

# SWP 2.3 System Specifications

## Explanatory Note Release 3.6

### WP 2 - System Definition

#### Version: 03.60

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Release Date: 2016-07-29	
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## Overview of changes

No.	Version	Status	Date	Type of Change
1	01.00	Released	2014-11-27	First Release
2	02.00	Released	2015-03-18	Second Release
3	03.00	Released	2015-07-15	Third Release
4	03.10	Released	2015-09-23	Third Release – Update
5	03.50	Released	2016-04-29	Third Release – Second Update
6	03.60	Released	2016-07-29	Third Release – Third Update

Table 1: Document History

Reference to the status and version administration:

### Status:

In progress            the document is currently in editing mode

Released                the document has been checked and released by quality assurance; it can only be modified if the version number is updated.

### Versions:

Takes place in two stages. Released documents receive the next highest integral version number.

00.01, 00.02 etc.      Not released versions, with the status in progress

01, 02, etc.            Released version with the status released

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## 1 Document Information

### 1.1 Purpose of this document

This explanatory note and document contains a general introduction to the ECo-AT project and the ECo-AT Living Lab and describes, which documents and deliverables belong to Release 3.6 of ECo-AT and what has changed in regard to previous releases.

### 1.2 Definitions, Terms and Abbreviations

Abbreviation / Term	Definition
AG	Amsterdam Group – co-operation of C2C-CC, CEDR, ASECAP & POLIS for European roll-out of Cooperative ITS
C-ITS	Cooperative ITS – C-ITS is a “subset of overall ITS that communicates and shares information between ITS stations to give advice or facilitate actions with the objective of improving safety, sustainability, efficiency and comfort beyond the scope of stand-alone systems” (ISO/TR 17465-1)
ISS	Intersection Safety
ITS	Intelligent Transport Systems – systems that use information and communication technology to improve transport systems
IVI	In-Vehicle Information
MAP	Message to convey local, detailed network topology in specific areas, as specified in ISO/PDTS 19091
MIF	Multimodal Information
PVD	Probe Vehicle Data
RWW	Road Works Warning
SPAT	Signal Phase & Timing
WP	Work Package

Table 2: Definitions, Terms and Abbreviations

### 1.3 References

All references in this document can be found in the master table of references available in the “Eco-AT\_SWP2.3\_MasterTableOfReferences\_v03.60.pdf” document.

## 2 Introduction

Noticing traffic jams before you see them. Detecting risks before they become a threat. Arriving at your destination safe and sound. This vision of safe and intelligent mobility can be realised by wirelessly connected vehicles and infrastructure. In technical terms, it is achieved with so called Cooperative Intelligent Transport Systems (C-ITS – also known as V2X communication for vehicle-to-vehicle and vehicle-to-infrastructure communication). Cooperative systems enable direct communication between vehicles, roadside infrastructure and traffic control centres. The benefits of V2X communication are numerous. It enables anticipatory and safe driving, as drivers are informed in advance about current traffic situations and danger zones. In addition traffic centres receive precise and comprehensive information from vehicles about the traffic situation. In this way, it is possible to control the traffic flow more minutely, efficiently and quickly, resulting in an improved flow of traffic. The effect: better safety, fewer accidents, improved use of the road network, less congestion and a decrease in CO<sub>2</sub> emissions.

Intelligent mobility – beyond national borders

The basis for the pan-European deployment of cooperative ITS is already in place. The Cooperative ITS technology has been developed within research and development projects (R&D) and is evaluated in field operational tests (FOTs). The majority of the enabling technology is already standardised. The non-technical aspects (e.g. organisational structures, safety concept, legal aspects) are currently addressed in public private partnerships in preparation for the market launch. On this basis, road operators in Germany, the Netherlands and Austria will now start joint deployment of cooperative ITS in Europe, with partners from industry.

Cooperative ITS Corridor Rotterdam – Frankfurt/M. – Vienna

It is planned that the roadside cooperative ITS infrastructure for the initial services in the Cooperative ITS Corridor Rotterdam – Frankfurt/M. – Vienna will be initialised by 2017. The EU Member States the Netherlands, Germany and Austria have signed a Memorandum of Understanding to realise this new technology in close cooperation. The deployment of the Corridor has been agreed with the automotive industry. Also starting in 2017, they will bring the first vehicles and telematic infrastructure to the market.

Development projects started internationally

Preliminary development projects on which organisational, functional and technological aspects are being dealt with are already running in the Netherlands, Germany and Austria for the deployment of the first cooperative ITS. Both the preparation and the gradual deployment of the new technology are taking place in close exchange with the partners on a European level. The vision and mission of these three “corridor” countries are aligned on a strategic level in the C-ITS corridor coordination and the two common services of RWW and PVD will be aligned on a technical level as well.

### 3 ECo-AT Phases and Releases

ECo-AT (European Corridor – Austrian Testbed for Cooperative Systems) is the Austrian project to create harmonised and standardised cooperative ITS applications jointly with partners in Germany and the Netherlands.

The following companies are project partners of the ECo-AT project:

- ASFINAG Maut Service GmbH on behalf of Autobahnen-und Schnellstraßen-Finanzierungs-Aktiengesellschaft
- KAPSCH TrafficCom AG
- SWARCO AG
- Siemens AG Österreich
- Vereinigung High Tech Marketing
- Volvo Technology AB
- FTW Forschungszentrum Telekommunikation Wien GmbH
- Bundesanstalt für Straßenwesen
- Verkehrsverbund Ost-Region VOR GmbH

The following figure shows a graphical overview of the different organizational building blocks of ECo-AT.

