C-ROADS

TERMS OF REFERENCE

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Table of Contents

2

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1. Preamble

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 of the Terms of Reference (ToR) document for the third phase. The main contents and the addressed activities are briefly described for a better understanding of the current challenges and their task´s and activities.

When talking about C-ITS, C-Roads is following the definitions given in the European ITS Directive 2020/40/EU:

- "cooperative intelligent transport systems" or "C-ITS" means intelligent transport systems that enable ITS users to interact and cooperate by exchanging secured and trusted messages, without any prior knowledge of each other and in a non-discriminatory manner;
- "C-ITS service" means an ITS service provided through C-ITS.

Phase 1 2016 – 2019 Initial phase Focus on Specifications and piloting along motorways	Phase 2 2020 – 2024 Motorway phase Focus on deployments along motorways and urban pilots	Phase 3 2024 – Urban phase Focus on operations along motorways, urban deployments and integration of new stakeholders
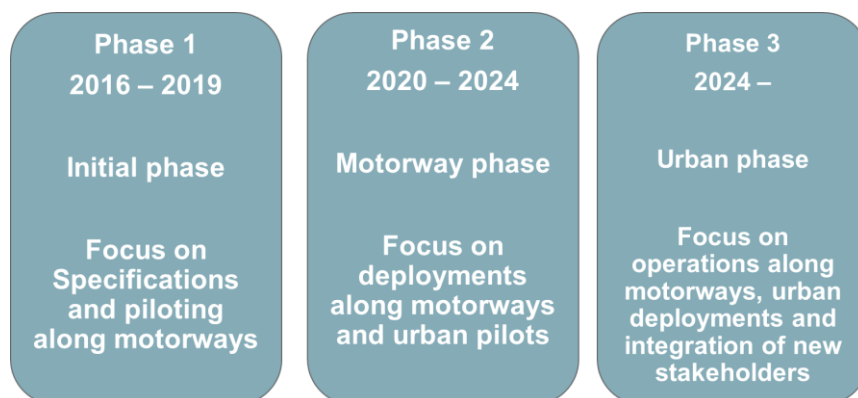
Figure 1: Phases of the European C-Roads Platform

C-Roads Platform Phase 1 (2016-2019), the initial phase, was characterised by the common definitions of the first complete C-ITS service set, defined within the partners network based on their single projects and pilot deployments mainly along motorway networks. The first common C-ITS specifications were mainly focused on motorway networks and on the cooperation between road infrastructure operators and the vehicle manufacturers. The tested and validated specifications on public roads confirmed possible roll out options. The initial phase came to an end with the announcement of the first OEM about including C-ITS services into serial vehicles.

In C-Roads Platform Phase 2 (2020-2024), in parallel with the launch of the first C-ITS equipped serial vehicles on the market, large scale C-ITS deployments along motorways were started together with the extension of the related network management centres with real time capabilities. The links between motorways and urban road networks were considered and cities started to pilot C-ITS based services for their public mobility related services in the public transport, but also in the ambulance and fire brigade sectors. C-Roads partners extended their specifications and added also additional documents

C-Roads Terms of Reference Phase 3

like the first version of the SPAT/MAP handbook to cover implementation aspects of complex C-ITS services on urban intersections. In this phase also the extension of basic C-ITS service specifications to other data networks, like the IP-based specifications were defined and published and implemented by first C-Roads members. Also, the preparations in C-ITS data security for the start of a public PKI system at European level were completed for an operational start.

With the start of **C-Roads Platform Phase 3** in 2024, exactly 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 of services 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.

C-Roads Terms of Reference Phase 3

2.   Purpose of the C-Roads Platform

The C-Roads Platform Terms of Reference (ToR) document for phase 3 defines the structure and procedures to be followed within the European C-Roads Platform as well as the elements to be discussed and agreed upon to achieve interoperable deployments of C-ITS services across Europe from a road operator's perspective. Additionally, it lays down the areas of activities with support for C-ITS deployments in cities, in conjunction with railways and with the blue light sector and the preparatory steps for the start of the operational phase of the C-ITS network in Europe.

The C-Roads Platform Agreement, which is signed by all C-Roads Partners, refers to the ToRs. So, both documents need to be seen together as they are a precondition for C-ITS deployments which are co-funded by the European Union through the Connecting Europe Facility. In addition, both documents form a basis for other C-ITS deployments using the latest set of C-Roads specifications.

In 2016, at the Kick-Off of the C-Roads Platform, the EC stated clearly the following expectation:

A C-Roads Platform Agreement will be signed by the representatives of all pilot actions. The C-Roads Platform Agreement shall specify with an appropriate level of details:

1. How each and every pilot action will participate to the C-Roads Platform and to the different Working Groups. Each pilot action shall actively participate to the C-Roads Platform and its Working Groups.

2. How technical and functional interoperability of the piloted C-ITS services will be achieved. The agreement shall make clear that the overarching goal of the pilot actions is to ensure interoperability. To that effect, the C-Roads Platform Agreement shall explain what mechanisms will be put in place to specify, test and validate the technical solutions of the commonly specified communication profile, detect as soon as possible any interoperability issues and propose solutions. Technical solutions shall be selected by each pilot action in line with the other pilot actions, so to ensure technical compatibility and interoperability.

3. How and when cross-site tests will be carried out. Each pilot action shall test at least one on-board unit on all other pilot sites and provide a test report. To that effect, the C-Roads Platform Agreement shall detail the main principles for these tests, in particular as regards the support provided by the "visited site" to the "visitor". Achieving interoperability based on the commonly specified communication profile shall be a joint responsibility of all C-Roads Platform partners.

4. How the progress and results of the EU C-ITS Platform will be taken into account. In the interest of EU interoperability, the solutions developed within the C-Roads Platform will have to be fully aligned with the guidelines and framework established for that specific domain by the EU C-ITS Platform.

This EC expectation still forms the basic frame of the C-Roads Platform activities. The obligations of single deployment projects and pilot activities are defined by the respective Grant Agreements, which especially goes for cross-site tests undertaken by these single activities.

European state authorities are invited to become active members (core partners) of the European C-Roads Platform.

3. Guiding principles of C-Roads Platform activities

3.1 Interoperability

The EU C-ITS Platform generated a C-ITS "day one service list", which formed the basis for the introduction of common services on European roads. This list was supported by various deployment initiatives in European States and was therefore the starting point for the foundation of the C-Roads Platform.

