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Deliverable 4.1 update

Website report on state-of-the-art strategy for C-ITS deployment

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PP	*Restricted to other programme participants (including the Commission)*	
RE	*Restricted to a group defined by the consortium (including the Commission)*	
CO	*Confidential, only for members of the consortium (including the Commission)*	

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Abbreviations

Abbreviation	Explanation
ADAS	Advanced Driver Assistance Systems
AG	Amsterdam Group
AT	Austria
BE	Belgium
BG	Bulgaria
C-ITS	Cooperative Intelligent Transport Systems and Services
CACC	Cooperative Adaptive Cruise Control
CBA	Cost Benefit Analysis
CODECS	Cooperative ITS Deployment Coordination Support
COOPERS	CO-OPerative SystEms for Intelligent Road Safety
CY	Cyprus
CZ	Czech Republic
D	Deliverable
DE	Deutschland (Germany)
DITCM	Dutch Integrated Testsite for Cooperative Mobility
DK	Denmark
DRIP	Dynamic Route Information Panel (specific type of VMS)
EC	European Commission
ERTRAC	European Road Transport Research Advisory Council
ES	Spain
FR	France
GR	Greece
HR	Croatia
HU	Hungary
I2V	Infrastructure-to-vehicle communication
IE	Ireland
IT	Italy

Abbreviation	Explanation
ITSAN	ITS automotive nord GmbH
LT	Lithuania
LV	Latvia
MT	Malta
NL	The Netherlands
NO	Norway
PC	Personal Computer
PL	Poland
PT	Portugal
RSU	Road Side Unit
RWS	Rijkswaterstaat
SE	Sweden
SI	Slovenia
SPITS	Strategic Platform for Intelligent Traffic Systems
T	task
UK	United Kingdom
V2I	Vehicle-to-infrastructure-communication
V2V	Vehicle-to-vehicle-communication
V2X	Vehicle-to-x-communication, with the x summarising other vehicles as well as ITS road side stations
VMS	Variable Message Sign
WG	Working Groups
WP	Work Package

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Executive Summary

CODECS project

The H2020 Coordination and Support Action CODECS has taken up its operation in May 2015. As the name COoperative ITS DEployment Coordination Support indicates, the project sustains the initial deployment of vehicle-to-x communication services in Europe. The COCECS project is supporting the Amsterdam Group, the C-ITS Deployment Platform of the European Commission, Standards Setting Organisations and other key deployment players in coming to a concerted C-ITS deployment approach.

For conducting deployment coordination support, CODECS has set-up several fundamental work packages, of which the fourth is the "Strategy Coordination Support" work package. The present report, deliverable 4.4 contains the results and findings of the state-of-the-art strategy inventory, the first activity of the Work Package 4 and is the updated and final version of the previous deliverable D4.1. The report has been updated relation to additional information, impressions and requirements formulated towards the state-of-the-art strategy, gathered e.g. through the CODECS workshops and webinars, or through monitoring the activities of deployment players and decision making councils like e.g. the Amsterdam Group, C-Roads and the C-ITS Deployment Platform.

Reports reviewed

Starting point for this research on strategic issues for C-ITS deployment are the country reports submitted to the European Commission (EC) within the framework of the ITS Directive 2010-40. Following this directive, countries are requested to submit reports on the status and plans with respect to ITS. In this inventory, in total 61 reports have been reviewed, including initial ITS reports, national five year ITS plan reports, progress reports and other reports discussing C-ITS. The main focus of the report will be on cooperative ITS related to road transport. This includes both private and public transport vehicles, but excludes all public transport systems that do not use road infrastructure. Furthermore, E-call and tolling systems are not in the scope of this report as such systems already have a clear place in the roadmap set up by the European Commission.

