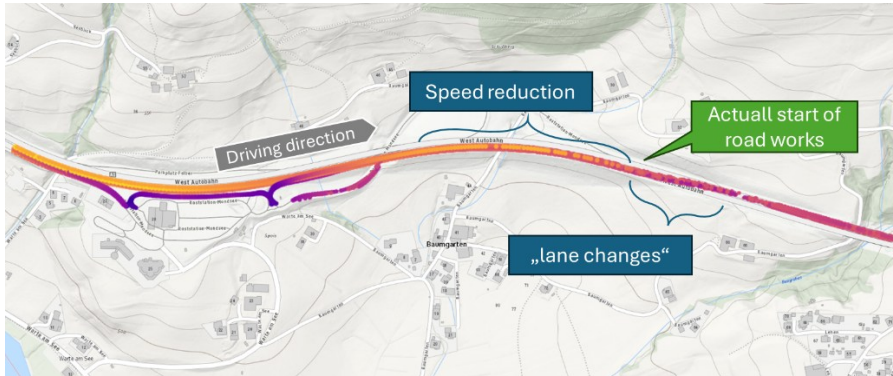
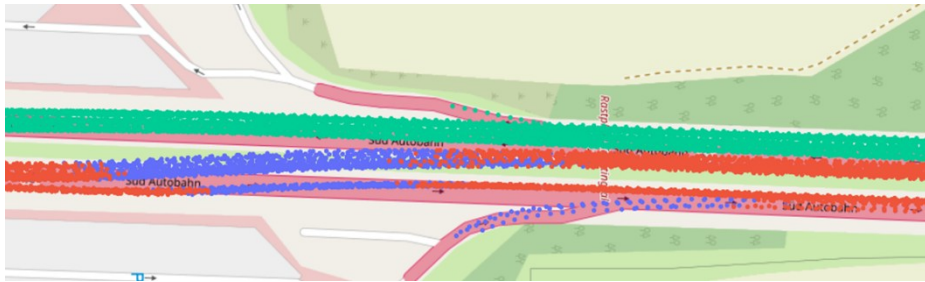

### 10.2.1 PVD – Vehicle Data Collection (PVD-VDC)

Type of road network	All
Type of vehicle (sender)	All C-ITS equipped vehicles
Use case introduction	
Summary	Vehicle data is automatically sent out by the in-vehicle system (i.e., vehicle C-ITS station). The road operator collects and processes the vehicle data sent out by vehicle C-ITS stations to improve traffic management and safety operations on the corresponding public road network.
Background	Vehicle data is a first-hand or original source of traffic information for road operators and service providers. Vehicle data from an adequate number of vehicles on the road network can provide valuable insight to the road operators and service providers regarding the current status of traffic conditions, network status etc. Therefore, this use case is intended to improve traffic management and safety operations, generate traffic information and enable new services for drivers by the road operators and service providers.
Objective	The objective of this use case is to collect data from vehicles on the public road network to improve traffic management and safety operations for drivers.
Expected vehicle data for traffic management operations	<p>The following vehicle data is expected by the road operators from the vehicles on the road network in (near) real-time for improving traffic management and safety operations:</p> <ul style="list-style-type: none"> <li>○ Timestamp</li> <li>○ (Temporary) Station ID</li> <li>○ Vehicle location (geo location coordinates with confidence level)</li> <li>○ Station type</li> <li>○ Vehicle role</li> <li>○ Speed</li> <li>○ Heading</li> <li>○ Vehicle length</li> <li>○ Vehicle width</li> </ul> <p>The following vehicle data may also be useful for traffic management applications, if the V-ITS-S can provide them (e.g., by connecting to the vehicle CAN bus):</p> <ul style="list-style-type: none"> <li>○ Longitudinal acceleration</li> <li>○ Drive direction</li> <li>○ Yaw rate</li> <li>○ Light/siren bar status (e.g., for emergency vehicles)</li> </ul>

