



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

**AUTOMATED VEHICLE GUIDANCE (AVG)  
[C-ROADS SUD06]**

**VERSION 3.0.0**

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# Introduction

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

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

## 6. Automated Vehicle Guidance (AVG)

### 6.1 AVG: Service introduction

Service introduction	
Summary	<p>For automated vehicles at various technical levels of automation, guidance and information from road operators provided via C-ITS can be one of the important input sources to help such vehicles in their highly automated decision making processes.</p> <p>Such additional guidance can be specific to certain types of road networks and dynamic traffic conditions, but also to specific vehicle types and their characteristics.</p> <p>The information provided ranges from simple guidance for certain road segments or lanes, but can also recommend parameters for highly automated vehicles not to drive in groups at certain unsuitable sections and/or lanes on the network (e.g., platooning guidance for trucks under certain road and traffic conditions).</p> <p>The service as a whole is strictly guidance and never to be understood as regulation or instruction. Any guidance provided is not a road operator's guarantee for a safe operation of certain modes of automation. It aims to be an additional piece of information for the vehicle's decision-making process while engaging in modes of automation, transporting the road operator's view into the vehicle.</p>
Background	<ul style="list-style-type: none"> <li>○ Road operators face the challenge to be responsible both for an uninterrupted operation of their networks and a dynamic adaption of said network to the future needs of its users and travellers.</li> <li>○ This is particularly true for the introduction of automated vehicles into the traffic situation, where long periods of mixed vehicle fleets can be foreseen: traditional, connected and automated vehicles will be operating in parallel for many years on the same road networks.</li> <li>○ Therefore, it is of high interest for road operators to use all options of connected vehicle communication and C-ITS messages to support this transition to automated traffic with highly dynamic use cases and scenarios targeted to these specific vehicle groups on the road network to enhance safety and efficiency.</li> </ul>
Objective	<ul style="list-style-type: none"> <li>○ Enhanced road safety and traffic efficiency on road networks by giving specific advice and guidance to various vehicle types and groups based on current traffic conditions and the road operator's view.</li> <li>○ Support the introduction of automated vehicles into the transport system by extending the communication to all types of vehicles via standard messages that can be interpreted in a uniform way by all passing vehicle types and can be used for safer and more efficient travel.</li> </ul>

Expected benefits	<ul style="list-style-type: none"> <li>○ Provide additional information and guidance for automated vehicles operating in regular traffic conditions, where most traffic is not yet automated.</li> <li>○ Provide more detailed and specifically tailored information in order to generate more uniform and dynamically adapted transport flows on road networks.</li> <li>○ Overall higher energy efficiency and reduced energy consumption, as well as reduced numbers of accidents and delays in transport operations.</li> <li>○ Safety gains and better decision-making processes for early adopters of vehicle automation in mixed traffic situations while transitioning to higher levels and volume of automation in traffic</li> </ul>
Use cases	<ul style="list-style-type: none"> <li>○ SAE Level Guidance (AVG – SAELG)</li> <li>○ Platoon Support Information (AVG – PSI)</li> <li>○ Vehicle Distance Information (AVG – VDI)</li> <li>○ Vehicle Speed Information (AVG – VSI)</li> </ul>

## 6.2 AVG: Use Cases

### 6.2.1 AVG – SAE Level Guidance (AVG-SAELG)

Type of road network	All
Type of vehicle (receiver)	Partly Automated Vehicles (at SAE levels 2,3,4)
Use case introduction	
Summary	<p>The purpose of this use case is to provide guidance and information on the SAE levels of automation road operators consider unsuitable for partly automated vehicles on certain road or lane segments on their network, at a given point in time, considering overall road conditions and the current traffic situation.</p> <p>The use case as a whole is strictly guidance and never to be understood as regulation or instruction. Any guidance provided is not a road operator's guarantee for safe operation of certain modes of automation nor is it a definitive statement that certain modes of automation are possible or impossible, allowed or not allowed.</p> <p>It aims to be an additional piece of information for the vehicle's decision-making process while engaging in modes of automation, transporting the road operator's view into the vehicle. This can result in an increase/decrease of functionalities required from the automated vehicle and a corresponding increase/decrease in what is required from the driver, based on the overall traffic situation, the sensory input from the vehicle itself and the message received by the infrastructure.</p>
Background	<p>Infrastructure based guidance on the unsuitable levels of automation is expected to provide improvements to the efficiency of traffic flow as well as road safety by providing automated vehicles with additional information in their assessment of possible automation.</p> <p>This will be especially useful/necessary in the transitional phase towards completely automated driving, which will include conventional vehicles, connected vehicles as well as autonomous vehicles. This transition phase of mixed vehicle fleets is expected to last at least 20 years, with overall traffic flows growing nonetheless.</p> <p>SAE levels are currently the only clearly defined metric for automation levels supported by standards and thus are utilised for this use case. Road operators are already working on other metrics to better convey support for automated driving on their road network, e.g., Infrastructure Support for Automated Driving (ISAD) levels. Once available in standards, such metrics might update or even replace this use case.</p>
Objective	<ul style="list-style-type: none"> <li>○ Guide and inform vehicles about the road operators' assessment of currently unsuitable SAE automation levels in a specific area.</li> </ul>

	<ul style="list-style-type: none"> <li>○ Provide detailed geographical information about the affected area as well as information about vehicles affected by this guidance information <ul style="list-style-type: none"> <li>○ specific road segment</li> <li>○ specific lane</li> <li>○ specific vehicle type</li> </ul> </li> <li>○ Inform vehicles about the start and end position of the guidance area.</li> <li>○ Provide additional speed recommendations for the affected road segments and lanes (optionally, if available).</li> </ul>
Desired behaviour	<ul style="list-style-type: none"> <li>○ Vehicles consider the information in their driving plans (e.g., lane selection) or trajectories.</li> <li>○ Automated vehicles consider the information in the selection of the level of automation used.</li> <li>○ Automated vehicle driver/operator is informed about a change in the automation level recommendation from the infrastructure, especially when switching from higher to lower levels of automation (reasoning).</li> </ul> <p>This use case describes guidance principles and information provided to automated vehicles for specific road segments and traffic conditions. It does not describe the behaviour of the automated vehicle, especially not at the end of any guidance information (e.g., how to switch automation levels in that case, guiding the vehicle to a safe place, ...)</p>
Expected benefits	<ul style="list-style-type: none"> <li>○ Drivers of conventional vehicles experience overall safer traffic conditions if automated vehicles select their level of automation based on the best possible inputs from all sources, including infrastructure.</li> <li>○ Automated vehicle guidance and information on the SAE level of automation road operators consider unsuitable for partly automated vehicles on certain road or lane segments on their network, at a given point in time, considering overall road conditions and the current traffic situation. Automated vehicles can include this information in their decision-making process and will be able to adjust their driving plans and trajectories as well as the usage of automation functions if necessary. Additionally, they may be able to inform their drivers in time about any adjustment that might require more attention from the driver.</li> <li>○ Road operator: <ul style="list-style-type: none"> <li>○ Supports a safer and more gradual introduction of automated driving on specific, C-ITS-equipped road segments and/or lanes.</li> <li>○ Brings the road operator's view on automation into the decision-making process of automated vehicles.</li> <li>○ Ensures traffic safety and traffic flow efficiency in the transitional phase towards fully automated driving.</li> <li>○ Reduces costs and congestion related to accidents.</li> </ul> </li> </ul>