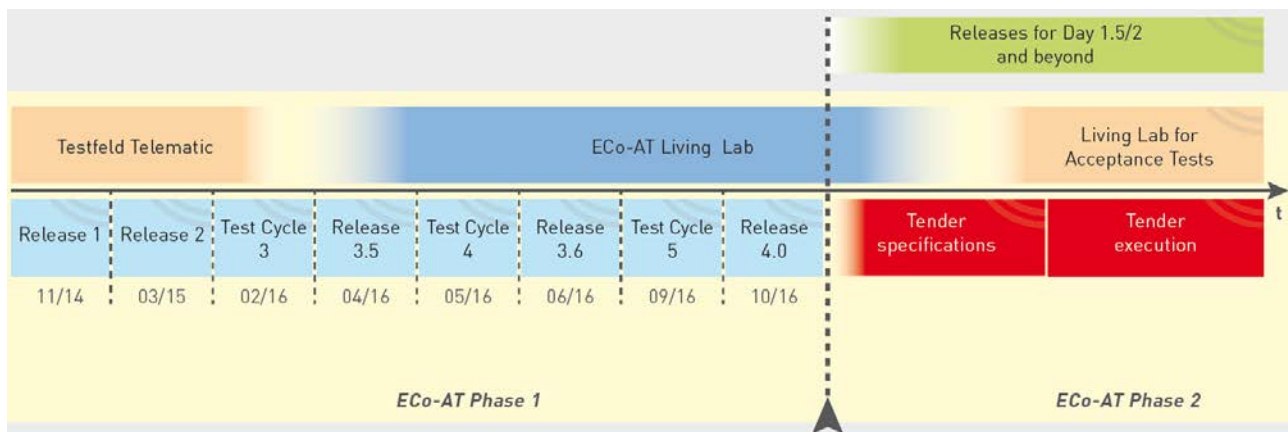


Figure 1: overview of the different organizational building blocks

In principle, ECo-AT is separated in two phases. Both phases are co-funded by the Klima & Energiefonds (climate & energy fund) in Austria. The result of phase 1 will be a full systems specification for C-ITS which has been tested and verified by the ECo-AT industry partners and by 3<sup>rd</sup> parties.

In Phase 2 ASFINAG will be the only partner of the ECo-AT project and will perform the tendering of the C-ITS system. This work requires the definition of the tender specifications and the tender execution.



Finalised and agreed Use Case specifications form a prerequisite for a system architecture document. In ECo-AT phase 1 all project partners will cooperate on the elaboration of system architecture specifications. These system architecture specifications will be developed in several releases and each release will be published after they have been accepted by the ECo-AT Steering Committee.

- Release 1 in 11/2014
- Release 2 in 03/2015
- Release 3 in 07/2015
- Release 3.1 in 10/2015
- Release 3.5 in 04/2016
- Release 3.6 in 07/2016
- Release 4 (Final) planned for 10/2016

3<sup>rd</sup> parties (industry partners not being project partners of ECo-AT) will have access to the system specifications as they will be published. It is the utmost aim of the ECo-AT partners to assure a short time frame between the elaboration of interim results in the different releases and the publishing of releases in order to assure that 3<sup>rd</sup> parties have the chance to give feedback to the specifications in due time.

The feedback from partners and 3<sup>rd</sup> parties to the overall system architecture of ECo-AT will be treated by change requests.

Until the start of the Living Lab, the Testfeld Telematik installations remained operational. Project partners as well as 3<sup>rd</sup> parties are invited to test against the system specification in the Living Lab on a voluntarily basis. For this purpose, access to the Living Lab and test tools will be granted under specific terms outlined in [ECo-AT SWP4.8 guideline living lab].

ASFINAG will develop the tender specifications and start the tendering procedures for the procurement of the C-ITS system in Phase 2. This work will be based on the published final phase 1 system specification. ASFINAG will use the Living Lab for acceptance tests of C-ITS systems and components for operational use, based on test procedures and tools agreed and developed in Phase 1.

All Use Cases deployed in the scope of ECo-AT Phase 2 are called "Day 1 Use Cases", all others "Day 2 Use Cases".

Further releases of system specifications for Day 2 may be developed and deployed outside the scope of the ECo-AT project.

## 4 ECo-AT Release 3.6 Documents

This chapter describes which documents and deliverables belong to Release 3.6:

1. Overview on the set of Release documents (present document)
2. Use Case Overview
3. Use Case Road Works Warning (RWW)
4. Use Case In-Vehicle Information (IVI)
5. Use Case Probe Vehicle Data (PVD) / CAM Aggregation
6. Use Case Intersection Safety (ISS)
7. Use Case Other DENM Applications
8. Master Table of Reference
9. System Overview
10. Functional Definition Central ITS Station
11. DATEX II Mapping Tables
12. Interface Definition IF1 (C-ITS-S <-> TCC)
13. Interface Definition IF3 (C-ITS-S <-> R-ITS-S)
14. IF3 (C-ITS-S <-> R-ITS-S) XML Schema Definition
15. Functional Definition Roadside ITS Station
16. Functional Definition Vehicle ITS Station
17. Security
18. Co-Existence
19. Convergence of ITS-G5 with cellular communication systems
20. Concept for Upwards Compatibility
21. Living Lab Concept
22. C-ITS System Monitoring
23. Guideline for Living Lab

- 24. C-ITS-S Test Specification
- 25. R-ITS-S Test Specification
- 26. Co-Existence Test Specification
- 27. Use Case Test Specification
- 28. Reference Messages

#### **4.1 Overview on the set of Release documents (present document)**

File Name: "ECo-AT\_SWP2.3\_ExplanatoryReleaseNote\_v03.60.pdf"

Version: 03.60

This document describes which documents and deliverables belong to Release 3.6 of ECo-AT and what has changed in regard to previous releases.

#### **4.2 Use Case Overview**

File Name: "ECo-AT\_SWP2.1\_OverviewOnUseCases\_v03.60.pdf"

Version: 03.60

This document describes which use cases will be specified in which release of the system architecture. All ECo-AT partners collaborate in developing the use case documents but ECo-AT also strives to harmonise these use cases with partners in the automotive industry and with other Cooperative ITS Corridor partners.

##### **First published in Release 1**

##### **No changes in Releases 2, 3 and 3.1**

##### **Changes in Release 3.5**

- All references changed to Master Table of References, all references updated
- Updated description of all Use Cases, updated overview table

##### **No changes in Release 3.6**

### 4.3 Use Case Road Works Warning Document (RWW)

File Name: "ECo-AT\_SWP2.1\_RoadWorksWarning\_v03.60.pdf"

Version: 03.60

The Use Case Road Works Warning (RWW) informs drivers of road works ahead, their relevant parameters and associated obstructions (e.g. closed lanes). The purpose is to alert the driver in time to increase awareness and to inform of potentially dangerous conditions. RWW is based on the functional description, message sets and triggering conditions from the Amsterdam Group (AG).