	<ul style="list-style-type: none"> <li>○ Exterior light status (e.g., for detecting visibility conditions)</li> </ul>
Expected benefits	See PVD service introduction
<b>Use case description</b>	
Situation	The V-ITS-S installed in a vehicle automatically sends out vehicle data as C-ITS messages to the service provider and/or the road operator via the communication infrastructure.
Logic of transmission	V2I
Actors and relations	<ul style="list-style-type: none"> <li>○ The vehicle driver may need to give consent for automatic sharing of vehicle data with the road operator or the service provider.</li> <li>○ The V-ITS-S sends out vehicle data as a C-ITS message regularly.</li> <li>○ The road operator collects, anonymises and processes vehicle data and may share processed data (in anonymised and/or aggregated form) with other road operators and service providers for improving traffic management and safety operations.</li> <li>○ Optional: A service provider collects and processes vehicle data and shares processed data with the road operators and other service providers for improving traffic management and safety operations.</li> <li>○ The TCC uses the (processed) data/information of the vehicles on the road network for improving traffic management and safety operations for drivers.</li> </ul>
Use case scenario	<ul style="list-style-type: none"> <li>○ The driver may provide consent via an activation switch in the V-ITS-S to share vehicle data with the road operator or the service provider for improving traffic management and safety operations on the public road network.</li> <li>○ The V-ITS-S automatically generates and sends out vehicle data as C-ITS messages.</li> <li>○ The Roadside C-ITS Station (R-ITS-S) or the service provider collects the data from the vehicles. The collected data from the vehicles might be sampled, aggregated or anonymised by the R-ITS-S before forwarding it to the Central C-ITS Station (C-ITS-S).</li> <li>○ The R-ITS-S or service provider may forward vehicle data/information to the C-ITS-S.</li> <li>○ The C-ITS-S may process the vehicle data.</li> <li>○ The C-ITS-S may forward (processed) vehicle data/information to the TCC (or to other service providers).</li> </ul> <p>Collected vehicle data shall be deleted by the R-ITS-S, C-ITS-S and the service provider as soon as they are processed for gathering information/insight needed for improving traffic management and safety operations on the public road network.</p>

Intended Presentation/Alert principle	<p>An indication of vehicle data transmission or consent status may be presented on the HMI.</p> <p>No other alert or information needs to be presented on the HMI.</p>
Functional constraints / dependencies	<p>Vehicle data collection and processing with or without the combination of other data available to the road operator/service provider shall be compliant with the GDPR and local legislation.</p> <p>Key issues, dependencies and assumptions related to the implementation of this use case are:</p> <ul style="list-style-type: none"> <li>(i) Compliance to GDPR and national regulations: <ul style="list-style-type: none"> <li>○ anonymisation of personal information for private vehicles</li> <li>○ anonymisation of personal information for operator/special purpose vehicles: when and how to track road operator vehicles and other special vehicles</li> </ul> </li> <li>(ii) Dependencies: <ul style="list-style-type: none"> <li>○ sufficient penetration of vehicles equipped with C-ITS</li> <li>○ willingness of drivers to share vehicle data (i.e., sending out CAM to the road operators and/or service providers)</li> <li>○ trust level of road operators and service providers</li> </ul> </li> <li>(iii) A low frequent change of Authorisation Tickets (aTs) may be considered by implementations of operator and/or special purpose vehicles' C-ITS stations for operational purposes</li> <li>(iv) CAM aggregation/processing at R-ITS-S or C-ITS-S may limit/prevent availability of (raw) vehicle data for certain applications (e.g., travel time estimation)</li> </ul> <p><i><u>NOTE this document does not specify how to be compliant with the GDPR and national regulations. Please refer to C-Roads WG1 work on this issue.</u></i></p>
Link to other use cases	None
<b>Expected usage of collected vehicle data by the road operator / service provider</b>	
Introduction	Among the C-Roads road operators the following common usages of vehicle data have been identified for improving traffic management operations.
Aggregated vehicle data for traffic management operations	<p>Aggregated vehicle data could create information similar to and/or compatible with the information collected using existing loop detectors and road sensors. The aggregated data can be used for traffic analyses, traffic modelling, traffic information, traffic regulation (e.g., speed advice/limit) etc. to enhance traffic management and safety operations on public roads.</p> <p>Aggregated vehicle data can provide the following in time and space:</p> <ul style="list-style-type: none"> <li>○ number of vehicles</li> <li>○ average speed</li> </ul>