Use case description	
Situation	<ul style="list-style-type: none"> <li>○ The road operator monitors the situation on the road and gives road segment and lane specific guidance on the SAE level of automation the road operator considers unsuitable for partly automated vehicles under current traffic conditions.</li> <li>○ Following changes in traffic and/or driving conditions (because of accidents, congestion, weather, etc.), a reassessment of the given advice can occur.</li> <li>○ If the assessment leads to a change of the guidance information, vehicles and the drivers need to be informed.</li> <li>○ Therefore, the road infrastructure operator distributes an updated and appropriate follow-up message.</li> </ul>
Logic of transmission	I2V
Actors and relations	<ul style="list-style-type: none"> <li>○ <b>Road operator:</b> Generates the use case information at the TCC, considering all available information for the specific road segment and the overall traffic conditions.</li> <li>○ <b>Drivers:</b> Drivers and their C-ITS connected vehicles are the end-users of this use case. They receive the information and include it in their decision-making process in selecting automation levels (for partly automated vehicles) or are simply informed about the guidance given to other vehicles on the road segment they are travelling on (in case of connected vehicles)</li> </ul>
Use case scenario	<p>Road operators monitor their road network, derive triggering conditions for the use case and apply them to specific parts of the road network.</p> <p><u>Scenario 1:</u></p> <ul style="list-style-type: none"> <li>○ Due to road conditions and current traffic on a stretch of the road, guidance information is sent out that vehicles (of type x.y, e.g. weight higher than 3.5 tons) should not use automation levels 3 or 4 on lane 2 of the network within a certain area, indicated by a zone (with start, end and intermediate points).</li> </ul> <p><u>Scenario 2:</u></p> <ul style="list-style-type: none"> <li>○ The guidance on the use of automation levels on a specific part of a road is set in a way that SAE level 4 is unsuitable from the infrastructure's point of view. Due to the overall traffic situation, an accident or weather conditions, the guidance information from the infrastructure on the unsuitable SAE automation levels changes to include levels 3 and 4.</li> </ul> <p>Connected vehicles approaching the section receive the message and consider it in their decision-making process when selecting the level of automation, speed or lane to be used.</p>

Intended Presentation/Alert principle	<ul style="list-style-type: none"> <li>○ The information is sent to the vehicle and is supposed to be considered in the decision-making process when selecting automation levels, speed, and lane usage.</li> <li>○ Presentation of information to the driver when changing automation level is expected, especially when the driver needs to increase driving efforts, but all requirements of in-vehicle visualisation and interaction are of course under the complete responsibility and decision authority of the vehicle manufacturer or operator of the automated vehicle.</li> <li>○ This includes the responsibility and decision to make the driver aware in time to be able to take needed actions to comply a change in automation level.</li> <li>○ The HMI presentation sequence is at the vehicle manufacturer's and/or service provider's own responsibility.</li> </ul>
Functional constraints / dependencies	<ul style="list-style-type: none"> <li>○ There is a need to present information to the driver if the guidance given leads to a change of automation requiring his reaction within a specific time or position on the network.</li> <li>○ How the information is presented to the drivers is not part of the service description. It is left to the provider of the in-vehicle information system with HMI how information is presented. Information might e.g., be translated to the preferred language of the driver.</li> </ul>
Link to other use cases	none
<b>Interoperability Requirements</b>	
Message profile requirements	<ul style="list-style-type: none"> <li>○ The IVI message for AVG-SAELG is profiled in chapter 4.2.2.4 of [C-Roads MP].</li> <li>○ IVI messages for AVG-SAELG shall use message management based on update and cancellation of messages.</li> <li>○ iviStatus shall be set to “new” for new information in the IVIM, to “update” when the IVIM changes and to “cancellation” when the information in the IVIM is no longer valid.</li> <li>○ A cancellation IVIM shall be repeated at least for 5min after its first transmission.</li> <li>○ NOTE: The exact effort to ensure that all vehicles receive the cancellation will be resolved in future releases.</li> <li>○ validTo may be used to encode an end time for the overall IVI message, at least 1 hour ahead of the time indicated by the DE timestamp. Providing this end time can serve the purpose of avoiding an issue of perpetually valid IVIM in case cancellation is missed repeatedly. The definition of all geographical zones should be included in as few GlcParts as possible.</li> <li>○ IVIM can contain more than one Geographical Location Container (GLC). An additional GLC should only be included in an IVIM if required</li> </ul>

zones cannot be defined within the value range constraints of DF DeltaPositions towards the referencePosition.

- IVIM shall be self-contained: definition of all zones referred to within the IVIM shall be included in the same IVIM.
- For this use case, the DF automatedVehicleRules shall be mandatory while the DF platooningRules shall be absent.
- As this use case informs about SAE levels road operators find unsuitable for automated driving on a selected segment, the respective opposite levels shall be encoded in the DE allowedSAEAutomationLevels. If for example SAE levels 4 and 5 are unsuitable from the road operator's point of view, levels 0, 1, 2, and 3 shall be put into allowedSaeAutomationLevels. Any guidance provided is not a road operator's guarantee for safe operation of certain modes of automation nor is it a definitive statement that certain modes of automation are possible or impossible, allowed or not allowed.
- If traffic signs for automated vehicles are present in the SAE Level Guidance:
  - RSCode in RoadSignCodes shall be used to encode up to 4 traffic signs.
  - Temporal restrictions of individual signs (when a sign is either valid or invalid only for a certain time period) shall be encoded with suitable ISO14823Attributes (DTM, EDT) in the DF roadSignCodes and not by using either validFrom or validTo of the overall IVIM.
  - The IVIM shall always correspond to the legal statement as displayed by the static or electronic sign it represents.
  - Signs which indicate the end of a specific or all regulations / restrictions should not be transmitted explicitly as individual signs in an IVIM
  - Within one or multiple IVIMs issued by the same road operator, the same traffic sign should not be assigned more than once to the same relevance zone.
  - Information corresponding to physical signs (either static or electronic) shall as far as possible be encoded using machine-readable message components, via adhering as much as possible to the following rules:
    - Shifting of relevance zone(s) according to subpanel information
    - Extension of relevance zone(s) in case of sign repetition
    - Restriction of signs to certain vehicle types and/or dimensions
    - Encoding of ISO14823Attributes where applicable
      - Validity in time (DMT, EDT)
      - Lane Flow (DFL)
      - Vehicle dimensions (VED)

