



WG2 ROADMAP 2025-2027

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Document history

Version	Date	Description, updates and changes	Status
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1. Introduction

Working Group 2 - Technical Aspects - is the key Group to fulfil the harmonized functional, technical and process specifications of the C-Roads platform, this includes both specifications for procurement, operations and qualification of those parts of C-ITS for which interoperability is mandatory to realize good operations of the services supported and being deployed throughout Europe.

Though the endorsement is done by the C-Roads Steering Committee, these specifications and definitions are being developed by the Working Group (**WG**) and its Task Forces (**TF**). The WG is responsible for completing the assigned tasks and documents according to defined objectives, schedules and costs. Therefore, WG2 plays an important role in the overall objective of the C-Roads Platform.

The Task Forces contain the main aspects of work within WG2 to reach the overall C-Roads objectives.

Currently, within WG2, five Task Forces are put in place (with an option to have their tasks extended or to have further groups added if required) in order to support and facilitate the technical aspects of interoperable pilot deployments.

If during the performance of the activities and pilots additional work items are needed, such as additional Task Forces, WG2 or C- Roads members may propose such organisational changes to the C-Roads Platform Steering Committee and decide about additional task forces or adaptations or updates of the work plan.

To realize the specifications and other deliverables WG2 makes use of 3 mechanisms:

1. A Quality plan
2. A Service Roadmap
3. An Execution Plan

The current version of this “Service Roadmap” or Roadmap outlines the activities and objectives of the WG2 and its TF(s) on the C-Roads platform for the years 2025 to 2027.

2. Description of this roadmap

2.1. Preamble from C-Roads Platform

In order to set this phase of the European C-Roads Platform in an overall context in the connected vehicles and mobility domain, but also with respect to the further next steps and activities of members and partners in the platform, a brief introduction to C-Roads as a whole and the single development phases are described in this preamble. This preamble is therefore essential to understand the role of the WG2 within the C-Roads platform. The main contents and the addressed activities are briefly characterised for a better understanding of the current challenges and their task's and activities.

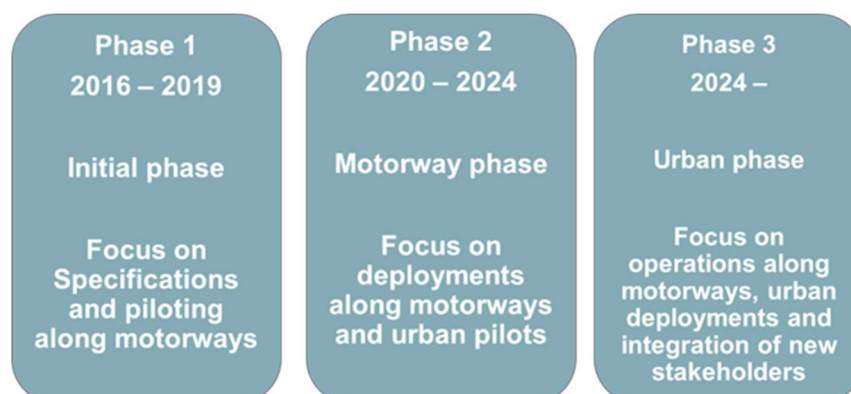


Figure 1 : Phases of the European C-Roads Platform

This roadmap starts in 2025 and will end in 2027. We will only describe phase 3, as it is the phase relevant to our roadmap for this document and for the WG2 and its various TF's.

With the start of **C-Roads Platform Phase 3** in mid-2024 exactly these activities for the fully operational set-up and roll out of C-ITS services on road infrastructures but also in large vehicle fleets need to be defined and completed. This will comprise operations on existing motorway networks, extensions to many areas in cities and urban services with their regular service introduction, but also the parallel on-boarding of new stakeholders and their needs for C-ITS service introduction and interactions with all stakeholders in their domain. For the traditional stakeholder groups the extension of C-ITS services specifications and validation with respect to vehicle automation, but also to urban access or other areas will be an important part of the activities in this phase of the C-Roads Platform and the related deployment projects based on the harmonised specifications.

2.2. Purpose of this Roadmap

The “C-Roads WG2 Roadmap 2025-2027” document for Phase 3 outlines the objectives for WG2 and its Task Forces (TFs) in this final phase. Each TF is required to define its work items, assign responsibilities, and establish timelines for their completion. The roadmap must align with the overall objectives set by the C-Roads Platform. Additionally, it will detail the specific objectives, technical approaches, liaisons with other WGs and TFs, and collaboration with external stakeholders for each TF within WG2.