C-Roads Platform focuses on deployment and operation of C-ITS services from an infrastructure perspective. C-Roads Platform has at the moment a close partnership with the Car-2-Car Communication Consortium that focuses on the vehicle side of C-ITS. Both together are working towards interoperable C-ITS operation all over Europe.

There are several levels of the understanding of interoperability and C-Roads as a European States driven initiative needs to discuss and agree on the common understanding of the way forward to achieve interoperability of C-ITS services completely and in a consistent way.

The building blocks of enabling interoperability can be defined as the following ones:

- The basic definitions are based on the C-ITS standards – and the set of standards and specifications used and referenced as the complete set for the mobile and roadside service implementations
- Where applicable, the used specifications are taken to be harmonized with the goal to create profiles of similar use cases.
- The common C-Roads specifications are tested based on predefined test cases. In the joint tests, the "communication level" message transmission between C-ITS stations from different vendors is tested (e.g. at an ETSI Plug Test).
- Service extensions and introductions in single C-ITS stations, environments and networks are identified. (hybrid cases of service transmission, and extensions to different platforms and channels.)

The C-Roads Platform activities are set up in a way to actively contribute to achieving interoperability across Europe. Hereby the discussion on and agreement of the mobile and roadside specifications have been the key step ensuring interoperability at European level. The elaborated C-Roads specifications led towards interoperable operations. In this respect, C-Roads specifications are important sources for the further development of ETSI standards, especially when it comes to new scenarios (e.g. in urban environments) and interoperability definitions.

3.2 C-ITS service quality in regular operations

In addition to the extension of existing C-ITS services with new use cases and based on new standard message types in the future, one of the main tasks of the C-Roads Platform in this third phase will be to define the needed common activities of involved operators and stakeholders for high quality C-ITS services in regular operations in Europe.

This includes contributions and possibly additional details in the specifications of different Working Groups and Task Forces as well as in the interaction with external stakeholders. The activities in this context may include not only the definition of additional processes and interactions between various stakeholders and partners, but also common communication actions and steps needed for addressing external entities or organisations. It could include C-ITS service testing and validation actions as well as regular sharing of monitoring data and message sets between all partners.

A contribution of partners from parallel running deployment projects to this common activity is expected, and possibly also a feedback loop to the specifications and contents of the service definitions needed. The definition of the first set of activities in the work plan of this third phase of the C-Roads Platform will be defined under the lead of the Working Group Operations and C-ITS Deployment Strategy with the involvement of partners from other Working Groups and Task Forces. These first set of activities will then be handover to the respective WGs and TFs to take actions accordingly.

4. Governance Structure

The driving body of the whole C-Roads Platform is the C-Roads Platform Steering Committee (Figure 2). It composes the interface to all internal and external stakeholders, including the European Services (European Commission and CINEA). Additionally, it has the responsibility to ensure interaction with external stakeholders through dedicated workshops and it acts as the ultimate decision body of the C-Roads Platform. It supervises and monitors the communication and promotion activities for C-ITS service deployments in several areas, like the urban and city domain, the rail sector and the blue light sector with C-ITS used for public services support. It supports the preparatory steps for the operational phase of a C-ITS system in the C-Roads member states. The C-Roads Steering Committee is chaired by the C-Roads Chair.

The proper functioning of the C-Roads Platform is organised by the Supporting Secretariat, composed by representatives nominated by the C-Roads member states and chaired by a Secretary General. The proper functioning covers communication of current C-ITS releases to external stakeholders, monitoring of progress, invitation to meetings, etc.

Single deployment and pilot activities should act according to the decisions done by the C-Roads Platform Steering Committee, where appropriate. This especially goes with technical decisions, which influence procurement and deployment decisions. In case that proposals or/and recommendations provided by Working Groups or Task Forces are not adopted by the C-Roads Platform Steering Committee, the C-Roads member states can continue in their deployment activities in accordance to valid standards and/or the latest C-Roads specifications, but they need to be ready to adopt their deployments to C-Roads Platform Steering Committee decisions on a later stage.

To ensure proper decisions towards interoperable C-ITS deployments according to the latest specification releases, Working Groups are installed to prepare decisions for the C-Roads Platform Steering Committee. Individual experts participating in the single deployment activities and pilots and nominated by C-Roads Platform Steering Committee members work together in these Working Groups to prepare specifications (e.g. in WG 2), analysis and reports (e.g. in WG 1), and activities needed. The C-Roads Platform Steering Committee decides on the recommendations (e.g. specifications) and uses them as basis for interoperable deployments (including the respective necessary procurements).

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 urban, rail and blue light sectors (including the use of a PKI and certificates as part of the EU CCMS). Addressing those areas, which are starting to use C-ITS services, will not only extend the geographic coverage and adoption rate of C-ITS, but also the type and number of involved stakeholders in the C-Roads Platform.

One specific task in the current phase 3 of the C-Roads Platform is the preparation and maintenance of the operational phase of the C-ITS System in large numbers of participating C-ITS stations. This work will be carried out in the Working Group Operations and C-ITS Deployment Strategy by contributions of the C-Roads members and their nominated experts of the single organisations. This group defines and agrees on the necessary details for the operational phase of the infrastructure-based C-ITS network and on the interactions between the C-ITS station operators along the infrastructure. The overall objective