	<ul style="list-style-type: none"><li>• Speed (SPE)</li><li>• Rate of Incline (ROI)</li><li>• Distance between vehicles (DBT)</li><li>• Destination (DDD)</li></ul> <ul style="list-style-type: none"><li>▪ Encoding of subpanels using roadSignCodes available in ISO 14823 for subpanels instead of extraText</li></ul> <ul style="list-style-type: none"><li>○ If the aim is to inform vehicles on all stretches of road diverging from or converging into a relevance zone, suitable zones for these stretches shall be present in the GLC and referenced in the AVC as necessary.</li><li>○ The RoadConfigurationContainer (RCC) shall be provided, except if the road operator does not have the information, then both RCC and (if signs are present) applicable lanes in the AutomatedVehicleContainer (AVC) should be omitted and only signs valid for all legally drivable lanes on the entire carriageway shall be transmitted.</li></ul>												
Security and data protection requirements	<p>Security requirements and specifications of certificates are described in [C-ITS Security Requirements and Specifications].</p> <p>An overall introduction to the common European trust model is described in [C-ITS Security and Governance] which is referring to the relevant ETSI standards for certificates and PKI management as the underlying technical basis.</p> <p>This use case is based on the “Road configuration container” as well as the “Automated Vehicle Container”. The IVIM permissions (SSP) have to be encoded as defined in [ETSI TS 103 301]. These SSPs are encoded in Octets 4-5 within the respective field of the certificate to be used (AT), in addition to the serviceProviderId encoded in Octets 1-3.</p> <table><tr><td></td><td colspan="2">SSP position</td></tr><tr><td>CauseCodeType / Container</td><td>Octet position</td><td>Bit position</td></tr><tr><td>Road Configuration Container</td><td>5</td><td>1</td></tr><tr><td>Automated Vehicle Container</td><td>5</td><td>5</td></tr></table> <p>The here listed SSP shall be granted only for C-ITS stations used by road operators or any contractor on their behalf.</p> <p><i>NOTE: The user in this sentence is not the station operator (as defined in the SP) who goes through the enrolment process and requests the necessary SSPs. The user is the party responsible for the use case (can be the same) which uses the C-ITS stations for it and therefore needs the respective SSPs.</i></p>		SSP position		CauseCodeType / Container	Octet position	Bit position	Road Configuration Container	5	1	Automated Vehicle Container	5	5
	SSP position												
CauseCodeType / Container	Octet position	Bit position											
Road Configuration Container	5	1											
Automated Vehicle Container	5	5											
Communication technology requirements: ITS-G5	For ITS-G5 based implementations of use cases where roadside stations are used, the requirements of [C-Roads RSP] shall apply.												

<p>Communication technology requirements: IP based</p>	<p>For ITS-G5 based implementations of use cases where mobile stations are allowed and used, the requirements of C-Roads, [C-Roads MSP] shall apply.</p> <p>For IP based implementations of use cases shared using backend communication, the requirements of [C-ITS IP Based Interface Profile] shall apply.</p> <p>For use cases based on IVIM messages the AMQP filtering tables specified in chapter 3.3 of [C-ITS IP Based Interface Profile] shall apply:</p> <ul style="list-style-type: none"> <li>○ serviceType= AVG-SAELG</li> <li>○ messageType = IVIM</li> </ul> <p>Geographic area (Quadtree) for IVIM message:</p> <p>The event is characterised by its referencePosition, detectionZone(s), relevanceZone(s) and DestinationArea. These fields draw a geographic area and C-ITS actors shall publish in a set of tiles corresponding to the maximum set of tiles containing all the geographic indication mentioned. Please be aware that the exact details of specification are defined in chapter 3.3 of [C-ITS IP Based Interface Profile].</p>
<p>Test and validation requirements</p>	<p>The document “C-ITS Cross-Border Testing and Validation Concept” [C-Roads_TVC] contains the generic applicable framework and process for interoperability testing.</p> <p>The applicable message and service generic and use case specific test cases are listed in the document “C-ITS Test Plan” [C-Roads_TP].</p>

## 6.2.2 AVG – Platoon Support Information (AVG-PSI)

Type of road network	Motorways
Type of vehicle (receiver)	Automated Vehicles that want to engage in platooning situations
<b>Use case introduction</b>	
Summary	<p>The purpose of the use case is to provide road operator-based guidance and information on the unsuitability of “platooning” on specific road or lane segments on the road network, considering different vehicle classes, overall road conditions and the current traffic situation. A platoon is a group of vehicles sharing the same destination, travelling closely together at a common speed.</p> <p>Platooning situations can involve different vehicle classes, including trucks as well as cars. Platoons itself can be either vehicle type specific (e.g., truck platooning) or consist of mixed vehicle types.</p> <p>The use case as a whole is strictly guidance and never to be understood as regulation or instruction. Any guidance provided is not a road operator’s guarantee for safe operation of certain modes of platooning nor is it a definitive statement that the formation of a platoon is possible or impossible, allowed or not allowed.</p> <p>It aims to be an additional piece of information for the vehicle’s decision-making process to enter a platooning situation, transporting the road operator’s view into the vehicle. This can influence the overall decision of the vehicle to enter a platooning situation and the parameters of platooning (number of vehicles, overall speed and distance gap between vehicles) used by these vehicles, based on the overall traffic situation, the sensory input from the vehicle itself and the messages received by the infrastructure.</p>
Background	<p>Infrastructure based guidance on the unsuitability of platooning is expected to provide improvements to the efficiency of traffic flow as well as road safety by providing automated vehicles with additional information in their assessment of possible automation.</p> <p>The legal framework for vehicles of all kinds to enter a platoon situation may be different in individual member states, some having no restrictions at all while others may limit platooning to certain vehicle classes or even dedicated environments only. The use case might therefore differ in national implementations. However, it is undisputed that large groups of automated vehicles driving in a very close distance to each other may pose a challenge for traffic management. A platoon of several automated vehicles may for example “block” the access to ramps for other vehicles due to short distance gaps or have a negative overall impact on traffic flow.</p> <p>This will especially be a topic in the transitional phase towards completely automated driving, which will include conventional vehicles, connected vehicles as well as autonomous vehicles. This transition phase of mixed vehicle fleets is expected to last at least 20 years, with overall traffic flow growing, nonetheless.</p>

	<p>Platooning support information may currently indicate unsuitable SAE levels because they are currently the only clearly defined metric supported by standards. Road operators are already working on other metrics to better convey support for automated driving on the road network, e.g., Infrastructure Support for Automated Driving (ISAD) levels. Once available in standards, such metrics might update or even replace this use case.</p> <p>Further work on a more comprehensive communication stream from road operators to vehicles will be necessary and not be limited to just this use case. The aim would be that vehicles, under certain prerequisites like e.g., functional safety, could potentially act solely based on the guidance received from infrastructure.</p>
Objective	<ul style="list-style-type: none"> <li>○ Guide and inform vehicles about the road operators' assessment of unsuitability of platooning in a specific area.</li> <li>○ Provide detailed geographical information about the affected area as well as information about vehicles affected by this guidance information <ul style="list-style-type: none"> <li>○ specific road segment</li> <li>○ specific lanes</li> <li>○ specific vehicle type</li> </ul> </li> <li>○ Inform vehicles about the start and end position of the guidance area.</li> <li>○ Provide additional guidance regarding platooning parameters (maximum number of vehicles, maximum length of platoon, minimum distance gap, speed limits and speed recommendations) for the affected road segments and lanes (optionally, if available).</li> <li>○ Provide learning possibilities on automated vehicle guidance using cross sector collaboration.</li> </ul>
Desired behaviour	<ul style="list-style-type: none"> <li>○ Vehicles consider the information in their overall driving plans (e.g., lane selection) or trajectories.</li> <li>○ Automated vehicles consider the information in their decision to enter, leave or change a platooning situation.</li> <li>○ Vehicles forming or leaving a platoon perform the desired actions without major disruptions for the other traffic participants.</li> <li>○ Platoons are operated on selected lanes only as indicated by the road operator's guidance on unsuitability.</li> <li>○ Automated vehicle drivers/operators are informed about changes in the platooning situation, in particular when starting or stopping a platoon or changing its core parameters (reasoning), especially when it requires additional attention from the driver.</li> </ul> <p>This use case describes guidance principles and information provided to automated vehicles on platooning for specific road segments and traffic conditions. It does not describe the behaviour of the automated vehicle inside or outside of the platoon, especially not at the end of any guidance information (e.g., how to enter or leave a platoon safely, ...)</p>

