

# Triggering Conditions and Data Quality Traffic Jam

CAR 2 CAR Communication Consortium



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## Document information

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## 1 Introduction

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### 1.1 Abstract

**Other (informational)**

**RS\_tcTrJa\_148**

This document describes the triggering conditions for traffic jam warning for the following two use cases:

- Traffic Jam – Dangerous End of Queue
- Traffic Jam – Traffic Jam Ahead

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## 2 Triggering conditions

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### 2.1 Traffic Jam

#### 2.1.1 Traffic Jam - Dangerous End of Queue

##### 2.1.1.1 Description of Use Case

**Other (informational)**

**RS\_tcTrJa\_93**

The following section describes a situation where an ego vehicle detects the end of a traffic jam, the so called dangerous end of queue. Such a situation is present, when the traffic lane of the ego vehicle is blocked and the vehicle is not able to proceed its way of driving. Urban environment is not part of this use case.

To distinguish this use case from other use cases, the triggering conditions in section 2.1.1.3 define how the end of a traffic jam exactly looks like.

##### 2.1.1.2 Relations to other Use Cases

**Other (informational)**

**RS\_tcTrJa\_149**

The following use cases are related to the *Traffic Jam - Dangerous End of Queue* use case, because they share similar triggering conditions:

- Dangerous Situations – Electronic Emergency Brake Light.

##### 2.1.1.3 Triggering Conditions

###### 2.1.1.3.1 Preconditions

**Requirement**

**RS\_tcTrJa\_94**

The following preconditions shall be satisfied every time before triggering of this use case is initialised:

1. The ego vehicle is located in non-urban environment. The location shall be determined by at least one of these ways:
  - 1.1. The velocity is greater than 80 km/h for a time block of at least 30 s in the last 60 s previous to each detection and the absolute value of the steering wheel angle is smaller than 90 degree for a time block of at least 30 s in the last 60 s previous to each detection (Dangerous End of Queue should not be detected in non-freeway environment).
  - 1.2. An on-board camera sensor indicates non-urban environment.
  - 1.3. An on-board digital map indicates non-urban environment.

Tested by:

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**Requirement**

**RS\_tcTrJa\_95**

The vehicle velocity and deceleration shall be determined by the vehicle bus signal, not by GNSS. The filtered vehicle velocity (with respect to sensor noise due to wheel ticks) shall be used. This requirement shall be applied for all following occurrences of vehicle velocity and deceleration analysis.

Tested by:

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**Requirement**

**RS\_tcTrJa\_96**

The velocity and angle values shall be measured in a continuous manner. The conditions shall be satisfied throughout the measurement duration. The process shall start all over again, when the conditions are not satisfied within measurement duration.

Tested by:

**2.1.1.3.2 Use Case Specific Conditions**

**Requirement**

**RS\_tcTrJa\_105**

Count	Triggering condition	Status
TC_0	The ego vehicle is driving with an initial velocity greater than or equal to 80 km/h and an initial deceleration smaller than or equal to 0.1 m/s <sup>2</sup> . The driver reacts on the dangerous end of queue by reducing the velocity from initial to target velocity smaller than or equal to 30 km/h. The duration between initial and target velocity shall be smaller than or equal to 10 s. An instant deceleration between initial and target velocity smaller than -3.5 m/s <sup>2</sup> is detected.	driver reaction
TC_1	Passengers of the ego vehicle react on the traffic jam by enabling hazard lights for at least 3 s	driver reaction
TC_2	At least three other vehicles with a velocity of at least 7 km/h have hazard lights enabled for at least 3 s which is determined by at least one of these ways: <ul style="list-style-type: none"> <li>• Indicated by an on-board camera sensor.</li> <li>• Indicated by CAMs.</li> </ul>	environment or on-board sensors
TC_3	At least one DENM corresponding to the use case <i>Dangerous End of Queue</i> has been received.	environment
TC_4	At least five different DENM (different <i>actionIDs</i> ) corresponding to the use case <i>Traffic Jam Ahead</i> has been received from the downstream traffic.	environment
TC_5	At least one DENM corresponding to the use case <i>Static Safeguarding Emergency Vehicle</i> has been received, with <i>linkedCause</i> equal to <i>Traffic Condition</i> or <i>Dangerous End of Queue</i> .	environment
TC_6	On-board sensors of the ego vehicle recognize that the ego vehicle is facing a dangerous end of queue.	on-board sensors

**Table 3: Traffic Jam - Dangerous End of Queue" use case specific conditions**

Once at least one of the following conditions is satisfied, the triggering conditions for this use case are fulfilled and the generation of a DENM shall be triggered.