#### First published in Release 1

#### Changes in Release 2

- The Release 2 version of the Road Works Warning Use Case document includes mainly improvements regarding the alignment of the content mapping of Road Works information to DENM data frames/elements
  - based on feedback from the Release 1 public event
  - based on clarifications with ASFINAG operational units
  - based on internal review by ECo-AT project partners and harmonisation with the Amsterdam Group specifications for Road Works Warning.
- Further to that, the missing mapping for mobile road works was included.

#### Changes in Release 3

- Modifications due to OEM workshops and the latest release of the Amsterdam Group Message Set and Triggering Conditions document
- Changes to Annex A.
  - *detectionTime* – The old text made the incorrect assumption that an update required because of expiring *validityDuration* requires an updated detection time. It rather is the reference time that will be updated, therefore part of the description was deleted.
  - *referenceTime* – Deleted all text referring to negations, as they will not be part of Eco-AT triggering conditions.
  - *relevanceDistance* – There had been an incorrect coding value in the document for `lessThan5km: 3` instead of 5
  - *validityDuration* – Modified text in order to make it consistent with recent changes in the AG document based on OEM workshops. The new proposal is 10s.
  - *eventHistory* – Text changed to reflect the clarification achieved with OEMs at the OEM workshop. *eventHistory* does not cover the longitudinal extent but the final release point and its approach (trace).
  - *lightBarSirenInUse* – Changed to 'not used' according to Amsterdam Group paper

- *closedLanes* – Changed to “not available” for stand-alone mode according to Amsterdam Group paper

### Changes in Release 3.1

- Adaption to the current valid Amsterdam Group document
- Incorporation of review comments
- Update of document references

### Changes in Release 3.5

- Added description of scenarios from requirements document
- All references changed to Master Table of References, all references updated
- Technical issues derived from Test Cycle 3 and resolved in TWG Open Issues
- Restructured chapter 4
- Incorporation of Long-Term Roadworks (chapter 4.3)
- Added some details in triggering conditions (chapter 5)
- Updated data element table in chapter 6

### Changes in Release 3.6

- Some textual clarification and editorial fixes
- Updated DENM mapping diagrams, including fixes due to issues detected in ECo-AT test cycles
- Updates regarding use of DENM elements
  - *closedLanes* (Don't Care Bit 0 included)
  - *eventHistory* (only provided when available; geographical extension of roadwork area, not only trace to release point)
  - *positionConfidenceEllipse* (not available in TCC generated coordinates)
  - *subCauseCode* (trailers use “0” in stand-alone)

## 4.4 Use Case In-Vehicle Information (IVI)

File Name: “ECo-AT\_SWP2.1\_InVehicleInformation\_v03.60.pdf”

Version: 03.60

This document describes the In-Vehicle Information that is used to inform drivers about present speed policy/advice and other relevant (hazard) information which are shown on dynamic traffic signs. The use case aims for the visualization of electronic signage directly in the vehicle, but not for the interpretation of the traffic impact of any given signs.

IVI is based on the functional description of the Amsterdam Group. IVI in ECo-AT will focus on the IVS subset (*In-Vehicle Signage* of traffic signs, e.g. speed limits) and is published for dynamic signs.

### First published in Release 1

#### Changes in Release 2

- Analysis of Data Sources for Dynamic Signage: analyses the procedure of changing the state of an electronic road sign and the inherent latency in the ASFINAG traffic management system and examines key parameters for the available IVI data sources
- Data Element Description: describes the relevant data elements of the IVI structure, determines the source for the provision of the data elements and comments on the interpretation and default values for each data element.
- IVI Location Encoding: analyses the geographic validity of Static and Dynamic Signage and how location information from the TCC can be mapped into the proper location referencing entities (reference position, detection zone, relevance zone) of the IVI message.
- Full IVI Message Example: presents a complete IVI message example, including all location information, based on an existing VMS gantry on the Austrian highway A4 near Vienna.
- IVI Dissemination and Format

#### Changes in Release 3

- Further Analysis and Final Recommendation on Data Sources for Electronic Signs
- Inclusion of Static Signs / Analysis on Data Source
- Integration of ETSI TS 103 301 / Facilities layer protocols and communication requirements for I2V messages

#### Changes in Release 3.1

- Minor updates correcting small errors, no change in content

#### Changes in Release 3.5

- Cleanup of document
- Chapter with scenario concept and description of scenarios
- All references changed to Master Table of References, all references updated
- New chapter on IVI validity / geographical vs. temporal validity as discussed in TWG Open Issues
- Updated analysis of data sources, including new illustrations and latency measurements for the chosen solution / CORBA
- Proper ISO14823 coding for the message examples in the IVI Profile chapter
- Updated Data Element Description based on the results of Test Cycle 3 / TWG Open Issues

- Reference and explanation that static signage will not be supported by the Use Case

### Changes in Release 3.6

- Textual clarification and editorial fixes
- Updates based on results and open issues from the ECo-AT Test Cycles
- Changed Data Element Description in regard to "serviceProviderId" (countryCode, providerIdentifier) and "ivIdentificationNumber" to make IVI messages unique and traceable throughout the ECo-AT communication chain
- "validTo" is now marked mandatory in the IVI Management container in the IVI profile and the Data Element Description
- Chapter "Full IVI Message Example" was rewritten and updated with a current / more detailed example

## 4.5 Use Case Probe Vehicle Data (PVD) / CAM Aggregation

File Name: "ECo-AT\_SWP2.1\_CAM\_Aggregation\_v03.60.pdf"

Version: 03.60

This document describes the collection of anonymised information from mobile ITS stations that would enlarge the information base for making traffic management decisions. The proposed stepwise approach comprises the definition of a use case for the aggregation of content of *Cooperative Awareness Messages* (CAM) in the R-ITS-S and the provision of the derived information to the C-ITS. In Release 3 the specification was updated and two further scenarios, beside CAM aggregation, were added: single vehicle data and travel time estimation.

The full PVD use case including PDM (*Probe Data Management*) is probably Day 2, but the requirements will be considered in the Day 1 system architecture.