Expected benefits	<ul style="list-style-type: none"> <li>○ Drivers of conventional vehicles experience overall safer traffic conditions if automated vehicles base their platooning decisions on the best possible inputs from all sources, including infrastructure.</li> <li>○ This use case provides automated vehicle guidance and information on the unsuitability of platooning on certain SAE automation levels for automated vehicles on certain road or lane segments on the road operator's network, at a given point in time, considering overall road conditions and the current traffic situation. Automated vehicles can include this information in their decision-making process and will be able to adjust their driving plans and trajectories as well as their platooning activities if necessary. Additionally, they may be able to inform their drivers in time about any adjustment that might require more attention from the driver.</li> <li>○ Road operator: <ul style="list-style-type: none"> <li>○ Supports a safer and more gradual introduction of automated driving on specific, C-ITS-equipped road segments and/or lanes.</li> <li>○ Brings the road operator's view on platooning into the decision-making process of automated vehicles.</li> <li>○ Ensures traffic safety and traffic flow efficiency in the transitional phase towards fully automated driving.</li> <li>○ Reduces costs and congestion related to accidents.</li> </ul> </li> </ul>
<b>Use case description</b>	
Situation	<ul style="list-style-type: none"> <li>○ The road operator monitors the situation on the road and gives road segment and lane specific guidance on the unsuitability of platooning as well as appropriate platooning parameters under current traffic conditions.</li> <li>○ Following changes in traffic and/or driving conditions (as a result of traffic density, accidents, congestion, weather, etc.), a reassessment of the given advice can occur.</li> <li>○ If the assessment leads to a change of the guidance information, vehicles and drivers need to be informed.</li> <li>○ Therefore, the road infrastructure operator distributes an updated and appropriate follow-up message.</li> </ul>
Logic of transmission	I2V
Actors and relations	<ul style="list-style-type: none"> <li>○ <b>Road operator:</b> Generates the use case information at the TCC, considering all available information for the specific road segment and the overall traffic conditions.</li> <li>○ <b>Drivers:</b> Drivers and their C-ITS connected vehicles are the end-users of this use case. They receive the information and include it in their decision when entering, leaving or maintaining platooning situations (for automated vehicles) or are simply informed about the guidance given to other vehicles on the road segment they are travelling on and</li> </ul>



	<p>select a different lane or segment to avoid interference with the platoon (in case of connected vehicles).</p>
Use case scenario	<p>Road operators monitor the road network, derive triggering conditions for the use case and apply them to specific parts of the road network.</p> <p><u>Scenario 1:</u></p> <ul style="list-style-type: none"> <li>○ The road operator wants to give guidance information that new platooning situations should not be created, or existing platooning situations should be dissolved, regardless of the SAE level, due to overall difficult traffic or environmental situations, e.g., in an area with multiple ramps and intersections given high traffic.</li> </ul> <p><u>Scenario 2:</u></p> <ul style="list-style-type: none"> <li>○ Due to road conditions and current traffic on a stretch of the road, guidance information is sent out that certain vehicle classes (e.g., vehicles with a weight higher than 3.5 tons) should not engage in platooning on the network within a certain area and certain lanes, indicated by a zone (with start, end, and intermediate points).</li> </ul> <p><u>Scenario 3:</u></p> <ul style="list-style-type: none"> <li>○ The guidance on the use of platooning on a specific part of a road is set in a way that platooning is unsuitable from the infrastructure's point of view under certain conditions. Due to the overall traffic situation, an accident or weather conditions, the conditions for platooning change in the view of the road operator and the guidance information from the infrastructure shall be updated in certain parameters (e.g., length of guidance zone, type of vehicles, affected lanes, level of automation (SAE), ...).</li> </ul> <p>Connected vehicles approaching the section receive the message and consider it in their decision-making process of engaging or maintaining platooning and their selection of number of vehicles or overall length of the platoon, speed, distance gap or lane selected.</p>
Intended Presentation/Alert principle	<ul style="list-style-type: none"> <li>○ The information is sent to the vehicle and is supposed to be considered in the decision-making process or the parameters of platooning of said vehicle when engaging or maintaining platooning situations.</li> <li>○ Presentation of information to the driver when engaging or disengaging platooning is expected, especially when the driver needs to increase driving efforts, but all requirements of in-vehicle visualisation and interaction are of course under the complete responsibility and decision authority of the vehicle manufacturer or operator of the automated vehicle. This includes the responsibility and decision to make the driver aware in time to be able to take needed actions to comply to change in the overall platooning situation or the parameters of platooning.</li> </ul>
Functional constraints /	<p>There is a need to present information to the driver if the given guidance leads</p>

dependencies	to a change of the platooning situation or its parameters requiring his reaction within a specific time or position on the network.
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Link to other use cases	none
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## Interoperability Requirements