	<ul style="list-style-type: none"> <li>○ average speed per vehicle type/class</li> <li>○ (average) length of the vehicles on the road</li> <li>○ classification (data per vehicle type) of vehicles on the road</li> <li>○ minimum and maximum speeds</li> </ul> <p>during a specified interval e.g., 1 min, 5 min, 30 min, 1 hour.</p>
Vehicle counting	This processing detects or counts the presence of vehicles in specific areas. The resulting data is used in e.g., tunnels and parking areas.
Traffic signal optimisation	This processing results in data to be used to optimise traffic signal timings. Applications include queue and delay measurement, signalised intersection manoeuvres analysis, verification of signal timings and sensor failings.
Event detection	<p>This processing detects events or trends in the vehicle data resulting in queue, congestion or event information.</p> <p>The processed data could provide:</p> <ul style="list-style-type: none"> <li>○ acceleration/deceleration</li> <li>○ speed and direction</li> <li>○ number of vehicles with headlights on</li> <li>○ number of vehicles with daytime running lights on</li> <li>○ number of vehicles with fog lights on</li> <li>○ specific vehicle roles (for e.g., emergency vehicle warning)</li> <li>○ positions of start and/or end of congested areas or queues</li> <li>○ positions of stationary vehicles</li> </ul>
Travel time estimation	<p>Vehicle data is processed in multiple locations to determine or estimate the travel time. The resulting data is used for traffic analyses, traffic modelling and traffic information.</p> <p>To be able to make the estimate, matches for vehicles in the different locations should be possible with sufficient confidence during a sufficiently large time interval.</p>
Construction zone and road works location validation	Vehicle data is processed to validate or improve location information of construction and road works zones such as start, end and lane availability. Here, CAM speed and location indicate slowdowns and “lane changes”:

	 <p>CAM location and heading indicate lane changes and lane separation:</p>  <p>Vehicles providing CAMs with location, speed and heading information contribute to the validation of road works location data.</p>
<p>Wrong-way driver</p>	<p>Vehicles providing CAMs with location and path history contribute to the detection of wrong way drivers.</p>  <p>The road operator might use such an incident to send a wrong way driver warning, see HLN-AWWD.</p> <p>Once the wrong-way driver makes a turn and continues in the right driving direction, the road operator and other vehicles immediately detect that the wrong-way driver is not there anymore, the wrong way driver warning can be cancelled.</p>
<p>Poor weather condition</p>	<p>Vehicle data from CAMs could indicate poor weather conditions:</p> <ul style="list-style-type: none"> <li>○ Fog lights could indicate low visibility (from CAM low frequency container)</li> <li>○ Low beam light at daytime might also indicate restricted visibility (rain), , unless low beam lights are generally recommended or mandatory at the location of data collection.</li> </ul>

	<ul style="list-style-type: none"> <li>○ Windshield wiper status (from the low frequency container of CAM Release 2) might also serve as a weather condition indicator.</li> </ul>
Actual performance indication of roads	Vehicle data is processed into information of actual performance of roads or road systems compared to regular, expected or optimal performance.
<b>Privacy-preserving measures</b>	
Introduction	The following measures are recommended for preserving privacy in probe vehicle data processing. The measures do not guarantee compliance with the GDPR, therefore GDPR and local legislation needs to be considered.
Anonymisation of personal data before processing	Generally, it supports the minimum availability of personal data in C-ITS stations, if the principle is applied that for every C-ITS message received, anonymisation is performed at the first point of message reception in the network and processing of message details is done only after the anonymisation step.
<b>C-Roads expectations with regards to interoperability requirements</b>	
Introduction	The following provides interoperability and harmonisation requirements of C-Roads for implementation of the PVD-VDC use case (i.e., collection of vehicle data from vehicles on the road network) by road operators. The requirements (expectations) specified here need to be discussed and agreed with the C2C-CC.
Security and data protection requirements	<p>Senders should comply to L1 or L2 specifications in the CPOC protocol.</p> <p>Receivers should maintain a trust list containing all trusted senders (e.g., L1, L2 and bilateral trust).</p> <p>All incoming C-ITS messages should be verified according to Annex B of [C-ITS Security Requirements and Specifications].</p>
Message profile requirements	<p><u>Case 1: Ordinary vehicles that are equipped with C-ITS stations covered by [C2C CC Vehicle C-ITS station profile]</u></p> <p>The list of CAM data frames (DFs) and data elements (Des) that are expected from ordinary vehicles for supporting traffic management operations applications by road operators (i.e., C-Roads members) is provided in Annex PVD-VDC of this document.</p> <p><i>NOTE: This list needs to be discussed and any relevant interoperability and harmonisation requirements are to be agreed with the C2C-CC, for making sure that those data will be provided by ordinary vehicles for supporting traffic management operations applications.</i></p> <p><u>Case 2: Special purpose vehicles that are equipped with C-ITS stations covered by C-Roads Specifications</u></p> <p>The CAM profile for special purpose vehicles that are covered by C-Roads specifications is provided in chapter 4.2.5 of [C-Roads MP].</p>