2.3. Description of the C-Roads objectives

In order to prepare information and share existing knowledge about C-ITS implementations on motorway networks and in urban environments C-Roads Platform members are active in the support of the promotion and dissemination activities in several collaboration areas, like the urban, the rail and the blue light sector, which start to use C-ITS services now and will extend the geographic coverage, but also the number of involved stakeholders in the C-Roads Platform and the respective intensity of their C-ITS use and application.

One specific task in the current phase 3 of the C-Roads Platform is the preparation of the operational phase of the C-ITS System in large numbers of participating C-ITS stations with contributions of the C-Roads members and their nominated experts of the single organisations to the Working Group Operations and Strategy. This group defines and agrees on the necessary details for the future operational phase of the C-ITS network and the interactions between the C-ITS station operators which collaborate with the objective to operate a high quality and up to date information service network based on C-ITS in Europe.

The description of the intended future work of C-Roads outlines the main efforts for the WG2 workplan for 2025-2027. **The key focus areas** and primary directions for WG2 roadmap are as follows:

- Extension of the geographic coverage of urban environments
- Extension of the geographic coverage of motorway networks
- Collaboration extends to new sectors such as urban area, rail and blue light sector within the respective collaboration Groups in C-Roads
- Contribute with WG2 experts on the operational phase in coordination with the Operations & Strategy WG
- Prepare for an increased use of C-ITS services and the involvement of additional stakeholders
- Focus on maintaining a high-quality, up-to-date information service network

3. Roadmap 2025 – 2027

3.1. Working Group 2 (WG2)

Objectives

The overall goals of the working group 2 (technical aspects) are:

- Handling of critical technical items and issues that need to be escalated to the WG Operations
- Improving operational collaboration processes with other C-ROADS groups (Urban, Rail, and Blue Light)
- The harmonisation of current (released and published) and future C-ITS services probably also in the context of automation
- To contribute to the definition and implementation of a harmonised communication profile for C-ITS services on road infrastructures across Europe
- To give recommendations on driver information through C-ITS services
- To take existing standards in the drafting of specifications into account and to contribute with new and/or updated items to the standardisation processes
- Provide support on technical topics for regular operations (in link with WG operations and training activities)
- Enhancing security, by identifying key security challenges, proposing solutions to achieve L1 and L2, and defining the necessary steps for operational deployment

Solutions

The following solutions will be developed within the workplan and addressed by the WG2 task forces:

- A harmonised C-ITS road infrastructure communication profile for all C-Roads deployments and pilots covering the complete day one services, and additional services proposed and specified by partners and their project activities
- A C-Roads approach for dealing with security issues for C-ITS service provision and secure communication within the EU CCMS trust model, allowing systems to comply with L1 and L2 requirements
- A C-ITS road infrastructure profile for improving traffic safety for “on railway level” crossings.
- Common Test and Validation procedures for implementing C-ITS services in Europe for pilot deployment but also for regular operations
- Continue to develop communication profiles for all C-Roads deployments ensuring a clear transition to operational implementation
- The methodology for dissemination of C-ITS messages by different communication technologies, including hybrid approach, and their interactions with changing service platforms
- Mechanisms to distribute communication certificates to all C-ITS-stations in a secure way and enable trustful communication in the C-ITS network between all collaborative stakeholders involved
- Properly address the hybrid component to ensure full-service operations. Ensuring that the specifications cover all identified technological possibilities
- Contribute to the technical aspects of cooperation with external stakeholders, such as C2C CC, NAPCORE, 5GAA, and others

3.2. Task Force 1

Objective

This Task Force is in place to collect, assess and/or create the basic documents required to commonly specify security aspects that are relevant for the operation of interoperable C-ITS services in Europe.

Goal of TF1 is to provide the harmonized specifications where harmonisation is crucial and additionally to give an overview of security aspects which need to be considered but do not necessarily need to be harmonized – ideally to provide best practises already established or define and recommend common baseline requirements.

Technical approach

The working method of the Task force Security is to collect the basic set of documents and setup a structure and a content table of the TF report, based on conference calls with all TF members. Work in TF1 is therefore based on the general definitions of ETSI, CEN/ISO standards, and additional requirements in the EU Certificate Policy, Security Policy and CPOC Protocol. The required security specifications for (infrastructure) C-ITS stations are also derived from existing profiles and specifications from various European C-ITS initiatives.