### First published in Release 1

### Changes in Release 2

- Added an additional option for the definition of the detection zones: using only the direction/heading information of the roads
- The information about the standard deviation of speed is deleted from the aggregated data (no requirement from the TCC)
- The information about exterior lights is added as further optional data element in the aggregated data (can be used e.g. for fog detection)
- Definition of a meaningful subset of station types (vehicles classes)

- The aggregation data is grouped into a short term aggregation and long term aggregation (requirement from TCC)
  - Added the possibility of assigning the station types (vehicle classes) to station type groups
- Added data element tables for CAM aggregation data and CAM aggregation configuration data

### Changes in Release 3

- Added average speed estimation algorithm
- Added configuration parameters (definition of detection zones) in reported aggregated data (self-contained message)
- Added self-configuration of detection zones
- Added MIN, MAX of speed
- Added buffer functionality for long term aggregation
- Added group of station types proposal in accordance with TLS (2+1)
- Added single vehicle data
- Added travel time calculation
- Additional time mean speed

### Changes in Release 3.1

- Minor changes in text in Table 4 (Comparison between TLS and CAM data)
- More detailed description about detectionZones (2 methods: detectionZone configuration method 1: rectangle method; detectionZone configuration method 2: heading method)
- A circle is specified (vehicles inside the circle are counted) for the heading method
- Reference position is added to the parameters for the heading method
- Specification of the tolerance angle, D, for the heading
- Specification of self-configuration
- Specification of process, when the configuration is updated
- Added trigger conditions
- Added the duration for keeping the stationID/vehicleID mapping in the C-ITS-S
- Added the method for ignoring CAMs for single vehicle data
- Structure of data model (Chapter 6.1.1 and Chapter 6.1.2) changed

### Changes in Release 3.5

- Included UC CAM aggregation scenarios
- Changed references table to master table references document
- Updated geoArea and toleranceAngle in Chapt. 6 Data element tables (Table 6, Table 7)



## No changes in Release 3.6

### 4.6 Use Case Intersection Safety (ISS)

File Name: "ECo-AT\_SWP2.1\_IntersectionSafety\_v03.60.pdf"

Version: 03.60

This document describes Cooperative Traffic Lights which will provide information on traffic-light status (SPaT – Signal Phase and Timing) and a geographical representation of the vicinity of the traffic light (MAP).

The use case description is based on the most promising possibilities to use SPaT/MAP based information in specific use cases, namely for the use cases:

1. Vehicle Speed optimisation approaching an intersection, based on signal status
2. Fast pre-emption of traffic due to traffic light signal change (red to green)
3. Prevention of red light violation

### First published in Release 1

### No changes in Release 2

### Changes in Release 3

- Consideration of new ETSI TS ITS 103 301 document

### Changes in Release 3.1

- Minor updates adding references and annex

### Changes in Release 3.5

- All references changed to Master Table of References, all references updated
- Example in Annex revised

### No changes in Release 3.6

### 4.7 Use Case Other DENM Applications

File Name: "ECo-AT\_SWP2.1\_DENM\_Applications\_v03.60.pdf"

Version: 03.60

The aim of this Use Case is to state how to create other DENM (Decentralized Environmental Notification Message) applications in ECo-AT – beside the Roadworks Warning application described in the RWW Use Case document. The Use Case supports two different scenarios:

1. Sending event information / DENMs from the TCC to the vehicles
2. Sending event information / DENMs from the vehicles to the TCC

### First published in Release 1

### Changes in Release 2

- Updated number of events from the ASFINAG event management system (from 10 to 34) and their mapping to DENM
- Principles of DENM Event Location encoding

### Changes in Release 3

- Restructuring into two parts
  - Infrastructure based DENM events and Vehicle based DENM events
- Updated mapping from ASFINAG events to DENM
  - There are now 200 ALERT-C event types properly mapped to DENM in Release 3
  - Release 2 had 34 event types, Release 1 had 10 event types
- Complete DENM data element description
  - Management, situation and location container
  - Similar to RWW data element description
- Updates on Event Location, Event Timing and Event Triggering
- First input for Vehicle based DENM events
  - to be updated in later Releases

### Changes in Release 3.1

- Chapters 2.6 (DENM overview) was restructured and no longer quotes the DENM standard directly but references to it
- The value of validityDuration was changed from 10s to 20s according to the latest AG update. This concerns chapters 2.9 (Event Timing) and 2.11 (DENM Data Element Description).

### Changes in Release 3.5

- Chapter with scenario concept and description of scenarios
- All references changed to Master Table of References, all references updated

- Updated event list / ASFINAG event management system
- Updated matching of ALERT-C to DENM cause / sub cause codes
- New references to DATEX II mapping tables which are now part of the Release 3.5
- Clearer differentiation between point events and events with spatial extension in the “Event Location” chapter
- Updated “Event timing” chapter
- Updated “DENM Data Element Description” based on the results of Test Cycle 3 / TWG Open Issues
- Added chapter for scenario “Vehicle based DENM events sent to the TCC”
  - Example and reference to full mapping table DENM cause / sub cause codes to DATEX II

### Changes in Release 3.6

- Textual clarification and editorial fixes
- Updates based on results and open issues from the ECo-AT Test Cycles
- Updated event list from the ASFINAG event management system / 7 new events
- Clarification of connection with TISA encoding guidelines for safety related messages
- Extension of “Event Location” chapter with clarifications for eventHistory
- Restructured “Event Timing” chapter
- New chapter on “Linked Events” / Linkage on IF1 / DATEX II and use of referenceDenms and linkedCause in DENM
- Updated “Mapping DENM events to DATEX II” for the V2I chapter / unmappable events are encoded differently in DATEX II

## 4.8 Master Table of Reference

File Name: “ECo-AT\_SWP2.3\_MasterTableOfReferences\_v03.60.pdf”

Version: 03.60

This document contains the master table of references for the whole ECo-AT project and specifications. All other documents released by ECo-AT will use the references listed in that document and directly refer to that document.

### First published in Release 3.5

#### Changes in Release 3.6

- Updated “ECo-AT Specification Documents” with new documents in Release 3.6
- Updated “ETSI Standards” with ETSI 202 663

## 4.9 System Overview Document

File Name: "ECo-AT\_SWP2.3\_SystemOverview\_v03.60.pdf"

Version: 03.60

This document describes the agreed ECo-AT system by all ECo-AT partners at the time of writing.

- It creates a common understanding for all project partners in ECo-AT regarding the system architecture, specification of system components, usage of data elements in ECo-AT, description of interfaces, security architecture and message management.
- It serves as the basis for the development of the general system requirements for components and interfaces in WP2 and, later, for the more detailed functional requirements in WP3.
- It is the basis for communication with the Corridor partner Germany and the Netherlands in order to create a set of harmonised Corridor-wide specifications.