Message profile requirements	<ul style="list-style-type: none"> <li>○ The IVI message for AVG-PSI is profiled in chapter 4.2.2.4 of [C-Roads MP]. IVI messages for AVG-PSI shall use message management based on update and cancellation of messages.</li> <li>○ iviStatus shall be set to “new” for new information in the IVIM, to “update” when the IVIM changes and to “cancellation” when the information in the IVIM is no longer valid.</li> <li>○ A cancellation IVIM shall be repeated at least for 5min after its first transmission.</li> <li>○ NOTE: The exact effort to ensure that all vehicles receive the cancellation will be resolved in future releases.</li> <li>○ validTo may be used to encode an end time for the overall IVI message, at least 1 hour ahead of the time indicated by the DE timestamp. Providing this end time can serve the purpose of avoiding an issue of perpetually valid IVIM in case cancellation is missed repeatedly.</li> <li>○ The definition of all geographical zones should be included in as few GlcParts as possible.</li> <li>○ IVIM can contain more than one Geographical Location Container (GLC). An additional GLC should only be included in an IVIM if required zones cannot be defined within the value range constraints of DF DeltaPositions towards the referencePosition.</li> <li>○ IVIM shall be self-contained: definition of all zones referred to within the IVIM shall be included in the same IVIM.</li> <li>○ For this use case, the DF automatedVehicleRules shall be mandatory while the DF platooningRules shall be absent.</li> <li>○ As this use case may include information about SAE levels road operators find unsuitable for platooning on a selected segment, the respective opposite levels shall be encoded in this DE. If for example SAE levels 4 and 5 are unsuitable for platooning from the road operator’s point of view, levels 0, 1, 2, and 3 shall be put into allowedSaeAutomationLevels. Any guidance provided is not a road operator’s guarantee for safe operation of certain modes of automation nor is it a definitive statement that certain modes of automation are possible or impossible, allowed or not allowed.</li> <li>○ If traffic signs for automated vehicles are present in the Platoon Support Information: <ul style="list-style-type: none"> <li>○ RSCode in RoadSignCodes shall be used to encode up to 4 traffic signs.</li> <li>○ Temporal restrictions of individual signs (when a sign is either valid or invalid only for a certain time period) shall be encoded with suitable ISO14823Attributes (DTM, EDT) in the DF</li> </ul> </li> </ul>
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	<p>roadSignCodes and not by using either validFrom or validTo of the overall IVIM.</p> <ul style="list-style-type: none"> <li>○ The IVIM shall always correspond to the legal statement as displayed by the static or electronic sign it represents.</li> <li>○ Signs which indicate the end of a specific or all regulations / restrictions should not be transmitted explicitly as individual signs in an IVIM</li> <li>○ Within one or multiple IVIMs issued by the same road operator, the same traffic sign should not be assigned more than once to the same relevance zone.</li> <li>○ Information corresponding to physical signs (either static or electronic) shall as far as possible be encoded using machine-readable message components, via adhering as much as possible to the following rules: <ul style="list-style-type: none"> <li>▪ Shifting of relevance zone(s) according to subpanel information</li> <li>▪ Extension of relevance zone(s) in case of sign repetition</li> <li>▪ Restriction of signs to certain vehicle types and/or dimensions</li> <li>▪ Encoding of ISO14823Attributes where applicable <ul style="list-style-type: none"> <li>• Validity in time (DMT, EDT)</li> <li>• Lane Flow (DFL)</li> <li>• Vehicle dimensions (VED)</li> <li>• Speed (SPE)</li> <li>• Rate of Incline (ROI)</li> <li>• Distance between vehicles (DBT)</li> <li>• Destination (DDD)</li> </ul> </li> <li>▪ Encoding of subpanels using roadSignCodes available in ISO 14823 for subpanels instead of extraText</li> </ul> </li> <li>○ If the aim is to inform vehicles on all stretches of road diverging from or converging into a relevance zone, suitable zones for these stretches shall be present in the GLC and referenced in the AVC as necessary.</li> <li>○ The RoadConfigurationContainer (RCC) shall be provided, except if the road operator does not have the information, then both RCC and (if signs are present) applicable lanes in the AutomatedVehicleContainer (AVC) should be omitted and only signs valid for all legally drivable lanes on the entire carriageway shall be transmitted.</li> </ul>
Security and data protection requirements	<p>Security requirements and specifications of certificates are described in [C-ITS Security Requirements and Specifications].</p> <p>An overall introduction to the common European trust model is described in [C-ITS Security and Governance] which is referring to the relevant ETSI standards for certificates and PKI management as the underlying technical basis.</p>

	<p>This use case is based on the “Road configuration container” as well as the “Automated Vehicle Container”. The IVIM permissions (SSP) have to be encoded as defined in [ETSI TS 103 301]. These SSPs are encoded in Octets 4-5 within the respective field of the certificate to be used (AT), in addition to the serviceProviderId encoded in Octets 1-3.</p> <table><tr><td></td><td colspan="2">SSP position</td></tr><tr><td>CauseCodeType / Container</td><td>Octet position</td><td>Bit position</td></tr><tr><td>Road Configuration Container</td><td>5</td><td>1</td></tr><tr><td>Automated Vehicle Container</td><td>5</td><td>5</td></tr></table> <p>The here listed SSP shall be granted only for C-ITS stations used by road operators or any contractor on their behalf.</p> <p><i>NOTE: The user in this sentence is not the station operator (as defined in the SP) who goes through the enrolment process and requests the necessary SSPs. The user is the party responsible for the use case (can be the same) which uses the C-ITS stations for it and therefore needs the respective SSPs.</i></p>		SSP position		CauseCodeType / Container	Octet position	Bit position	Road Configuration Container	5	1	Automated Vehicle Container	5	5
	SSP position												
CauseCodeType / Container	Octet position	Bit position											
Road Configuration Container	5	1											
Automated Vehicle Container	5	5											
Communication technology requirements: ITS-G5	<p>For ITS-G5 based implementations of use cases where roadside stations are used, the requirements of [C-Roads RSP] shall apply.</p> <p>For ITS-G5 based implementations of use cases where mobile stations are allowed and used, the requirements of C-Roads, [C-Roads MSP] shall apply.</p>												
Communication technology requirements: IP based	<p>For IP based implementations of use cases shared using backend communication, the requirements of [C-ITS IP Based Interface Profile] shall apply.</p> <p>For use cases based on IVIM messages the AMQP filtering tables specified in chapter 3.3 of [C-ITS IP Based Interface Profile] shall apply:</p> <ul style="list-style-type: none"><li>○ serviceType= AVG-PSI</li><li>○ messageType = IVIM</li></ul> <p>Geographic area (Quadtree) for IVIM message:</p> <p>The event is characterised by its referencePosition, detectionZone(s), relevanceZone(s) and DestinationArea. These fields draw a geographic area and C-ITS actors shall publish in a set of tiles corresponding to the maximum set of tiles containing all the geographic indication mentioned. Please be aware that the exact details of the specification are defined in chapter 3.3 of [C-ITS IP Based Interface Profile].</p>												
Test and validation requirements	<p>The document “C-ITS Cross-Border Testing and Validation Concept” [C-Roads_TVC] contains the generic applicable framework and process for interoperability testing.</p>												

The applicable message and service generic and use case specific test cases are listed in the document “C-ITS Test Plan” [C-Roads_TP].
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### 6.2.3 AVG – Vehicle Distance Information (AVG-VDI)

Type of road network	All
Type of vehicle (receiver)	Automated Vehicles (at SAE levels 1-5)
<b>Use case introduction</b>	
Summary	<p>The purpose of this use case is to provide guidance and information on the recommended and minimum distance gap between vehicles on certain road or lane segment. The recommendation is provided by the road operator and is based on the road topology (e.g. Sharp turns), occupancy (e.g. high traffic) as well as national obligations.</p> <p>The use case as a whole is strictly guidance and never to be understood as regulation or instruction.</p>
Background	Infrastructure based vehicle distance information aims to raise traffic safety and flow by recommending the ideal vehicle distance for certain traffic and driving situations of a certain road segment.
Objective	<ul style="list-style-type: none"> <li>○ Inform vehicles about the ideal and minimum required vehicle distance gap on a certain road segment.</li> <li>○ Provide detailed information addressing vehicles affected by this guidance information. <ul style="list-style-type: none"> <li>○ specific road segment</li> <li>○ specific lane</li> <li>○ specific vehicle type</li> </ul> </li> <li>○ Inform vehicles about the start and end position of the relevant area.</li> <li>○ Provide additional speed recommendations for the affected road segments and lanes (optionally, if available).</li> </ul>
Desired behaviour	<ul style="list-style-type: none"> <li>○ Vehicles consider the information in their driving plans (e.g., increase distance to vehicle ahead) or trajectories.</li> <li>○ Automated vehicles consider the information in the selection of the level of automation used.</li> </ul> <p>This use case describes guidance principles and information provided to automated vehicles for specific road segments and traffic conditions. It does not describe the behaviour of the automated vehicle, especially not at the end of any recommendation (e.g., how quickly to react on vehicle distance gap recommendation).</p>
Expected benefits	<ul style="list-style-type: none"> <li>○ Increased traffic flow</li> <li>○ Increased traffic safety</li> <li>○ Decreased emissions (due to reduced “braking”)</li> <li>○ Drivers of conventional vehicles experience overall safer traffic conditions if Reduces costs and congestion related to accidents.</li> </ul>

