Triggering Conditions and Data Quality Stationary Vehicle Warning
CAR 2 CAR Communication Consortium

About the C2C-CC

Enhancing road safety and traffic efficiency by means of Cooperative Intelligent Transport Systems and Services (C-ITS) is the dedicated goal of the CAR 2 CAR Communication Consortium. The industrial driven, non-commercial association was founded in 2002 by vehicle manufacturers affiliated with the idea of cooperative road traffic based on Vehicle-to-Vehicle Communications (V2V) and supported by Vehicle-to-Infrastructure Communications (V2I). Today, the Consortium comprises 73 members, with 12 vehicle manufacturers, 33 equipment suppliers and 28 research organisations.

Over the years, the CAR 2 CAR Communication Consortium has evolved to be one of the key players in preparing the initial deployment of C-ITS in Europe and the subsequent innovation phases. CAR 2 CAR members focus on wireless V2V communication applications based on ITS-G5 and concentrate all efforts on creating standards to ensure the interoperability of cooperative systems, spanning all vehicle classes across borders and brands as well as other road users. As a key contributor, the CAR 2 CAR Communication Consortium works in close cooperation with the European and international standardisation organisations such as ETSI and CEN.

Disclaimer

Document information

Number:	2006	Version:	n.a.	Date:	13/09/2019
Title:	Triggering Conditions and Data Quality Stationary Vehicle Warning			Document Type:	RS
Release	1.4.0				
Release Status:	Public				
Status:	Final				

Table 1: Document information

Changes since last version

Title:	**Triggering Conditions and Data Quality Stationary Vehicle Warning**		
Explanatory notes:			
13/09/2019	Minor corrections	Release Management	Steering Committee
31/08/2018	Minor corrections	Release Management	Steering Committee
Date	**Changes**	**Edited by**	**Approved**

Table 2: Changes since last version

Table of contents

List of tables

1 Introduction

1.1 Abstract

Other (informational)   **RS_tcStVe_183**

This document describes the triggering conditions for stationary vehicle warning for the following three C-ITS service:

- 'stationary vehicle warning — stopped vehicle';
- 'stationary vehicle warning — broken-down vehicle';
- 'stationary vehicle warning — post-crash'.

2 Definitions and abbreviations

2.1 Abbreviations

Other (informational)   **RS_tcStVe_200**

ABS	Anti-lock Braking System
ASN.1	Abstract Syntax Notation One
ASR	Anti-Slip Regulation
AT	Authorization Ticket
AUT	Automatic Transmission
CAM	Cooperative Awareness Message
C2C-CC	Car to Car Communication Consortium
CDD	Common Data Dictionary
DEN	Decentralized Environmental Notification
DENM	DEN Message
ECE	Economic Commission for Europe
ETSI	European Telecommunications Standards Institute
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
ITS	Intelligent Transport System
ITS-S	ITS Station
KAF	Keep-Alive Forwarding
PTW	Powered Two Wheeler (motorcycles and scooters)
TC	Triggering Conditions
TTC	Time To Collision
V2V	Vehicle to Vehicle

Table 3: Abbreviations

2.2 Definitions

Definition   **RS_tcStVe_642**

'*Vehicle speed*' is the length of the velocity-vector of the reference position point.

3 Triggering conditions

3.1 Stationary vehicle warning

Requirement   **RS_tcStVe_208**

The Stationary Vehicle Warning C-ITS services deals with vehicles which are "stationary". A stationary vehicle is defined as follows:

- the vehicle is moving with an absolute speed <= 8 centimeter per second. This state shall be determined by internal vehicle sensors (e.g. wheel ticks).

3.1.1 Stationary vehicle warning - stopped vehicle

3.1.1.1 Description of C-ITS service

Other (informational)   **RS_tcStVe_184**

This section describes the triggering of V2V messages for stopped vehicles. Various reasons could lead to a situation involving a stopped vehicle, like human problems, accidents, rubbish collection, delivery service or a stopping bus. This section focuses on situations without particular information about the reason of the stopping maneuver.

Other (informational)   **RS_tcStVe_185**

The following C-ITS services are related to this service, because they share similar triggering conditions:

- 'special vehicle warning — stationary recovery service warning';
- 'stationary vehicle warning — broken-down vehicle';
- 'stationary vehicle warning — post-crash'.

Requirement   **RS_tcStVe_116**

A DENM signal shall be sent to the stack only if the triggering conditions described in this section are evaluated as being met. Such a signal prompts the stack to generate a new, update or cancellation DENM. If the triggering conditions are not fulfilled, a DENM signal shall not be generated.

Tested by:

3.1.1.2 Triggering conditions

3.1.1.2.1 Preconditions

Requirement   **RS_tcStVe_117**

The following preconditions shall be satisfied when this use case is triggered:

1. no breakdown warning message, that prevents the driver from continuing driving (e.g. red warning symbols, in accordance with [ECE 121]) is shown on the instrument cluster.