Methodology

The reports have been analysed using an evaluation template, which is filled in for every report that was reviewed within this study. The template consists of three sections: Firstly, the full title of the document and the area to which it applies. In addition, the strategies that the document discusses on cooperative systems and the general policy areas it contributes to. Secondly, the objectives and measures on the subject of C-ITS that are identified throughout the documents are described, as well as the issues that are brought forward in the reports. Thirdly, the template distinguishes six transition paths or routes, which are used to see the progress or stance in the different reports on the deployment of cooperative services from different perspectives.

Strategies and aims of C-ITS

Throughout the different reports from 2011 to 2014 analysed in the present study, there is a clear trend towards more interest in the actual deployment of cooperative systems. While in 2011 the focus was on research and testing, in 2014 more and more countries are drawing up national strategies that involve C-ITS, and are implementing or planning pilots and/or projects that involve the deployment of cooperative systems.

There are several front runners in this development, namely the Netherlands, Germany and Austria who strive for EU-wide deployment of cooperative systems through implementing several projects where deployment of cooperative systems is the focus, such as the C-ITS corridor Austria-Germany-The Netherlands.

In terms of policy areas, the front-runners focus on several fields such as traffic safety, traffic efficiency and sustainability. Countries that are less focused on cooperative systems see them mainly as a mean to improve traffic safety.

In the reports from 2011, strategies on cooperative ITS are limited to research, while frontrunners are planning or have implemented testing facilities. From 2012 on and especially in 2014, the strategies show a clear trend towards interest in the actual deployment of C-ITS, with more countries testing several C-ITS services and applications. The frontrunners occupy themselves with setting up roadmaps for the deployment of C-ITS, and with testing deployment by updating roadside systems to make sure they can support cooperative systems. This change is also evident in the objectives that have been identified throughout the documents.

Transition paths and C-ITS

In the next step, the progress on the topic of cooperative ITS has been analysed using the six transition paths. Again, a clear trend towards more interest in C-ITS was identified, although the transitions towards for example more individual services remained unclear. Roadside systems are changing as frontrunners are updating these systems to be able to test cooperative systems, and private parties are more and more involved in the testing, innovation and deployment of cooperative services. The scale of traffic information and management has clearly shifted towards a nationally focused approach, with more and more countries aiming to set up a framework for C-ITS and/ or a national architecture for traffic management. More openness of data is a trend that is becoming more apparent from 2014 onwards, however, this transition is not yet mature. With regards to the role of public and private parties, frontrunners are showing that a cooperation between both types of parties is necessary to successfully deploy cooperative ITS. This development is also apparent in the strategic issues that have been identified.

Strategic issues identified in the reports

Many strategic issues have been identified throughout the documents that have been analysed. A strong focus lies on organisational issues, where the topic of cooperation and coordination is the most important among all countries. Next to organisational issues, (technical) standardisation is called for by many countries, and interoperability is also seen as a major concern. Other issues include security and privacy aspects of cooperative ITS deployment, and concerns with regards to the business case and the roadmap.

In comparison with the strategic issues identified by the Amsterdam Group (AG), the issues brought forward through the ITS reports have a clear focus on organisational issues, while the issues identified by the AG are more focused on the technical aspects of deployment. This can be explained by the fact that the Amsterdam Group is a major frontrunner, and as such is more focussed on the actual deployment and the practical issues that come with this goal. In the meantime, most countries are still focused on bringing together public and private parties before they can start thinking about deployment activities.

Results of mapping the identified issues with Open Issues of the Amsterdam Group, the C-ITS Deployment Platform's Working Groups and the C-Roads Working Groups

Since the CODECS project supports both the Amsterdam Group and the C-ITS Deployment Platform of the European Commission in coming to a concerted C-ITS deployment approach, the strategic issues identified in this report have been mapped with the strategic issues of the Amsterdam Group as well as with the Working Groups (WGs) of the EU C-ITS Deployment Platform (Phase I and Phase II) and C-Roads and two specific papers (Art 29 WP and Position paper on 5.9 GHz (C-Roads, 2017)).