- TC\_0 AND (TC\_2 OR TC\_3 OR TC\_4 OR TC\_5 OR TC\_6)
- TC\_1 AND TC\_2

Tested by:

**Requirement**

**RS\_tcTrJa\_151**

A new DENM shall not be requested within the *Detection Blocking Time*. The *Detection Blocking Time* is launched after the event is detected and a respective DENM has been requested. In this way, a single event is not able to flood the transmission channel. The *Detection Blocking Time* shall be 60 s no matter how the event is detected. The detection period between two detected events shall be at minimum equal to the *Detection Blocking Time*; the detection algorithm may run during *Detection Blocking Time*.

NOTE: No time period for the braking maneuvers is presented, because the initial ego vehicle velocity has no upper restriction.

Tested by:

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**Requirement**

**RS\_tcTrJa\_107**

A Condition shall be valid as long as it is active and for an extra time period of 5 s (the time period increases the determinism of the detection algorithm). The validity shall decrease from the moment the condition is not satisfied anymore. The combination of triggering conditions is facilitated this way.

Tested by:

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**Requirement**

**RS\_tcTrJa\_108**

CAMs and DENMs from remote vehicles used for evaluating use case specific conditions as described above shall be relevant for the ego vehicle. The relevance shall be determined in one of these ways:

- a) A digital map indicates that the event and the ego vehicle are separated by a distance less than 500 m and share the same driving direction.
- b) A path history match indicates that the event and the ego vehicle are separated by a distance less than 500 m and share the same driving direction.
- c) The Euclidean distance between the event and the ego vehicle shall be smaller than 500 m and the absolute value of the heading difference shall be less than 10 degree. The Traffic Jam reference positions according to the DENMs shall be located within an area spanning from -45 to +45 degree starting at the ego vehicle's longitudinal axis.

NOTE: When counting vehicles or events, authorization ticket change should be considered in a way no vehicle or event is counted multiple times.

Tested by:

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**2.1.1.3.3 Information Quality**

**Requirement**

**RS\_tcTrJa\_109**

The value of the data element *informationQuality* in the DENM depends on the way this use case is detected. Triggering conditions are divided into groups: Driver reaction, vehicle dynamics, environment and on-board sensors. The *informationQuality* value shall be set in the following way (highest possible value shall be used):

Event detection	Value of InformationQuality
No TC compliant implementation	unknown(0)



At least one condition from the driver reaction AND environment group is fulfilled.	1
At least one condition from the driver reaction AND on-board sensors group is fulfilled.	2
At least one condition from the driver reaction AND environment AND on-board sensors group is fulfilled.	3

**Table 4: Information quality of "Traffic Jam - Dangerous End of Queue"**

Tested by:

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**2.1.1.4 Termination Conditions**

**Requirement**

**RS\_tcTrJa\_110**

A termination of the use case shall not be considered.

Tested by:

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**2.1.1.4.1 Cancellation**

**Requirement**

**RS\_tcTrJa\_111**

A cancellation DENM shall not be used for this use case.

Tested by:

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**2.1.1.4.2 Negation**

**Requirement**

**RS\_tcTrJa\_112**

A negation DENM shall not be used for this use case.

Tested by:

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**2.1.1.5 Update**

**Requirement**

**RS\_tcTrJa\_113**

An update DENM shall not be used for this use case.

Tested by:

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**2.1.1.6 Repetition Duration and Repetition Interval**

**Requirement**

**RS\_tcTrJa\_114**

New DENMs shall be repeated for a *repetitionDuration* of 20 s with a *repetitionInterval* of 0.5 s.

Therefore the interface parameters *Repetition duration* and *Repetition interval* between the application and the DEN basic service shall be set according to the values above.

NOTE: The case of managing two DENMs with the same *causeCode* from the same originating ITS-S has to be handled by the receiving ITS station.

Tested by:

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**2.1.1.7 Traffic class**

**Requirement**

RS\_tcTrJa\_115

New DENMs shall be set to *traffic class 1*.

Tested by:

**2.1.1.8 Message Parameter**

**2.1.1.8.1 DENM**

**Requirement**

RS\_tcTrJa\_116

Table 5 specifies the data elements of the DENM that shall be set.