<p>Communication technology requirements: ITS-G5</p>	<p>For the implementation of the PVD-VDC use case using ITS-G5 based communication, the mobile C-ITS stations equipped in ordinary vehicles are expected to comply with [C2C CC Vehicle C-ITS station profile].</p> <p>For the implementation of the PVD-VDC use case using ITS-G5 based communication, the mobile C-ITS stations equipped in special purpose vehicles shall comply with [C-Roads MSP].</p>
<p>Communication technology requirements: IP based</p>	<p><u>Back end (IP based):</u></p> <p>Compliance to the GDPR and local legislation should be checked and validated by the respective data providers.</p> <p>C-Roads C-ITS IP-based Interface Profile [C-ITS IP Based Interface Profile] shall be used for communication of PVD-VDC use case messages based on CAM between C-ITS actors, in the backend. The Basic Interface (BI) of the C-ITS IP-based Interface Profile [C-ITS IP Based Interface Profile] shall be used for exchanging the CAM between the actors.</p> <p>For exchanging PVD-VDC messages based on CAM via the BI, the AMQP filtering tables specified in Chapter 3.3 of C-ITS IP Based Interface Profile [C-ITS IP Based Interface Profile] shall apply:</p> <ul style="list-style-type: none"> <li>○ serviceType = PVD-VDC</li> <li>○ messageType = CAM</li> </ul>

## 10.2.2 PVD – Event Data Collection (PVD-EDC)

Type of road network	All
Type of vehicle (sender)	All C-ITS equipped vehicles
<b>Use case introduction</b>	
Summary	Event data is generated by C-ITS equipped vehicles based on certain conditions that indicate an event, in contrast to probe data, which refers to the status of the vehicle (location, speed etc.). The in-vehicle system (i.e., V-ITS-S) sends out event data that was detected by the vehicle itself or manually by the drivers. Drivers may also report event data via their personal devices (e.g., smartphones). The road operator (or the service provider) collects and processes the event data sent out by the in-vehicle systems or reported by the drivers to improve traffic management and safety operations on the public road network.
Background	Today's vehicles are equipped with sensors and embedded technologies to detect events that might affect the safety and driving experience of the user (e.g., windscreen wiper status, ABS, ESC, collision sensors, etc.). These event notifications directly reach other vehicles. They are also a valuable data source for the road operator and complement other data sources used in traffic management. Some events may not be detected automatically by the vehicle itself (e.g., animal on the road, unmanaged blockage of road, etc.). The drivers may also visually detect some events (e.g., animal on road) and report them to the road operator or service provider via the in-vehicle system. Maintenance workers or road operator personnel can be seen as specific types of drivers, who can detect and manually report events via in-vehicle system. These data collected from the vehicles on the road directly can be used to enhance the road operator's or service provider's knowledge of events, complementing the event data collected from the existing legacy sources such as CCTVs, vehicle detection loops, roadside radars etc.
Objective	See PVD service introduction
Expected event notifications from the vehicles or the drivers, to be used by the road operators to improve traffic management operations	<p>The following events (e.g., based on DENM messages) are collected by the road operators from the vehicles and the drivers on the road network in (near) real time for improving traffic management and safety operations:</p> <ul style="list-style-type: none"> <li>○ Temporary slippery road</li> <li>○ Stationary vehicle</li> <li>○ Vehicle breakdown</li> <li>○ Vehicle in accident (post crash)</li> <li>○ Reduced visibility</li> <li>○ Emergency braking</li> </ul>

