



C-ITS SERVICE AND USE CASE DEFINITIONS

**NAVIGATION GUIDANCE (NG)
[C-ROADS SUD07]**

VERSION 3.1.0

C-Roads Platform

Working Group 2 Technical Aspects

Taskforce 2 Service Harmonisation

Vienna, 01.11.2025



Co-funded by
the European Union

Publication History

Note: The publication history of releases 1.x and 2.x can be found in the release 2.3.0 documentation.

Version	Date	Description, updates and changes	Status
3.0.0	01.09.2025	Extracting the service categories into separate documents and updated message requirements	Final
3.1.0	01.11.2025	Created new version without any further changes	Final

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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.

7. Navigation Guidance (NG)

7.1 NG: Service introduction

Service introduction	
Summary	This service aims to provide accurate navigation guidance in complex and dynamic traffic situations in order to support a human driver or an automated driving system when approaching or passing these situations on the route to their destination.
Background	<p>For human drivers, navigating towards and through specific (dynamic) complex traffic situations can be challenging. Additional digital supporting information to anticipate the navigation in these specific (dynamic) situations could help to reduce the number of accidents and smoothen traffic.</p> <p>Approaching these (dynamic) situations is also an important challenge to tackle for vehicles with automated driving systems (ADS). Humans are (still) able to collect and process the necessary information when approaching (dynamic) complex situations and able to adapt to any unpredicted situations. The automated driving system and its sensors may have more difficulties and might/will need this additional information.</p>
Objective	The objective is to guide drivers in such a way that the automated driving system or the human driver adapts its speed, trajectory or route, in order to navigate correctly and safely through the (dynamic) complex traffic situation to their destination.
Expected benefits	<ul style="list-style-type: none"> ○ Improved safety (less accidents or potential unsafe situations) and improved throughput by providing accurate information / guidance ○ To enable automated vehicles to get through these (dynamic) complex situations without deactivating the automated driving system which means that no transition of control to a human driver is necessary.
Use Cases	<ol style="list-style-type: none"> 1. Toll Station Approaching 2. Smart Routing 3. Route Advice <p>Other Navigation Guidance use cases may be added in future releases</p>

7.2 NG: Use Cases

7.2.1 NG – Toll Station Approaching (NG-TSA)

Type of road network	Motorways
Type of vehicle	All, adapted for automated driving systems
Use case introduction	
Summary	As a vehicle is approaching a toll station, a specific message is sent by the road operator, helping to orient the driver/vehicle towards the appropriate toll collection lane(s). Multiple information elements are provided within this message, amongst others the availability and authorized means of payment for each lane.
Background	For human drivers, navigating towards the appropriate lane can be challenging. Having the necessary information to anticipate the navigation in the toll station area can reduce the number of accidents and smoothen traffic. Approaching a toll station correctly is also an important challenge for automated vehicles to tackle. While humans are able to collect and process the necessary information approaching a toll station and to adapt to any unpredicted situations, the automated driving system and its sensors may have more difficulties and will need this additional information.
Objective	The objective is to help anticipating the navigation towards the most appropriate lane for the vehicles according to the configuration of the toll station.
Desired behaviour	The automated driving system or the human driver adapts its speed and trajectory in order to approach the toll station safely and in the correct direction depending on the different types of lanes.
Expected benefits	<ul style="list-style-type: none"> • To improve the traffic flow of all traffic at the toll platform and upstream. • To enable automated vehicles to get through toll stations without deactivating the automated driving system. • To improve the security at the approach of toll stations.
Use case description	
Situation	A driver or vehicle approaches a toll station on a motorway and receives information about the upcoming toll lanes in order to facilitate the selection and navigation process towards the most appropriate one. Multiple information elements characterizing the lanes can be provided such as their availability and the authorized means of payments but also other specificities that may apply (e.g. authorized categories of vehicles, maximum height, maximum crossing speed, etc.)"