Data Field	Value
<b>Management Container</b>	
<i>actionID</i>	Identifier of a DENM. Shall be set according to [TS 102 894-2].
<i>detectionTime</i>	<i>Timestamppts</i> -Timestamp at which the event is detected by the originating ITS-S. Shall be set according to [TS 102 894-2].
<i>referenceTime</i>	<i>Timestamppts</i> -Timestamp at which a new DENM is generated. Shall be set according to [TS 102 894-2].
<i>termination</i>	Shall not be set, because neither negation nor cancellation shall be used in this use case.
<i>eventPosition</i>	<i>ReferencePosition</i> . Shall be set according to [TS 102 894-2].
<i>relevanceDistance</i>	lessThan1000m(4)
<i>relevanceTrafficDirection</i>	upstreamTraffic(1)
<i>validityDuration</i>	20 seconds (it is expected that vehicles are facing a different traffic situation 20 seconds after detection)
<i>stationType</i>	The type of the originating ITS-S. Shall be set according to [TS 102 894-2].
<b>Situation Container</b>	
<i>informationQuality</i>	See RS_tcTrJa_109.
<i>causeCode</i>	dangerousEndOfQueue(27)
<i>subCauseCode</i>	unavailable(0)
<b>Location Container</b>	
<i>eventSpeed</i>	Speed of the originating ITS-S. Shall be set according to [TS 102 894-2].

<i>eventPositionHeading</i>	Heading of the originating ITS-S. Shall be set according to [TS 102 894-2].		
<i>traces</i>	<i>PathHistory</i> of the originating ITS-S. Shall be set according to [TS 102 894-2].		
<i>roadType</i>	<i>RoadType</i> of the road the detecting ITS-S is situated on.		
	Shall be set according to [TS 102 894-2] in combination with the following rules:		
	<b>Urban / Non-Urban</b>	<b>Structural Separation</b>	<b>Data Element</b>
	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)
	Otherwise, if the information about the urban/non-urban status cannot be determined, the data element shall be omitted.		
<b>Alacarte Container</b>			
<i>lanePosition</i>	If the <i>lanePosition</i> is provided by an onboard sensor (e.g. radar, camera), the value shall be set according to [TS 102 894-2]. The use of GPS and a digital map for the estimation of the lane number is not legitimate for this version of the triggering condition.		
	If the <i>lanePosition</i> is unknown, the data element shall be omitted.		

**Table 5: DENM data elements of "Traffic Jam - Dangerous End of Queue"**

Tested by:

**2.1.1.8.2 CAM**

**Requirement**

**RS\_tcTrJa\_117**

CAM adaption shall not be used for this use case.

Tested by:

**2.1.1.9 Networking and Transport Layer**

**Requirement**

**RS\_tcTrJa\_118**

For the Day One version of this application, the destination area is the same as the relevance area - in this case, a circle of radius *relevanceDistance*. Therefore, the interface parameter *DENM destination area* between the DEN basic service and the Networking & Transport layer shall be equal to a circular shape with radius equal to *relevanceDistance*.

Tested by:

**2.1.1.10 Security Layer**

**Requirement**

**RS\_tcTrJa\_120**

If the triggering conditions as described in chapter 2.1.1.3 apply, an AT change shall be blocked for new, update and cancellation DENMs as long as the *validityDuration* is not expired (see section 2.1.1.8.1). Corresponding new DENMs shall be sent with the same authorization ticket.

Tested by:

**2.1.1.11 Scenarios**

**Other (informational)**

**RS\_tcTrJa\_152**

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 use case:

Count	Description	Status
SC_0	A towing maneuver consisting of two vehicles both with enabled hazard lights no matter whether stationary or moving.	Irrelevant
SC_1	A braking maneuver due to a red traffic light.	Irrelevant
SC_2	Freeway.	Relevant
SC_4	The ego vehicle is arriving at the end of a traffic queue. Other vehicles have hazard lights enabled to notify inbound traffic. Passengers of the ego-vehicle react by enabling hazard lights.	Relevant
SC_5	The ego vehicle is standing still at the end of a traffic queue with no vehicles behind. Hazard lights of the ego vehicle may be enabled.	Relevant
SC_6	The ego vehicle is performing a braking maneuver due to the end of a traffic queue. Hazard lights of the ego vehicle may be enabled.	Relevant
SC_6	Traffic on a different road.	Irrelevant
SC_7	Traffic in the opposite driving direction.	Irrelevant
SC_8	Other vehicles than passenger cars.	Irrelevant
SC_9	Using hazard lights for "saying sorry".	Irrelevant