	<ul style="list-style-type: none"> <li>○ More comfortable trip for driver</li> </ul>
<b>Use case description</b>	
Situation	<ul style="list-style-type: none"> <li>○ The road operator gives information and recommendations for vehicle distance gaps based on the overall traffic as well as driving condition and/or applicable regulation on a road segment.</li> <li>○ In case of a change of the traffic as well as driving condition (e.g. less vehicles, heavy fog, roadworks), the road operator must reassess the distance gap information.</li> <li>○ If the assessment leads to a change of the recommended vehicle distance gap, vehicles and the drivers need to be informed.</li> <li>○ Therefore, the road infrastructure operator distributes an updated and appropriate follow-up message.</li> </ul>
Logic of transmission	I2V
Actors and relations	<ul style="list-style-type: none"> <li>● <b>Road operator:</b> Generates the use case information at the TCC, national regulations or on monitoring devices on the road, considering all available information for the specific road segment and the overall traffic conditions.</li> <li>● <b>Drivers:</b> Drivers and their C-ITS connected vehicles are the end-users of this use case. They receive the information and include it in their decision-making process in selecting the vehicle distance gap to the vehicle in front of them.</li> </ul>
Scenario	<p>Road operators monitor their road network, derive triggering conditions for the use case and apply them to specific parts of the road network.</p> <p><u>Scenario 1:</u></p> <p>On the main driveway of a highway, vehicles must increase gaps to allow vehicles on a ramp to merge into the lane. The guidance information is sent out that vehicles can increase their vehicle distance gap on a defined road segment.</p> <p><u>Scenario 2:</u></p> <p>Due to road conditions (e.g. heavy fog, slippery road, ...) and current traffic on a stretch of the road, guidance information is sent out that vehicles should increase their distance gap to increase traffic safety or traffic flow, in order to avoid traffic jams or accidents.</p> <p>Connected vehicles approaching the section receive the message and consider it in their decision-making process when selecting the level of automation, speed or lane to be used.</p>
Display / alert principle	<ul style="list-style-type: none"> <li>○ The information is sent to the vehicle and is supposed to be considered in the decision-making process when the vehicle distance gap to the vehicle in front of them.</li> <li>○ Presentation of information to the driver when changing the vehicle distance gap is expected, especially when the driver needs to increase driving efforts, but all requirements of in-vehicle visualisation and interaction are of course under the complete responsibility and decision authority of the vehicle manufacturer or operator of the automated vehicle.</li> <li>○ This includes the responsibility and decision to make the driver aware in time</li> </ul>

	<p>to be able to take needed actions to comply a change in automation level.</p> <ul style="list-style-type: none"> <li>○ The HMI presentation sequence is at the vehicle manufacturer's and/or service provider's own responsibility.</li> </ul>
Functional Constraints / dependencies	<ul style="list-style-type: none"> <li>○ There is a need to present information to the driver if the distance gap information given leads to a change of the vehicles distance gap.</li> <li>○ How the information is presented to the drivers is not part of the service description. It is left to the provider of the in-vehicle information system with HMI how information is presented. Information might e.g., be translated to the preferred language of the driver.</li> </ul>
Link with other Use Cases	N/A

### Interoperability Requirements

Message profile requirements	<p>The IVI message for AVG-VDI is profiled in chapter 4.2.2.4 of [C-Roads MP].</p> <ul style="list-style-type: none"> <li>• The AvcPart applicableLanes shall be used, if different recommendations are necessary for each lane on a road segment.</li> <li>• The AvcPart vehicleCharacteristics shall be used if different vehicle classes require different information/recommendations.</li> <li>• IVI messages for AVG-VDI shall use message management based on update and cancellation of messages.</li> <li>• iviStatus shall be set to “new” for new information in the IVIM, to “update” when the IVIM changes and to “cancellation” when the information in the IVIM is no longer valid.</li> <li>• validTo may be used to encode an end time for the overall IVI message, at least 1 hour ahead of the time indicated by the DE timestamp. Providing this end time can serve the purpose of avoiding an issue of perpetually valid IVIM in case cancellation is missed repeatedly. The definition of all geographical zones should be included in as few GlcParts as possible.</li> <li>• IVIM can contain more than one Geographical Location Container (GLC). An additional GLC should only be included in an IVIM if required zones cannot be defined within the value range constraints of DF DeltaPositions towards the referencePosition.</li> <li>• IVIM shall be self-contained: definition of all zones referred to within the IVIM shall be included in the same IVIM.</li> <li>• For this use case, the DF automatedVehicleRules shall be mandatory while the DF platooningRules shall be absent.</li> <li>• The DE allowedSAEAutomationLevels shall be set according to the Use-Case AVG-SAE. In case no SAE-Level guidance can be given by the road-operator, level 0 shall be transmitted, meaning that the information is relevant for all vehicle automation levels.</li> <li>• To show the obligated minimum vehicle distance, the DE minGapBetweenVehicles must be used. In any case, this is the minimum distance for each vehicles class if necessary.</li> </ul>
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- To provide the recommended vehicles distance, based on the overall traffic and driving conditions, the DE recGapBetweenVehicles should be used. This DE must not show a shorter distance than the minimum obligated vehicle distance.

If traffic signs for automated vehicles are present for this Use-Case:

RSCode in RoadSignCodes shall be used to encode up to 4 traffic signs.

Traffic signs could be:

41-124 to keep safe distance

**ABSTAND**



12-515 to inform about minimum distance



12-516 to keep safe distance

Temporal restrictions of individual signs (when a sign is either valid or invalid only for a certain time period) shall be encoded with suitable ISO14823Attributes (DTM, EDT) in the DF roadSignCodes and not by using either validFrom or validTo of the overall IVIM.

Information corresponding to physical signs (either static or electronic) shall as far as possible be encoded using machine-readable message components, via adhering as much as possible to the following rules:

- Shifting of relevance zone(s) according to subpanel information
- Extension of relevance zone(s) in case of sign repetition
- Restriction of signs to certain vehicle types and/or dimensions
- Encoding of ISO14823Attributes where applicable
- Validity in time (DMT, EDT)
- Lane Flow (DFL)
- Vehicle dimensions (VED)
- Speed (SPE)
- Rate of Incline (ROI)
- Distance between vehicles (DBT)
- Destination (DDD)

Encoding of subpanels using roadSignCodes available in ISO 14823 for subpanels instead of extraText

The RoadConfigurationContainer (RCC) shall be provided, except if the road operator does not have the information, then both RCC and (if signs are present) applicable lanes in the AutomatedVehicleContainer (AVC) should be omitted and only signs valid for all legally drivable lanes on the entire carriageway shall be transmitted.

Security and data protection requirements

Security requirements and specifications of certificates are described in [C-ITS Security Requirements and Specifications].