Logic of transmission	I2V
Actors and relations	<ul style="list-style-type: none"> ○ Road Operator: the sender of the information is the TCC or the Toll Management Center (TMC). ○ Automated driving system or human driver: end-user of the service.
Scenario	<ul style="list-style-type: none"> ○ The TCC, knowing the configuration of the toll station, sends information about the static and dynamic characteristics and the state of each lane to all vehicles. ○ Vehicles receive the toll information and processes it. The information given is anticipated enough to permit the drivers/vehicles to adapt their speed and trajectory towards the selected toll lane in advance. ○ The automated driving system or the human driver use the received information to identify the most appropriate toll lane to navigate towards. The selection can either be made automatically, manually on the HMI or even mentally for human drivers, depending on the vehicle implementation.
Display / alert principle	<p>It is important that the vehicle gets the information in time (upstream of the toll station) so that it can process the information in time and act accordingly.</p> <p>The information may be displayed through the HMI, it is the manufacturer's choice to do so. It is not specifically required for automated vehicles.</p>
Functional Constraints / dependencies	<ul style="list-style-type: none"> ○ If the automated driving system cannot manage to reach the selected toll station, it reacts accordingly in order to prevent any risk for the vehicle or other road users. ○ In case of an automated driving system, it is required that the automated driving systems has all the other necessary information to select the appropriate toll station, e.g. the means of payment.
Link to other use cases	<ul style="list-style-type: none"> ○ This use case is strongly linked to SI-TSC (Signalized Intersections - Toll Station Crossing) use case. These two use cases should work successively. ○ Dependencies with the use case specifying "SI-TSC". The MAP and SPAT messages specified in that use case should be technically specified and developed using the same lane configuration as the one used in the present use case.
Interoperability Requirements	
Message profile requirements	<p>The IVI message for NG-TSA shall be based on the requirements in chapters 4.2.2.1 & 4.2.2.2 of the message profiles document [C-ITS MP].</p> <p><u>IVIStructure.optional.giv.relevanceZoneIds:</u></p> <p>The relevanceZone shall be described as a segment-setOfLanes leading from the referencePosition to the lateral center of the toll island (the beacons at the entrance of the lanes). (see figure below).</p>

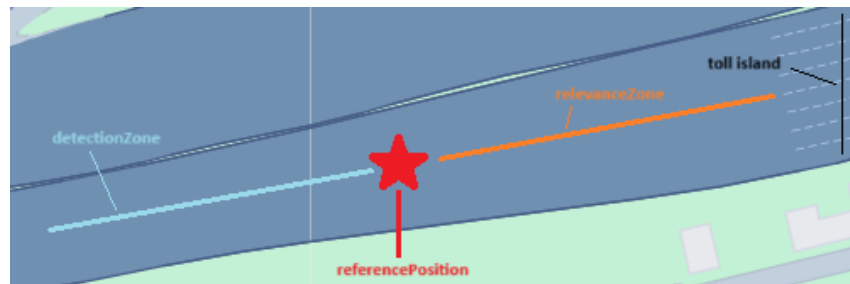








Figure 7:1 Example of a toll approaching zone






lviStructure.optional.giv:




Information about payment options shall be provided by using signage information on lane level, using the selection of roadSignCodes below. For every combination of payment options available, one GicPart shall be used to inform about all lanes providing these methods of payment, using the following roadSignCodes:

- Main sign (mandatory): 8-33 “Automatic toll gate” pictogram 
- Secondary signs (optional): up to 3 among the following options, for the means of payment:
 - 6-81 (toll booth with human operator) 
 - 6-82 (credit card) 
 - 6-83 (coins) 
 - 6-84 (coins and banknotes) 
 - 6-85 (electronic toll subscription) 

lviStructure.optional.giv:

Information about lane availability and traffic restrictions should be provided by using signage information on lane level, using the selection of roadSignCodes below. For every combination of lane availability and traffic restrictions, one GicPart should be used to inform of the availability of lanes, and possible traffic restrictions, with the following roadSignCodes:

- Main sign - lane availability: must be one single alternative among the following options:
 - 6-59 for a red cross 
 - 6-60 for a green arrow 
 - 9-99 when a danger is identified (e.g. lane open but vehicle temporarily blocked) 
 - 9-98  or 4-12  when the reversible lane is closed in the concerning direction

	<ul style="list-style-type: none">Secondary signs – traffic restrictions: up to 3 signs among the following options:<ul style="list-style-type: none">5-57 when a maximum speed limit traffic sign is given, e.g. 30km/h 5-11 when the lane is prohibited for vehicles of a certain height, e.g. 2 meters 1-34 for HOV reserved lane  <p><u>lviStructure.optional.glc.parts.zone.segment-setOfLanes.segmentWidthLeft:</u></p> <ul style="list-style-type: none">In case no RccPart covering the relevance zone is present in the RCC of the same IVIM, the relevance zone shall provide this component since tolling islands can provide a lot of different lanes with a large lateral extensionIf the RCC is present in the same IVIM and contains an RccPart covering the relevance zone, thus providing laneWidth for all available lanes, this component should be provided. <p><i>Note: In this case, it is not mandatory to provide this component.</i></p>																					
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 “General IVI Container” including lane status and all types of ISO/TS 14823 signs, the “Road configuration container” as well as the “Text container”. The IVIM permissions (SSP) shall 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><th></th><th colspan="2">SSP position</th></tr><tr><th>CauseCodeType / Container</th><th>Octet position</th><th>Bit position</th></tr><tr><td>General IVI Container / ISO 14823 / Danger Warning</td><td>4</td><td>1</td></tr><tr><td>General IVI Container / ISO 14823 / Regulatory</td><td>4</td><td>2</td></tr><tr><td>General IVI Container / ISO 14823 / Informative</td><td>4</td><td>3</td></tr><tr><td>General IVI Container / ISO 14823 / Public Facilities</td><td>4</td><td>4</td></tr><tr><td>General IVI Container / ISO 14823 / Ambient Condition</td><td>4</td><td>5</td></tr></table>		SSP position		CauseCodeType / Container	Octet position	Bit position	General IVI Container / ISO 14823 / Danger Warning	4	1	General IVI Container / ISO 14823 / Regulatory	4	2	General IVI Container / ISO 14823 / Informative	4	3	General IVI Container / ISO 14823 / Public Facilities	4	4	General IVI Container / ISO 14823 / Ambient Condition	4	5
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General IVI Container / ISO 14823 / Road Condition	4	6											
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Road Configuration Container	5	1											
Text Container	5	2											
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 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 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">• serviceType = NG-TSA (Navigation Guidance – Toll Station Approaching)• messageType = IVIM <p>Geographic area (Quadtree) for IVIM:</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.</p> <p>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> <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>												

7.2.2 NG – Smart Routing (NG-SR)

Type of road network	Major non-urban roads / Urban roads
Type of vehicle	Passenger vehicles
Use case introduction	
Summary	Optimizes traffic flows by providing dynamic travel time to key landmarks and traffic hubs (e.g. airport or train station) in response to traffic congestion levels caused by events such as jams, road closure and adverse weather conditions, etc. The information can be used to provide either simple travel time display on HMI or re-routing advice if an integrated navigation system is available.
Background	As the urban areas are getting more congested, it is important to provide drivers with adaptive route proposals that take into consideration the real-time travel time to destination based on current traffic congestion levels. This not only saves time and resources for the individual driver but ensures a balanced congestion levels and intended use of the network in various parts of the urban areas. This can also benefit traffic management plans (TMPs) by road or city authorities.
Objective	The use case is to provide to drivers the comprehensive information related to their travel time to destination, guiding the users to take the optimized route based on current levels of the traffic congestion.
Desired behaviour	The driver can adapt the route to the destination on the basis of perceived limitations and congestion levels on alternative options
Expected benefits	<p>The expected benefit of the service is better traffic management and support based on a more comprehensive and up-to-date picture of the state of the road network and of the traffic situation. This includes, among others</p> <ul style="list-style-type: none"> • For drivers, more efficient route choices based on the real travel time to destination • For the Traffic Control Centre, better balance traffic flows in urban areas and/or on non-urban network with less impact on the environment and saving resources. This also gives the possibilities to issue information on traffic management plans or strategic routes as well as to guide traffic around sensitive areas such as residential areas.
Use case description	
Situation	<p>The driver plans to travel from an origin to a destination in an urban area and/or on non-urban road network.</p> <p>While travelling the driver gets notified real-time through HMI of the expected travel time to destination with several alternative route options or be suggested of the optimal route by the integrated navigator if available.</p>