The document is not a finalised complete specification of the system, but it reflects the current status of the ECo-AT project. The description of the data elements, for example, is based on the UC RWW, and the data elements for other use cases are not part of this document. All not-yet-agreed specifications are described as such with an additional note.

### First published in Release 1

### Changes in Release 2

- Added general requirements for all system components
- Deleted the data element tables for UC RWW (they are now part of the RWW use case document)
- Updates in the ANNEX about DENM parameter usage in ECo-AT
  - The default value for relevanceDistance for SC1 and SC2 is changed to 5km (proposal from Amsterdam Group)
  - Station type for mobile R-ITS-S (Warnleitanhänger) is set to roadSideUnit(15) for SC1 and SC2
  - Station type for mobile R-ITS-S (Vorwarner) is set to specialVehicle(10) for SC1 and SC2
- Updated general message management chapter
  - Added a list about message management topics
- Deleted the chapter about security (this is now available as separate security document)

### Changes in Release 3

- New chapter: 5.3.1 Maintenance and Operations
  - Input coming from security group about operational scenarios. Depending who is operating the system, different architectures have to be considered.
- Deleted chapter 5.2.2.3 R-ITS-S dissemination selection method

- This is moved to SWP3.1 (C-ITS-S) document

### No Changes in Release 3.1

### Changes in Release 3.5

- Changed references table (Chapt 1.3) to master table references document
- Updated the requirements (REQs) based on TWG
- Updated Chapt. 1.2: definitions, terms and abbreviations
- Updated structure of the document in Chapt. 2.1
- Chapt. 2.2: updated SWP3.x naming, included WP4, updated list of TWGs
- Updated Chapt. 3.2 Releases
- Updated Figure 2, 4, 5, and 6
- Added overview of ECo-AT topics/scenarios in beginning of Chapt. 5
- Added mapping tables (requirements to ECo-AT topics/scenarios) in Chapt. 5 for all system components (general, TCC, C-ITS-S, R-ITS-S, V-ITS-S)
- Chapt. 6 Description of Data Elements
  - Updated Chapt. 6.1 (RWW scenarios, UC other DENM data elements are now available)
  - Updated Chapt 6.2 (included single vehicle data)
  - Deleted Chapt 6.4 Message Management Data
- Updated Chapt. 7.1.1, Chapt. 7.1.2, Chapt. 7.2, Chapt. 7.3, and Chapt. 7.4
- Added management scenario description in Chapt. 7.1
- Updated Figure 11: deleted sending RWW data sets to the TCC – the RWW data sets will be just sent to the C-ITS-S
- ANNEX: DENM Parameter Usage in ECo-AT
  - Updated Chapt. 8.1.2.3
  - Updated validityDuration in Chapt. 8.5.2.3
  - Updated validityDuration in Chapt. 8.5.3.3
  - Updated eventHistory usage in ECo-AT in Chapt. 8.8.3.3
  - Updated trace setting in ECo-AT in Chapt. 8.9.2.3
  - Included repetitionDuration setting in ECo-AT in Chapt. 8.15.2.3
  - Included repetitionDuration setting in ECo-AT in Chapt. 8.15.3.3
  - Updated informationQuality = 4 for TCC triggered RWW, informationQuality = 2 (R-ITS-S with simple GNSS) or 3 (R-ITS-S with differential GNSS) for augmented RWW in Chapt. 8.7.2.3
  - Added in Chapt. 8.6 that the RW pre-warner trailer is not part of the ECo-AT C-ITS specification
- Added 9 ANNEX: Geonetworking Profiling

### Changes in Release 3.6

- Updated version numbers
  - Updated version number of master table of references
  - Updated version number for Ref. [ECo-AT SWP3.1 DATEX II mapping] tables
- Status of REQs
  - Set all new/updated (from release 3.1 to release 3.5) to agreed
- Requirements
  - Added new REQ: R\_R\_101: ITS-G5 CAM transmission
  - Deleted REQ R\_G\_003: Check of message content
  - Updated REQ R\_R\_073: SPAT Data Reception from TLC
  - Updated guidance in REQ R\_G\_002: Unique messages
  - Added new REQ: R\_R\_102: RWW transmission indication
  - Updated REQ R\_R\_092: ITS-G5 BTP ports
- Updated mapping of R\_G\_002 (Unique messages) to ECo-AT topics/scenarios in Table 3
- Updated the availability and references for message management, Chapt. 7.1.1 and Chapt. 7.1.2
- Changed the example radius for GN destination area from 500m to 1000m in Chapt. 8.17
- Updated GeoNetworking profiling tables in Chapt. 9 ANNEX: Geonetworking Profiling
  - Included GBC for IVI
- Added detailed profiling for GBC, SHB, and multi-hop TSB

### 4.10 Functional Definition Central ITS Station

File Name: "ECo-AT\_SWP3.1\_C-ITS-S\_Functional Description\_v03.60.pdf"

Version: 03.60

This document gives an overview about the functions and interfaces of the cooperative central system C-ITS-S of the ECo-AT project. It describes the system architecture and general basic functionality to operate the C-ITS platform. Furthermore, it specifies various specific functions in the cooperative context.

#### First published in Release 3

#### Changes in Release 3.1

- Added text about 'interim trailer movement' and 'two trailer scenario' in chapter 4.4.3.1

#### Changes in Release 3.5

- All references changed to Master Table of References, all references updated

- Update of RWW process
- Update of CAM Aggregation process
- Updated requirements (REQs) based on TWG Open Issues

#### Changes in Release 3.6

- DENM references included
- IVI message validity update process overview included
- Remark included that the a split of related messages over two R-ITS-S is not allowed

#### 4.11 DATEX II Mapping Tables

File Name: "ECo-AT\_SWP3.1\_DATEXII\_Mapping\_Tables\_v03.60.zip"

Version: 03.60

This release document contains several Excel spreadsheets that define translation rules for mapping DATEX II source data from the TCC into the target formats of the ECo-AT Use Cases and vice versa. The mapping information supports downlink applications (from DATEX II to CAM, DENM and IVI) as well as uplink applications (from CAM, DENM to DATEX II) based on the existing DATEX II profiles of ECo-AT.