**Table 6: Traffic Jam - Dangerous End of Queue scenarios**

## 2.1.2 Traffic Jam - Traffic Jam Ahead

### 2.1.2.1 Description of Use Case

#### Other (informational)

**RS\_tcTrJa\_121**

The following section describes a situation where an ego vehicle detects a traffic jam. Such a situation shall be present, if the ego vehicle is surrounded by stationary traffic or a heavy volume of traffic. Urban environment is not part of this use case.

It is important that a traffic jam shall be detected only in appropriate situations. All other situations though related with this use case or not, shall not be detected. Section 2.1.2.2 presents use cases with possible relations to this use case.

To distinguish this use case from other use cases, the triggering conditions in section 2.1.2.3 define how a traffic jam exactly looks like.

### 2.1.2.2 Relations to other Use Cases

#### Other (informational)

**RS\_tcTrJa\_155**

The following use cases are related to the *Traffic Jam - Traffic Jam Ahead* use case, because they share similar triggering conditions:

- Stationary Vehicle Warning - Stopped Vehicle
- Stationary Vehicle Warning - Broken-down Vehicle
- Stationary Vehicle Warning - Post-Crash
- Special Vehicle Warning - Stationary Wrecking Service Warning

### 2.1.2.3 Triggering Conditions

#### 2.1.2.3.1 Preconditions

##### Requirement

**RS\_tcTrJa\_122**

The following preconditions shall be satisfied every time before triggering of this use case is initialised:

1. No Stationary Vehicle Warning use case is detected.
2. No Special Vehicle Warning use case is detected.
3. The ego vehicle is located in non-urban environment. The location shall be determined by at least one of these ways:
  - 3.1. The velocity is greater than 80 km/h for a time block of at least 30 s in the last 180 s previous to each detection and the absolute value of the steering wheel angle is smaller than 90 degree for a time block of at least 30 s in the last 60 s previous to each detection (Traffic jam should not be detected on freeways).
  - 3.2. An on-board camera sensor indicates non-urban environment.
  - 3.3. An on-board digital map indicates non-urban environment.

Tested by:

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##### Requirement

**RS\_tcTrJa\_123**

The vehicle velocity shall be determined by the vehicle bus signal, not by GNSS. The filtered vehicle velocity (with respect to sensor noise due to wheel ticks) shall be used. This requirement shall be applied for all following occurrences of vehicle velocity analysis.

Tested by:

**Requirement**

**RS\_tcTrJa\_124**

The velocity and angle values shall be measured in a continuous manner. The conditions shall be satisfied throughout the measurement duration. The process shall start all over again, when the conditions are not satisfied within measurement duration.

Tested by:

**2.1.2.3.2 Use Case Specific Conditions**

**Requirement**

**RS\_tcTrJa\_131**

Count	Triggering Conditions	Status
TC_0	The ego vehicle is moving with an average velocity less than or equal to 30 km/h and greater than 0 km/h (to avoid an overlapping and to distinguish TC_0 and TC_1 this threshold is introduced). The average velocity shall be calculated over a period of 120 s (the duration condition excludes frequently changing traffic states from triggering). NOTE: This TC covers the scenario Wide Moving Jam. See SC_5 in section 2.1.2.11.	vehicle dynamics
TC_1	The ego vehicle velocity is equal to 0 km/h throughout a duration of at least 30 s. NOTE: This TC covers the scenario Stationary Traffic. See SC_4 in section 2.1.2.11.	vehicle dynamics
TC_2	At least one DENM corresponding to the use case <i>Traffic Jam Ahead</i> with the same driving direction has been received.	environment
TC_3	At least one traffic jam notification with the same driving direction has been received by means of mobile radio.	environment
TC_4	CAMs indicate a velocity less than or equal to 30 km/h of at least five other vehicles in at most 100 m distance and the same driving direction.	environment
TC_5	On-board sensors indicate a velocity less than or equal to 30 km/h of at least five other vehicles in at most 100 m distance and the same driving direction.	on-board sensor

**Table 7: "Traffic Jam - Traffic Jam Ahead" use case specific conditions**

Once at least one of the following conditions is satisfied, the triggering conditions for this use case are fulfilled and the generation of a DENM shall be triggered.