In addition, TF1 has identified a list of security-related topics which are not necessarily defining technical requirements and specifications, but rather deal with guidance and recommendations, e.g. various aspects related to migration paths from piloting to regular operations.

As main focus, single C-ITS station security elements are to be covered, as well as the set up and operation of a “Trust Network” according to the results of the European Commission’s C-ITS Platform Working Group on Security.

Specifying the use of one or more proxy systems (“interchange nodes”) to exchange C-ITS messages also over long distances, e.g. across cities, regions or even between European countries, is covering the IP-based communication branch of the overall architecture. The combination of the long-range and short-range communication approaches, ensuring interoperability across European actors and aiming for coherent information delivery to the road users, forms the “hybrid communication” approach. So, in addition to the security of C-ITS messages that are directly exchanged between C-ITS stations, additional security requirements for communication via backend systems are to be considered.

Moreover, factors addressing the “hardening” of C-ITS stations against misuse are considered, i.e. device certification according to common criteria. Additional, overall “cybersecurity aspects” of C-ITS stations and the necessary provisions for preventing general IT security attacks (e.g. intrusion and/or anomaly detection, misuse of certificates or complete C-ITS stations) cannot be covered in full detail by TF1. Such aspects certainly pose risks to an active C-ITS network, but the provisions need to be taken by all “operators of C-ITS stations” within their general IT security responsibility anyway, since they are not C-ITS specific. Crucial aspects will certainly be referenced, e.g. organizational measures like ISMS for secure operational environments or technical measures like Protection Profiles and Security Targets according to Common Criteria, but the exact level of elaboration and harmonization within TF1 needs to be assessed case by case.

In general, the following steps can be identified:

- Inventory phase regarding existing documents & concepts
- Identify commonalities/differences across the pilots and existing deployments

- Identify crucial interoperability aspects and common requirements in the emerging policy framework:
 - Map findings to EU Certificate Policy and potentially to provide feedback to the European Commission
 - Assess options for roles & responsibilities according to EU Security Policy and potentially to provide feedback to the European Commission
- Establish harmonized PKI requirements as required by C-Roads pilots and existing deployment
- Alignment with other stakeholders regarding regulatory frameworks (RED)

Liaison with other WGs and TFs

TF1 will collaborate with all other activities in WG2 by providing baseline security requirements that apply for all use cases and services, but also regarding technical details and specific requirements if/where necessary:

- With TF2: Identify and document specific functional requirements related to security (and potentially privacy) for each use case within the TF2 document “C-ITS Service and Use Case Definitions”, ensuring these requirements are included in the TF2 document. Additionally, TF1 will provide input to TF2, including Service Specific Permission (SSP) settings for each use case to ensure interoperability.
- With TF3: Address the specifications regarding the security component of the ITS station architecture – it is intended here to have only short text in the TF3 deliverables and refer to the specific TF1 deliverables for detailed specifications
- With TF4: The required security provisions for the IP-based interface and a hybrid communication system will be agreed on. While TF4 provides the specifications for the IP-based interface and the architecture of a hybrid communication system, TF1 is in charge of the detailed security aspects and the alignment of the overall security mechanism for C-Roads
- With TF5: Suitable test procedures and the expected amount of cross-testing needs to be assessed. This is needed since the required level of security testing might vary considerably, also depending on what can be realized within the C-Roads community alone and what requires more in-depth access to stations and (PKI) systems

With the overarching WG2, TF1 continues to implement the commonly agreed release and change management process for the produced deliverables.

With WG1, TF1 had already established a liaison to ensure a consistent approach of specifying roles and responsibilities and organisational aspects, like the future operation of the European C-ITS system. Regarding regular operation, strategic deployment plans and long-term planning and alignment, a new collaboration is to be established with WG Operations.

Cooperation with external stakeholders

TF1 will furthermore cooperate with relevant external stakeholders:

- With the C-ITS Expert group E01941 originating from the C-ITS Platform of the European Commission, to ensure compliance with Certificate Policy, Security Policy and CPOC Protocol as well the Certificate Policy Authority (CPA). These groups also include actors like Car 2 Car Communication consortium and other industry stakeholders
- With the Car 2 Car Communication Consortium, there is an established collaboration agreement and process for the exchange of documents, requirements, reviews and change request, including collaboration with respect to specific topics

- With standardisation organisations like ETSI in terms of required/expected changes of existing standards, (potential) future updates of standards in terms of functionality and in terms of standardized testing procedures, e.g. as established for ETSI plug test
- With non-C-Roads deployment activities, in particular in the Urban environment, on a best effort basis in order to ensure compatibility and interoperability with any (future) infrastructure-related C-ITS specification