For example, the driver travelling to an airport in Verona may be notified of several expected travel time to destination depending on which street he or she may take (e.g. 30 minutes via street A, 20 minutes via street B). If there is an integrated navigation system, the user may be notified of the best route to take based on the travel time information received, as shown in below.

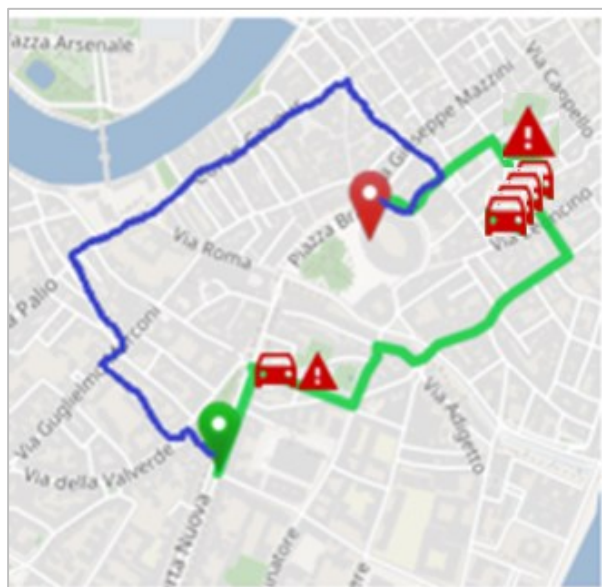


Figure 7:2: Example of Traffic Information and Smart Routing in urban area. User is provided with an alternative route (blue) instead of the usual route (green)

Logic of transmission

I2V

Actors and relations

- **TCC:** Receives traffic congestion and situation information. The sources can be sensors in the field, incident detection system, vehicle-detected events or 3rd party content provider such as meteorological service. The TCC then sends out travel time information via Roadside units and/or IP communication channel.
- **Service Provider:** receives information messages on the travel time to destinations from TCC via RSU or IP channel and presents the information via the HMI.
- **Driver:** receives travel time to destination information and can adjust the travel itinerary.

OR

- **Service Provider:** receives travel time and situation information from TCC and calculates optimized routes based on the vehicle's position and displays them on the smartphone app (or similar)
- **Driver:** receives travel time to destination information presented through an HMI or best route suggested from the trip planner if an integrated navigation system is available via HMI or smartphone application. And can adjust the travel itinerary.