is to operate a high quality and up to date information service network as the infrastructure operators' contribution to C-ITS in Europe.
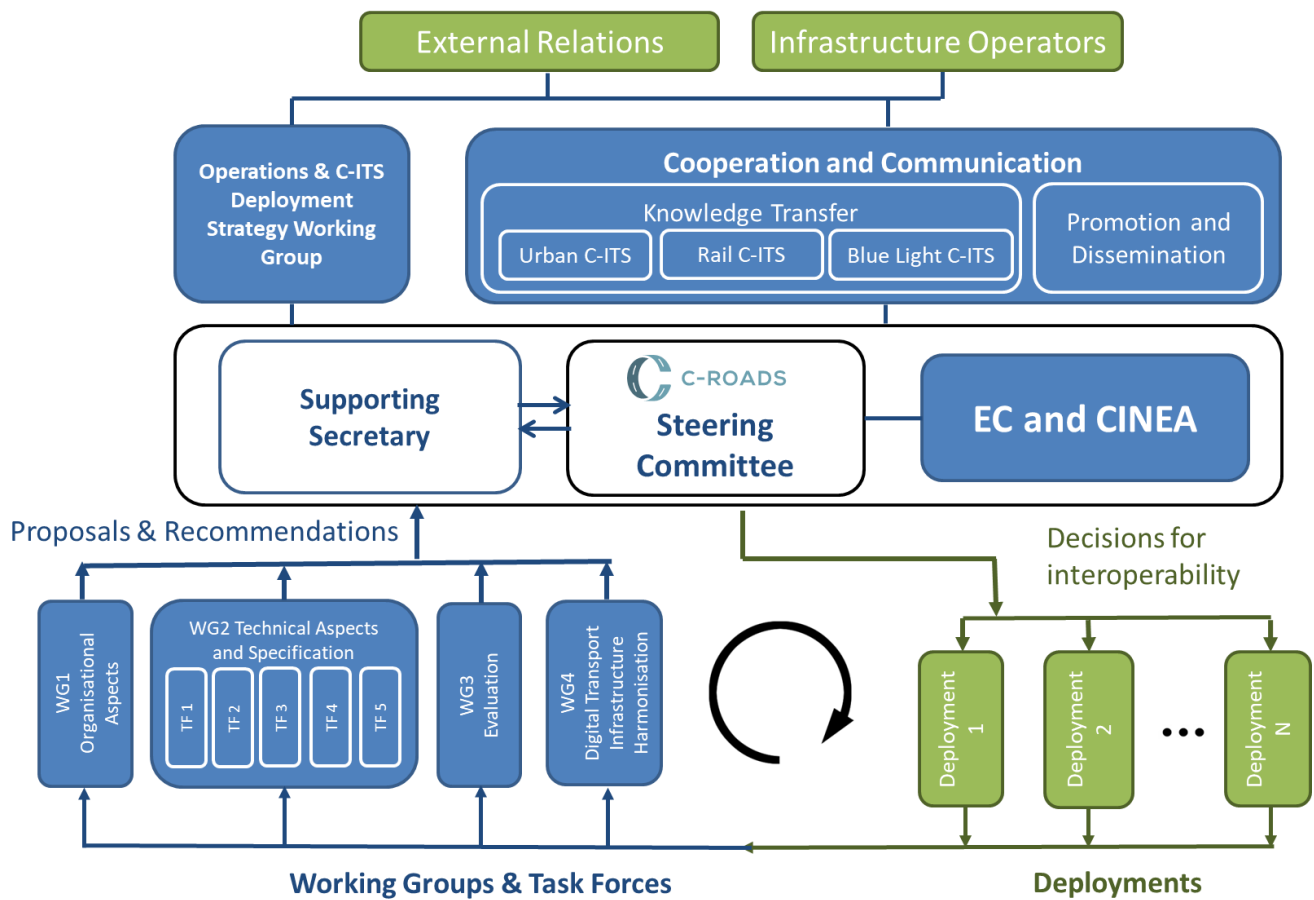
Figure 2: C-Roads Platform - Governance Structure

C-Roads Terms of Reference Phase 3

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5. C-Roads member types and their roles and responsibilities

Only state authorities can become members of the European C-Roads Platform. C-Roads Platform has both Core Members and Associated Members, with the following differentiation these roles:

- Core Members are representing European states, which can be both, EU and non-EU member states
- Core Members acknowledge the general principles of the C-Roads Platform stated in Chapter 2
- Core Members commit themselves to actively participate in all relevant Working Groups (at least one expert per Working Group) drafting C-Roads specifications, analysis and/or reports. Especially, they contribute to the Working Groups by bringing in their national findings.
- Core Members are allowed to vote on C-Roads specifications to be used for C-ITS deployments
- Core Members commit themselves to use the current C-Roads specifications, when setting up pilot implementations and deployments of specific C-Roads defined C-ITS services

- Associated Members might represent even non-European states
- Associated Members acknowledge the general principles of the C-Roads Platform
- Associated Members have access to gathered knowledge, but they have no voting rights.
- Associated Members commit themselves to use C-Roads specifications in their pilot implementations and deployments

The European Services, composed by representatives of the European Commission (EC) and the European Climate, Infrastructure and Environment Executive Agency (CINEA), are closely linked to the C-Roads Platform through policy guidance and the legislative framework of C-ITS. Even if the European Services have no voting right at C-Roads Platform Steering Committee level, they are invited to follow and actively participate to discussions at all C-Roads Platform levels, ensuring also the link to other C-ITS relevant stakeholder groups. They additionally will bring in the policy support needed for such a pan-European deployment platform.

The different bodies of the C-Roads Platform, their members, their roles and responsibilities are described in detail in the following sections.

6.   Roads Platform Steering Committee

6.1   Tasks and responsibilities

The C-Roads Platform Steering Committee is composed by representatives of European States or an infrastructure operator nominated by an European State.

The C-Roads Platform Steering Committee is responsible for

- the overall steering of the platform
- the formal representation of the C-Roads Platform to the EC
- the representation of the C-Roads Platform towards external stakeholders
- establishing Working Groups and Task Forces for single work items and allocating needed resources
- assigning, revising and adoption of the work items from all Working Groups
- endorsement of deliverables from the Working Groups
- deciding on WG and TF recommendations (e.g. specifications) and
- using them as basis for interoperable deployments (including the respective necessary procurements)

The C-Roads Platform Steering Committee is chaired by the C-Roads Chair, who is elected by the C-Roads Platform Steering Committee for a period of 2 years.

All decisions in the C-Roads Platform Steering Committee are done in a unanimous way and have to be taken on full consensus. That includes, that all decisions, when effecting deployments in C-Roads member states need to take national legislations into account. It is expected that only unanimous decisions lead to interoperable C-ITS service deployments.

Voting in C-Roads Platform Steering Committee can be either done directly at the meeting or in written form beforehand and after a C-Roads Platform Steering Committee Meeting. A deadline of 15 working-days after dissemination of the final decision points (sent after the C-Roads Platform Steering Committee meeting) needs to be followed. If no direct feedback is received, an agreement to the decisions by the respective Core Member is estimated.