Roadmap for TF1

For TF1, from **March 2025 until December 2025** the objectives are:

- Revival of Security & Privacy Protocols (SPP) discussion. The TF will first revisit the discussions on SSP, update the list of relevant “special governmental” services, and align these efforts with the ongoing work of the Expert Group and CPA by providing a proposal as input from the C-Roads community.
- Bring additional topics to the attention of the CPA for consideration/discussion, e.g. the challenging timeline for migration to L1 terminating in 2025.
- Progress Report on the harmonized standards developed under the Radio Equipment Directive (RED). An analysis will be conducted in collaboration with Car2Car-CC, concerning the “cybersecurity” standards according to RED article 3 (3) lit. d,e,f and their (potential) impact on current C-ITS specifications and security provisions.
- Analysis of the need for additional Protection Profile(s) (PP). The purpose of this analysis is to determine whether a new PP or even several PPs are necessary, i.e. for mobile units and/or central C-ITS station.
- A guidance document (or separate, topic-specific papers) will be developed to address several technical and organizational aspects. An inventory of these topics is established, at least comprising the topics “PKI management” and “RSU management”.
- An inventory regarding “Hybrid” topics and architecture in coordination with TF4 is required, clearly structuring the specific topics, assigning a relevance and priority for the overall system and outlining a way forward.

For TF1, from **December 2025 until end 2027** the objectives are:

- Updating the two main deliverables (Governance, Specifications) according to the needs, potentially restructuring the document in line with relevant other developments in TF1 (e.g. Guidance papers), WG2 (e.g. document structure, references) or outside of C-Roads (e.g. impact from policy changes).
- Continued monitoring of CPA topics and discussions, with TF1 providing the room for discussion and ideally forming a common opinion for the road operators in the C-Roads community. In the longer run, one additional topic for consideration will be “Misbehaviour Detection”.
- Depending on the outcomes obtained from the analysis, a new PP activity might need to be defined and kicked off, carrying out the respective work between 2025 and 2027.
- Additional topics might be identified for the guidance document (or separate, topic-specific papers), addressing several technical and organizational aspects. To ensure clarity, it is proposed to create separate, targeted papers for specific topics, e.g. ISMS (Information security management), also in the light of NIS/NIS2 (Network and Information systems) directive.
- “Hybrid” topics and architecture in coordination with TF4 need to be tackled, for example:
 - Implementing and securing messages or channels within this architecture, including brokers and clients.
 - Questions around Central C-ITS Stations, including procurement and contracts, using HSM (Hardware Security Module) for the central station, potential (common) cloud deployments etc.

- The workplan aims to ensure secure communications and data, while also addressing the management of cryptographic keys within the organization.

Please note: Several topics are also to be monitored and addressed in collaboration with C2C-CC, e.g. regarding RED and PPs. These activities will be kicked off and followed up on in line with the dynamics of the respective topic, potentially ranging from monthly to annually meetings or even one-time exchanges/workshops only.

3.3. Task Force 2

Objective

The goal of this Task Force is to establish consensus on the definition and functional description of C-ITS services and associated use cases for deployment by road operators, ensuring interoperability and harmonisation. Additionally, this TF will maintain an overview of both the currently implemented C-ITS services and use cases and those planned for future implementation by C-Roads members.

Technical approach

The steps towards harmonisation start with the identification of Day-1-services and connected use cases, as well as how they are handled in the individual member states. In particular, the following aspects need to be considered:

- Identification of functional requirements for C-ITS services and use cases in close engagement with other C-Roads working groups and collaboration groups
- Specification and management of harmonised definition and functional description of C-ITS services and use cases for implementation by road operators
- Identification and definition of interoperability requirements in collaboration with other task forces
- Maintaining an overview of implemented and planned use cases by member states

First, an overview of service and/or use case description will be provided by individual member states implemented or planned the corresponding service and/or use case, using the agreed-upon template. All inputs will be collected from individual member states that are involved in the implementation of the specific service and/or use case.

Within TF2, small working groups will take care of the harmonisation of each use case under its corresponding service (e.g., RWW, IVS, SI, HLN, AVG, POI, CP, NG). A harmonised functional description will be agreed upon within TF2 and then at WG2 level. This process also involves coordination with other task forces to ensure interoperability.

For organisational purpose, service and use case descriptions are categorised into Category A and Category B.

Category A: This category includes descriptions based on tested and validated implementations by C-Roads members. These descriptions will be included in the officially released C-ITS service and use case definitions document upon approval by the SCOM.

