



Common C-ITS Service Definitions

Platoon Support Information for Automated Vehicles

C-Roads Platform

Working Group 2 Technical Aspects

Taskforce 2 Service Harmonisation

Publication History

Version	Date	Description, updates and changes	Status
0.1	31.01.2020	Converted input from Austrian document where applicable into the C-Roads template	Draft
0.2	15.02.2020	Additional input provided by Austria on the use case description part	Draft
0.3	23-03-2020	Improvements based on WG2 review + comments to be addressed	Draft
0.4	08.05.2020	Revision of single elements of the draft according to TF2 Telco discussions and feedback.	Draft
1.7.0.TF.5	12.05.2020	Incorporated new template and deleted service introduction as this was already defined in the document: C_Roads_WG2_TF2_SAE Level Guidance v1.07.0.F5.doc	Draft

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1 Functional Description of <Service Name>

1.1 Automated Vehicles Guidance service introduction

Service introduction	
Summary	See document± C_Roads_WG2_TF2_SAE Level Guidance v1.07.0.F5.doc
Background	See C_Roads_WG2_TF2_SAE Level Guidance v1.07.0.F5.doc.
Objective	See document: C_Roads_WG2_TF2_SAE Level Guidance v1.07.0.F5.doc
Expected benefits	See document: C_Roads_WG2_TF2_SAE Level Guidance v1.07.0.F5.doc
Use Cases	See document: C_Roads_WG2_TF2_SAE Level Guidance v1.07.0.F5.doc

1.2 Platoon Support Information for Automated Vehicles>

Type of road network	Highways with more than one lane per driving direction
Type of vehicle	Automated Vehicles
Use case introduction	
Summary	The road operator would like to inform connected and automated vehicles about the suitability of road segments or lanes for platooning or “vehicle group travel”. Platoon support information would convey the view of the road operator into the vehicle, giving advice about applicable sections and lanes for platooning and the recommended parameters (vehicle classes, number of vehicles, overall length) for forming a platoon in these areas, thus optimizing the flow of traffic on the network. The information is sent from the infrastructure to the vehicles (I2V).
Background	<p>On European road networks platooning of trucks is generally not allowed, unless specific conditions for participating vehicles, road segments, R&D pilot environments or other specific conditions are met and considered to be an acceptable risk for all involved parties and the general public. On the other hand large groups of automated vehicles driving in a very close distance to each other may pose a challenge for infrastructure based traffic management, a platoon of several automated vehicles may for example block the access to ramps for other vehicles or have a negative impact on overall traffic flow. If a road operator wants to optimize traffic flow in “mixed” traffic, it might need to set boundaries on the applicability of platooning based on the assessment of the situation (e.g. weather, traffic intensity, incidents and more).</p> <p>Therefore this use case defines a first set of information parameters needed to be able to support platooning of vehicles on a specific road segment under regular traffic monitoring conditions on this segment.</p>
Objective	<p>Support the safe and secure operation of a travelling platoon on a specific motorway road section, by generating a set of information needed by the vehicles participating in the platoon, but also for the vehicles travelling to the road section involved. The information is as follows:</p> <ul style="list-style-type: none"> • Inform vehicles about the start of platoon section (i.e. section where platooning is possible from an infrastructure perspective) • Inform vehicles about the end of platoon section (i.e. section where platooning is not possible or not desired from an infrastructure perspective) • Inform vehicles about the maximum number of vehicles in a platoon for a predefined stretch on the road • Inform vehicles about the minimum safety gap between vehicles in a platoon for a predefined stretch on the road • Inform vehicles about the vehicle class that can form a platoon for a predefined stretch on the road • Inform vehicles about applicable lanes for a platoon • Inform vehicles about the speed limit of a platoon • Inform vehicles about the road layout of the platoon-section • Inform vehicles about the maximum overall length of a platoon <p>Inform all vehicles of the end of the platooning section.</p>
Desired behaviour	<ul style="list-style-type: none"> • Platoons are only formed in a suitable section of the road infrastructure (but it is not required to form a platoon if not wanted). • The vehicles forming or leaving a platoon perform the desired actions without major disruptions for the other traffic participants. • The platoons are operated on predefined lanes. • The vehicles of a platoon cooperate to fulfil the specified parameters of the platoon (maximum speed, maximum number of vehicles, maximum length).

	<ul style="list-style-type: none"> • Each vehicle that wants to be part of a platoon is aware of its own total length (vehicle and trailer). • The platoons avoid blocking of other traffic participants and dissolve the platoon based on an updated set of traffic parameters if traffic conditions have changed.
Expected benefits	<p><u>Driver in automated vehicles</u></p> <ul style="list-style-type: none"> • Higher comfort for driver. • Reduced probability of accidents. <p><u>Automated vehicle</u></p> <ul style="list-style-type: none"> • Safer and more efficient adaptation to current traffic situation on the road. <p><u>National Economy</u></p> <ul style="list-style-type: none"> • Less disruption of traffic flow. <p><u>Road operator</u></p> <ul style="list-style-type: none"> • Increased quality of traffic management through active influence on platoons. <p><u>Other traffic participants</u></p> <ul style="list-style-type: none"> • Platoons are only allowed in specified zones, resulting in a better prediction of the expected traffic. • Better avoidance of possible blocking of ramps for vehicles that want to enter or leave the highway.
Use case description	
Situation	<p>Depending on the traffic situation and road segment topology, platooning may be desired to improve the overall traffic flow.</p> <p>The road operator generates the currently valid attributes of a platoon (number of vehicles, vehicle type, length of platoon, ...) need to be adapted to the characteristics of the road section and the traffic situation.</p> <p>The road operator communicates changes in the set of parameters or the overall message that platooning is not possible any more.</p>
Logic of transmission	I2V and "collection of feedback" V2I
Actors and relations	<p>Road operator send the supporting information for platooning and updates according to traffic conditions</p> <p>Vehicles in the platoon or service providers send feedback about the current status of the platoon to the road operator responsible for this segment of the infrastructure.</p> <p>End user is the driver of automated vehicles with the possibility and intention of platooning, or with the option to join or leave an existing platoon on a road segment ahead.</p>
Scenario	<p>Road operator monitors the traffic conditions and senses / analyses a status were platooning is possible for a number of vehicles higher than the set minimum for an acceptable prediction period.</p> <ul style="list-style-type: none"> - Road operator sends the set of information to all vehicles ahead of the specific road section. - Road sections with ramps or intersections: reduce maximum length of platoon. - Traffic flow on long road sections without intersections and multiple lanes can be improved by allowing long platoons, moderate speed limit and reducing the minimum distance between vehicles. - Additional information for the platooning vehicles is send if changes occur or if the platoon has reached his end point of the road segment.
Display / alert principle	The information needs to reach the automated vehicles system.

	<p>Overall the principles of in-vehicle interactions and alerts are under complete responsibility of the vehicle manufacturer or operator of the automated vehicle. This could include manual confirmation of e.g. platoon forming and travelling.</p> <p>This includes the responsibility to make the driver aware in time to be able to take needed actions to comply to a given road specific advice.</p>
Functional Constraints / dependencies	The vehicle must be able to identify, whether, for example, the length of the platoon will be exceeded, if the particular vehicle also joins the platoon.
Interoperability Requirements	
Message profile requirements	For this use case the message format IVI shall be used.
Security and data protection requirements	The IVI profile (including its extension: automated vehicle container) for this use case is specified in XXXX
Communication technology requirements	
Test and validation requirements	