Based on the mapping it can be concluded that strategic issues have been identified through the review of the reports that are not (yet) covered by the Amsterdam Group. These are mainly found in the domains 'business case', 'financial risks' and 'evaluation'. The Amsterdam Group started in the early phases of the development of C-ITS. After their start, more stakeholders got involved and on a larger

scale through the C-ITS Platform and C-Roads. And due to the developments new strategic issues emerged.

Based on the mapping shown in table 1 it can be concluded that one strategic issue has been identified through the review of the country reports that is not (yet) covered by the C-ITS Platform or the C-Roads initiative. This is:

- Especially from the perspective of urban mobility, the added benefits gained from floating vehicle data will create additional challenges for the management of extensive real-time data for network management and traffic and travel information.

There are also some issues that are only partially covered. They can also be found in table 1.

Next to the issues that were identified in the review of documents, 'new' issues were identified by the Amsterdam Group, C-ITS Platform WGs and C-Roads WGs that were not brought forward in the reviewed reports. This report will not describe all new issues in detail, but will point out categories of issues that were not discussed in the reviewed reports as well as some examples of more detailed issues.

In table 1 of this document a new overall overview of strategic issues is provided. This table varies from the table presented in the previous version of this report, since in this report the table is based (among others) on the final report of the C-ITS Deployment Platform Phase II.

Finally, conclusions have been drawn and relevant developments have been outlined that will help in addressing the different strategic issues.

The present report does not in any way pretend to be an exhaustive overview of all possible strategic issues with respect to C-ITS implementation. It merely shows the current state-of-the-art as of February 2018 as identified in the reports mentioned above.

1. Introduction to CODECS

1.1. The CODECS project

The H2020 Coordination and Support Action CODECS has taken up its operation in May 2015. As the name **CO**operative ITS **DE**ployment **C**oordination **S**upport indicates, the project sustains the initial deployment of vehicle-to-x communication services in Europe. These Cooperative Intelligent Transport Systems and Services, at least those supporting traffic safety, efficiency and driving comfort with basic applications at Day One, have left the research stage. Corridor projects and pilots are today arising all over Europe and form the first example of real C-ITS deployment.

An aligned roll-out of systems and services remains challenging. To avoid fragmentation, missing interoperability of systems and lacking coherency of services, CODECS acts as a nodal point pooling the interests, preferences and requirements of all C-ITS stakeholders – also of those who might step into the deployment process at a later stage.

