Triggering Conditions and Data Quality Wrongway Driver

CAR 2 CAR Communication Consortium

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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 (C2C-CC). 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). The Consortium members represent worldwide major vehicle manufactures, equipment suppliers and research organisations.

Over the years, the C2C-CC has evolved to be one of the key players in preparing the initial deployment of C-ITS in Europe and the subsequent innovation phases. C2C members focus on wireless V2V communication applications based on Direct Communication and concentrate all efforts on creating standards to ensure the interoperability of cooperative systems, spanning all vehicle classes across borders and brands. As a key contributor, the C2C-CC and its members work in close cooperation with the European and international standardisation organisations.

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Document information

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Table 1: Document information

Changes since last release

Release	Date	Changes	Edited by	Approved
1.6.9	2025-12-19	Initial release	Release Management	Steering Committee

Table 2: Changes since last release

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1 Introduction

Other (informational) **RS_tcWWD_1**

This document describes the triggering conditions for the following C-ITS services:

- Wrongway Driver – Entering road in wrong direction

2 Definitions

Definition **RS_tcWWD_2**

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

Definition **RS_tcWWD_3**

A "*Turn Maneuver*" in the context of a wrong way driver scenario is characterized by the ego vehicle altering its driving direction significantly within a specified time frame. This maneuver is identified if one of the following conditions is fulfilled:

- The ego vehicle's heading changes by more than 150 degrees within a period of less than 20 seconds.
- The ego vehicle speeds drop to less than 20 km/h and the heading changes by more than 150 degrees within a period of less than 60 seconds.
- The ego vehicle speeds drop to standstill and the reverse gear is used and the heading changes by more than 150 degrees within a period of less than 90 seconds (without counting standstill time).

3 Requirement specifications

3.1 Wrongway Driver – Entering road in wrong direction

3.1.1 Description of vehicle C-ITS service

Other (informational) **RS_tcWWD_4**

This clause describes the triggering of V2X messages for *Wrongway Driver – Entering road in wrong direction* vehicle C-ITS service. When the ego vehicle enters a road in the wrong direction, a DENM shall be triggered.

Other (informational) **RS_tcWWD_5**

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

3.1.2 Triggering conditions

3.1.2.1 Preconditions

Requirement (i) **RS_tcWWD_6**

No specific preconditions apply for this vehicle C-ITS service.

Tested by:

3.1.2.2 Service-specific conditions

Requirement (i) **RS_tcWWD_7**

If at least one of the following conditions is satisfied, the triggering conditions for this vehicle C-ITS service are fulfilled and the generation of a DENM shall be triggered.

- Condition 1: (TRCO_0 | TRCO_1) & **(**TRCO_2 | TRCO_3 | TRCO_5)
- Condition 2: TRCO_4

Table 3: ‘Wrongway Driver – Entering road in wrong direction’ service-specific conditions

ID	Triggering condition (TRCO)
TRCO_0	The ego vehicle detects passing a relevant “No Entry” traffic sign.
TRCO_1	The ego vehicle detects driving through a relevant “No Entry” gate consisting of two signs positioned beside the road.
TRCO_2	On board map-matching indicates that the ego vehicle is driving in the wrong direction

TRCO_3	The ego vehicle detects one or more vehicles driving in the opposite direction on the the same or an adjacent lane
TRCO_4	A cloud service identifies the ego vehicle as a wrong-way driver based on vehicle trajectory and transmits this information to the vehicle. Note: The cloud service is integrated within the OEM backend or connected backends from service providers associated with the OEM. It utilizes various information sources, including vehicle position and dynamics, map data, and additional data such as swarm information, to accurately identify wrong way driving scenarios. The OEM holds the responsibility to ensure that the cloud service functions as a reliable triggering source, maintaining the integrity and accuracy of the detection process. This involves regular checks and validations to confirm the service's effectiveness in real-time traffic conditions.
TRCO_5	The ego vehicle receives a DENM corresponding to the AWWD service from a roadside unit that can be matched to the ego vehicle.

Tested by:

Requirement (i) **RS_tcWWD_8**

A condition shall be valid as long as it is active and for an extra period of 20 s (the period increases the determinism of the detection algorithm). The validity shall decrease from the moment the condition is no longer satisfied, thus facilitating the combination of triggering conditions.

Tested by:

3.1.2.3 Information quality

Requirement (i) **RS_tcWWD_8**

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 ‘unresponsive driver warning – risk mitigation function active’

Event detection	Value of InformationQuality
No TRCO-compliant implementation	0
TRCO_0 and one of the conditions TRCO_2, TRCO_3, TRCO_5 are fulfilled	1

TRCO_4 OR TRCO_1 and one of the conditions TRCO_2, TRCO_3, TRCO_5 are fulfilled	2
TRCO_4 and another condition are fulfilled	3

Tested by:

Requirement (i) **RS_tcWWD_10**

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 Termination conditions

Requirement (i) **RS_tcWWD_11**

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

Tested by:

3.1.4 Cancellation

Requirement (i) **RS_tcWWD_12**

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:

Table 5: ‘Wrongway Driver – Entering road in wrong direction’ service-specific cancellation conditions

ID	Cancellation condition (CNCO)
CNCO_0	Map data indicates that the vehicle is driving in the correct direction
CNCO_1	The position of the vehicle has changed more than 5000 m from the first Event position.
CNCO_2	A Turn Maneuver was detected (see RS_tcWWD_3).
CNCO_3	Detected a ground arrow pointing in the driving direction of the ego vehicle.
CNCO_4	A backend service identifies that the ego vehicle is no longer a wrong-way driver based on position data and transmits this information to the vehicle.