If the C-Roads Platform Steering Committee in its meeting decides on content-wise amendments to relevant and previously distributed texts, a 15 working-days voting period following the meeting shall apply. If required, an (additionally) revised text will be subject to a formal endorsement by written procedure, or the voting can be postponed to the next C-Roads Platform Steering Committee meeting by decision of the C-Roads Chair.

6.2   Member structure

The C-Roads Platform Steering Committee is composed by one representative per each European state which has committed to become a Core member.

6.3　Meetings

To the C-Roads Platform Steering Committee meetings C-Roads Platform Steering Committee members (both, core and associated), members of the C-Roads Platform Supporting Secretariat as well as Working Group leaders are invited.

Core members need to be represented at C-Roads Platform Steering Committee meetings. If a Core member cannot participate, the Core Member can hand over its voting right to a proxy. In that case, the proxy needs to be indicated beforehand by the Core member to the Supporting Secretariat.

C-Roads Platform Steering Committee meetings will take place on a quarterly basis and are planned as physical meetings. However, all C-Roads Platform Steering Committee meetings will provide also the possibility for virtual participation (= hybrid meetings). Under specific circumstances, e.g. for pandemic or geopolitical reasons, C-Roads Platform Steering Committee meetings might be held only virtually.

C-Roads Platform Steering Committee meetings are arranged by the C-Roads Supporting Secretariat, which as well prepares the agenda and minutes. Decision points need to be clearly indicated in the agenda and supporting documents need to be delivered beforehand. For all decision points, supporting documents need to be delivered at least five working days in advance to the C-Roads Platform Steering Committee Meeting.

7. C-Roads Platform Supporting Secretariat

7.1 Tasks and responsibilities

The C-Roads Platform Supporting Secretariat is responsible for the management of the day-to-day work in C-Roads.

It supports the C-Roads Platform Steering Committee and in this respect it will

- perform the overall coordination of the platform activities; this includes administrative tasks, planning, quality assurance, document procedures and reporting
- monitor the progress of the Working Groups
- coordinate the information flow between the different Platform bodies and the C-ITS implementations
- monitor the progress of the C-ITS implementations
- collect inputs for the annual reporting for all C-ITS deployments, focusing on the platform activities
- be the day-to-day interface for EC, CINEA and external stakeholders
- draft agendas and write minutes of the C-Roads Platform Steering Committee meetings
- organise and moderate the C-Roads Platform Steering Committee meetings
- operate the C-Roads Platform-website
- coordinate dissemination activities
- follow up external information and contacts on behalf of the C-Roads Platform Steering Committee, the work groups or pilots, if needed
- organise workshops for the interested external stakeholders
- represent the C-Roads Platform at public events, if requested by the C-Roads Platform Steering Committee.

The C-Roads Platform Supporting Secretariat is chaired by the C-Roads Secretary General, who is elected by the C-Roads Platform Steering Committee for a period of 2 years.

7.2 Member structure

The C-Roads Platform Supporting Secretariat consists of experts, nominated by the C-Roads Platform Steering Committee members. Ideally, members of the C-Roads Platform Supporting Secretariat are involved in national deployment activities.

If a member of the C-Roads Platform Supporting Secretariat cannot participate in meetings, the respective C-Roads Platform Steering Committee member shall appoint a replacing delegate.

8. Working and collaboration groups of the C-Roads Platform

8.1 General

The Working Groups contain the main aspects of work to contribute to the overall C-Roads Platform objectives regarding European C-ITS harmonisation and interoperability. Members of Working Groups (WG), Task Forces (TF), or Collaboration Groups (CG) are nominated by core members and associated members of the C-Roads Platform and therefore they are participating in these groups on behalf of the nominating C-Roads member state. The main specification and definition work will be performed by the C-Roads Working Groups under the strategic control of WG leaders. If during the performance of the activities, additional work items are needed, C-Roads members will discuss this at C-Roads Platform Steering Committee level and decide about additional/adopted Work Groups or Task Forces.

At the start of the C-Roads Platform, three Working Groups were planned, with the option that further topics will be added if needed; two additional WGs, working on Urban C-ITS Harmonisation and aspects of Digital Infrastructures were set up in 2019.

For phase 3 of the C-Roads Platform, the organizational structure is adapted with the following two elements that are introduced:

1) a building block on "Cooperation and Communication", comprising promotion and dissemination activities along with three C-ITS collaboration groups in the areas of Urban, Rail and Blue Light C-ITS for further service extensions and knowledge transfer between active stakeholders for deployment. These collaboration groups will enable intensive discussions also with C-Roads external partners in the urban, rail and blue-light area to reflect C-Roads Platform results and in parallel contribute to C-ITS being integrated in future strategies (e.g. SUMPs for cities). Hereby the Collaboration Group on Urban C-ITS is taking over the tasks of the previous Working Group on Urban C-ITS Harmonisation (previous WG 4).

2) an additional Working Group Operations & C-ITS Deployment Strategy, with the objective to prepare for the operational roll out of the C-ITS network on road infrastructures and vehicles and the necessary activities for the operation of high quality C-ITS services based on a single trust domain between all stakeholders involved in Europe.

The previous WG 5 (Digital Transport Infrastructure) is now WG 4.

8.2 Leaders

C-Roads Working Groups, Task Forces and Collaboration Groups are chaired by the WG/TF/CG Leaders, who are elected by the C-Roads Platform Steering Committee.

WG leaders can, where necessary, propose to the C-Roads Platform Steering Committee Task Forces to work on specific topics within a WG. It is important to reflect in the WG/TF/CG work the common elements of all pilots and deployments of C-Roads partners as they are of high importance for the overall success of C-Roads.

8.3 Tasks and responsibilities

Working Groups and their leaders play a formal and important role in the overall management of the C-Roads Platform. In this respect, they are part of the management of C-Roads.