The COCECS project is supporting the Amsterdam Group, the C-ITS Deployment Platform of the European Commission, Standards Setting Organisations and other key deployment players in coming to a concerted C-ITS deployment approach. The overall CODECS approach is shown in figure 1.
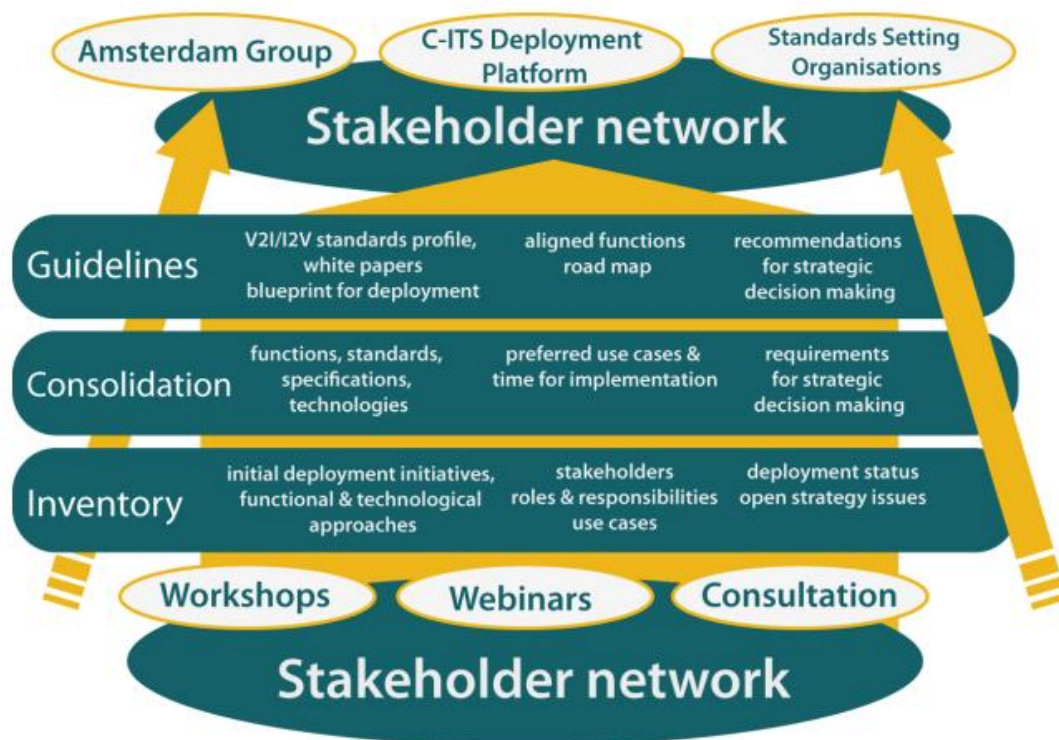
Figure 1: Overall CODECS approach
Source: CODECS

1.2. Work package structure

For conducting deployment coordination support in this manner, CODECS has set-up three fundamental work packages. For all of them, a crucial step is the interactive discussion with the stakeholder network – not only for starting the inventory on the technical as well as strategic deployment status, but also for making the consolidated results and developed guidelines available and providing them for discussion by high-level decision makers.

Work Package 2 "Coordination of initial deployment activities in Europe" focuses on consolidating implementation approaches, services, technologies, standards and specifications being applied all over Europe. To support the interoperability in the initial deployment activities and hot spots following later on, WP 2 partners develop a standards profile for V2I/I2V applications, white papers closing gaps in standardisation, and a blueprint for deployment.

Work Package 3 "Road mapping for cooperative ITS Deployment in Europe" aims at roadmapping for C-ITS deployment, giving guidance to later innovation phases with the corresponding research, testing and standardisation. The partners figure out which use cases of V2X communication are preferred by different stakeholders, and at which point in time they consider these for implementation. The result will be a consolidated use case roadmap positioning V2X services in the consecutive deployment phases.

Last but not least, Work Package 4 "Strategy Coordination Support" is dedicated to strategy coordination support. Its partners take inventory on the state-of-the art strategy, and consolidate open strategy issues for a concerted C-ITS roll-out perceived by different stakeholders – with a special focus on the requirements for strategic decision making formulated by urban transport authorities.

1.3. Strategy Coordination Support (WP4)

State-of-the-Art Strategy

Strategy coordination support started with an inventory on the state-of-the-art strategy for C-ITS deployment in Europe. It aims at declaring already existing (best practice) strategies for C-ITS deployment and discussing them in the stakeholder network for stimulating a common strategic framework. Relevant strategy documents related to the deployment of C-ITS, with a international, national and also regional focus, are analysed with respect to the state-of-the-art as well as strategy issues needing special attention.

The results of the analysis, fixed in the present report, form the basis for the second core activity of the Strategy Coordination Support work package: identifying open strategy issues for deployment and reaching consensus on strategy bottlenecks.

Open strategy issues for deployment

For characterising open strategy issues, for identifying differences in stakeholder views, and for stimulating sufficient consensus building, CODECS brings stakeholders together in a series of workshops as well as bi-lateral and round-table discussions on strategy aspects. In this way and in terms of inventory and consolidation, conflicts between stakeholder views can be made explicit, and trade-offs between potential measures can be assessed. This may concern views of stakeholders on e.g. privacy, security, spectrum regulation and economic, business, strategy, social, ecological and legal deployment aspects. Out of the results of the inventory and consolidation, CODECS will develop and propose options for overcoming shortcomings and bottlenecks in strategic decision making.

