



C-ITS SERVICE AND USE CASE DEFINITIONS

**POINTS OF INTEREST (POI)
[C-ROADS SUD09]**

VERSION 3.1.0

C-Roads Platform

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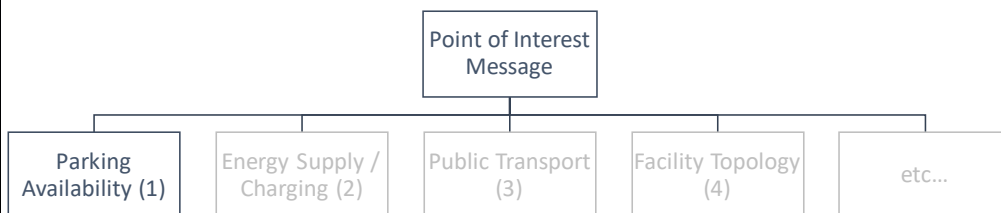
Introduction

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.

9. Points of Interest

9.1 Points of Interest service introduction

Service introduction	
Summary	<p>The Points of Interest (POI) service can provide up-to-date information of points of interests along the road, being e.g. free parking spaces/places, gas stations or EV charging points, park-and-ride facilities and more. Providing this information from the infrastructure helps vehicles to plan routes accordingly and therefore increases traffic flow and efficiency as well as reducing emissions on the trip.</p> <p>The POI service makes use of the Point of Interest Message (POIM) and its container structure. Each container may be used to describe one or more Use-Cases. The following figure shows the current draft with the Parking Availability (POIM-PA) container and future examples.</p> <div data-bbox="418 788 1423 999">  <pre> graph TD POIM[Point of Interest Message] --- PA[Parking Availability (1)] POIM --- ESC[Energy Supply / Charging (2)] POIM --- PT[Public Transport (3)] POIM --- FT[Facility Topology (4)] POIM --- etc[etc...] </pre> </div> <p><i>Figure 9:1 ETSI POIM structure</i></p>
Background	<p>Route planning can be challenging for drivers and vehicles due to the absence of up-to-date POI information along the roads. For instance, truck drivers often struggle to find available parking spaces for (mandatory) rest during their long journeys, leading to situations where trucks are parked at breakdown bays or the hard shoulder. Similarly, EVs require information about charging points along their routes. The C-ITS POI service can significantly enhance route decision making by providing accurate and timely information about relevant POIs, resulting in more efficient and informed journeys.</p>
Objective	<p>Providing detailed information about points of interest, e.g. parking spaces, along the road, resulting in better traffic flow and efficiency.</p>
Expected benefits	<p>Improved traffic flow and efficiency as well as reduced emissions.</p>
Use Cases	<ul style="list-style-type: none"> ○ Parking Availability (POI – PA)

9.2 POI: Use Cases

9.2.1 POI – Parking Availability Information (POI-PA)

Type of road network	All
Type of vehicle	All
Use case introduction	
Summary	<p>The use case aims to provide to drivers of all vehicles (real-time) information related to parking places (location, availability, services, rates, etc) as well as potential specific information on parking spaces. This could be about parking lots on the highway as well in urban areas. In this use case there is a distinction between information on the aggregated area/facility level versus specific parking spot information by scenario. For further clarity in this use case description the following definitions are used:</p> <ul style="list-style-type: none"> ○ Parking place (a.k.a. parking lot, parking facility) = a place or location used for parking, loading, unloading, standing, or some other mobility or transport related activity. Place typically identifies a parking structure, surface lot or on street parking zone. ○ Parking space (a.k.a. parking spot) = a single space for parking, usually designed for one vehicle, which may, but not necessarily, be denoted by painted or other road surface marker.
Background	<p>Today, there are announcements for parking places/spaces via static and variable message signs. This use case brings the information into the vehicle.</p> <p>The core value of this service is to create and share the same display for this type of information, by being independent of the sources of information (which are numerous and have different communication means). Above all, it is a matter of bringing more comfort to the road user. However, this information can also bring more safety by helping the road users manage/minimize their driving time.</p> <p>For passenger cars, the information on accessible park-and-ride facilities has value itself because some park-and-ride facilities are not accessible to all users as they are restricted to subscribers.</p> <p>The urban on-street parking spaces are generally scattered with no clear indication of the available parking places, which makes it challenging for drivers to search for an available space. For traffic control centres, it is important to maximize the utilization of on-street parking spaces by providing the real-time availability to the drivers, also as to guide users to park in available spaces out of the congested city centres.</p> <p>The following figure shows an example of on-street parking in an urban area, where the parking spaces are grouped as parking areas (zones) with color-coded occupancy rates. Each parking area contains information about the availability</p>

of each parking space, and it is also possible to indicate the reserved spaces for loading and unloading of the goods, for disabled or women drivers, to name a few.