Category B: This category includes early descriptions of new C-ITS services and/or use cases established based on implementations from one or more member states. However, these descriptions:

- Have not been fully tested and validated yet, or
- Are not fully aligned with established European or international standards

Category B descriptions will be submitted for review and feedback but will not be included in the official release.

Once approved by the SCOM, the harmonised Category A C-ITS service and use case descriptions will be included into the officially released C-Roads C-ITS service and use case definitions document. This document serves as a European catalogue of C-ITS services and use cases for implementation by road operators.

Liaison with other WGs and TFs

TF2 will work with other C-Roads WGs and TFs.

- TF2 will work with TF1 to identify and specify functional requirements related to security and privacy. This also includes interoperability requirements associated with C-ITS security
- TF2 will work with TF3 to ensure interoperability, in particular message profile settings for implementation of specific use cases
- TF2 will work with TF4 to identify and specify functional, and interoperability requirements related to IP-based and hybrid communications
- TF2 will work with TF5 to create test cases to validate the functional operation of use cases
- TF2 will work with WG1 to identify and include functional requirements associated with organisational aspects
- TF2 will work with WG3 to identify any necessary updates to functional requirements based on the findings from evaluation and assessment of use cases
- TF2 will work with Operation and Strategy WG to identify and include functional requirements associated with C-ITS operations and strategy across the member states
- TF2 will work with collaboration WGs (Urban, Blue light service and Rail) to identify and incorporate functional requirements for C-ITS services and use cases relevant to these groups and stakeholders

Cooperation with external stakeholders

TF2 will cooperate with external stakeholders and projects working on C-ITS use case specifications and implementations in projects and demonstration phases but also interact with stakeholders active in the standardisation domains, where functional descriptions and service definitions are concerned.

Roadmap for TF2

From the outset of C-Roads, TF2 has been responsible for harmonising the functional descriptions of C-ITS services and use cases implemented across various C-Roads pilots projects. Throughout the course of C-Roads, TF2 has developed and maintained an introductory document to the WG2 documentation. Additionally, incorporating use case specific interoperability requirements into the C-Roads C-ITS Services and Use Cases definitions has been a significant step in ensuring interoperability and harmonisation of C-ITS services across deployments.

For TF2, **from April to December 2025**, the focus will be on:

- Updating Road Works Warning (RWW) descriptions in the TF2 document based on the approved content of RWW handbook
- Discussing the maintenance vehicle use case and incorporating the outcome into the TF2 document
- Addressing change requests and improvements on Signalised Intersection (SI) use cases from the Signalized intersections subgroup
- Defining new use cases from:
 - Austria: Vehicle distance information, Vehicle speed information
 - Belgium Flanders: Vehicle height warning
 - Italy: Dangerous goods vehicle monitoring and warning
 - Other member states, including contributions from SCALE and C-Roads Germany 3 projects, if any
- Improving the PVD (Probe Vehicle Data) privacy working document and discussing it with C2C-CC

- Collaborating with C2C-CC on the development of a joint document for V2V use cases
- Establishing a common approach to Quality of Service in collaboration with Operations and Strategy WG
- Engaging with collaboration groups to identify new functional requirements for both existing and new services and use cases

For TF2, the global workplan **for 2025-2027** will include improvements to the following topics:

- Quality of service elements
- Triggering conditions
- Lifetime management of use cases
- New and improved use cases, including those related to urban environments, blue light services and railway

Additionally, TF2 will continue to collaborate with other C-Roads WGs, including collaboration groups and other stakeholders to improve the functional descriptions of C-ITS services and use cases.

3.4. Task Force 3

Objective

Task Force 3 aims at providing a specification of Infrastructure-to-Vehicle communication that allows application developers to implement applications receiving data from the infrastructure for real-world service deployment. The specification represents a harmonised view of all C-Roads partners, thus addressing a European scope.

The first phase of TF3 concentrates on two parts:

1. Message profiling: TF3 profiles all messages for all use cases in a general manner. For specific services, which use the same message, separate profiles are defined (e.g. specific DENM profiles for RWW and HLN)
2. System profiles for ITS G5 short range communication: TF3 specifies system profiles for RSUs and aftermarket OBUs for special purpose vehicles (e.g. Road operator vehicles, trailer)

TF4 will in the second phase build on this and extend the results for long-range communication, so in the end hybrid communication, at least comprising ITS G5 and IP-based long-range services, will be covered. The exact approach on hybrid communication will be developed by TF4.