Corridor projects and pilots

During the total runtime of CODECS, the practice from corridor projects and pilots will be taken into account for the development of strategic options, e. g. very generally, measures undertaken by the projects to ensure amongst others interoperability, privacy, security, urban mobility, hybrid communication, business models and harmonisation efforts. Meetings with key persons from the corridor-projects and pilots, but also with other important stakeholders and experts will be organised to discuss the background for these decisions taken on strategy aspects. Recommendations will be drafted and reported on the CODECS website.

Cities requirements

Within CODECS' strategy coordination support on the vertical level, cities get a special place: Even though C-ITS unfold wide potential for traffic management in cities, most pilots until now focus on providing cooperative services on rural roads and motorways. To get a better insight into necessary general strategies to stimulate development of cooperative services in cities, CODECS invites urban and regional authorities to a series of city meetings. The stated needs for strategic decision making from the perspective of cities will flow into the recommendations for overcoming strategic bottlenecks.

1.4. The present report

The present report contains the results and findings of the state-of-the-art inventory, which is the first core activity of the CODECS Work Package 4 with respect to strategy coordination support. In terms of monitoring the deployment landscape and activities of main deployment actors, the report is regularly supplemented. In the present version, first, a short description is given about C-ITS. Then, in chapter 3 the methodology of the inventory is described. In chapter 4, the analysed reports are summarised with respect to their objectives, policies and measures. Chapter 5 and 6 describe the results of the analysis with respect to transition paths (chapter 5) and the strategic issues deducted from the reviewed documents (chapter 6). In chapter 7 the Amsterdam Group, the EU C-ITS Deployment Platform and C-Roads are presented.

Chapter 8 maps the findings of the review with the open issues of the Amsterdam Group, the Working Groups of the EU C-ITS Deployment Platform (Phase I and II) and the C-Roads initiative. The result is an inventory of strategic issues.

In chapter 9, an overview is given that shows which strategic issues are covered by which platform (AG, C-ITS Platform, C-Roads). In this table, each strategic issue is linked to the relevant WG's/taskforces/paper from the platforms mentioned above. Chapter 10 shows the list of reports reviewed as references.

2. Cooperative Intelligent Transport Systems (C-ITS)

Intelligent Transport Systems

Intelligent Transport Systems (ITS) are used to add information and communications technologies to transport infrastructure and vehicles which can result in major improvements in safety, network management, information provision, environmental management, integration, accessibility and public perception (ATKINS, 2015).

ITS are vital to increase safety and to tackle Europe's growing emission and congestion problems. They can make transport safer, more efficient and more sustainable by applying various information and communication technologies to all modes of passenger and freight transport. However, in order to be effective, the roll-out of ITS needs to be coherent and properly coordinated across the EU (European Commission, 2015).

In the oncoming years, the digitalisation of transport in general and ITS in particular are expected to take a leap forwards. The European Commission works to set the ground for the next generation of ITS solutions, through the deployment of Cooperative ITS, thereby also paving the way for automation in the transport sector.

Cooperative ITS

The implementation of Cooperative ITS (C-ITS) will provide communication and sharing of real-time information between road users such as vehicles, motorbikes, moppets, bikes, pedestrians and the road information infrastructure, which is called X2X communication. C-ITS enables the exchange of information to support road safety, traffic efficiency and sustainable travel beyond the scope of standalone systems. The implementation of C-ITS will bring overall increased and detailed awareness of the surrounding for all actors in the road traffic environment and by that supports innovative services to be brought to the road users. It will support road authorities and road operators in their roles as traffic managers and network operators. It will also change the behaviour of road users as well as influence the road authorities' and the road operators' investments in cooperative systems (Amsterdam Group, 2013).