- Use Case RWW (downlink)
  - *DATEXII\_Translation\_RWW\_V03.60.xlsx*
- Use Case Other DENM Applications (downlink and uplink)
  - *DATEXII\_Translation\_OtherDENM\_V03.60.xlsx*
- Use Case IVI (downlink)
  - *DATEXII\_Translation\_IVI\_V03.60.xlsx*
- Use Case CAM Aggregation (incl. single vehicle data and travel time estimation) (uplink)
  - *DATEXII\_Translation\_CAMAggregation\_V03.60.xlsx*
- Co-Existence / DSRC Protected Zones (downlink)
  - *DATEXII\_Translation\_ProtectedZones\_V03.60.xlsx*

#### First published in Release 3.5

### Changes in Release 3.6

- RWW
  - Clarification on mapping of actionId
  - Corrected validityStatus definition
  - Added mapping for hardShoulderStatus
  - Added two additional elements (mobilityType (mobile, stationary) and roadworksDuration (longTerm, shortTerm))
- OtherDENM
  - Clarification on mapping of actionId
  - Corrected validityStatus definition
  - Added mapping for 7 new event types
  - Changed mapping of DENM events to DATEX II if no direct mapping is possible to the generic DATEX II record "Conditions" (with drivingConditionType = passableWithCare) with the description of the cause code to be put into the "nonGenericPublicComment" container
  - Updated safety related messages and added the "urgency" data element
- IVI
  - Clarification on mapping of ivIdentificationNumber
  - Updated pictogram codes

#### 4.12 Interface Definition IF1 (C-ITS-S <-> TCC)

File Name: "ECo-AT\_SWP3.1\_IF1\_DataSpecification\_v03.60.pdf"

Version: 03.60

This document specifies the data exchange between Traffic Control Centre (TCC) and the cooperative ITS Server (C-ITS-S). The TCC sends use case related information (e.g. roadwork warnings, traffic events, signage information) to the C-ITS-S, which generates C-ITS conform messages and distributes them to the vehicles (V-ITS-S) using one or more Roadside Units (R-ITS). Vice versa, C-ITS-S receives ITS messages and traffic information from the V-ITS-S via the connected R-ITS-S and delivers this information to the TCC.



The purpose of this document is to specify the data elements which are exchanged on Interface 1 (IF1) between the TCC and the C-ITS.

### **First published in Release 3**

### **No Changes in Release 3.1**

### **Changes in Release 3.5**

- All references changed to Master Table of References, all references updated
- New organization of document with references to external DATEX II mapping tables
- New DATEX II structure illustrations
- Inclusion of IF1 communication / data exchange between TCC and C-ITS-S
- New data elements (CAM Aggregation, Single Vehicle Data, Protected Zones)
- Data element description updated
- Content updated based on TWG Open Issues
- Concept of DATEX II message validity
- Message traceability concept

### **Changes in Release 3.6**

- Typos and textual clarifications
- Sequence number schema
- Updated Augmented RWW description (multiple MaintenanceWork container)

## **4.13 Interface Definition IF3 Communication (C-ITS-S <-> R-ITS-S)**

File Name: "ECo-AT\_SWP3.1\_IF3\_Communication\_v03.60.pdf"

Version: 03.60

This document specifies the interface and describes the (OCIT-C) data objects used for communication operations between C-ITS-S and R-ITS-S.

### **First published in Release 3**

### **Changes in Release 3.1**

- Updated system overview and editorial changes
- Bidirectional communication between C-ITS-S and R-ITS-S
- Protocol encoding

- Update on data types

### Changes in Release 3.5

- Changed references table to master table references document
- updated "ItsCommDENMType"
  - included the optional flag "augmentation"
- updated "ItsCommDetectionZone" in Chapt. 4.1.3
  - included "toleranceAngle"
  - mentioned that the "angle" in "geoArea" are used in ECo-AT for the heading
- updated "ItsCommItsMessage" in Chapt. 4.1.9
  - "gnInfo" is now optional
- deleted "ItsCommItsMessagetrace"
  - the traceability is now covered by mapping of DATEX II "id" to ITS-G5 "sequenceNumber"
- added "ItsCommProtectedZones" for coexistence
- updated "dayTimeRunnigLightsOn" to "dayTimeRunningLightsOn"
- updated "ItsCommSecurityData"
  - "sec-general" for IVI
- minor editorial changes

### Changes in Release 3.6

- Typos and textual clarifications
- clarification of IF3 data encoding rules
- definition of specific data element of e.g. DENM which are send with value 0 from C-ITS-S to R-ITS-S. The R-ITS-S inserts its own configured values in the data element before sending
- Scenario "R-ITS-S sending "basic RWW from R-ITS-S" DENM to C-ITS-S" added
- ItsCommGnData Destination area circle changed from 500m to 1000m
- ItsCommIVIType/mgmt changed from mandatory to optional
- ItsCommValidity/key changed from optional to mandatory
- ItsCommSecurityData sec-cam deleted
- ItsCommTransportType gn-gac included

- Values aligned to XSD schema (ItsCommAggregation, ItsCommDENMType, ItsCommGnSource, ItsCommHeading, ItsCommIVIType, ItsCommPosition, ItsCommProtectedZones, ItsCommTrailerStatus, ItsCommValidity)

#### 4.14 Interface Definition IF3 Management (C-ITS-S <-> R-ITS-S)

File Name: "ECo-AT\_SWP3.1\_IF3\_Management\_v03.60.pdf"

Version: 03.60

This document specifies the interface and describes the (OCIT-C) data objects used for device management operations between C-ITS-S and R-ITS-S.

##### First published in Release 3

##### Changes in Release 3.1

- Updated system overview and editorial changes
- Bidirectional communication between C-ITS-S and R-ITS-S
- Protocol encoding
- Update on data types

##### Changes in Release 3.5

- Changed references table to master table references document
- updated Figure 1: Communication scenarios
- updated first paragraph of Chapt. 3.2
- updated structure of Chapt. 4 Data types (former Chapt. 3.4)
- updated data element names (e.g. "DeviceCommand" à "RSU\_Device\_Command")
- updated "DeviceDownload"
  - "content" is of type "xs:base64Binary"
  - "url" is of type "xs:string"

##### Changes in Release 3.6

- Typos and textual clarifications
- Improved Download description
- CAM forwarding deleted from R-ITS-S parameter data model
- R-ITS-S first installation and setup deleted and moved to R-ITS-S Functional Description
- Tables included for simple data elements ParameterNameType and KeyStringType

- Values aligned to XSD schema (base64Binary)

#### 4.15 IF3 (C-ITS-S <-> R-ITS-S) XML Schema Definition

File Name: "ECo-AT\_SWP3.1\_IF3\_XML\_Schema\_Definition.zip"

Version: 03.60

This release document contains the XML Schema Definitions for transfer of information over IF3 between C-ITS-S and R-ITS-S. The IF3 protocol defines data communication and management data elements which are encoded in the XML format which uses an XSD-Schema for validation. The data communication part is described in *itscomm-v03.60.xsd* and defines ECo-AT specific data and the transport of ITS data payload defined by ETSI and ISO. The management part is described in *devicemanagement-v03.60.xsd* and defines several management functionalities.