The tasks and responsibilities of the WG/TF/CG leaders are

- to coordinate the work by focusing on the completion of tasks and documents according to defined objectives and schedules as assigned by the C-Roads Platform Steering Committee
- to steer the WG/TF/CG contributions
- to ensure that all contributions are taken into account and treated in an equal and fair manner,
- to find the common elements of all pilots and deployments
- to coordinate the collection of contributions from C-Roads Core Members representatives and, where applicable, from Associated Members
- to setup, coordinate and monitor the schedules of all related tasks and check their validity in terms of resources and competencies allocated
- to monitor the progress of the WG
- to monitor timely availability of results
- to monitor the agreed milestones
- to identify delays and risks (in work content and time) as soon as possible
- to provide reports to the C-Roads Platform Steering Committee
- to define a work program for the respective Working Group, covering the full scope of C-Roads for the single working group topics
- To hold WG meetings (face-to-face meetings as well as phone-conferences) with the appropriate persons within their group on a regular basis and to use (e-mail) reporting and monitoring to perform these obligations
- To perform a state of the art analysis based on the contributions and documents from single partners and the next activities they propose with inputs from all WG/TF/CG members
- for new documents, to generate a first document structure and main contents for the WG/TF/CG and attribute single chapters editor responsibilities, if needed
- to define the next versions of the Work Group report, taking into account all feedback received and elaborate the common aspects of the C-Roads contents agreed by all implementations. (WG/TF/CG Leader with inputs from all members)
- to ensure regularly reporting to single deployments/pilots and to the C-Roads Platform Steering Committee during the document refinement phase. (WG/TF/CG Leader with inputs from all members)
- to distribute the final version of the WG/TF/CG report (with document status adopted) via the Supporting Secretariat to the C-Roads Platform Steering Committee. Where appropriate, WG/TF/CG reports are complemented with background material.

The tasks and responsibilities of the WG/TF/CG members are

- to actively participate in WG/TF/CG meetings
- to bring in their expertise in the work of the respective WG/TF/CG
- to focus on European harmonisation
- to contribute, revise and comment the Working Group results (e.g. specifications, analyses, reports)

16

- to feed-back findings and results to the national stakeholders
- If Working Group members are unable to participate in meetings, then the C-Roads representatives in the C-Roads Platform Steering Committee need to ensure proper representation.

8.4 Working Groups

8.4.1 WG 1 – Organisational Aspects

WG 1 will deal with all levels of C-ITS deployment, including test-environments, pilot operation as well as regular full operation. The focus on the work is setting up guiding principles that support Road Network Operators (RNOs) towards reaching the level of regular full operation. In that respect WG 1 will specifically work in following areas:

- organisational and legal aspects with regard to the operation of the infrastructure-based C-ITS systems:
  - o definition of system boundaries, conditions to be met and their handover points between test-environments, pilot-operation for single C-ITS services and regular full operation of harmonized services of Road Network Operators (RNOs). This as well takes different use cases into account (e.g. use cases supporting public transport vehicles might have different system boundaries than private vehicle fleets).
  - o collection and exchange of business models for the deployment of C-ITS infrastructures in different types of road networks. Focus here is the business case of public authorities and road operators, including expectations towards improved safety, improved efficiency, and reduced negative environmental impact.
- impact assessment:
  - o Monitoring the deployment of C-ITS technologies from the perspective of human-technology interaction (HTI) as well as the implementation of advanced AI technologies from the perspective of their impact on society and their use in the cooperative mobility context. WG 1 transfers the findings to individual other WGs for elaboration in their area of expertise with a general approach to facilitate cooperation between I2V mobility stakeholders in all the C-ITS service domains.
- legal aspects:
  - o Collection and exchange on best practises on legal aspects for active stakeholders are considered, especially for quite new and emerging regulations affecting the C-ITS ecosystem. The likely impacts on the systems operated on the partners' networks will be assessed. Solutions are investigated to overcome known and newly identified legal barriers and obstacles (including privacy issues) related to C-ITS. Most important will be their appropriate documentation so that other partners and stakeholders will have the possibility to apply these in their own operating environments and assess whether they could pose risks to the service implementation steps.
  - o Future CCAM service environments and networks will need a strong organisational background and a collaborative working environment in urban domains and public transport related shuttle operations, but also at TEN-T network level and the future transport of goods including elements of automated operation of vehicles. This Work Group will work on the

legal references and basic elements to enable to shift to CCAM environments in connected transport networks.

- o Preparing a process proposal for moving the identified use cases (Speed management including ISA, Incident- and Accident-management, Roadworks-management) C-ITS and, where applicable, ITS services from information services to legally binding services in the future. This is of specific importance, where infrastructure driven services might intervene with automated in-vehicle services (e.g. speed reduction) in future CCAM service and network scenarios.

Quarterly meetings (physical or web meeting) are planned to be organised, based on a decision of the Working Group. At least one annual physical meeting is hereby foreseen, dedicated to deliverable discussion and revision (all WG members).

8.4.2 WG 2 – Technical Aspects

The focus of this Working Group is technical standardisation and interfacing issues to be able to provide a common standard repository in the shape of a web service, incorporating interface description to data and services. WG 2 hereby harmonises C-ITS services, the use of standards by specifying profiles not only within the C-Roads stakeholder group but as well with external stakeholders that are already undertaking C-ITS deployments. WG 2 forms the technical basis for C-ITS operations and provides change requests to standardisation, etc.

This includes dedicated monitoring of standards, identification of relevant aspects and alignment with respective pilot and operations requirements. Inputs from existing projects and implementations (on national as well as international level) and platforms will be taken into account in the specification drafting.

Overall goals of Working Group 2 are, among others:

- to harmonise the current (released and published) and future C-ITS services, also in the context of automation
- to contribute to the definition and implementation of harmonised communication profiles for C-ITS services for road infrastructure operators 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.
- to provide support on technical topics for regular operations (in link with the Working Group Operations and C-ITS Deployment Strategy and training activities).

Solutions to be elaborated include:

- the further work on harmonised C-ITS communication profiles for infrastructure-based C-ITS deployments and pilots covering the complete day one services and additional services proposed and specified by C-Roads Platform members and their project activities
- a C-Roads approach for dealing with security issues for C-ITS service provision and secure communication within the EU C-ITS Trust model

- common test and validation procedures for implementing C-ITS services in Europe for pilot deployments and regular operations
- the methodology for dissemination of C-ITS messages by different communication technologies 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

Regular meetings (physical or videoconference) are planned with at least two physical meetings per year for document discussion and revision before a release of a complete set of documents.