C-ITS brings intelligence to road users, roadside systems, and operators, by creating a universally understood communication "language" allowing road users and infrastructure to share information and cooperate in an unlimited range of new applications and services.

Cooperative means that data is shared among all users in the area of relevance and sent from roadside stations to the road user, from the road user to roadside stations (V2I/I2V) and between road users (V2V) by all communication means. In a cooperative system, each of the participating road users or infrastructure systems evaluate the received shared information to identify specific actions that need to be taken based on their own situation. These could be related to the road user itself but also to notify others to take action. In addition, these specific actions could be actions that need to be executed by the driver or they could be automated. All in all, in the "cooperative" situation coordination takes place both between vehicles and between vehicles and the roadside infrastructure.

The scope of this document

The focus of this document will not lie on all C-ITS aspects. The main focus of the document will be on C-ITS related to road transport. This includes both private and public transportation vehicles, but excludes all public transport systems which do not use road infrastructure. Furthermore, E-call and tolling systems are not in the scope of this document as such systems already have a clear place in the roadmap set up by the European Commission.

3. Methodology

Starting point for this research on strategic issues for C-ITS deployment are the country reports submitted to the EC within the framework of the ITS Directive 2010-40. Following this directive countries are requested to submit reports on the status and plans with respect to ITS.

In this inventory in total 61 reports[1] have been reviewed, i.e.

- 8 ITS country reports from 2011 (Initial ITS report)
- 21 ITS country reports from 2012 (National 5 year ITS plan)
- 22 ITS country reports from 2014 (Progress report)
- 10 other reports about C-ITS.

A full list of these reports can be found in chapter 10: References.

These reports have been analysed using an evaluation template, which is filled in for every report that was reviewed within this study.

The template consists of three sections:

- Firstly, the full title of the document and the area to which it applies. In addition, the strategies that the document discusses on cooperative systems and the general policy areas it contributes to.

- Secondly, the objectives and measures that are identified throughout the documents on the subject of C-ITS are described, as well as the issues that are brought forward in the reports. These issues are categorised as follows:
    - Technical (system specification, profiling, radio spectrum/frequency, conformity assessment, hybrid communication concept, back-end services)
    - Functional
    - Organisational
    - Legal
    - Security
    - Privacy
    - Business case
    - Financial risks
    - Evaluation
    - Roadmap (deployment Day One, Roadmap beyond Day One, Use cases)

- Thirdly, the template distinguishes six transition paths or routes, which determine the direction to be taken when aiming for C-ITS deployment. These transition paths, which originate from the Dutch report 'Better Informed on the Road', are used to see the progress or stance in the different reports on the deployment of cooperative services from different perspectives:
    1. From collective influence to a smart mix of collective and individual services
    2. The changing role of roadside systems
    3. From local/regional to national coverage for road traffic/travel information and traffic management

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[1] Some reports that were written in foreign (non-English) language have been translated using Google Translate, and thus the analysis might not have a depth of English language reports.

4. From business to government (B2G) to business to consumer (B2C) and business to business (B2B)
5. From ownership of data to maximum openness and availability of data (public *and* private)
6. From government supervision to public-private collaboration and alliances.

Based on the 61 templates thus completed, an analysis has been carried out identifying the relevant aspects in relation to the transition paths as well as the strategic issues that could be identified for C-ITS[2], either directly or from the transition paths.

Since the CODECS project supports both the Amsterdam Group and the C-ITS Deployment Platform of the European Commission in coming to a concerted C-ITS deployment approach, the strategic issues identified in this report have been mapped with the strategic issues of the Amsterdam Group as well as with the Working Groups (WGs) of the EU C-ITS Deployment Platform and C-Roads and two papers (Art 29 WP and Position paper on 5.9 GHz (C-Roads, 2017)). Initially this was done on the basis of the C-ITS Deployment Platform Phase I final report and Phase II interim report. This was reported in the previous version of this report. In the current version of this report the previous report is updated based on the final report of the C-ITS Deployment Platform Phase II. Mapping means comparing the identified strategic issues and determining whether the strategic issues identified, in the CODECS study, are answered or discussed in the Amsterdam Group Report, the C-ITS Platform reports (Phase I or II) or within C-Roads.