- TC\_0
- TC\_1 AND (TC\_2 OR TC\_3 OR TC\_4 OR TC\_5)

Tested by:

**Requirement**

**RS\_tcTrJa\_156**

A new DENM shall not be requested within the *Detection Blocking Time*. The *Detection Blocking Time* is launched after the event is detected and a respective DENM has been

requested. In this way, a single event is not able to flood the transmission channel. The *Detection Blocking Time* shall be 180 s no matter how the event is detected. The detection period between two detected events shall be at minimum equal to the *Detection Blocking Time*; the detection algorithm may run during *Detection Blocking Time*.

Tested by:

**Requirement**

**RS\_tcTrJa\_133**

A condition shall be valid as long as it is active and for an extra time period of 5 s (the time period increases the determinism of the detection algorithm). The validity decreases from the moment the condition is not satisfied anymore. The combination of triggering conditions is facilitated this way.

Tested by:

**Requirement**

**RS\_tcTrJa\_134**

CAMs and DENMs from remote vehicles as well as mobile radio events for evaluating use case specific conditions as described above shall be relevant for the ego vehicle. The relevance shall be determined by at least one of these ways:

- a) A digital map indicates that the event and the ego vehicle are separated by a distance less than 500 m and share the same driving direction.
- b) A path history match indicates that the event and the ego vehicle are separated by a distance less than 500 m and share the same driving direction.
- c) The Euclidean distance between event and ego vehicle shall be smaller than 500 m and the absolute value of the heading difference shall be less than 10 degree. The Traffic Jam reference positions according to DENMs shall be located within an area spanning from -45 to +45 degree starting at the ego vehicle's longitudinal axis.

NOTE: When counting vehicles or events, authorization ticket change should be considered in a way no vehicle or event is counted multiple times.

Tested by:

**2.1.2.3.3 Information Quality**

**Requirement**

**RS\_tcTrJa\_135**

The value of the data element *informationQuality* in the DENM depends on the way the event is detected. Triggering conditions are divided into groups: Driver reaction, vehicle dynamics, environment and on-board sensors. The *informationQuality* value shall be set in the following way (highest possible value shall be used):

Event detection	Value of InformationQuality
No TC compliant implementation	unknown(0)
At least one condition from the vehicle dynamics group is fulfilled. This means condition TC_0 is fulfilled.	1
At least one condition from the vehicle dynamics AND environment group is fulfilled.	2

At least one condition from the vehicle dynamics AND on-board sensor group is fulfilled.	3
At least one condition from the vehicle dynamics AND environment group AND on-board sensor group is fulfilled	4

**Table 8: Information quality of "Traffic Jam - Traffic Jam Ahead"**

Tested by:

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**2.1.2.4 Termination Conditions**

**Requirement**

**RS\_tcTrJa\_136**

A termination of the use case shall not be considered.

Tested by:

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**2.1.2.4.1 Cancellation**

**Requirement**

**RS\_tcTrJa\_137**

A cancellation DENM shall not be used for this use case.

Tested by:

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**2.1.2.4.2 Negation**

**Requirement**

**RS\_tcTrJa\_138**

A negation DENM shall not be used for this use case.

Tested by:

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**2.1.2.5 Update**

**Requirement**

**RS\_tcTrJa\_139**

An update DENM shall not be used for this use case.

Tested by:

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**2.1.2.6 Repetition Duration and Repetition Interval**

**Requirement**

**RS\_tcTrJa\_140**

New DENMs 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 according to the values above.

NOTE: The case of managing two DENMs with the same *causeCode* from the same originating ITS-S has to be handled by the receiving ITS station.

Tested by:

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**2.1.2.7 Traffic class**

**Requirement**

RS\_tcTrJa\_141

New DENMs shall be set to *traffic class 1*.

Tested by:

**2.1.2.8 Message Parameter**

**2.1.2.8.1 DENM**

**Requirement**

RS\_tcTrJa\_142

Table 9 specifies the data elements of the DENM that shall be set.