An overall introduction to the common European trust model is described in C-Roads, C-ITS Security and Governance [C-ITS Security and Governance] which is referring to the relevant ETSI standards for certificates and PKI management as the underlying technical basis.

This use case is based on the “Road configuration container” as well as the “Automated Vehicle Container”. The IVIM permissions (SSP) have to be encoded as defined in [ETSI TS 103 301]. These SSPs are encoded in Octets 4-5 within the respective field of the certificate to be used (AT), in addition to the serviceProviderId encoded in Octets 1-3.

CauseCodeType / Container	SSP position	
	Octet Position	Bit position
Road Configuration Container	5	1
Automated Vehicle Container	5	5

The here listed SSP shall be granted only for C-ITS stations used by road operators or any contractor on their behalf.

*NOTE: The user in this sentence is not the station operator (as defined in the SP) who goes through the enrolment process and requests the necessary SSPs. The user is the party responsible for the use case (can be the same) which uses the C-ITS stations for it and therefore needs the respective SSPs.*

Communication technology requirements: ITS-G5

For ITS-G5 based implementations of use cases where roadside stations are used, the requirements of [C-Roads RSP] shall apply.

For ITS-G5 based implementations of use cases where mobile stations are allowed and used, the requirements of [C-Roads MSP] shall apply.

Communication technology requirements: IP-Based

For IP based implementations of use cases shared using backend communication, the requirements of [C-ITS IP Based Interface Profile] shall apply.

For use cases based on IVIM messages the AMQP filtering tables specified in chapter 3.3 of [C-ITS IP Based Interface Profile] shall apply:

- serviceType= AVG-VDI
- messageType = IVIM

Geographic area (Quadtree) for IVIM message:

The event is characterized by its referencePosition, detectionZone(s), relevanceZone(s) and DestinationArea. These fields draw a geographic area and C-ITS actors shall publish in a set of tiles corresponding to the maximum set of tiles containing all the geographic indication mentioned. Please be aware that the exact details of specification are defined in chapter 3.3 of [C-ITS IP Based Interface Profile].

Test and validation requirements

The document “C-ITS Cross-Border Testing and Validation Concept” [C-Roads\_TVC] contains the generic applicable framework and process for interoperability testing.

The applicable message and service generic and use case specific test cases are listed in the document “C-ITS Test Plan” [C-Roads\_TP].

## 6.2.4 AVG – Vehicle Speed Information (AVG-VSI)

Type of road network	All
Type of vehicle (receiver)	Automated Vehicles (at SAE levels 1-5)
<b>Use case introduction</b>	
Summary	<p>The purpose of this use case is to provide guidance and information on the recommended, minimum, and maximum speed on certain road or lane segment for automated vehicles. The information is provided by the road operator and is based on the traffic and road conditions as well as national obligations.</p> <p>The use case as a whole is strictly guidance and never to be understood as regulation or instruction.</p>
Background	Infrastructure based automated vehicle speed information aims to raise traffic safety and flow by recommending the ideal vehicle speed for certain traffic and driving situations of a certain road segment.
Objective	<ul style="list-style-type: none"> <li>○ Inform automated vehicles about the ideal and minimum required vehicle speed on a certain road segment.</li> <li>○ Provide detailed information addressing vehicles affected by this guidance information. <ul style="list-style-type: none"> <li>○ specific road segment</li> <li>○ specific lane</li> <li>○ specific vehicle type</li> </ul> </li> <li>○ Inform automated vehicles about the start and end position of the relevant area.</li> </ul>
Desired behaviour	<ul style="list-style-type: none"> <li>○ Vehicles consider the information in their driving plans (e.g., increase/decrease to vehicle speed).</li> <li>○ Automated vehicles consider the information in the selection of the level of automation used.</li> </ul> <p>This use case describes guidance principles and information provided to automated vehicles for specific road segments and traffic conditions. It does not describe the behaviour of the automated vehicle, especially not at the end of any recommendation (e.g., how quickly to react on vehicle distance gap recommendation).</p>
Expected benefits	<ul style="list-style-type: none"> <li>○ Increased traffic flow</li> <li>○ Increased traffic safety</li> <li>○ Decreased emissions (due to reduced “breaking”)</li> <li>○ Drivers of conventional vehicles experience overall safer traffic conditions if Reduces costs and congestion related to accidents.</li> <li>○ More comfortable trip for driver</li> </ul>
<b>Use case description</b>	
Situation	<ul style="list-style-type: none"> <li>○ The road operator gives information and recommendations for automated</li> </ul>

	<p>vehicle speed based on the overall traffic as well as driving condition and/or applicable regulation on a road segment.</p> <ul style="list-style-type: none"> <li>○ In case of a change of the traffic as well as driving condition (e.g. less vehicles, heavy fog, roadworks), the road operator must reassess the vehicle speed information.</li> <li>○ If the assessment leads to a change of the recommended vehicle distance gap, vehicles and the drivers need to be informed.</li> <li>○ Therefore, the road infrastructure operator distributes an updated and appropriate follow-up message.</li> </ul>
Logic of transmission	I2V
Actors and relations	<ul style="list-style-type: none"> <li>○ <b>Road operator:</b> Generates the use case information at the TCC, national regulations or on monitoring devices on the road, considering all available information for the specific road segment and the overall traffic conditions.</li> <li>○ <b>Drivers:</b> Drivers and their C-ITS connected vehicles are the end-users of this use case. They receive the information and include it in their decision-making process in selecting the vehicle speed.</li> </ul>
Scenario	<p>Road operators monitor their road network, derive triggering conditions for the use case and apply them to specific parts of the road network.</p> <p><u>Scenario 1:</u></p> <ul style="list-style-type: none"> <li>• Due to national regulation, automated vehicles of a certain SAE level are limited on the maximum speed on a road segment. For instance, if there is no speed limit for non-automated vehicles, a speed limit might be required for automated ones.</li> </ul> <p><u>Scenario 2:</u></p> <ul style="list-style-type: none"> <li>• Due to the traffic and driving conditions, the TCC monitors the road segment and broadcasts vehicle speed recommendation to decrease traffic jams ahead and increase traffic safety (e.g. at heavy fog).</li> </ul> <p>Connected vehicles approaching the section receive the message and consider it in their decision-making process when selecting the level of automation and speed.</p>
Display / alert principle	<ul style="list-style-type: none"> <li>○ The information is sent to the vehicle and is supposed to be considered in the decision-making process when the automated vehicle speed is selected.</li> <li>○ Presentation of information to the driver when changing the vehicle speed is expected, especially when the driver needs to increase driving efforts, but all requirements of in-vehicle visualisation and interaction are of course under the complete responsibility and decision authority of the vehicle manufacturer or operator of the automated vehicle.</li> <li>○ This includes the responsibility and decision to make the driver aware in time to be able to take needed actions to comply a change in automation level.</li> <li>○ The HMI presentation sequence is at the vehicle manufacturer's and/or service provider's own responsibility.</li> </ul>