Under the umbrella of WG 2, there are the following 5 Task Forces:

- TF 1: Security Aspects
- TF 2: Use Case Harmonisation for Motorways and Urban environments
- TF 3: Infrastructure Communication profile, bidirectional I2V
- TF 4: Hybrid C-ITS & IP-Based Communication
- TF 5: Cross-Testing and Validation

These tasks can be seen as core assets of the C-Roads Platform and are handled as separate Task Forces linked to WG 2. This is not only to reflect their importance, but also to structure them and get them organized in the same way as this is done with Working Groups. These Task Forces report to the Working Group 2 leader to ensure that all proposed specifications fit together as well in technical as functional terms. To achieve this, all Task Force chairs need to participate in Working Group 2 meetings and need to report on progress and results.

8.4.3   WG 3 – Evaluation and Assessment

The aim of the WG 3 is to provide guidance and support to C-ITS and ITS evaluation activities, collect the results of the evaluation studies of deployment projects, and provide a synthesis of them and provide conclusions on the European level. The key areas for benefits of C-ITS and ITS are the improvements in road safety, transport efficiency and environment in the European transport system. ITS technologies are mostly in the full deployment phase while C-ITS services are still in the market developing phase, and these differences will influence the evaluation activities and results. Even TF 5 defines the technical elements of cross-tests, this WG defines how cross-site test evaluation is done and which aspects (safety, efficiency, etc.) are assessed. WG 3 will specifically work in following areas:

- Harmonisation of test and evaluation procedures:
    - Defining an evaluation and assessment methodology for C-ITS and selected ITS deployments across Europe. Key Performance Indicators will deal with at least road safety, transport efficiency, and environmental impacts.
    - Support all evaluation studies carried out and also decision making on whether C-ITS and ITS deployments are large- scale or innovative enough to require specific evaluation studies.
- Synthesis of impact assessment results for C-ITS and dedicated ITS technologies.

- Collection and analysis of findings from C-ITS and ITS evaluations. Where possible, provision of an impact assessment at the European level based on the evaluation results collected from deployment projects.
- Specific attention on assessing the environmental impacts of C-ITS and ITS, particularly in the context of the Green Deal activity.

Working Group 3 will provide a synthesis of the assessments concerning the impacts of C-ITS services and ITS technologies on mobility and other relevant aspects considering the transferability of the collected results. To achieve long term solutions, Working Group 3 will also provide generic recommendations on where and how C-ITS and ITS services could be deployed in order to maximise their benefits. Provision of the services to the users. Working Group 3 will collaborate with the other Working Groups in the preparation of the specifications (e.g. localisation of the information).

Monthly meetings (physical or videoconference) are foreseen with additional physical meetings for document discussion and revision.

8.4.4 WG 4 – Digital Transport Infrastructure Harmonisation

To provide high-quality C-ITS services, specific quality requirements on the underlying digital infrastructure need to be met. Fulfilling these requirements will support not only C-ITS services but improve also relevant ITS services. E.g., many ITS services are linked to specific road sections between intersections, but C-ITS services often need lane level accuracy to provide proper service quality. In this respect, the existing data qualities and the performance of the overall system often needs to be enhanced to become an acceptable source for C-ITS service provision. The I2V C-ITS messaging will itself be part of the solution providing accurately positioned data from the vehicles to be used by the service. Therefore, quality improvement both, on data level and system-performance level, does not necessitate extensive and expensive monitoring system investments by Road Network Operators (RNOs).

Improving the data quality for C-ITS services, and a further development/optimisation of existing ITS services will go hand-in-hand. In detail, the following activities are planned under this Working Group:

- Harmonisation of digital elements for C-ITS:
    - Elaboration of common digital elements that need to be harmonised considering C-ITS services.
    - Harmonisation of electronic transport regulations provision according to current METR standardisation, including e.g. speed limit information which is the key ISA element to be provided by road operators.
    - Identification of harmonisation needs in the area of digital twins of infrastructure operators that are currently being developed and deployed in Europe from the point of view from ITS, C-ITS and future CCAM services.
    - Definition of certain data needs and quality requirements based on WG 2 work (profiles), e.g. the use case descriptions in Task Force 2.
- Improved Traffic Management Procedures for Multi-Stakeholder Environments:
    - Collection and analysis of best practices for embedding the C-ITS service creation in operative and running Traffic Management Systems.

o Elaboration of recommendations to infrastructure operators for internal procedures to serve ITS and C-ITS service provision by one data source.

Quarterly meetings (physical or web meeting) were planned from Q3/2019 onwards. At least one physical meeting per year was hereby foreseen, dedicated to deliverable discussion and revision (all WG members).

8.4.5 WG - Operations & C-ITS Deployment Strategy

The main objective of this WG is to setup of structures for permanent operation of the infrastructure based European C-ITS system and networks (including security and trust), including C-ITS service maintenance, in a multi-stakeholder environment.

This WG will elaborate a current overview of the infrastructure operator driven operative C-ITS system actively sharing secure and trusted traffic messages in Europe and monitor the evolution of the operative C-ITS system in the TEN-T and urban domains with vulnerable road users (VRUs) as well as in the vehicle fleets with active C-ITS units, being part of the common C-ITS traffic information network in Europe.

The WG will discuss, define and propose the needed operation and maintenance structures for ensuring sustainable C-ITS service maintenance in a multi-stakeholder environment within one common EU trust domain. Hereby C-Roads partners that are either in the long-term operation of their C-ITS services, or are in the migration to become long-term operative, will collaborate with stakeholders to harmonize the infrastructure viewpoints and bring it into the discussions with external C-ITS operators, e.g. in the WG Operations of the Car-2-Car Communications Consortium. The work will comprise organizational, technical and stakeholder management aspects.

The following activities of the WG will be thematically undertaken:

- monitor the current status of C-ITS service roll out and the progress of the C-ITS implementations operational in both road infrastructures and vehicle fleets (including public transport and blue-light vehicles) with a specific focus of active C-ITS stakeholder networks. This activity includes the monitoring of the respective levels of the C-ITS security system in operation (ECTL levels) and the definition of the next development steps with active and participating stakeholders.
- Operations
  - o evaluate the need for knowledge transfer activities with WG 1 and WG 2. This includes different operational aspects of this multi stakeholder environment whereby the continuous operation as well as the maintenance of the C-ITS eco-system will be a specific focus such as:
    - ensure smooth transition of services from development to operational status,
    - consider the common EU trust domain as an important precondition of the permanent operation of the European C-ITS system and networks.
  - o Define a framework of an operational concept
- C-ITS Deployment Strategy
  - o define a common vision for C-ITS operations agreed by active and participating stakeholders. This vision needs to be discussed as well with C-Roads external stakeholders, e.g. members of the Car-2-Car Consortium;

- define a common mission to ensure concerted actions of active and participating stakeholders involved from the road operator and from the vehicle and service provider domain.
- determination of necessary C-ITS cooperation agreements with a focus on a "C-ITS Deployment Strategy". Such agreements shall include a description of tasks, responsibilities and commitments of stakeholders;
- propose, discuss and agree on the next strategy steps to setup and operate a future I2V C-ITS Network Europe which supports connected and automated vehicles in a variety of road networks (along motorways, rural roads, urban networks) and relevant contact points.
- Explore what kind of entity is needed to agree upon operational aspects (e.g. when to shift to what release) including harmonization aspects.