CNCO_5	The vehicle is stationary for more than 180 s

Tested by:

3.1.5 Negation

Requirement (i) **RS_tcWWD_13**

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

Tested by:

3.1.6 Update

Requirement (i) **RS_tcWWD_14**

The generated DENM shall be updated every 500 ms if the triggering conditions are still satisfied. All data fields that are assigned new values are defined in RS_tcWWD_17.

Tested by:

3.1.7 Repetition duration and repetition interval

Requirement (i) **RS_tcWWD_15**

A repetition of the DENM shall not be used for this vehicle C-ITS service.

Tested by:

3.1.8 Traffic class

Requirement (i) **RS_tcWWD_16**

New and update DENMs shall be set to *traffic class* 0.

Tested by:

3.1.9 Message parameters

3.1.9.1 DENM

Requirement (i) **RS_tcWWD_17**

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

Table 6: DENM data elements of ‘Wrongway Driver – Entering road in wrong direction’

Data field	Value
Management container	

<table>
<tr><td>actionID</td><td colspan="3">Identifier of a DENM. Shall be set in accordance with [TS 102 894-2].</td></tr>
<tr><td rowspan="2">detectionTime</td><td colspan="3">TimestampIts-timestamp at which the event is detected by the originating vehicle C-ITS station. Shall be set in accordance with [TS 102 894-2].</td></tr>
<tr><td colspan="3">Shall be refreshed for an update DENM.</td></tr>
<tr><td>referenceTime</td><td colspan="3">TimestampIts-Timestamp at which a new DENM or an update DENM is generated. Shall be set in accordance with [TS 102 894-2].</td></tr>
<tr><td>termination</td><td colspan="3">A cancellation shall be set according to RS_tcWWD_12.</td></tr>
<tr><td rowspan="2">eventPosition</td><td colspan="3">ReferencePosition. Shall be set in accordance with [TS 102 894-2].</td></tr>
<tr><td colspan="3">Shall be refreshed for every update DENM.</td></tr>
<tr><td>relevanceDistance</td><td colspan="3">lessThan5km(5)</td></tr>
<tr><td rowspan="7">relevanceTrafficDirection</td><td colspan="3">If the roadType is known the value shall be set as follows:</td></tr>
<tr><td>RoadType</td><td>Direction</td><td></td></tr>
<tr><td>0</td><td>upstreamTraffic(1)</td><td></td></tr>
<tr><td>1</td><td>upstreamTraffic(1)</td><td></td></tr>
<tr><td>2</td><td>upstreamTraffic(1)</td><td></td></tr>
<tr><td>3</td><td>upstreamTraffic(1)</td><td></td></tr>
<tr><td colspan="3">Otherwise, the value shall be set to allTrafficDirections(0)</td></tr>
<tr><td>validityDuration</td><td colspan="3">10 s</td></tr>
<tr><td>stationType</td><td colspan="3">The type of the originating vehicle C-ITS station. Shall be set in accordance with [TS 102 894-2].</td></tr>
<tr><td colspan="4">Situation container</td></tr>
<tr><td>informationQuality</td><td colspan="3">See RS_tcWWD_8</td></tr>
<tr><td>causeCode</td><td colspan="3">wrongWayDriving(14)</td></tr>
<tr><td>subCauseCode</td><td colspan="3">wrongDirection(2)</td></tr>
<tr><td colspan="4">Location container</td></tr>
<tr><td rowspan="2">eventSpeed</td><td colspan="3">Speed of the originating vehicle C-ITS station. Shall be set in accordance with [TS 102 894-2].</td></tr>
<tr><td colspan="3">Shall be refreshed for an update DENM.</td></tr>
</table>

<table>
<tr><td>eventPositionHeading</td><td colspan="3">Heading of the originating vehicle C-ITS station. Shall be set in accordance with [TS 102 894-2].</td></tr>
<tr><td></td><td colspan="3">Shall be refreshed for an update DENM.</td></tr>
<tr><td>traces</td><td colspan="3">PathHistory of the originating vehicle C-ITS station. Shall be set in accordance with [TS 102 894-2].</td></tr>
<tr><td></td><td colspan="3">Shall be refreshed for an update DENM.</td></tr>
<tr><td rowspan="11">roadType</td><td colspan="3">RoadType of the road on which the detecting vehicle C-ITS station is situated.</td></tr>
<tr><td colspan="3">Shall be refreshed for an update DENM.</td></tr>
<tr><td colspan="3">Shall be set in accordance with [TS 102 894-2] in combination with the following rules:</td></tr>
<tr><td>Urban / non-urban</td><td>Structural separation</td><td>Data element</td></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>
<tr><td colspan="3">If the information about the urban/non-urban status cannot be determined, the data element shall be omitted.</td></tr>
<tr><td colspan="4">Alacarte container</td></tr>
<tr><td>lanePosition</td><td colspan="3">The data element shall not be set.</td></tr>
</table>

Tested by:

3.1.9.2 CAM

Requirement (i) **RS_tcWWD_18**

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

Tested by:

3.1.10 Network and transport layer

Requirement (i) **RS_tcWWD_19**

The interface parameter destination area in IF.DEN.1 [ETSI EN 302 637-3] shall be equal to a circular shape with centre point equal to *eventPosition* and radius equal to r*elevanceDistance*.

Tested by:

3.1.11 Security layer

Requirement (i) **RS_tcWWD_20**

When the triggering conditions as described in clause 3.1.2 apply, the application shall request the blocking of the AT changeover as defined in RS_BSP_184.

Tested by:

3.1.12 Transition towards the stationary vehicle Warning

Other (informational) **RS_tcWWD_21**

The wrong-way driving situation may end with the vehicle stopping. After stopping, a DENM is triggered according to the conditions outlined in “Triggering Conditions and Data Quality Stationary Vehicle Warning.”