	<ul style="list-style-type: none"> <li>○ End of queue (traffic jam)</li> <li>○ Adverse weather conditions</li> <li>○ etc.</li> </ul>
Desired behaviour	<ul style="list-style-type: none"> <li>○ In the automatic event detection and reporting case, no specific behaviour is expected from the drivers (i.e., the driver) for whom the operation of the service is totally invisible unless the HMI is programmed to present the events declared by the in-vehicle system (choice of the OEM).</li> <li>○ In the manual event reporting case, the drivers need to be able to detect and report the event safely and quickly if allowed by the national regulation/law.</li> <li>○ For the road operator, the collected data may give insight regarding the current traffic situation and surroundings. These can be used as input for traffic performance monitoring &amp; evaluation, traffic modelling (e.g., for policy making) as well as to trigger some I2V use cases such as traffic condition warning, hazardous location notification and adverse weather condition.</li> </ul>
Expected benefits	See the PVD service introduction
<b>Use case description</b>	
Situation	A vehicle is driving along the road. A vehicle or a driver detects a specific event and reports it via its V-ITS-S to the road operator or the service provider. The roadside communication infrastructure receives the message sent out by the V-ITS-S and forwards it to the C-ITS-S.
Logic of transmission	V2I
Actors and relations	<ul style="list-style-type: none"> <li>○ The V-ITS-S gathers event data automatically from the vehicle's sensors and sends out event data.</li> <li>○ The drivers may also manually declare specific events or feedback via the HMI of the V-ITS-S.</li> <li>○ The drivers are the owners of the information and might need to give consent for automatic sharing of event data by the V-ITS-S.</li> <li>○ The road operator collects, anonymises and processes the event data from vehicles and may share processed data/information (in anonymised and/or aggregated form) regarding the event with other service providers for improving traffic management and safety operations.</li> <li>○ Optional: A service provider collects and processes data and may share processed data/information regarding the event with the road operators and/or the other service providers for improving traffic management and safety operations.</li> </ul>

	<ul style="list-style-type: none"> <li>○ The TCC uses the (processed) data/information regarding the event for traffic management and safety operations as well as to communicate with public drivers.</li> </ul>
Use case scenario	<ul style="list-style-type: none"> <li>○ Either the V-ITS-S automatically gathers event data from vehicle sensors/embedded technologies, or the drivers visually detect an event (or the absence of an event) and report it via the HMI of the V-ITS-S.</li> <li>○ The V-ITS-S automatically generates and sends out event data as a C-ITS message.</li> <li>○ The R-ITS-S or the service provider collects the event data sent out by the vehicles.</li> <li>○ The collected data from the vehicles may be anonymised or aggregated by the R-ITS-S before forwarding them to the C-ITS-S.</li> <li>○ The R-ITS-S or service provider may forward event data/information to the C-ITS-S.</li> <li>○ The C-ITS-S may process the event data.</li> <li>○ The C-ITS-S may forward (processed) event data/information to the TCC (or to other service providers).</li> <li>○ The TCC (or the service provider) may validate, process or consolidate the event data collected from the vehicles, use them for traffic management and safety operations and share them with service providers and drivers.</li> <li>○ Collected (raw) event data (with any personal information) shall be deleted by the R-ITS-S, C-ITS-S and the service provider as soon as they are processed for gathering information/insights needed for traffic management and safety operations on the public road network.</li> </ul>
Intended Presentation/Alert principle	<p>When drivers manually report a specific event on the HMI of the V-ITS-S, a confirmation of sending out the event may be presented on the HMI.</p> <p>When triggered automatically by the vehicle, the use case may be totally invisible for the driver. No alert or information will be presented on the vehicle's HMI unless the HMI is programmed to present the events declared by the vehicle automatically (choice of the OEM).</p>
Functional constraints / dependencies	<p>See PVD-VDC</p> <p>Additionally:</p> <p>In the manual reporting case: the drivers should be able to safely report the event on the HMI (manual reporting is not permitted while driving in some member states).</p>
Link to other use cases	none
<b>C-Roads expectations with regards to interoperability requirements</b>	
Introduction	The following provides interoperability and harmonisation requirements of C-Roads for implementation of PVD-EDC use case (i.e., collection of event data