Note: This service is not required to check ignition terminal 15 status for triggering (can be on or off). Operation of this service is optional when ignition terminal 15 is off.

Tested by:

Requirement   **RS_tcStVe_205**

Parallel activation with the other related C-ITS services shall be avoided. Where the '*broken-down vehicle*' and/or 'p*ost-crash*' C-ITS services are triggered simultaneously, the C-ITS services shall be prioritised as follows:

    1.) 'post-crash' (highest priority);

    2.) 'broken-down vehicle';

    3.) 'stopped vehicle' (lowest priority).

Tested by:

3.1.1.2.2 Service-specific conditions

Requirement   **RS_tcStVe_118**

If the preconditions in RS_tcStVe_117 and all of the following conditions are satisfied, the triggering conditions for this C-ITS service are fulfilled and the generation of a DENM shall be triggered:

- the ego vehicle has enabled hazard lights;
- the vehicle is stationary;
- the *Triggering Timer* has expired.

Note: PTWs may not be equipped with hazard lights. PTWs without hazard lights will not trigger this use case.

Tested by:

Requirement   **RS_tcStVe_120**

If the vehicle has enabled hazard lights and is stationary, the *Triggering Timer* shall be set to 30 s and started. The *Triggering Timer* shall be reduced, if the following situations arise:

a) the timer shall be reduced by 10 s if the automatic transmission (AUT) is set to 'park' for at least 3 s;

b) the timer shall be reduced by 10 s if the gear box is set to idle for at least 3 s;

c) the timer shall be reduced by 10 s if the parking brake is enabled for at least 3 s;

d) the timer shall be reduced by 10 s if an arbitrary number of the seatbelt buckles change from 'connected' to 'disconnected' for at least 3 s;

e) the timer shall be set to 0 if an arbitrary number of doors are open for at least 3 s;

f) the timer shall be set to 0 if the ignition terminal is switched from on to off for at least 3 s;

g) the timer shall be set to 0 if the boot is open for at least 3 s;

h) the timer shall be set to 0 if the bonnet is open for at least 3 s.

Note: For PTWs the side stand is used for at least 3 s is equivalent to point e) (car doors open for more than 3 s).

Tested by:

Requirement   **RS_tcStVe_121**

All above-listed procedures for the timer reduction shall be applied only once during initial detection. If the *Triggering Timer* has been counted down to 0, no further reduction is necessary in the current detection cycle.

Tested by:

Requirement   **RS_tcStVe_122**

During the runtime of the *Triggering Timer*, the hazard lights shall be enabled and the vehicle shall be stationary. Otherwise, the detection shall be cancelled.

Tested by:

3.1.1.2.3 Information quality

Requirement   **RS_tcStVe_123**

The value of the data element *informationQuality* in the DENM depends on how the event is detected. The *informationQuality* value shall be set in accordance with the following table (highest possible value shall be used):

Table 4: Information quality of 'stationary vehicle — stopped vehicle'

Event detection	Value of InformationQuality
No TRCO-compliant implementation	unknown(0)
None of the conditions a) — h) are fulfilled.	1
At least one condition of a) — d) is fulfilled.	2
At least one condition of e) — h) is fulfilled.	3

Tested by:

Requirement   **RS_tcStVe_124**

If the triggering conditions change between two updates, the *informationQuality* shall not be changed until the next update. If the changed conditions are still fulfilled while the DENM is updated, the *informationQuality* shall be updated.

In the update phase, only the conditions that would lead to a timer reduction shall be evaluated, but not the timer itself.

Tested by:

3.1.1.3 Termination conditions

Requirement   **RS_tcStVe_125**

This C-ITS service is terminated by a cancellation of the originating C-ITS station. At the termination of the C-ITS service, update DENM request shall be terminated.

Tested by:

3.1.1.3.1 Cancellation

Requirement   **RS_tcStVe_126**

If at least one of the following conditions is satisfied before the time period set in the data element *validityDuration* has expired, the generation of a cancellation DENM shall be triggered:

a) the vehicle is no longer stationary for a duration of 5 s;

b) the hazard lights are disabled;

c) the position of the vehicle has changed more than 500 m (e.g. because the vehicle has been towed away).

Note: The cancellation condition does not imply that the C2C-CC Basic System needs to be permanently operational or extend its operation during that cancellation condition.

Tested by:

3.1.1.3.2 Negation

Requirement **RS_tcStVe_127**

A negation DENM shall not be used for this C-ITS service.

Tested by:

3.1.1.4 Update

Requirement **RS_tcStVe_128**

If the previously detected *Stopped Vehicle* was not cancelled (see RS_tcStVe_126), the generation of an update DENM shall be triggered every 15 s.

Tested by:

Requirement **RS_tcStVe_129**

In the update phase, only the triggering conditions shall be checked (further evaluation of timers shall not be executed).