Scenario	<p>Scenarios can be divided into two: vehicles simply displaying travel time information or providing the best route based on the information received.</p> <p><u>Scenario 1: Dynamic travel time to destinations</u></p> <ul style="list-style-type: none"> a) Drivers receive travel time to destinations such as famous landmarks or travel hubs while driving. b) Different travel times to the same destination via different routes are also provided on the HMI so drivers can choose the best option. <p><u>Scenario 2: Dynamic smart routing to destinations</u></p> <ul style="list-style-type: none"> a) Navigation system (e.g. HMI, smartphone app): The vehicle sends origin, destination, (vehicle type and planned stops if applicable) to Service Provider (OEM or a 3rd party). Service Provider then receives real time travel time to destinations and provides the dynamic optimal route based on travel time and other traffic events and also provide updates on the route if there is a significant change in the traffic situation along the way. Optionally, the vehicle may send its current location frequently to receive dynamically adapted route information. b) The drivers adapt their route to optimize the trip.
Intended Presentation/Alert principle	<ul style="list-style-type: none"> 1. Drivers are informed via HMI in the car or a dedicated app (e.g. Smartphone) 2. Drivers should be informed early enough of the routes to take (but not too early to forget) to take action and be moderately intrusive for immediate attention
Functional Constraints / dependencies	<p>Constraints</p> <ul style="list-style-type: none"> 1. The provision of information and its quality (validity, confidence, up-to-date). 2. HMI / Smartphone constraints to correctly display information. <p>Dependencies</p> <ul style="list-style-type: none"> 3. The availability and accessibility of real-time travel time to destination from TMC based on traffic congestion /traffic events. 4. The accuracy of the route information also depends on the computational model used to calculate the route by the service provider. <p>How the optimal route is calculated is not part of the use case description. It is left to the service provider. The service provider also decides how often the routes are re-calculated.</p> <p>How the information is presented to the driver is not part of the service description. It is left to the provider of HMI how information is presented. Information may be translated to the preferred language of the driver.</p>

	The route information presented is not obligatory but a guidance: Information should be handled as 'convenience information' and presented accordingly to the driver, as currently done within navigation systems.
Link with other Use Cases	This use case loosely linked to the other use case "Route Advice". While this use case is focused on providing dynamic route information based on travel time to the destination, "Route Advice" provides route information following TCC / TMC's strategic guidance under different traffic conditions and events and/or vehicle types
Interoperability Requirements	
Message profile requirements	<ul style="list-style-type: none"> • The IVI message for Destination Travel Time is profiled in chapter 4.2.2.6 of [C-Roads MP]. • The settings mentioned below, apply to scenario 1 and 2. • IVI messages for NG-SR shall use message management based on update and cancellation of messages. • 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. • A cancellation IVIM shall be repeated at least for 5min after its first transmission NOTE: The exact effort to ensure that all vehicles receive the cancellation will be resolved in future releases. • 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. • 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. • IVIM shall be self-contained: definition of all zones referred to within the IVIM shall be included in the same IVIM. • One GicPart in the GeneralIviContainer shall be used to encode one traffic sign (main sign) and up to three additional signs (subsigns) that may be associated to the main sign using DF RSCode. • extraText shall be used to present additional text associated to a traffic sign (sub-panel text) only if there is no subpanel code available in ISO 14823. extraText is ordered, so the first line of extraText corresponds to the first RSCode and so on. If a traffic sign does not have extra text, a string with a single NULL character (ASCII 0x00) shall be added. extraText may be ignored by receiving vehicles (i.e. neither evaluated nor shown to the driver) and should only be used for informative and not regulatory data.

	<ul style="list-style-type: none">For this use case, ISO14823 DF is set with appropriate serviceCategoryCode, nature, serialnumber and attributes<ul style="list-style-type: none">serviceCategory = informative (13), nature = 1 and serialNumber = 11 shall be usedddd [InternationalSign-destinationInformation] attribute shall be used																														
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 “General IVI Container” and a specific attribute of IOS/TS 14823 signs - informative. 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><th></th><th colspan="2">SSP position</th></tr><tr><th>CauseCodeType / Container</th><th>Octet position</th><th>Bit position</th></tr><tr><td>General IVI Container / ISO 14823 / Danger Warning</td><td>4</td><td>1</td></tr><tr><td>General IVI Container / ISO 14823 / Regulatory</td><td>4</td><td>2</td></tr><tr><td>General IVI Container / ISO 14823 / Informative</td><td>4</td><td>3</td></tr><tr><td>General IVI Container / ISO 14823 / Public Facilities</td><td>4</td><td>4</td></tr><tr><td>General IVI Container / ISO 14823 / Ambient Condition</td><td>4</td><td>5</td></tr><tr><td>General IVI Container / ISO 14823 / Road Condition</td><td>4</td><td>6</td></tr><tr><td>General IVI Container / Lane Status</td><td>5</td><td>0</td></tr><tr><td>Road Configuration Container</td><td>5</td><td>1</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	General IVI Container / ISO 14823 / Danger Warning	4	1	General IVI Container / ISO 14823 / Regulatory	4	2	General IVI Container / ISO 14823 / Informative	4	3	General IVI Container / ISO 14823 / Public Facilities	4	4	General IVI Container / ISO 14823 / Ambient Condition	4	5	General IVI Container / ISO 14823 / Road Condition	4	6	General IVI Container / Lane Status	5	0	Road Configuration Container	5	1
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General IVI Container / Lane Status	5	0																													
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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.
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 in chapter 3.3 of [C-ITS IP Based Interface Profile] shall apply:</p> <ul style="list-style-type: none"> • serviceType= NG-SR • messageType = IVIM <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.</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>