Figure 9.2: Example of on-street parking area and space

On highways, especially trucks benefit from real-time parking information to plan their routes and rest times. This leads to better traffic flow and less traffic on smaller roads close to highway ramps.

Figure 9.3 below shows the idea of the levels of parking facility. The facility itself can consist of multiple areas of different vehicle types. The areas consist of spaces, the share the characteristics, e.g. the same dimensions or heading. The spaces itself show the most detailed level of information, providing if a space is free or not. Each level can be used to inform vehicles about the status of the parking facility, area or space. Hence, road operators are able to adapt the information according to their technical possibilities when it comes to detect free spaces.

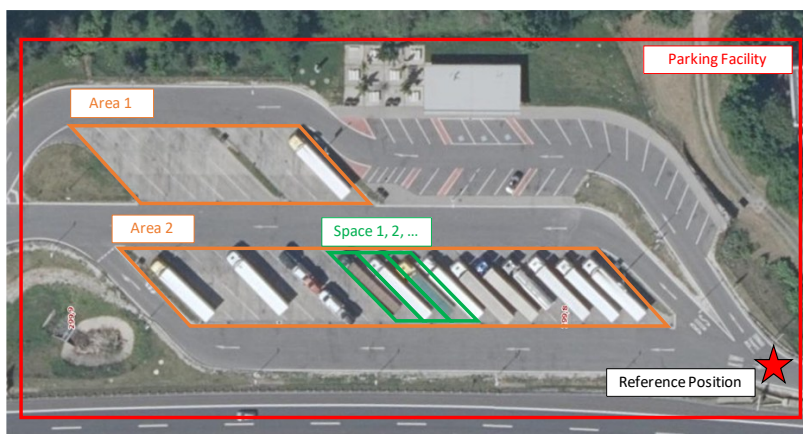


Figure 9.3: Parking facility, area and space

Objective

- Allow drivers to manage their driving time according to the availability of parking places and spaces and associated services;
- This use case also applies to HGV drivers who are subject to regulations on the maximal time of driving, as well as to light vehicles drivers;
- To prevent overcrowded (truck) parking and illegal parking on hard shoulders (or other places that are not suitable as parking spaces);

	<ul style="list-style-type: none"> ○ To prevent (truck) drivers searching for an available parking space, causing unnecessary traffic movements from (heavy goods) vehicles; ○ To facilitate urban delivery by making them find more easily an available space and deliver without staying on the road.
Desired behaviour	Drivers adapt their journey based on the received information.
Expected benefits	<ul style="list-style-type: none"> ○ Safety: As the driver will have the information upstream, it will allow the driver to plan his stop accordingly, especially for an HGV driver. Thus, the driver will be able to drive more safely; ○ Traffic management; ○ Better parking place/space management; ○ Comfort (information on services at the parking place/space).
Use case description	
Situation	<p>The information provided can be:</p> <ul style="list-style-type: none"> ○ The location of parking places/spaces; ○ Opening hours; ○ If the parking place is open or closed (can be closed due to maintenance, roadworks, event in the area); ○ The number of their available spaces. If not known, information provided is just “full” or “free”. Additionally, a complete or partial set of information on the availability and location of each space can be provided; ○ The location of spaces for people with reduced mobility; ○ The location spaces reserved for on/off loading goods; ○ The occupancy trend; ○ Information about the service provider, including an address, phone number or website address; ○ Vehicle Types and/or transported goods permitted to be parked; ○ Services provided in the parking place, and associated rates; ○ If there is a charging point for electric vehicles; ○ Multimodal facilities in the vicinity; ○ The type of parking for each space, including detailed information e.g. the position, the layout, the orientation a.o.; ○ The lanes, how to access certain areas. <p>Additional information (e.g. signage, navigation support) can be sent via a message that is linked to the parking information message.</p>
Logic of transmission	I2V