Tested by:

Requirement **RS_tcStVe_130**

New values shall be assigned to data fields or elements in the DENM according to the changed event (e.g. *detectionTime* or *informationQuality*, see RS_tcStVe_133).

Note: The update condition does not imply that the C2C-CC Basic System needs to be permanently operational or extend its operation during that update condition.

Tested by:

3.1.1.5 Repetition duration and repetition interval

Requirement **RS_tcStVe_131**

DENMs, that are new, have been updated or have been cancelled shall be repeated for a *repetitionDuration* of 15 s with a *repetitionInterval* of 1 s. Therefore, the interface parameters *Repetition duration* and *Repetition interval* between the application and the DEN basic service shall be set in accordance with the above values.

Note: The *validityDuration* is set to 30 s. Therefore, one can prevent a gap of DENMs if the *repetitionDuration* of the original DENM has expired and the update has not yet been received.

Note: Where two DENMs with the same *causeCode* originate from the same C-ITS station, the case shall be managed by the receiving C-ITS station.

Tested by:

3.1.1.6 Traffic class

Requirement   **RS_tcStVe_132**

New, update and cancellation DENMs shall be set to *traffic class* 1.

Tested by:

3.1.1.7 Message parameters

3.1.1.7.1 DENM

Requirement   **RS_tcStVe_133**

The following table specifies the data elements of the DENM that shall be set.

Table 5: DENM data elements of 'stationary vehicle warning — stopped vehicle'

Data field	Value
Management container	
actionID	Identifier of a DENM. Shall be set in accordance with [TS 102 894-2].
detectionTime	*TimestampIts*-timestamp at which the event is detected by the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
referenceTime	*TimestampIts*-timestamp at which a new, update or cancellation DENM is generated. Shall be set in accordance with [TS 102 894-2].
termination	Shall not be set in the case of new or update DENM. Shall be set to isCancellation(0) in the case of a cancellation DENM.
eventPosition	*ReferencePosition*. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
relevanceDistance	lessThan1000m(4)
relevanceTrafficDirection	If the roadType is known, the value shall be set as follows: RoadType / Direction: 0 — allTrafficDirections(0) 1 — upstreamTraffic(1) 2 — allTrafficDirections(0) 3 — upstreamTraffic(1) Otherwise, the value shall be set to allTrafficDirections(0)
validityDuration	30 s

stationType	The type of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2].
Situation container	
informationQuality	See RS_tcStVe_123. Shall be refreshed for every update DENM.
causeCode	stationaryVehicle(94)
subCauseCode	unavailable(0)
Location container	
eventSpeed	Speed of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
eventPositionHeading	Heading of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
traces	*PathHistory* of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. If the PathDeltaTime is used in the PathPoints, the PathDeltaTime of the first PathPoint (closest point to the ReferencePosition) shall be refreshed for an update DENM. All other PathPoints shall not be refreshed. If the PathDeltaTime of the first PathPoint exceeds the maximum value in accordance with [TS 102 894-2], the PathDeltaTime shall not be further refreshed. If the PathDeltaTime is not used in the PathPoints, the PathHistory shall not be refreshed for an update DENM.
roadType	*RoadType* of the road on which the detecting C-ITS station is situated. Shall be refreshed for an update DENM. Shall be set in accordance with [TS 102 894-2] in combination with the following rules:

Urban / non-Urban	Structural separation	Data element
Urban	No	urban-NoStructuralSeparationToOppositeLanes(0)
Urban	Yes	urban-WithStructuralSeparationToOppositeLanes(1)
Urban	Unknown	urban-NoStructuralSeparationToOppositeLanes(0)
Non-urban	No	nonUrban-NoStructuralSeparationToOppositeLanes(2)

Non-urban	Yes	nonUrban-WithStructuralSeparation ToOppositeLanes(3)
Non-urban	Unknown	nonUrban-NoStructuralSeparation ToOppositeLanes(2)
If the information about the urban/non-urban status cannot be determined, the data element shall be omitted.		
Alacarte container		
lanePosition	If the lanePosition is provided by an on-board sensor (e.g. radar, camera), the value shall be set in accordance with [TS 102 894-2]. Use of GNSS and a digital map to estimate the lane number is not legitimate for this version of the triggering condition. If the lanePosition is unknown, the data element shall be omitted. Shall be refreshed for an update DENM.	
Alacarte container: StationaryVehicleContainer		
stationarySince	Shall be set in accordance with the duration in minutes of the detecting C-ITS station being stationary. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.	

Tested by:

3.1.1.7.2 CAM

Requirement   **RS_tcStVe_134**

CAM adaption shall not be used for this C-ITS service.

Tested by:

3.1.1.8 Network and transport layer

Requirement   **RS_tcStVe_135**

The interface parameter *DENM destination area* between the DEN basic service and the networking and transport layer shall be equal to a circular shape with radius equal to *relevanceDistance*.