**First published in Release 3.5**

**Changes in Release 3.6**

- Data element alignment between updated IF3 document and XSD

#### 4.16 Functional Definition Roadside ITS Station

File Name: "ECo-AT\_SWP3.2\_R-ITS-S\_Functional\_Description\_v03.60.pdf"

Version: 03.60

This document describes the functionality in detail, which will be relevant for the R-ITS-S development. The document contains some clarification of the open issues of the SWP 2 documents by a functional description of the R-ITS-S. It will not be a detailed document for development. It clarifies and addresses the following issues:

- Description of the Interfaces to Trailer, V-ITS-S, TLC (Interface to C-ITS-S will be described in a separate document.
- Description of the data processing and management
- Description of the security

**First published in Release 3**

**Changes in Release 3.1**

- Figure 3: remove network connection TLC to the ASFINAG roadside backbone

- Add capture 5.1.2 TLC in standalone mode
- Move of chapter 6.2.3 “remote access” to chapter 6.1.1 “configuration”

#### **Changes in Release 3.5**

- All references changed to Master Table of References, all references updated
- Updated requirements (REQs) based on TWG Open Issues

#### **Changes in Release 3.6**

- Typos and textual clarifications after review
- Informative Annex added (chapter 7)

### **4.17 Functional Definition Vehicle ITS Station**

File Name: “ECo-AT\_SWP3.4\_V-ITS-S\_Functional Description\_v03.60.pdf”

Version: 03.60

This document describes the ECo-AT V-ITS-S functionalities as it has been agreed by all ECo-AT partners at the time of writing.

- It creates a common understanding for all project partners in ECo-AT regarding the functionalities of the V-ITS-S.
- It serves as the basis for the development of the V-ITS-S in WP3.
- It is the basis for communication with the other Corridor partners in DE and NL in order to come to harmonized Corridor-wide specifications.

The document is not a finalized complete specification of the system, but it reflects the current status of the ECo-AT project. All not-yet-agreed specifications are described as such with an additional note.

#### **First published in Release 3**

##### **Changes in Release 3.1**

- Updated references for chapter 3.1 overview: IF4 (R-ITS-S <-> V-ITS-S) interface

##### **Changes in Release 3.5**

- Changed references table to master table references document
- Updated Figure 1 (changed IF5 from proprietary to specified in ECo-AT, added IF8)
- Split up the interface from C-ITS-S to V-ITS-S into IF5 (C-ITS-S <-> WEB server) and IF8 (WEB server <-> V-ITS-S) – changed text in Chapt. 3.1

##### **No changes in Release 3.6**

## 4.18 Security

File Name: "ECo-AT\_SWP3.4\_Security\_v03.60.pdf"

Version: 03.60

The security architecture document describes the IT system architecture to grant information security for the Eco-AT system. Information security is the preservation of confidentiality, integrity and availability of information; in addition, other properties, such as authenticity, accountability, non-repudiation, and reliability can also be involved. The security architecture document starts with the evaluation of the security architecture methodology, analyses the interfaces of the system and finishes by selecting security controls which need to be applied in the Eco-AT system.

### First published in Release 2

### Changes in Release 3

- ETSI Threat Vulnerability and Risk Analysis (TVRA)
- Specification of security measures/protocol for the R-ITS-S to C-ITS-S interface, based on requirements identified in SWP 2.4
- Security management for ITS-G5 was put on hold
- Security management for the C-ITS-S to R-ITS-S interface was deemed unnecessary, as underlying interfaces (as implemented by ASFINAG and mobile communication operators) are considered secure.

### No Changes in Release 3.1

### Changes in Release 3.5

- Changed references table to master table references document

### Changes in Release 3.6

- Updated Figure 1: High level ECo-AT system architecture

## 4.19 Co-Existence

File Name: "ECo-AT\_SWP3.5\_Coexistence\_v03.60.pdf"

Version: 03.60

This document gives an overview about the radio frequency coexistence of the new emerging cooperative intelligent transportation system operating at 5.9 GHz frequency and the existing road tolling installations operating at 5.8 GHz. The document defines the requirements for the coexistence within the ECo-AT project.

### First published in Release 3.5

#### Changes in Release 3.6

- Revision of description of the coexistence modes in the Introduction
- Revision of protected zone and radius description, adding that the radius is set by the operator and is then adapted by the OBU based on emission parameters
- Added overview figure of a coexistence scenario
- Technical details added to description of 3 detection strategies
- Added paragraph on what is different for fixed ITS stations
- Minor changes in Section 3
- Technical details added to data element description in Section 4
- Short description of protected zone data dissemination added with reference to requirements
- Example changed to a real toll gantry with non-default protection radius

## 4.20 Convergence of ITS-G5 with cellular communication systems

File Name: "ECo-AT\_SWP3.6\_Convergence\_v03.60.pdf"

Version: 03.60

The document presents the approach that Eco-AT will adopt regarding the convergence strategy among ITS G5 and mobile networks. In addition, it presents the main considerations with respect to the use of the technologies involved in the Eco-AT use cases and the C-ITS entities involved in the convergence process. It analyses and describes the ways to achieve an independent implementation of the communication technology related to the use cases. Messages transmitted through ETSI ITS G5 or cellular networks should convey the same information to the final user.

### First published in Release 2

#### Changes in Release 3

- Minor refinements on the Release 2 document version
- New section called implementation that includes the specification of IF5: ITS-MOB (based on IF3: C-ITS-S <> R-ITS-S)

#### Changes in Release 3.1

- Minor changes based on project partner comments

#### Changes in Release 3.5

- All references changed to Master Table of References, all references updated

## No Changes in Release 3.6

### 4.21 Concept for Upwards Compatibility

File Name: "ECo-AT\_SWP2.7\_UpwardsCompatibility\_v03.60.pdf"

Version: 03.60

Cooperative ITS systems are just before its first step of commercial introduction. Despite all the progress made, it is obvious that further operational experience will trigger several changes to the C-ITS system and its affiliated operational processes. Thus the system is exposed to unexpected and expected changes due to various influence factors.