Quarterly meetings (physical or web meeting) are planned from Q1/2025 onwards. At least one physical meeting per year is hereby foreseen, dedicated to deliverable discussion and revision (all WG members).

8.5 ITS Collaboration Groups for Knowledge Transfer

8.5.1 General

In the C-ITS Collaboration Groups, experts from C-Roads and external stakeholders meet at least two times a year, work together on strategies and define common priorities. In addition, the Collaboration Groups will discuss technical specifications for their relevance as well as identify additional new use cases not covered so far. External stakeholders will also provide valuable feedback to the proposed results of C-Roads Working Groups.

One Collaboration Group will focus on Urban C-ITS. Other Collaboration Groups, such as for C-ITS use cases related to railways, and one specific group related to blue light use cases and their specific aspects of C-ITS service definitions, will focus on the interactions with regular users.

To gain maximum benefit out of the cooperation, these Collaboration Groups will be open for external stakeholders deploying C-ITS and also for other relevant stakeholders in the transport domain. The Collaboration Groups focus especially on services in implementation and the definition of respective C-ITS Deployment Roadmaps based on the C-ITS Deployment Strategy which support also regular operation of services on public roads incl. road/railway level crossings and in cities.

Overall, the C-ITS Collaboration Groups will provide the forum with experts to exchange views and to learn from each other. In addition, the goals are as follows:

- Based on existing specifications and C-ITS use case descriptions, existing materials will be reviewed for the usage in their specific operating environments. If changes or adoptions in existing materials are identified, those are handed over to the respective WG for further elaboration.
- The identification of additional use cases in the C-ITS domain will be added based on real deployments. There additional use cases are presented and discussed with WG 2 for further elaboration.
- Relevant draft findings, specifications and results of C-Roads working groups will be discussed and crosschecked within the Collaboration Groups.

- Overall, the Collaboration Groups plan to work towards common positions and definitions on both existing and new services. This is expected to provide harmonized feedback within the specific core-topic and subsequently facilitate and contribute to related C-Roads Platform activities in all the three activity areas of the groups

8.5.2   Urban C-ITS Collaboration Group

The Urban C-ITS Collaboration Group brings urban experts from a variety of fields together reflecting needs and expectations on C-ITS for urban environments. The Group enhances the awareness for and proactively addresses C-ITS Service interoperability challenges within the C-ITS Platform. The group is the continuation of C-Roads' previously existing Urban C-ITS Working Group where urban authorities met regularly to discuss their expectations on C-ITS and exchanged views on embedding C-ITS services in their current operational systems. The Urban C-ITS Collaboration Group will discuss, define and agree on inputs for their urban mobility strategies, including their Sustainable Urban Mobility Plans (SUMPs). It engages with urban nodes involved in the C-ITS Platform to validate continuous deployment and implementation activities and keeps the deployment roadmaps of city use cases regularly updated.

8.5.3   Rail C-ITS Collaboration Group

Discussions with rail organisations have shown that it is very difficult to embed new technologies into the public transport system. In the rail domain systems are more or less closed, but the benefits of the current C-ITS solutions are obvious. As first Public Transport fleet operators (e.g. in the cities of Kassel, Brno, and Graz) have started to use C-ITS solutions for Public Transport management (e.g. priority services at traffic lights), the C-ITS Rail Collaboration Group will build on this knowledge as well as on learnings from level-crossing-railway use-cases to discuss possibilities and advantages of embedding C-ITS services into the overall rail system.

8.5.4   Blue Light C-ITS Collaboration Group

In the area of Blue-Light C-ITS services, first C-ITS implementations have shown huge benefits. This includes fire brigade priority systems (e.g. in Brno), road operators' traffic managing vehicles (e.g. in Austria), or rescue vehicles (e.g. in Salzburg). For the moment several isolated initiatives are popping up in the blue light transport context. Here C-Roads aims to bring all stakeholders together to exchange learnings and needs with the goal to harmonise C-ITS service deployments in the blue-light service domain.

9. Deployment activities and pilots

Setup and operation of deployment activities and pilots is in the responsibility of single C-Roads members. WG3 together with TF5 shall detail the main principles for tests, in particular regarding the support provided by the "visited site" to the "visitor". Achieving interoperability based on the commonly specified communication profile is a joint responsibility of all C-Roads members.

Deployment and pilot operations are taking place in all C-Roads Member States.

10. Communications

10.1 Stakeholder Support and Training

A specific task is with dedicated Stakeholder Support and Training. Hereby following elements will be taken into account:

- Stakeholder support to public stakeholders and infrastructure operators in technical, organisational as well as strategic matters is organised within this Task. This support consists of two dimensions: availability of training materials (such as making training sessions on new releases of basic message standards and their proposed use in the communication profiles for interoperable C-ITS services.) as well as personal support by experts that run/implemented a dedicated C-ITS service.
- Create a guidance document for procurement procedures of C-ITS stations taking the hybrid communication mix into account, to ensure the purchased hard- and software adheres to C-Roads specifications.
- Newcomers and C-ITS professionals will be supported in their deployment activities for C-ITS infrastructure units and services.

10.2 Internal Communication

To enable fast and direct communication in the various Groups of the C-Roads Platform a number of email distribution lists are created within the single groups involved.

A general rule is, that the topic of all C-Roads related emails shall start with "C-Roads:…". This enables a quick recognition of C-Roads related emails for all involved partners.

As many of the C-Roads related meetings will be online, one of the following tools should be used and proposed in the work plan of the single WG or TF for all online meetings. e.g. Goto meeting, Zoom, MS Teams, Webex.