Tested by:

3.1.1.9 Security layer

Requirement   **RS_tcStVe_137**

If the triggering conditions as described in section 3.1.1.2 apply, an AT change shall be blocked for new, update and cancellation DENMs as long as the *validityDuration* has not expired (see RS_tcStVe_133). Corresponding new, update and cancellation DENMs shall be sent with the same AT.

Tested by:

3.1.1.10   Scenarios

Other (informational)   **RS_tcStVe_186**

This section has an informational character and is not part of the requirement specification.

The following list encompasses scenarios which are regarded as relevant or irrelevant considering the present C-ITS services:

Table 6: Stationary vehicle warning — stopped vehicle scenarios

Count	Description	Status
	tbd.	
	tbd.	

3.1.2 Stationary vehicle warning - broken-down vehicle

3.1.2.1 Description of C-ITS service

Other (informational)   **RS_tcStVe_190**

This section describes the triggering of V2V messages for broken-down vehicle. Though various reasons could cause a vehicle breakdown, such as bursting tires, lack of fuel or engine failure, this section focuses on reasons indicated by breakdown warning messages in the instrument cluster.

Other (informational)   **RS_tcStVe_191**

The following C-ITS services are related to this service, because they share similar triggering conditions:

- 'special vehicle warning — stationary recovery service warning';
- 'stationary vehicle warning — stopped vehicle';
- 'stationary vehicle warning — post-crash'.

Requirement   **RS_tcStVe_138**

A DENM signal shall be sent to the stack only if the triggering conditions described in this section are evaluated as valid. Such a signal prompts the stack to generate a new, update or cancellation DENM. If the triggering conditions are not fulfilled, a DENM signal shall not be generated.

Tested by:

3.1.2.2 Triggering conditions

3.1.2.2.1 Preconditions

Requirement   **RS_tcStVe_139**

The following preconditions shall be satisfied when this use case is triggered:

    1.) a breakdown warning message that prevents the driver from continuing driving (e.g. red warning symbols, in accordance with [ECE 121]) is shown on the instrument cluster.

Note: This service is not required to check ignition terminal 15 status for triggering (can be on or off). Operation of this service is optional when ignition terminal 15 is off.

Tested by:

Requirement **RS_tcStVe_206**

Parallel activation with the other related C-ITS services shall be avoided. Where the 's*topped vehicle'* and/or 'p*ost-crash' C-ITS services are triggered* simultaneously, the C-ITS services shall be prioritised as follows:

    1.) 'post-crash' (highest priority);

    2.) 'broken-down vehicle';

    3.) 'stopped vehicle' (lowest priority).

Tested by:

3.1.2.2.2 Service-specific conditions

Requirement **RS_tcStVe_140**

If the precondition in RS_tcStVe_139 and all of the following conditions are satisfied, the triggering conditions for this C-ITS service are fulfilled and the generation of a DENM shall be triggered:

- the ego vehicle has enabled hazard lights;
- the vehicle is stationary;
- the *Triggering Timer* has expired.

Note: PTWs may not be equipped with hazard lights. PTW without hazard lights will not trigger this use case.

Tested by:

Requirement **RS_tcStVe_142**

If the vehicle has enabled hazard lights and is stationary, the *Triggering Timer* shall be set to 30 s and started. The *Triggering Timer* shall be reduced, if the following situations arise:

    a) the timer shall be reduced by 10 s if the automatic transmission (AUT) is set to 'park' for at least 3 s;

    b) the timer shall be reduced by 10 s if the gear box is set to idle for at least 3 s;

    c) the timer shall be reduced by 10 s if the parking brake is enabled for at least 3 s;

    d) the timer shall be reduced by 10 s if an arbitrary number of the seatbelt buckles change from 'connected' to 'disconnected' for at least 3 s;

    e) the timer shall be set to 0 if an arbitrary number of doors are open for at least 3 s;

    f) the timer shall be set to 0 if the ignition terminal is switched from on to off for at least 3 s;

    g) the timer shall be set to 0 if the boot is open for at least 3 s;

    h) the timer shall be set to 0 if the bonnet is open for at least 3 s.

Note: For PTWs the side stand is used for at least 3 s is equivalent to point e) (car doors open for more than 3 s).

Tested by:

Requirement **RS_tcStVe_143**

All above listed procedures for the timer reduction shall be applied only once during initial detection. If the *Triggering Timer* has been counted down to 0, no further reduction is necessary in the current detection cycle.

Tested by:

Requirement **RS_tcStVe_144**

During the runtime of the *Triggering Timer*, the hazard lights shall be enabled and the vehicle shall be stationary all the time. Otherwise the detection shall be cancelled.