7.2.3 NG – Route Advice (NG-RA)

Type of road network	Motorways, dual carriageways, rural roads, urban roads
Type of vehicle	All
Use case introduction	
Summary	The goal of route advice is to inform all road users of a detour route recommendation (collective routing) provided by road operators according to special circumstances (e.g., major event). It enables road users to receive the route recommendations through in-vehicle information as a supplement to existing physical variable message signs (VMS) or as an extension in the form of a virtual VMS (no existing physical VMS) on locations, where relevant route decisions can be made.
Background	With the help of route recommendations and traffic information provided by VMSs, large concentrations of traffic can be effectively managed. Providing in-vehicle information can enhance this by offering continuous routing updates, independent of the fixed VMS locations. When many road users converge, for instance during public events, potential overloads at motorway exits and linked rural or urban roads can emerge. Using in-vehicle information, continuous route advice can be provided with redirection recommendations to alternative georeferenced routes regardless of fixed VMS locations, enabling smoother traffic flows.
Objective	<ul style="list-style-type: none"> Machine readably coded georeferenced routing information so that the Route Advice can be processed by the vehicles, e.g. by their navigation systems, to provide more precise and comprehensive information to the road users to achieve the desired behaviour of the road operator. Agreed and consistent traffic strategies at the interface between urban and interurban areas to guide road users seamlessly
Desired behaviour	By providing road users with up-to-date route advice, their route selection can be supported.
Expected benefits	Optimised utilisation of the entire road network, including motorways, urban, and interurban roads, can be achieved by providing road users with routing based on traffic management strategies. This approach improves traffic efficiency by avoiding congestion and reducing the risk of accidents caused by congestion. Furthermore, traffic routing strategies can minimise the environmental impact by reducing CO2 and noise emissions
Use case description	
Situation	On the road network, for which the road operator is responsible on, a road closure (restricted to all or specific vehicles), a delay or another cause the road operator wants to reroute, takes place. Specific situations can be:

- (1) **Recommendation to use neighbouring motorway exits/access:** Overload of motorway sections or rural/urban roads. Using route advice, large-scale routing advice can be given with a shift recommendation to neighbouring exits or accesses.
- (2) **Routing for motorway bypasses:** Routing in case of an incident. In general, according to the related static and dynamic traffic signs with the possibility of further bypass optimizations depending on the current traffic situation and road conditions.
- (3) **Route advice for events:** Route recommendations in the context of events can be broadcasted to vehicles.
- (4) **Restrictions for vehicle types:** Route recommendations in case of restrictions for vehicle types (e.g. critical bridges).