Functional Constraints / dependencies	<ul style="list-style-type: none"> <li>○ There is a need to present information to the driver if the automated vehicle speed information given leads to a change of the vehicle speed.</li> <li>○ How the information is presented to the drivers is not part of the service description. It is left to the provider of the in-vehicle information system with HMI how information is presented. Information might e.g., be translated to the preferred language of the driver.</li> </ul>
Link with other Use Cases	N/A
<b>Interoperability Requirements</b>	
Message profile requirements	<p>The IVI message for AVG-VSI is profiled in chapter 4.2.2.4 of C-Roads, C-ITS Message Profiles [C-Roads MP].</p> <ul style="list-style-type: none"> <li>• The AvcPart applicableLanes shall be used, if different recommendations are necessary for each lane on a road segment.</li> <li>• The AvcPart vehicleCharacterisitcs shall be used if different vehicle classes require different information/recommendations.</li> <li>• IVI messages for AVG-VSI shall use message management based on update and cancellation of messages.</li> <li>• iviStatus shall be set to “new” for new information in the IVIM, to “update” when the IVIM changes and to “cancellation” when the information in the IVIM is no longer valid.</li> <li>• validTo may be used to encode an end time for the overall IVI message, at least 1 hour ahead of the time indicated by the DE timestamp. Providing this end time can serve the purpose of avoiding an issue of perpetually valid IVIM in case cancellation is missed repeatedly. The definition of all geographical zones should be included in as few GlcParts as possible.</li> <li>• IVIM can contain more than one Geographical Location Container (GLC). An additional GLC should only be included in an IVIM if required zones cannot be defined within the value range constraints of DF DeltaPositions towards the referencePosition.</li> <li>• IVIM shall be self-contained: definition of all zones referred to within the IVIM shall be included in the same IVIM.</li> <li>• For this use case, the DF automatedVehicleRules shall be mandatory while the DF platooningRules shall be used if relevant.</li> <li>• The DE allowedSAEAutomationLevels shall be set according to the Use-Case AVG-SAE. In case no SAE-Level guidance can be given by the road-operator, level 0 shall be transmitted, meaning that the information is relevant for all vehicle automation levels.</li> <li>• To show the national regulated maximum speed limit for automated vehicles on a defined road segment, the DE automatedVehicleMaxSpeedLimit must be used.</li> <li>• To show the national regulated minimum speed limit for automated vehicles on a defined road segment, the DE automatedVehicleMinSpeedLimit must be used.</li> </ul>

	<ul style="list-style-type: none"> <li>• To provide the recommended automated vehicle speed based on the overall traffic and driving conditions the DE automatedVehicleSpeedRecommendation should be used.</li> <li>• If traffic signs for automated vehicles are present for this Use-Case:</li> <li>• RSCode in RoadSignCodes shall be used to encode up to 4 traffic signs.</li> <li>• Temporal restrictions of individual signs (when a sign is either valid or invalid only for a certain time period) shall be encoded with suitable ISO14823Attributes (DTM, EDT) in the DF roadSignCodes and not by using either validFrom or validTo of the overall IVIM.</li> <li>• Information corresponding to physical signs (either static or electronic) shall as far as possible be encoded using machine-readable message components, via adhering as much as possible to the following rules: <ul style="list-style-type: none"> <li>• Shifting of relevance zone(s) according to subpanel information</li> <li>• Extension of relevance zone(s) in case of sign repetition</li> <li>• Restriction of signs to certain vehicle types and/or dimensions</li> <li>• Encoding of ISO14823 attributes where applicable <ul style="list-style-type: none"> <li>○ Validity in time (DMT, EDT)</li> <li>○ Lane Flow (DFL)</li> <li>○ Vehicle dimensions (VED)</li> <li>○ Speed (SPE)</li> <li>○ Rate of Incline (ROI)</li> <li>○ Distance between vehicles (DBT)</li> <li>○ Destination (DDD)</li> </ul> </li> </ul> </li> <li>• Encoding of subpanels using roadSignCodes available in ISO 14823 for subpanels instead of extraText</li> <li>• The RoadConfigurationContainer (RCC) shall be provided, except if the road operator does not have the information, then both RCC and (if signs are present) applicable lanes in the AutomatedVehicleContainer (AVC) should be omitted and only signs valid for all legally drivable lanes on the entire carriageway shall be transmitted.</li> </ul>
Security and data protection requirements	<p>Security requirements and specifications of certificates are described in C-Roads, C-ITS Security Requirements and Specifications [C-ITS Security Requirements and Specifications].</p> <p>An overall introduction to the common European trust model is described in C-Roads, C-ITS Security and Governance [C-ITS Security and Governance] which is referring to the relevant ETSI standards for certificates and PKI management as the underlying technical basis.</p> <p>This use case is based on the “Road configuration container” as well as the “Automated Vehicle Container”. The IVIM permissions (SSP) have to be encoded as defined in [ETSI TS 103 301]. These SSPs are encoded in Octets 4-5 within the respective field of the certificate to be used (AT), in addition to the serviceProviderId encoded in Octets 1-3.</p>

	<table><tr><td></td><td colspan="2">SSP position</td></tr><tr><td>CauseCodeType / Container</td><td>Octet Position</td><td>Bit position</td></tr><tr><td>Road Configuration Container</td><td>5</td><td>1</td></tr><tr><td>Automated Vehicle Container</td><td>5</td><td>5</td></tr></table> <p>The here listed SSP shall be granted only for C-ITS stations used by road operators or any contractor on their behalf.</p> <p><i>NOTE: The user in this sentence is not the station operator (as defined in the SP) who goes through the enrolment process and requests the necessary SSPs. The user is the party responsible for the use case (can be the same) which uses the C-ITS stations for it and therefore needs the respective SSPs.</i></p>		SSP position		CauseCodeType / Container	Octet Position	Bit position	Road Configuration Container	5	1	Automated Vehicle Container	5	5
	SSP position												
CauseCodeType / Container	Octet Position	Bit position											
Road Configuration Container	5	1											
Automated Vehicle Container	5	5											
Communication technology requirements: ITS-G5	<p>For ITS-G5 based implementations of use cases where roadside stations are used, the requirements of C-Roads, C-ITS Roadside ITS G5 System Profile [C-Roads RSP] shall apply.</p> <p>For ITS-G5 based implementations of use cases where mobile stations are allowed and used, the requirements of [C-Roads MSP] shall apply.</p>												
Communication technology requirements: IP-Based	<p>For IP based implementations of use cases shared using backend communication, the requirements of [C-ITS IP Based Interface Profile] shall apply.</p> <p>For use cases based on IVIM messages the AMQP filtering tables specified in chapter 3.3 of [C-ITS IP Based Interface Profile] shall apply:</p> <ul style="list-style-type: none"><li>• serviceType= AVG-VSI</li><li>• messageType = IVIM</li></ul> <p>Geographic area (Quadtree) for IVIM message:</p> <p>The event is characterized by its referencePosition, detectionZone(s), relevanceZone(s) and DestinationArea. These fields draw a geographic area and C-ITS actors shall publish in a set of tiles corresponding to the maximum set of tiles containing all the geographic indication mentioned. Please be aware that the exact details of specification are defined in chapter 3.3 of [C-ITS IP Based Interface Profile].</p>												
Test and validation requirements	<p>The document “C-ITS Cross-Border Testing and Validation Concept” [C-Roads_TVC] contains the generic applicable framework and process for interoperability testing.</p> <p>The applicable message and service generic and use case specific test cases are listed in the document “C-ITS Test Plan” [C-Roads_TP].</p>												