Tested by:

3.1.2.2.3 Information quality

Requirement **RS_tcStVe_145**

The value of the data element *informationQuality* in the DENM depends on how the event is detected. The *informationQuality* value shall be set in accordance with the following table (highest possible value shall be used):

Table 7: Information quality of 'stationary vehicle - broken-down vehicle'

Event detection	Value of informationQuality
No TRCO-compliant implementation	unknown(0)
None of conditions a) — h) are fulfilled.	1
At least one condition of a) — d) is fulfilled.	2
At least one condition of e) — h) is fulfilled.	3

Tested by:

Requirement **RS_tcStVe_146**

If the triggering conditions change between two updates, the *informationQuality* shall not be changed until the next update. If the changed conditions are still fulfilled while the DENM is updated, the *informationQuality* shall be updated.

In the update phase, only the conditions that would lead to a timer reduction shall be evaluated, but not the timer itself.

Tested by:

3.1.2.3 Termination conditions

Requirement **RS_tcStVe_147**

This C-ITS service is terminated by a cancellation of the originating C-ITS station. At the termination of the C-ITS service, update DENM request shall be terminated.

Tested by:

3.1.2.3.1 Cancellation

Requirement   **RS_tcStVe_148**

If at least one of the following conditions is satisfied before the period set in the data element *validityDuration* has expired, the generation of a cancellation DENM shall be triggered:

       a) the vehicle is no longer stationary for a duration of 5 s;

       b) the hazard lights are disabled;

       c) the position of the vehicle has changed more than 500 m (e.g. because the vehicle has been towed away).

Note: The cancellation condition does not imply that the C2C-CC Basic System needs to be permanently operational or extend its operation during that cancellation condition.

Tested by:

3.1.2.3.2 Negation

Requirement   **RS_tcStVe_149**

A negation DENM shall not be used for this C-ITS service.

Tested by:

3.1.2.4 Update

Requirement   **RS_tcStVe_150**

If the previously triggered DENM for a detected *Broken-down Vehicle* was not cancelled (see RS_tcStVe_148), the generation of an update DENM shall be triggered every 15 s.

Tested by:

Requirement   **RS_tcStVe_151**

In the update phase, only the triggering conditions shall be checked (timers shall not be evaluated further).

Tested by:

Requirement   **RS_tcStVe_152**

If the ignition terminal 15 is switched from on to off, an update DENM shall be triggered immediately.

Tested by:

Requirement   **RS_tcStVe_153**

New values shall be assigned to data fields or elements in the DENM according to the changed event (e.g. *detectionTime* or *informationQuality*, see RS_tcStVe_157).

Note: The update condition does not imply that the C2C-CC Basic System needs to be permanently operational or extend its operation during that update condition.

Tested by:

3.1.2.5 Repetition duration and repetition interval

Requirement   **RS_tcStVe_154**

DENMs, that are new, have been updated or have been cancelled shall be repeated for a *repetitionDuration* of 15 s with a *repetitionInterval* of 1 s. Therefore, the interface parameters *Repetition duration* and *Repetition interval* between the application and the DEN basic service shall be set in accordance with the above values.

Tested by:

Requirement   **RS_tcStVe_155**

In the case of an enabled ignition terminal 15, the *validityDuration* shall be set to 30 s. Therefore, one can prevent a gap of DENMs if the *repetitionDuration* of the original DENM has expired and the update has not yet been received.

Note: The *validityDuration* is set to a higher value in the case of a disabled ignition terminal 15 than in the case of an enabled ignition terminal 15. This is due to the fact that update DENM cannot be triggered and can no longer be sent. Therefore, the last DENM shall be kept alive longer.

Note: Where two DENMs with the same *causeCode* originate from the same C-ITS station, the case shall be managed by the receiving C-ITS station.

Tested by:

3.1.2.6 Traffic class

Requirement   **RS_tcStVe_156**

New, update and cancellation DENMs shall be set to *traffic class* 1.

Tested by:

3.1.2.7 Message parameters

3.1.2.7.1 DENM

Requirement   **RS_tcStVe_157**

The following table specifies the data elements of the DENM that shall be set.

Table 8: DENM data elements of 'stationary vehicle warning — broken-down vehicle'

Data field	Value
Management container	
actionID	Identifier of a DENM. Shall be set in accordance with [TS 102 894-2].
detectionTime	*TimestampIts*-timestamp at which the event is detected by the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.

referenceTime	*TimestampIts*-timestamp at which a new, update or cancellation DENM is generated. Shall be set in accordance with [TS 102 894-2].
termination	Shall not be set in the case of a new or update DENM. Shall be set to isCancellation(0) in the case of a cancellation DENM.
eventPosition	*ReferencePosition*. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
relevanceDistance	lessThan1000m(4)
relevanceTrafficDirection	If the roadType is known the value shall be set as follows: <table><tr><th>RoadType</th><th>Direction</th></tr><tr><td>0</td><td>allTrafficDirections(0)</td></tr><tr><td>1</td><td>upstreamTraffic(1)</td></tr><tr><td>2</td><td>allTrafficDirections(0)</td></tr><tr><td>3</td><td>upstreamTraffic(1)</td></tr></table> Otherwise, the value shall be set to allTrafficDirections(0)
validityDuration	• Ignition terminal 15 enabled: 30 s • Ignition terminal 15 disabled: 900 s
stationType	The type of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2].
Situation container	
informationQuality	See RS_tcStVe_145. Shall be refreshed for every update DENM.
causeCode	stationaryVehicle(94)
subCauseCode	vehicleBreakdown(2)
Location container	
eventSpeed	Speed of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
eventPositionHeading	Heading of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
traces	*PathHistory* of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2].