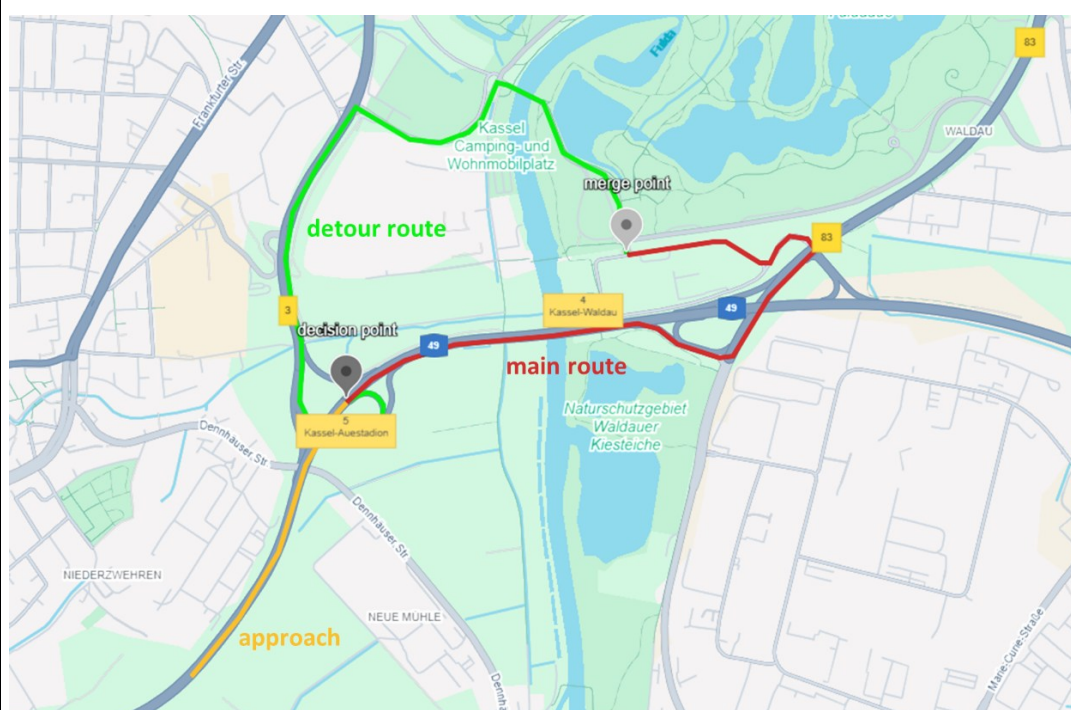


Figure 7:3 - Example illustration of route advice in the TCC



Figure 7:4 - Example illustration of route advice in the vehicle

Logic of transmission

I2V

Actors and relations	<ul style="list-style-type: none"> • Road operator: The source of this information is the road operator via the Traffic Control Centre (TCC). The road operator is expected to have validated the content of the message before sending this message into the system. • Driver: The route advice information is continuously received by all C-ITS equipped vehicles and displayed to the drivers. Drivers can choose the route according to this information. The exact details of the presentation (how and when) is based on the individual application designer's decision. The route advice information from TCC might also be processed by service providers to leverage the dissemination to the drivers.
Scenario	<ul style="list-style-type: none"> • If VMS is available, VMS display information about route recommendations at single locations and the TCC sends the coherent C-ITS information on the corresponding route to the road users. The information is based on TCC strategies. • If VMS is not available, the TCC can independently send a C-ITS information to the road users. The information is based on TCC strategies.
Intended Presentation/Alert principle	<ul style="list-style-type: none"> • IVS information shall be presented to the drivers and shall be consistent with the current valid (dynamic) traffic signs. • The information shall be presented to the driver early enough and in the appropriate location on the road. • The HMI presentation sequence is at the vehicle manufacturer's and/or service provider's own responsibility.
Functional Constraints / dependencies	To enable a cooperative traffic management supported by coordinated route advice, the involved road operators need to develop a coordination process to harmonise the respectively relevant strategy and thereby the information content to be published. This includes the definition of joint traffic strategies and measures in the first place, a matching of the data basis, a common triggering approach, and a cooperative interface.
Link with other use cases	TBD
Interoperability Requirements	
Message profile requirements	<ul style="list-style-type: none"> • The IVI message for NG-RA is profiled in chapter 4.2.2.2 of [C-Roads MP]. • IVI messages for IVS-TS shall use message management based on update and cancellation of messages • 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 • A cancellation IVIM shall be repeated at least for 5min after its first transmission <i>NOTE: The exact effort to ensure that all vehicles receive the cancellation will be resolved in future releases</i> • 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 GicParts as possible. The following zones exist:
 - detectionZone: all zones that run to the decision point
 - relevanceZone: all zones that run from the decision point to the merge point
- The DF zone must be created with the DF segment and the DF line grouped below it
- 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.
- IVIM shall be self-contained: definition of all zones referred to within the IVIM shall be included in the same IVIM.
- One GicPart in the GeneralIviContainer shall be used to encode one traffic sign (main sign) and up to three additional signs (subsigns) that may be associated to the main sign using DF RSCode.
- Information shall as far as possible be encoded using machine-readable message components, via adhering as much as possible to the following rules:
 - Restriction of signs to certain vehicle types and/or dimensions
 - Encoding of subpanels using roadSignCodes available in ISO 14823 for sub-panels instead of extraText
- For this use case, ISO14823 DF is set with appropriate serviceCategoryCode, nature, serialnumber and attributes and referenced to two or more relevanceZone:
 - Main route (relevanceZone 1)
 - closed