Actors and relations	<ul style="list-style-type: none"> ○ Parking operators: The parking operator sends the parking information to road operator or the TCC; ○ Road operator / TCC: The road operator /TCC is the sender of the information, being the parking operator or after obtaining the information from the parking operator or from embedded sensors in parking spaces; ○ Drivers are the end-users of the use case.
Scenario	<p>(1) <u>Place information (aggregate level information)</u></p> <ul style="list-style-type: none"> ○ The road operator / TCC gets the information by his own means or through his data/service provider/parking operator. The information may be in the form of the exact number of vacant spaces or the probability of finding an available space; ○ The road operator / TCC sends it to all the vehicles, in a relevant area; ○ Vehicles receive the information and pending the implementation display it directly or on request by the driver; ○ The information is displayed in the vehicle on the HMI, adapted, if possible, to the type of vehicle (e.g., Light Vehicle or Heavy Goods Vehicle); ○ Drivers adapt their trip and choose a parking place/space according to their needs; ○ Eventually, the driver could put his itinerary in the guidance system of the vehicle that is connected to the C-ITS system to go to the parking place/space. <p>(2) <u>Space information (individual spot information)</u></p> <ul style="list-style-type: none"> ○ The road operator / TCC gets the information by his own means or through his data/service provider. This is specific information about 1 individual parking space; ○ The road operator / TCC sends it to all the vehicles, in a relevant area. The road operator / TCC can send information about multiple individual parking spaces in the message; ○ Vehicles receive the information and pending the implementation display it directly or on request by the driver; ○ The information is displayed in the vehicle on the HMI, adapted, if possible, to the type of vehicle (e.g., Light Vehicle or Heavy Goods Vehicle); ○ Drivers adapt their trip and choose a parking space according to their needs;

	<ul style="list-style-type: none"> ○ Eventually, the driver could put his itinerary in the guidance system of the vehicle that is connected to the C-ITS system to go to the parking space.
Presentation/Alert principle	<p>Information is provided to drivers automatically or who request it via the HMI or a dedicated app (e.g., smartphone).</p> <p>How the information is presented to the driver is not part of the service description. It is left to the provider of the HMI how information is presented. Information may be translated to the preferred language of the road user</p>
Functional Constraints / dependencies	<p>Constraints</p> <ul style="list-style-type: none"> ○ The provision of information and its quality (validity, confidence, up to date) should be available early enough to act. Depending on the type of parking, the timing of the information is essential (e.g. receiving parking information for trucks on motorways versus parking information in an urban environment). <p>Dependencies</p> <ul style="list-style-type: none"> ○ The availability and accessibility of real-time on-street parking availability information from TMC in case of the space information. <p>How the information is presented to the road user 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 road user.</p> <p>The parking information presented is not obligatory but a guidance: Information should be handled as 'convenience information' and presented accordingly to the road user.</p>
Link with other use cases	
Interoperability Requirements	
Message profile requirements	<p>For this use case, the POIM-PA shall be sent according to the POIM-PA message for Parking Availability Facility Layer Service (PA-FLS) as profiled in chapters 4.2.7 of [C-Roads MP].</p> <p><u>Triggering conditions:</u></p> <p>The PA-FLS is managed in cooperation between the PA-FLS provider (Roadside equipment or a central system) and users of the service which can be vehicles controlled by human (SAE levels 0 to 3) or which can be fully automated vehicles (SAE level 4 and 5) or motorized VRUs searching for a dedicated parking. The PAS is triggered by a parking management application which provides the service. At the level of the service provider, the POIMs-PA dissemination is controlled via several triggering conditions relatively to the type of ITS communication profile being used:</p> <ul style="list-style-type: none"> ○ Continuous broadcast from a Roadside Unit: In this case, the POIM-PA is continuously broadcasted at a predefined frequency which can be

	<p>adjusted according to the used channel congestion management. Local users are then constantly receiving the broadcasted POIMs-PA and then filter them according to their local mobility application needs.</p> <ul style="list-style-type: none"> ○ Push unicast mode from a central station: The unicast mode is used by long range communication systems, in this case directly addressing a user which has a service contract with the parking management service operator. Then, the dissemination of POIMs-PA to the user is under the initiative of the service operator which may infer, according to some received information, that the user needs to be informed about local parking' availabilities.
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><i>NOTE: The definition of relevant SSPs will be added in a later release.</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>
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 POIM 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 = POIM – PA ○ messageType = POIM <p>Geographic area (Quadtree) for POIM:</p> <p>The event is primarily characterized by the DF “position” in the placeinfo of the ParkingAvailabilityBlock. If the optional DF “detailedStatus” in ParkingAvailabilityBlock is available and used, then “location” and the optional “boundary” set within the sequence of “ParkingArea” should be considered as well. 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> <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>