	If the PathDeltaTime is used in the PathPoints, the PathDeltaTime of the first PathPoint (closest point to the ReferencePosition) shall be refreshed for an update DENM. All other PathPoints shall not be refreshed. If the PathDeltaTime of the first PathPoint exceeds the maximum value in accordance with [TS 102 894-2], the PathDeltaTime shall not be further refreshed. If the PathDeltaTime is not used in the PathPoints, the PathHistory shall not be refreshed for an update DENM.
roadType	*RoadType* of the road on which the detecting C-ITS station is situated. Shall be refreshed for an update DENM. Shall be set in accordance with [TS 102 894-2] in combination with the following rules: <table><tr><th>Urban / non-urban</th><th>Structural separation</th><th>Data element</th></tr><tr><td>Urban</td><td>No</td><td>urban-NoStructuralSeparationToOppositeLanes(0)</td></tr><tr><td>Urban</td><td>Yes</td><td>urban-WithStructuralSeparationToOppositeLanes(1)</td></tr><tr><td>Urban</td><td>Unknown</td><td>urban-NoStructuralSeparationToOppositeLanes(0)</td></tr><tr><td>Non-urban</td><td>No</td><td>nonUrban-NoStructuralSeparationToOppositeLanes(2)</td></tr><tr><td>Non-urban</td><td>Yes</td><td>nonUrban-WithStructuralSeparationToOppositeLanes(3)</td></tr><tr><td>Non-urban</td><td>Unknown</td><td>nonUrban-NoStructuralSeparationToOppositeLanes(2)</td></tr></table> If the information about the urban/non-urban status cannot be determined, the data element shall be omitted.
Alacarte container	
lanePosition	If the lanePosition is provided by an on-board sensor (e.g. radar, camera), the value shall be set in accordance with [TS 102 894-2]. Use of GNSS and a digital map to estimate the lane number is not legitimate for this version of the triggering condition. If the lanePosition is unknown, the data element shall be omitted. Shall be refreshed for an update DENM.
Alacarte container: StationaryVehicleContainer	

stationarySince	Shall be set according to the duration in minutes of the detecting C-ITS station being stationary. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.

Tested by:

3.1.2.7.2 CAM

Requirement **RS_tcStVe_158**

CAM adaption shall not be used for this C-ITS service.

Tested by:

3.1.2.8 Network and transport layer

Requirement **RS_tcStVe_159**

The interface parameter *DENM destination area* between the DEN basic service and the networking and transport layer shall be equal to a circular shape with radius equal to *relevanceDistance*.

Tested by:

3.1.2.9 Security layer

Requirement **RS_tcStVe_161**

If the triggering conditions as described in section 3.1.2.2 apply, an AT change shall be blocked for new, update and cancellation DENMs as long as the *validityDuration* has not expired (see RS_tcStVe_157). Corresponding new, update and cancellation DENMs shall be sent with the same AT.

Tested by:

3.1.2.10 Scenarios

Other (informational) **RS_tcStVe_192**

This section has an informational character and is not part of the requirement specification.

The following list encompasses scenarios which are regarded as relevant or irrelevant considering the present C-ITS services:

Table 9: Stationary vehicle warning - broken-down vehicle scenarios

Count	Description	Status
	tbd.	
	tbd.	

3.1.3 Stationary vehicle warning - post-crash

3.1.3.1 Description of C-ITS service

Other (informational)   **RS_tcStVe_195**

This section describes the triggering conditions for a V2V DENM transmission caused by a traffic accident.

Other (informational)   **RS_tcStVe_196**

The following C-ITS services are related to this service, because they share similar triggering conditions:

- 'stationary vehicle warning — stopped vehicle';
- 'stationary vehicle warning — broken-down vehicle'.

Requirement   **RS_tcStVe_162**

A DENM signal shall be sent to the stack only if the triggering conditions described in this section are evaluated as valid. Such a signal prompts the stack to generate a new, update or cancellation DENM. If the triggering conditions are not fulfilled, a DENM signal shall not be generated.

Tested by:

3.1.3.2 Triggering conditions

3.1.3.2.1 Preconditions

Requirement   **RS_tcStVe_163**

No specific preconditions apply for this C-ITS service.

Tested by:

Requirement   **RS_tcStVe_207**

Parallel activation with the other related C-ITS services shall be avoided. Where the C-ITS services '*stopped vehicle'* and/or *'broken-down vehicle'* are triggered simultaneously, the C-ITS services shall be prioritised as follows:

1.) 'post-crash' (highest priority);
2.) 'broken-down vehicle';
3.) 'stopped vehicle' (lowest priority).