	from vehicles on the road network) by road operators. The requirements (expectations) specified here need to be discussed and agreed with the C2C-CC.
Security and data protection requirements	All incoming C-ITS messages should be verified according to Annex B in [C-ITS Security Requirements and Specifications].
Message profile requirements	<p>With respect to the triggering conditions for certain event data, these are specified in [C2C CC Vehicle C-ITS station profile], e.g.:</p> <ul style="list-style-type: none"> <li>○ Stationary vehicle, breakdown and post-crash: Triggering Conditions and Data Quality Stationary Vehicle Warning</li> <li>○ Emergency braking etc.: Triggering Conditions and Data Quality Dangerous Situation</li> <li>○ Poor weather conditions and slippery road: Triggering Conditions and Data Quality Adverse Weather Conditions</li> <li>○ Traffic jam: Triggering Conditions and Data Quality Traffic Condition</li> </ul>
Communication Requirements: ITS-G5	<p>For the implementation of the PVD-EDC use case using ITS-G5 based communication, the mobile C-ITS stations equipped in ordinary vehicles are expected to comply with [C2C CC Vehicle C-ITS station profile].</p> <p>For the implementation of the PVD-EDC use case using ITS-G5 based communication, the mobile C-ITS stations equipped in special purpose vehicles shall comply with [C-Roads MSP].</p>
Communication technology requirements: IP based	To be determined

# Annex PVD

## Annex PVD-VDC

The following table provides CAM DFs and DEs that are expected from ordinary vehicles (i.e., the vehicles covered by [C2C CC Vehicle C-ITS station profile]) on the road network by C-Roads members for traffic management operations applications. The CAM DFs and DEs are based on [ETSI TS 103 900].

Level	Name	Type	Mandatory /Optional	Expected by C-Roads	Comment
0.0	Header	DF (ItsPDUHeader)	Mandatory	YES	
1.0	CAM	DF (payload)	Mandatory	YES	
1.1	generationDeltaTime	DE	Mandatory	YES	
2.0	basicContainer	DF (container)	Mandatory	YES	
2.1	stationType	DE	Mandatory	YES	
2.2	referencePosition	DE	Mandatory	YES	
3.0	highFrequency Container	DF (container)	Mandatory	YES	
3.1	basicVehicleContainer HighFrequency	DF (container)	Mandatory	YES	
3.1.1	heading	DE	Mandatory	YES	
3.1.2	speed	DE	Mandatory	YES	
3.1.3	driveDirection	DE	Mandatory	YES	
3.1.4	vehicleLength	DF	Mandatory	YES	
3.1.5	vehicleWidth	DE	Mandatory	YES	

3.1.6	curvature	DF	Mandatory	YES	
3.1.7	curvatureCalculationMode	DE	Mandatory	YES	
3.1.8	yawRate	DF	Mandatory	YES	
3.1.9	accelerationControl	DE	Optional	YES	
3.1.10	lanePosition	DE	Optional	YES	
3.1.11	steeringWheelAngle	DF	Optional	YES	
3.1.12	lateralAcceleration	DE	Optional	nice-to-have	
3.1.13	verticalAcceleration	DE	Optional	nice-to-have	
3.1.14	performanceClass	DE	Optional	nice-to-have	
3.1.15	cenDsrcTollingZone	DE	Optional	No	
3.2	rsuContainerHighFrequency	DF (container)	N/A	N/A	
4.0	lowFrequencyContainer	DF (container)	Optional	YES	
4.1	basicVehicleContainerLowFrequency	DF (container)	Optional	YES	
4.1.1	vehicleRole	DE	Mandatory	YES	
4.1.2	exteriorLights	DE	Mandatory	nice-to-have	
4.1.3	pathHistory	DF	Mandatory	nice-to-have	
5.0	specialVehicleContainer	DF (container)	Optional	N/A	
5.1	publicTransportContainer	DF (container)	Optional	N/A	
5.2	specialTransportContainer	DF (container)	Optional	N/A	

5.3	dangerousGoods Container	DF (container)	Optional	N/A	
5.4	roadWorks ContainerBasic	DF (container)	Optional	N/A	
5.4	rescueContainer	DF (container)	Optional	N/A	
5.5	emergency Container	DF (container)	Optional	N/A	
5.6	safetyCar Container	DF (container)	Optional	N/A	

## Annex PVD-EDC

To be determined