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[2] It should be noted that the focus of this report is on C-ITS. However, in some cases also strategic issues have been included that were mentioned in relation to ITS in general, but that were considered as relevant also for C-ITS.

4. Summary of the analysed reports

4.1. ITS reports from 2011

Reports reviewed

In total eight ITS country reports from 2011 have been reviewed (AT, DE, FR, IT, NL, NO, SE and UK) as well as two of the other documents, which to a certain degree discuss cooperative systems from a strategic perspective:

- Policy framework for utilisation – A pillar of better accessibility (Netherlands, 2008) [9]
- POLIS position paper – Cooperative systems in urban mobility (2010) [10]

Strategies 2011

The strategies on C-ITS among the different ITS country reports from 2011 are similar. Seven out of eight countries agree that cooperative systems will be very important in the future and are therefore exploring these systems through research or pilot testing. Deployment of such systems is something that lies in the future for most countries, although The Netherlands is already discussing how to upgrade their roadside equipment for the upgrade path towards cooperative systems to be opened.

Policy areas 2011

In terms of the policy areas to which the C-ITS strategies contribute, there is a consensus that the most important policy area is road safety. For countries that are more advanced in the field of cooperate ITS, road efficiency is also of importance.

One notable example of C-ITS and road safety is the aim of many countries to deploy Advanced Driver Assistance Systems (ADAS). An example of C-ITS and road efficiency would be Cooperative Adaptive Cruise Control (CACC), which is one application that has been brought forward in the Netherlands through SPITS (Strategic Platform for Intelligent Traffic Systems), which will be discussed later.

Objectives and measures 2011

There are several objectives mentioned across the different reports from 2011 regarding C-ITS and related concepts. One of these is the integration of different ITS in an open in-vehicle platform. This is regarded as a basis for future deployment of cooperative systems and is therefore something all countries aim for. Questions remain on how this platform should be set up, and which standards should be put in place.

Another important objective is the researching and testing of cooperative systems. Several countries have put in place a testing facility or are part of a research group that is working on cooperative systems. One such research group is Easyway, which is a platform for harmonisation and cooperation with neighbouring networks. All the road operators in Easyway, both public and private, are working together to collectively try to develop and deploy cooperative systems.

The Netherlands has set up their own platform, called SPITS (Strategic Platform for Intelligent Traffic Systems), which focuses on three areas: traffic management, in-vehicle solutions as well as service download and management solutions. SPITS has defined an open, affordable, and scalable in-car platform for future systems, and explores new techniques in cooperative driving and mobility. One application that has been brought forward through SPITS is the Cooperative Adaptive Cruise Control (CACC).

Austria also contributes to research on cooperative systems. They are for example involved in the European COOPERS project and several tests with cooperative systems. One of their programmes is called 'Austrian Advanced Automotive Technology', which is designed for cooperative research projects between industrial, university and non-university research. It aims at the development of innovative approaches and real technological leaps in the Austrian automotive industry.

Germany contributes to this line of developments through tests done in the largest field test of vehicle-to-vehicle or vehicle-to-infrastructure communications in the world, called 'sim^{TD}'. In addition, German companies and institutions are important partners in EU projects on cooperative systems, EU-wide field trails, the CAR 2 CAR Communication Consortium and the relevant standardisation initiatives of ETSI TC ITS, CEN278, ISO204, ISO22 and SAE.