Tested by:

3.1.3.2.2 Service-specific conditions

Requirement   **RS_tcStVe_164**

If the preconditions in RS_tcStVe_163 and at least one of the following conditions are satisfied, the triggering conditions for this C-ITS service are fulfilled and the generation of a DENM shall be triggered:

a) an eCall has been triggered manually by an occupant of the vehicle by the eCall button and the vehicle becomes stationary within 15 s. If the vehicle is already

stationary, the condition is fulfilled immediately;

b) a low-severity crash is detected without the activation of an irreversible occupant restraint system (e.g. high-voltage battery cut-off, door unlock) and the vehicle becomes stationary within 15 s. If the vehicle is already stationary, the condition is fulfilled immediately;

c) a pedestrian collision is detected with the activation of at least one irreversible pedestrian-protection system (e.g. pop-up bonnet, outside airbag) and the vehicle becomes stationary within 15 s. If the vehicle is already stationary, the condition is fulfilled immediately;

d) a high-severity crash is detected with the activation of at least one irreversible occupant-restraint system (e.g. pyrotechnic belt-tightener, airbag).

Note: The condition 'vehicle becomes/is stationary' is defined in RS_tcStVe_208.

Note: The conditions need to be checked only if the necessary power supply is present. This means that crash-secure implementation of the system is not required.

Tested by:

3.1.3.2.3 Information quality

Requirement   **RS_tcStVe_166**

The value of the data element *informationQuality* in the DENM depends on how the event is detected. The *informationQuality* value shall be set in accordance with the following table (highest possible value shall be used):

Table 10: Information quality of 'stationary vehicle — post-crash'

Event detection	Value of InformationQuality
No TRCO-compliant implementation	unknown(0)
Condition a) is fulfilled.	1
Condition b) or c) is fulfilled.	2
Condition d) is fulfilled.	3

Tested by:

Requirement   **RS_tcStVe_167**

If the triggering conditions change between two updates, the *informationQuality* shall not be changed until the next update. If the changed conditions are still fulfilled while the DENM is updated, the *informationQuality* shall be updated.

Tested by:

3.1.3.3 Termination conditions

Requirement   **RS_tcStVe_168**

This C-ITS service is terminated by a cancellation of the originating C-ITS station. At the termination of the C-ITS service, update DENM request shall be terminated.

Tested by:

3.1.3.3.1 Cancellation

Requirement   **RS_tcStVe_169**

Once at least one of the following conditions is satisfied before the period set in the data element *validityDuration* has expired, the generation of a cancellation DENM shall be triggered:

      a) the ego vehicle is not stationary for a duration of 15 s;

      b) the position of the vehicle has changed more than 500 m (e.g. because the vehicle has been towed away).

Note: The cancellation condition does not imply that the C2C-CC Basic System needs to be permanently operational or extend its operation during that cancellation condition.

Tested by:

3.1.3.3.2 Negation

Requirement   **RS_tcStVe_170**

A negation DENM shall not be used for this C-ITS service.

Tested by:

3.1.3.4 Update

Requirement   **RS_tcStVe_171**

An update DENM shall be triggered every 60 s if the C-ITS service has not been cancelled.

Tested by:

Requirement   **RS_tcStVe_172**

If the ignition terminal 15 is switched from on to off, an update DENM shall be triggered immediately.

Tested by:

Requirement   **RS_tcStVe_173**

New values shall be assigned to data fields or elements in the DENM according to the changed event (e.g. *detectionTime* or *informationQuality*, see RS_tcStVe_177).

Note: The update condition does not imply that the C2C-CC Basic System needs to be permanently operational or extend its operation during that update condition.

Tested by:

3.1.3.5 Repetition duration and repetition interval

Requirement   **RS_tcStVe_174**

DENMs, that are new, have been updated or have been cancelled, shall be repeated for a *repetitionDuration* of 60 s with a *repetitionInterval* of 1 s. Therefore, the interface parameters *Repetition duration* and *Repetition interval* between the application and the DEN basic service shall be set in accordance with the above values.

Tested by:

Requirement   **RS_tcStVe_175**

In the case of an enabled ignition terminal 15, the *validityDuration* shall be set to 180 s. Therefore, one can prevent a gap of DENMs if the *repetitionDuration* of the original DENM has expired and the update has not yet been received.

Note: The *validityDuration* is set to a higher value in the case of a disabled ignition terminal 15 than in the case of an enabled ignition terminal 15. This is due to the fact that update DENM cannot be triggered and can no longer be sent. Therefore, the last DENM shall be kept alive longer.

Note: Where two DENMs with the same *causeCode* originate from the same C-ITS station, the case shall be managed by the receiving C-ITS station.

Tested by:

3.1.3.6 Traffic class

Requirement   **RS_tcStVe_176**

New, update and cancellation DENMs shall be set to *traffic class* 1.