Technical approach

Since the TF3 deliverables are based on a constant evolution of inputs from all participating member states - plus external sources taken into account – every deliverable will be based upon a fixed deadline where a list of available and sufficiently mature specifications is fixed. Based on this fixed set of inputs, the technical specifications are compared and merged into harmonised specifications – regarding use case description, data profiles / use of message sets, and operational specifications like message management and triggering conditions.

Before technical analysis in detail can start, a mapping of use case / scenario / application / service is carried out in order to handle the diverging use of terms in the different pilots. This mapping provides the basis for the harmonised vocabulary used throughout the subsequent documents.

The use cases need to be fully specified and tested in order to create firstly the functional descriptions by TF2. Secondly, this description along with the technical specifications will be provided as input to TF3 for incorporation into the Roadside ITS-G5 System Profile and/or the Infrastructure Mobile ITS-G5 System Profile, which provides a full system profile of the standards applied in all components of the Roadside ITS Station / mobile C-ITS station, including a section on security with requirements regarding compliance with relevant security standards, as well as the C-ITS Message Profiles.

While the core partners of TF3 are responsible for creating the drafts, all partners are invited for review to ensure the compatibility of the specifications with their own pilot.

It should also be noted that both documents, by nature, have an iterative lifecycle due to technical evolution.

During the work of TF3, gaps in the standards are identified, solutions proposed, validated at WG2 level, aligned with the C2C-CC, approved by the SCOM and then proposed to the respective SDOs.

Liaison with other WGs and TFs

TF3 will closely collaborate with all other activities in WG2:

- With TF1 to address the specifications regarding the security component of the ITS station architecture – it is intended here to have only short text in the TF3 deliverables and refer to the specific TF1 deliverables for detailed specifications

- With TF2 to integrate the reference to the use case descriptions into the TF3 deliverables and also to provide fitting technical specifications for the use cases described by TF2
- With TF4 to amend the profile, to also support hybrid communication
- With TF5 to consult on the creation of test cases out of requirements of TF3 documents
- For all TFs, TF3 will maintain the common document of C-Roads WG2 references used in all WG2 specifications. Changes are managed by the established change management process

Cooperation with external stakeholders

TF3 will furthermore cooperate with relevant external stakeholders:

- With the Car 2 Car Communication Consortium in the scope of technical and strategic alignment carried out in regular alignment meetings. Topics of strategic alignment are taken up, discussed at WG2 and prepared for SCOM decision, if necessary. The technical alignment is done using a ticket tracking system (Mantis) and dedicated alignment meetings
- With SDOs by proposing changes of and additions to standards
- With non-C-Roads deployment activities, in particular in the Urban environment, on a best effort basis in order to ensure compatibility and interoperability with any infrastructure-related C-ITS specification

Roadmap for TF3

TF3 ongoing work:

- Collaboration with NAPCORE (comparison of ITS and C-ITS standards)
- Collaboration with TISA
- Participation to WG strategy and operations
- Possibly collaboration with 5GAA
- Contribution to triggering conditions for use cases (after initial work in TF2 was done)
- C2C-CC Alignment: the alignment with C2C-CC requires regularly a change of the specifications, which are handled by TF3 for all documents maintained in the task force (MSP, RSP and MP)

TF3 will work from **December 2024 to June 2025** on the following topics:

- RWW handbook rework and publication as RWW use case and message profile in alignment with C2C-CC for the technical part
- New use cases like vulnerable road user protection (VRU) Urban requirements

TF3 will work from **June 2025 to December 2025** on the following topics:

- The possibility of GNSS correction as a system use case
- New use cases (like e.g. route advice) will be worked on as soon as the technical specifications reach the required maturity level
- Service announcement
- Update the message profile (MP) regarding the new sign catalogue version (ISO 14823-1:2024 (GDD)) used for in-vehicle signage
- Urban requirements

TF3 will work from **2026 to 2027** on the following topics:

- Quality requirements: data, data delivery (e.g. at least once, exactly once etc.) in coordination with TF2
- Performance requirements
- Urban requirements
- Definition of C-ADS (cooperative automated driving systems) functionality (formerly also called: ISAD – infrastructure support for automated driving) based on the new Infrastructure Support Container (ISC) added in the ISO 19321:2024 update
- Requirements of specific stakeholder groups: Agricultural, VRU, blue light, railway
- Functional safety requirements (e.g. multi-channel operation)
- Misbehaviour detection

3.5. Task Force 4

Objective

The objectives of TF4 “IP-based C-ITS communications” are to:

- Provide specifications in the long-range I2V communication channels. In addition, these specifications define the usage of standards within Europe for the provision of dedicated C-ITS services. Again, the work undertaken within C-Roads is as well comparable to the work undertaken within NAPCORE for the ITS domain. Therefore, the focus of the IP-Based communication within C-Roads Extended is as well on C-ITS specifications only, but for all IP based networks in the message transmission to mobile users. Therefore, the close liaison with NAPCORE will be continued in this area. The Task Force will liaise with 5GAA and other industry platforms where and when relevant
- Definition of a harmonised C-ITS road I2V communication long-range profile covering all European relevant C-ITS deployments focusing on collaborative message sharing and strong cooperation between C-ITS actors involved later on
- Assessment of the technical requirements for the existing and future networks resulting in recommendations and possible specifications
- Continuation of the work on the IP-based C-ITS Broker System, which makes a fully scalable deployment in Europe possible and supports high quality traffic information services in the personal but also in the goods transport

Technical approach

The work builds on the specifications developed in the previous years. Several member states have started to deploy IP-based C-ITS communication systems. A specific subgroup “TF4 Hybrid Cross Testing Group” consists of member states deploying IP-based communication, collects experiences from the member states on cross-border communications and monitors the overall network.

The main scope for TF4 is to form a set of common requirements to implement C-ITS services on both national and European level. Several member states have started to deploy the specifications and are scaling up the operations. Based on the experiences of the member states, the architecture will be reviewed, verifying whether it is in line with the plans of the member states and allows to scale up the current operations on a European scale, as well allows the systems to comply with L1 and L2 requirements. Following the reviewed architecture, and based on the experiences of the member states, the specifications will be reviewed, however keeping in keeping in mind interoperability with the already deployed solutions. This covers both the BI (Basic Interface, data plane) between stakeholder backends and the II specifications (Improved Interface, control plane) between interchange entities. Potential synergies with the work of NAPCORE will be identified.

The specifications must assure the performance of the C-ITS systems. Best practices will be collected and guidelines provided for setting up, operation and procurement of the IP-based backends, especially with regards to the transition path toward L2. This will be performed together with the relevant subgroup of TF1, which addresses the security aspects of the communications.

The current specifications concentrate on the exchange of C-ITS messages between backends. The work will be extended to cover guidelines for the communication between backends and vehicles equipped with hybrid C-ITS stations, i.e. vehicle ITS stations supporting both short range and long-range communications., e.g on the protocol between backend and vehicle, handling of both short- and long-range messages at the hybrid C-ITS station.

The work is carried out by online meetings and F2F meetings and follows the WG2 process of review and release management.

Liaison with other WGs and TGs

- TF4 will work closely with all the other TF's in WG2
- TF4 will work closely with TF1, especially with the subgroup on security of hybrid communications
- TF4 will collaborate with TF2 to define the special implications for the use cases involving IP-based communications as well as hybrid C-ITS stations
- TF4 will also work together with WG1 and WG Operations regarding “deployment models” for IP-based communication systems, as well as on general operational principles, such as listener-only
- TF4 will also collaborate with the newly established collaboration groups in C-Roads for Urban, Rail and Blue-light C-ITS, where the IP-based aspects of C-ITS transfer is concerned
- TF4 will also work together with WG4 on the Digital Transport Infrastructure, more specifically regarding issues related to data sharing with other stakeholders, e.g. through the EMDS (common European mobility data space)

Cooperation with external stakeholders

TF4 will cooperate with relevant external stakeholders:

- C2C CC with respect to Hybrid C-ITS stations
- NAPCORE. The collaboration is specified in the “C-ROADS – NAPCORE cooperation and the Ecosystem relationships between NAP (ITS) and C-ITS”¹ document. The collaboration will address the relation between NAPs and C-ITS brokers. Another issue of interest is the use of interchanges to exchange metadata between NAPs, as demonstrated in the NAPCORE demonstrator
- 5GAA. 5GAA has worked on the architecture of IP-based communications². The work will be discussed and attempted to align
- With SDOs to align on potential standards, e.g. for ETSI TR 102 962, Mobile network support of C-ITS
- National C-Roads pilot implementations and other C-ITS deployment projects in the member states to ensure proper implementation and establish a feedback loop such as SCALE and C-ROADS Germany ³

Roadmap for TF4 and the Subgroup Hybrid x-Testing

TF4 ongoing work:

- Adaptations of the specifications to include CPM and POIM-PA messages

¹ J. Montenegro, A. Froetscher, C-ROADS – NAPCORE cooperation and the Ecosystem relationships between NAP (ITS) and C-ITS, 25.10.2024

² 5GAA, Road Traffic Operation in a Digital Age: A Holistic Cross-Stakeholder Approach, <https://5gaa.org/road-traffic-operation-in-a-digital-age-a-holistic-cross-stakeholder-approach/>

Tasks identified for **March 2025 to September 2025** on the following topics:

- Review of the basic principles for C-ITS message distribution, and the service-oriented architecture, including recommendations for delivery of C-ITS services
- Perform a gap analysis for long range specifications
- Review of the BI and II specifications. This includes e.g. the harmonisation of message transmission frequencies. For II it includes dynamic filtering, misbehaviour handling
- Security issues of IP-based communications, together with TF1
- Preparing the technical elements of the IP based message transmission to work together and follow up their extensions into operational systems in the near future

Potential tasks identified from **September 2025 to 2027**:

- Continue the work on specifications and recommendations for C-ITS brokers
- Developing guidelines and recommendations for the operation of the C-ITS broker ecosystem, which is scalable in Europe and can be extended to different roles and participations from a variety of actors/organizations
- Recommendations for lower-left quadrant communications (i.e. between backend and vehicles) and hybrid C-ITS devices, including the interaction between short-range and long-range communications
- Monitor the operation of a trusted C-ITS broker network and provide recommendations for improvements, extensions of partnerships and outreach
- Definition and agreement on links and data sharing with other stakeholders and ecosystems in the operational phase
- Governance document for the long-range solution
- Monitoring and supporting CBTs

3.6. Task Force 5

Objective

The scope of TF5 is to provide a common approach on how to conduct cross-testing and validation to ensure the interoperability of implemented services within the C-Roads Platform.

Technical approach

Starting on the available harmonized specifications for C-ITS services, as developed by TF1, TF2, TF3 and TF4, the TF5 is developing a common approach for technical cross-border interoperability testing.

In a first step, these specifications will be examined and a subset of requirements, that are critical for cross-border interoperability, will be compiled. This subset will be discussed and validated in liaison with the responsible TFs.

In a second step, an appropriate testing procedure for each requirement will be derived. The testing procedures will be described in a common way by using a test case template. The test cases will be compiled as sets to test and validate the conformity of an implemented C-ITS service / use case according to the C-Roads specifications and to approve the interoperability. All test cases will be put together in the deliverable “Test Plan”.

To facilitate the usage of the “Test Plan”, a test concept document will be provided by TF5. In this document, the definitions, the approaches and the limitations of the designed testing procedures will be described and the general testing process will be outlined.

To prioritize the work within this task force, the major test subjects will be aligned as follows:

- C-ITS Messages via ITS-G5
- Security Aspects
- C-ITS Message distribution via hybrid communication channels

Given the evolving processes of the C-Roads platform and the ongoing work of all TFs, the TF5 will take new and updated specifications into account to keep the test plan and the test concept up-to-date.

Liaison with other WGs and TGs

The TF5 will work with other WGs and TFs:

- With TF1 to address the specifications regarding the security
- With TF2 to integrate the refer to the use case descriptions into the TF5 deliverables
- With TF3 to address the specifications regarding the C-ITS messages and the ITS-G5 communication
- With TF4 to address the specifications regarding the hybrid communication
- With WG3 to address the perimeters between functional and technical validation and testing

Cooperation with external stakeholders

TF5 will furthermore investigate on the cooperation with relevant external stakeholders from the Car 2 Car Communication Consortium on joining efforts on the testing.

Roadmap for TF5

TF5 will work on the following topics:

- Working on the RWW Specifications from TF2/TF3
- Studying the impact of re-structuration of TF3 Message Profile in Test-Plan
- Working on how to test the Quality of Data and Quality of Service linked with the inputs from WG-OS
- Aligning the work with all MS projects on testing methodologies
- Proposing a harmonized way of testing equipment before operations linked also to WG-OS including:
 - Conformance testing
 - Plug & Play for R-ITS-S/V-ITS-S and Central equipment
- Maintaining the TF5 Test-Plan deliverable consistent with other TFs' deliverables updates
- Monitoring and supporting CBTs
- Developing recommendations for CBT on cross border checks for existing/ updated deployments and cross border tests for recently harmonized / not yet tested UCs and for new MS deploying C-ITS
- Updating the M24 - EU-C-ITS Interoperability Report based on the MS inputs