10.3 Website

The C-Roads Platform-related information (external and internal) will be distributed via the webpage of C-Roads (https://www.c-roads.eu). The member area is at the same time the document repository for all project documentation. Following the registration process all interested stakeholders and

organisations have access to the latest C-Roads release of documents at the following sub-section of the C-Roads Platform Website: https://releases.c-roads.eu/ .

Deployment and pilot partners are invited to update their respective information pages and contribute to regular C-ITS related information exchanges with EC services (e.g. TENTEC map with the C-ITS layer) and external parties and organisations.

10.4 Documentation

10.4.1 Creating Documents

Project related templates (Word template for reports as well as a PowerPoint template for presentations) that are needed for the official documents are available on the C-Roads Portal, which is accessible via the C-Roads website and open for C-Roads members For project related communication to persons outside the project, these templates have to be used for each deliverable unless agreed by the C-Roads Platform Steering Committee.

10.4.2 Status of documents within C-Roads

For the effective exchange of documents within the C-Roads Platform the following steps during the creation of project documents are defined and used within C-Roads:

- Draft versions (v0.1 to v0.9) (initial status of the document)

- final or version v1.0 (sent to Steering Committee)

- C-Roads approved (approved by Steering Committee)

Updates of existing documents will start with the current version indicator (e.g. V2) followed by the alteration number (e.g. V2.3).

11. Milestones

In order to achieve the result of the C-Roads Platform, the following list of milestones has been agreed by the C-Roads Platform Steering Committee. As soon as a milestone has been achieved, the C-Roads Platform Steering Committee needs to be informed by the responsible group. Also, a delay needs to be reported as soon as it is identified.

To increase the readability, all milestones are listed concerning the level responsible for drafting a proposal for a C-Roads Platform Steering Committee decision.

11.1   Milestones of the Steering Committee

Milestone Name	Date	Means of Verification
C-Roads Platform Steering Committee Meeting	Q3/2024	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q4/2024	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q1/2025	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q2/2025	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q3/2025	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q4/2025	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q1/2026	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q2/2026	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q3/2026	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q4/2026	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q1/2027	Minutes of the meeting
C-Roads Platform Steering Committee Meeting	Q2/2027	Minutes of the meeting

Table 1: List of Steering Committee' Milestones

11.2 Milestones to be prepared by the Supporting Secretariat for Steering Committee approval

Milestone Name	Date	Means of Verification
Annual C-ITS Deployment Overview Report 2024	Q2/2025	Report published
Annual C-ITS Deployment Overview Report 2025	Q2/2026	Report published
Annual C-ITS Deployment Overview Report 2026	Q2/2027	Report published

Table 2: List of Milestones to be prepared by the Supporting Secretariat

11.3 Milestones to be prepared by WG 1 for Steering Committee approval

Milestone Name	Date	Means of Verification
C-ITS deployment organisational framework	Q1/2026	Report available and approved by the Steering Committee
C-ITS deployment legal best practices	Q1/2027	Report available and approved by the Steering Committee

Table 3: List of Milestones to be prepared by WG 1

11.4 Milestones to be prepared by WG 2 for Steering Committee approval

Milestone Name	Date	Means of Verification
Publication of C-Roads harmonised C-ITS Specifications	Q1/2025	Report available and approved by the Steering Committee
Publication of C-Roads harmonised C-ITS Specifications	Q1/2026	Report available and approved by the Steering Committee
Publication of C-Roads harmonised C-ITS Specifications	Q1/2027	Report available and approved by the Steering Committee

Table 4: List of Milestones to be prepared by WG 2

11.5　Milestones to be prepared by WG 3 for Steering Committee approval

Milestone Name	Date	Means of Verification
Evaluation and assessment methodology for C-ITS and ITS – completed and handed-over to deployment project	Q1/2026	Minutes of the meeting with deployment projects, including Q&A session contents published
Synthesis of European C-ITS and ITS assessment results	Q2/2027	Synthesis of European C-ITS and ITS assessment results approved by the Steering Committee

Table 9: List of Milestones to be prepared by WG 3

11.6　Milestones to be prepared by WG 4 for Steering Committee approval

Milestone Name	Date	Means of Verification
Report on harmonised digital elements for C- ITS and CCAM	Q1/2026	Report approved by the Steering Committee
Report on Traffic Management Procedures for Multi-Stakeholder Environments	Q1/2027	Report approved by the Steering Committee

Table 10: List of Milestones to be prepared by WG 4

11.7　Milestones to be prepared by the Working Group Operations and C-ITS Deployment Strategy for Steering Committee approval

Milestone Name	Date	Means of Verification
C-ITS Cooperation Agreements defined and finalized	Q1/2026	approved by the C-Roads Platform SCOM and published via the C-Roads website to be publicly available

Table 11: List of Milestones to be prepared by WG OS

11.8 Milestones to be prepared by C-ITS Collaboration Groups for Knowledge Transfer for Steering Committee approval

Milestone Name	Date	Means of Verification
C-Roads Webinar	Q3/2024	Presentations online
Communication and dissemination plan	Q3/2024	Communication and dissemination plan approved by the Steering Committee
Collaboration Group Urban CITS, stakeholder meeting	Q1/2025	Presentation slides of the Urban C-ITS Meeting
C-ITS training session 1	Q2/2025	Training material published or presentation slides of training session
C-ITS Training Handbook	Q2/2025	C-ITS Training Handbook addressing the training activities approved by the Steering Committee
Guidance document for RSU and OBU procurement	Q2/2025	Guidance document for RSU and OBU procurement approved by the Steering Committee
Communication and dissemination report	Q4/2025	approved by the C-Roads Platform SCOM
Collaboration Group Rail CITS, stakeholder meeting	Q1/2026	Presentation slides of the Rail C-ITS Meeting
C-ITS training session 2	Q1/2026	Training material published or presentation slides of training session
Collaboration Group Blue Light CITS, stakeholder meeting	Q3/2026	Presentation slides of the Blue Light C-ITS Meeting
Communication and dissemination report	Q4/2026	approved by the C-Roads Platform SCOM
C-ITS training session 3	Q1/2027	Training material published or

		presentation slides of training session
collaboration Group activity report	Q2/2027	Report approved by the Steering Committee

Table 12: List of Milestones to be prepared by C-ITS Collaboration Groups for Knowledge Transfer