Tested by:

3.1.3.7 Message parameters

3.1.3.7.1 DENM

Requirement   **RS_tcStVe_177**

The following table specifies the data elements of the DENM that shall be set.

Table 11: DENM data elements of 'stationary vehicle warning — post-crash'

Data field	Value
Management container	
actionID	Identifier of a DENM. Shall be set in accordance with [TS 102 894-2].
detectionTime	*TimestampIts*-timestamp at which the event is detected by the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
referenceTime	*TimestampIts*-timestamp at which a new DENM, an update DENM or a cancellation DENM is generated. Shall be set in accordance with [TS 102 894-2].
termination	Shall not be set in case of new or update DENM. Shall be set to isCancellation(0) in case of a cancellation DENM.

---

eventPosition	*ReferencePosition*. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
relevanceDistance	lessThan5km(5)
relevanceTrafficDirection	If the roadType is known the value shall be set as follows: <table><tr><th>RoadType</th><th>Direction</th></tr><tr><td>0</td><td>allTrafficDirections(0)</td></tr><tr><td>1</td><td>upstreamTraffic(1)</td></tr><tr><td>2</td><td>allTrafficDirections(0)</td></tr><tr><td>3</td><td>upstreamTraffic(1)</td></tr></table> Otherwise, the value shall be set to allTrafficDirections(0)
validityDuration	• Ignition terminal 15 enabled: 180 s • Ignition terminal 15 disabled: 1800 s
stationType	The type of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2].
Situation container	
informationQuality	See RS_tcStVe_166. Shall be refreshed for every update DENM.
causeCode	stationaryVehicle(94)
subCauseCode	postCrash(3)
Location container	
eventSpeed	Speed of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
eventPositionHeading	Heading of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.
traces	*PathHistory* of the originating C-ITS station. Shall be set in accordance with [TS 102 894-2]. If the PathDeltaTime is used in the PathPoints, the PathDeltaTime of the first PathPoint (closest point to the ReferencePosition) shall be refreshed for an update DENM. All other PathPoints shall not be refreshed. If the PathDeltaTime of the first PathPoint exceeds the maximum value in accordance with [TS 102 894-2], the PathDeltaTime shall not be further refreshed. If the PathDeltaTime is not used in the PathPoints, the PathHistory shall not be refreshed for an update DENM.
roadType	*RoadType* of the road on which the detecting C-ITS station is situated. Shall be refreshed for an update DENM.

	Shall be set in accordance with [TS 102 894-2] in combination with the following rules:

Urban / non-urban	Structural separation	Data element
Urban	No	urban-NoStructuralSeparationToOppositeLanes(0)
Urban	Yes	urban-WithStructuralSeparationToOppositeLanes(1)
Urban	Unknown	urban-NoStructuralSeparationToOppositeLanes(0)
Non-urban	No	nonUrban-NoStructuralSeparationToOppositeLanes(2)
Non-urban	Yes	nonUrban-WithStructuralSeparationToOppositeLanes(3)
Non-urban	Unknown	nonUrban-NoStructuralSeparationToOppositeLanes(2)

	If the information about the urban/non-urban status cannot be determined, the data element shall be omitted.
Alacarte container	
lanePosition	If the lanePosition is provided by an on-board sensor (e.g. radar, camera), the value shall be set in accordance with [TS 102 894-2]. Use of GNSS and a digital map to estimate the lane number is not legitimate for this version of the triggering condition. If the lanePosition is unknown, the data element shall be omitted. Shall be refreshed for an update DENM.
Alacarte container: StationaryVehicleContainer	
stationarySince	Shall be set according to the duration in minutes of the detecting C-ITS station being stationary. Shall be set in accordance with [TS 102 894-2]. Shall be refreshed for an update DENM.

Tested by:

3.1.3.7.2 CAM

Requirement   **RS_tcStVe_178**

CAM adaption shall not be used for this C-ITS service.

Tested by:

3.1.3.8 Network and transport layer

Requirement   **RS_tcStVe_179**

The interface parameter *DENM destination area* between the DEN basic service and the networking and transport layer shall be equal to a circular shape with radius equal to *relevanceDistance*.

Tested by:

3.1.3.9 Security layer

Requirement   **RS_tcStVe_181**

If the triggering conditions as described in section 3.1.3.2 apply, an AT change shall be blocked for new, update and cancellation DENMs as long as the *validityDuration* has not expired (see chapter RS_tcStVe_177). Corresponding new, update and cancellation DENMs shall be sent with the same AT.

Tested by:

3.1.3.10   Scenarios

Other (informational)   **RS_tcStVe_197**

This section has an informational character and is not part of the requirement specification.

The following list encompasses scenarios which are regarded as relevant or irrelevant considering the present C-ITS service:

Table 12: Stationary vehicle warning - post-crash scenarios

Count	Description	Status
	tbd.	
	tbd.	