closed for	service Category	nature	serial Number
all vehicles	12	4	15
goods vehicle	12	4	21
goods vehicle with trailer	12	4	22
vehicles carrying dangerous goods for which special sign plating is required	12	4	76
for vehicles carrying more than a certain quantity of substances liable to cause water pollution	12	4	77
for vehicles having an overall width exceeding X	12	4	99

for vehicles having an overall height exceeding specified height	12	5	11
for vehicles exceeding specified weight	12	5	12
for vehicles having a weight exceeding specified axial weight on one axle	12	5	13
for vehicles or combinations of vehicles exceeding specified length X in length	12	5	14

or other suitable traffic sign

- disabled

disabled, because of	service Category	nature	serial Number
Traffic congestion	32	1	11

or other suitable traffic sign

- Detour route (relevanceZone 2+)

detour	service Category	nature	serial Number
detour	13	6	18

- extraText may be used to present additional textual information.

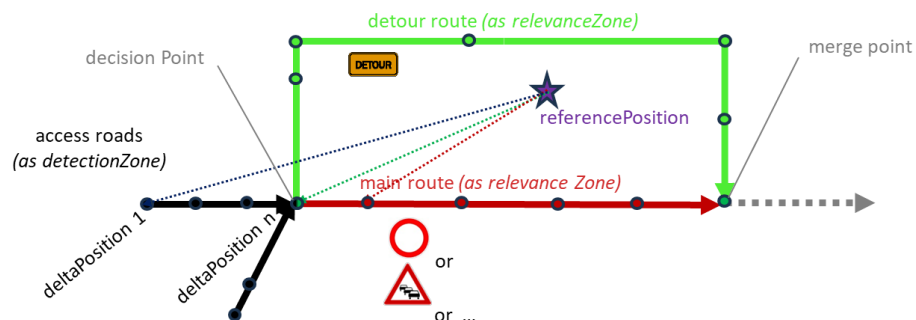


Figure 3: Illustration of the glc and giv container in the IVIM

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>
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This use case is based on the “General IVI Container” including lane status and all types of ISO/TS 14823 signs, the “Road configuration container” as well as the “Text container”. The IVIM permissions (SSP) shall 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.

	SSP position	
CauseCodeType / Container	Octet position	Bit position
General IVI Container / ISO 14823 / Danger Warning	4	1
General IVI Container / ISO 14823 / Regulatory	4	2
General IVI Container / ISO 14823 / Informative	4	3
General IVI Container / ISO 14823 / Public Facilities	4	4
General IVI Container / ISO 14823 / Ambient Condition	4	5
General IVI Container / ISO 14823 / Road Condition	4	6
General IVI Container / Lane Status	5	0
Road Configuration Container	5	1

	<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>
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 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 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"> • serviceType = NG-RA • messageType = IVIM <p>Geographic area (Quadtree) for IVIM:</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.</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>