Data Field	Value
<b>Management Container</b>	
<i>actionID</i>	Identifier of a DENM. Shall be set according to [TS 102 894-2].
<i>detectionTime</i>	<i>Timestamppts</i> -Timestamp at which the event is detected by the originating ITS-S. Shall be set according to [TS 102 894-2].
<i>referenceTime</i>	<i>Timestamppts</i> -Timestamp at which a new DENM is generated. Shall be set according to [TS 102 894-2].
<i>termination</i>	Shall not be set, because neither negation nor cancellation shall be used in this use case.
<i>eventPosition</i>	<i>ReferencePosition</i> . Shall be set according to [TS 102 894-2].
<i>relevanceDistance</i>	lessThan1000m(4)
<i>relevanceTrafficDirection</i>	upstreamTraffic(1)
<i>validityDuration</i>	60 seconds (a traffic jam situation is expected to last at least 60 seconds)
<i>stationType</i>	The type of the originating ITS-S. Shall be set according to [TS 102 894-2].
<b>Situation Container</b>	
<i>informationQuality</i>	See RS_tcTrJa_135.
<i>causeCode</i>	trafficCondition(1)
<i>subCauseCode</i>	unavailable(0)
<b>Location Container</b>	
<i>eventSpeed</i>	Speed of the originating ITS-S. Shall be set according to [TS 102 894-2].

<i>eventPositionHeading</i>	Heading of the originating ITS-S. Shall be set according to [TS 102 894-2].		
<i>traces</i>	<i>PathHistory</i> of the originating ITS-S. Shall be set according to [TS 102 894-2].		
<i>roadType</i>	<i>RoadType</i> of the road the detecting ITS-S is situated on.		
	Shall be set according to [TS 102 894-2] in combination with the following rules:		
	<b>Urban / Non-Urban</b>	<b>Structural Separation</b>	<b>Data Element</b>
	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)
	Otherwise, if the information about the urban/non-urban status cannot be determined, the data element shall be omitted.		
<b>Alacarte Container</b>			
<i>lanePosition</i>	If the lanePosition is provided by an onboard sensor (e.g. radar, camera), the value shall be set according to [TS 102 894-2]. The use of GPS and a digital map for the estimation of the lane number is not legitimate for this version of the triggering condition.		
	If the lanePosition is unknown, the data element shall be omitted.		

**Table 9: DENM data elements of "Traffic Jam - Traffic Jam Ahead"**

Tested by:

**2.1.2.8.2 CAM**

**Requirement**

**RS\_tcTrJa\_143**

CAM adaption shall not be used for this use case.

Tested by:

### 2.1.2.9 Networking and Transport Layer

**Requirement**

**RS\_tcTrJa\_144**

For the Day One version of this application, the destination area is the same as the relevance area - in this case, a circle of radius *relevanceDistance*. Therefore, the interface parameter *DENM destination area* between the DEN basic service and the Networking & Transport layer shall be equal to a circular shape with radius equal to *relevanceDistance*.

Tested by:

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### 2.1.2.10 Security Layer

**Requirement**

**RS\_tcTrJa\_146**

If the triggering conditions as described in chapter 2.1.2.3 apply, an AT change shall be blocked for new, update and cancellation DENMs as long as the *validityDuration* is not expired (see section 2.1.2.8.1). Corresponding new DENMs shall be sent with the same authorization ticket.

Tested by:

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### 2.1.2.11 Scenarios

**Other (informational)**

**RS\_tcTrJa\_158**

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 use case:

Count	Description	Status
SC_0	Freeway.	Relevant
SC_1	The ego vehicle is in a breakdown state.	Irrelevant
SC_2	The ego vehicle is in a crash state.	Irrelevant.
SC_3	The ego vehicle performs a rescue and recovery operation.	Irrelevant
SC_4	The ego-vehicle is stationary surrounded by other road users.	Relevant
SC_5	The ego-vehicle is surrounded by stop-and-go traffic.	Relevant
SC_6	Traffic on a different road.	Irrelevant
SC_7	Traffic in the opposite driving direction.	Irrelevant
SC_8	Other vehicles than passenger cars.	Irrelevant

**Table 10: Traffic Jam - Traffic Jam Ahead scenarios**

### 3 Appendix

#### 3.1 List of abbreviations

Other (informational)

RS\_tcTrJa\_161

ABS	Anti-lock Braking System
ASN.1	Abstract Syntax Notation One
ASR	Anti-Slide 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
TTC	Time To Collision
V2V	Vehicle to Vehicle
TC	Triggering Condition

**Table 11: Abbreviations**