This document investigates potential changes of the environment and technology of C-ITS and derives requirements and design recommendations which allow the cooperative ITS system to cope best expected developments in future.

#### First published in Release 2

#### No Changes in Releases 3, 3.1, 3.5 and 3.6

### 4.22 Living Lab Concept

File Name: "ECo-AT\_SWP3.7\_LivingLab\_v03.60.pdf"

Version: 03.60

The Living Lab document shall clarify the role of the Living Lab in the project phases 1 and 2 and declare the necessary parts of the Living Lab as well as the Test objectives and Test objects in the two phases of ECo-AT. Furthermore, the test concept is explained and the necessary steps for the implementation of the Living Lab are pointed out.

The document shall clarify and address the following issues

- what is the role of the Living Lab in the different project phases
- what are the test objectives
- what is "inside" Living Lab and what is "outside"
- which types of tests are necessary to reach the test objectives
- what are the necessary Test tools
- what is a possible plan for the test sequence
- what are the implementation steps for the Living Lab und the Test tools



### First published in Release 2

### No Changes in Release 3

### Changes in Release 3.1

- Non-functional requirements have been commented and moved to appendix
- Objective and scope of Living Lab have been clarified. For instance, since C2C-CC specification is applied for PKI, interface IF2 is not within test scope
- Details for Living Lab network concept have been added
- Details for particular test sites for third parties (easier access aso.) have been added.
- Overview of test concept has been clarified
- Background for test areas as well as co-existence and cross-border tests have been added
- The test procedure has been updated

### Changes in Release 3.5

- All references changed to Master Table of References, all references updated
- Updated Living Lab Role and Scope

### No Changes in Release 3.6

## 4.23 C-ITS System Monitoring

File Name: "ECo-AT\_SWP2.3\_SystemMonitoring\_v03.60.pdf"

Version: 03.60

This document describes a high level, system wide monitoring framework, which runs in parallel of the ECo-AT C-ITS architecture. The monitoring framework enables the operator to identify faults at a system level that the individual system components are not capable of detecting themselves, such as bottleneck and anomaly detection. A monitoring system, which is distinctly parallel to the C-ITS system is used for capturing network traffic flows and analysing this traffic for the use of reasoning on network behaviour. It is not used for any maintenance specific aspects (like logging or SNMP), which focus on the operation of the network.

The concept of a C-ITS monitoring system defines an independent system from C-ITS that observes network operation in real-time. This provides a holistic view on the network that enables various analysing capabilities such as quality management of the network, traceability of network events and detection of network anomalies. The monitoring system generates data at each monitored network element, processes the data and provides information to the operators of the C-ITS. Therefore, it represents a tool that supports network operations and enables complex analyses that exceed common network management functions.

### First published in Release 2

### Changes in Release 3

- Removal of all traffic encryption scenarios as road operators networks are considered as trusted networks (based on discussion with ASFINAG and ECo-AT project partners)
- Adaptation of non-encryption scenario for monitoring without R-ITS-S LAN interface
- Removal of concept disclaimer
- Changes to the security chapter to match non-encryption scenarios
- Clean-up and preparation for Release 3

### Changes in Release 3.1

- Added explanation of IVI and SPAT/MAP within the context of the Living Lab C-ITS Monitoring deployment

### Changes in Release 3.5

- All references changed to Master Table of References, all references updated
- Removal of outdated information

### No Changes in Release 3.6

## 4.24 Guideline for Living Lab

File Name: "ECo-AT\_SWP4.8\_GuidelineForLivingLab\_v03.60.pdf"

Version: 03.60

This document contains general information for ECo-AT project partners and 3<sup>rd</sup> parties in order to access the Living Lab environment for performing conformance and acceptance tests:

- Living Lab Network Access and Integration
- Installation Guideline Roadside Infrastructure
- Test Procedure
- Contact Persons
- Terms & Conditions

### First published in Release 3.1

### Changes in Release 3.5

- All references changed to Master Table of References, all references updated

- Updated Test sites for third parties
- Updated Test Procedure

**No Changes in Release 3.6**

**4.25 C-ITS-S Test Specification**

File Name: "ECo-AT\_SWP4.1\_C-ITS-S\_Test\_Specification\_v03.60.pdf"

Version: 03.60

This document lists all test cases relevant to the C-ITS-S required for system requirements verification and validation. Each test case is described using the same template striving after completeness and comprehensibility.

**First published in Release 3.6**

**4.26 R-ITS-S Test Specification**

File Name: "ECo-AT\_SWP4.2\_R-ITS-S\_Test\_Specification\_v03.60.pdf"

Version: 03.60

This document lists all test cases relevant to the R-ITS-S required for system requirements verification and validation. Each test case is described using the same template striving after completeness and comprehensibility.

**First published in Release 3.6**

**4.27 Co-Existence Test Specification**

File Name: "ECo-AT\_SWP4.5\_Coexistence\_Test\_Specification\_v03.60.pdf"

Version: 03.60

This document lists all test cases relevant to the topic of coexistence required for system requirements verification and validation. Each test case is described using the same template striving after completeness and comprehensibility.

**First published in Release 3.6**

#### **4.28 Use Case Test Specification**

File Name: "ECo-AT\_SWP4.6\_Use\_Case\_Test\_Specification\_v03.60.pdf"

Version: 03.60

This document lists all test cases required for Use case validation. Each test case is described using the same template striving after completeness and comprehensibility

**First published in Release 3.6**

#### **4.29 Reference Messages**

File Name: "ECo-AT\_SWP4.7\_Reference\_Messages\_v03.60.zip"

Version: 03.60

This release document contains IF4 (ITS-G5) reference messages (as PCAP capture files and Text Files) for all Use Cases of ECo-AT (RWW, OtherDENM, IVI, Coexistence, ISS), together with the originating (IF1) DATEX II information from the TCC, Google Maps KMZ files detailing message positioning and location points used as well as additional notes about the status of each message in regard to the ECo-AT specification.

**First published in Release 3.6**

(End of Document)