The French project called SCORE@F aims for deployment of road cooperative systems in Europe. Although the primary focus lies on improving road safety, solutions that will be proposed will enable a multi-service approach to ensure the profitability of the system. The main objectives of the project are:

- To prepare the deployment of road cooperative systems for the purpose of improving road safety

- To develop and validate a profitable business model for all partners in the value chain

- To develop and validate business processes required to deploy cooperative road systems and generally, their life cycles

- To coordinate French experiments on road cooperative systems and communicate their results to the French and European level.

Norway has implemented a test site for ITS in Trondheim, where they test for example communication platforms, cooperative systems and cooperative driving.

Less practical objectives include a joint feasibility study between Swedish authorities, automotive industry, telecom industry and other involved parties with regards to cooperative systems. The United Kingdom focuses on monitoring developments in cooperative technologies and explores how these might be facilitated on the strategic road network.

One measure that should also be mentioned is the increasing use of floating car data by several countries and service providers such as TomTom. Floating car data of today is mainly used to improve the traffic flow and by that the predictability of the travel time to increase user comfort and reduce CO_2 emissions. When shared via mid/short range communication, floating car data can also be used for more demanding safety related C-ITS applications.

4.2. ITS reports from 2012

Reports reviewed

In total 19 ITS country reports from 2012 have been reviewed (i.e. BE, CY, CZ, DE, DK, ES, GR, HU, IE, IT, LT, MT, NL, NO, PL, PT, SE, SI and UK) as well as four of the other documents which discuss cooperative systems from a strategic perspective to a certain degree:

- POLIS - European cities' perspective on cooperative junctions [38]

- Amsterdam Group – Roadmap between automotive industry and infrastructure organisations on initial deployment of Cooperative ITS in Europe (2013) [36]

- Better informed on the road – Roadmap 2013-2023 [37]

- Austroads Ltd. - Cooperative ITS Strategic Plan (2012) [63]

Strategies 2012

The strategies on C-ITS described in the reports from 2012 are not that different compared to the reports from 2011. Testing and researching cooperative systems is still the main focus, although more attention is now placed on preparing for actual deployment of such systems.

Cooperative systems are now also brought forward to improve public transport efficiency through giving priority to public transport vehicles for example in the Czech Republic.

In general, according to a survey done by POLIS on cooperative junctions, it seems to be important to the cities to save expensive infrastructure in future (in particular induction loops) and to get better quality of data to assess the traffic situation, which is the basis for a high quality prediction of signal phase and timing on adaptive controlled junctions.

Policy areas 2012

The main policy areas are still road safety and road efficiency; however sustainability is also mentioned more often as a policy area. A practical example of road safety is the aim to implement nomadic devices which support driving. A document drawn up by the Amsterdam Group states that C-ITS enable the exchange of information to support road safety, traffic efficiency and sustainable travel beyond the scope of stand-alone systems. This shows that a broader view of C-ITS is being adopted.

Objectives and measures 2012

With regards to preparing for deployment of cooperative systems in the future, the following main objectives can be identified, with several measures to achieve these objectives:

- Establishing methods for preparing ITS technology infrastructure for the future use of cooperative systems:
    - Set up an open in-vehicle platform architecture including standard interfaces for the provision of ITS services.
    - The implementation of testing and checking procedures that are laboratory-based and also set up in the field under actual conditions.
- Drawing up national ITS strategies in order to facilitate the coordination of ITS deployment.
- Promotion of the deployment of vehicle-to-vehicle and vehicle-to-infrastructure data exchange systems. For example: Organization of campaigns and educational training actions to raise awareness of new information and communication technologies in transport.
- Harmonisation of European (C-)ITS services, e.g. definition of EC mandate M/453 for the European standardisation organisations to develop harmonised standards for C-ITS implementation, in particular regarding cooperative systems.

Next to these objectives, the reports show a shift towards the more technical aspects of the actual implementation of cooperative services. Such measures include:

- The identification of ICT solutions that enable real-time vehicle-to-vehicle and vehicle-to-infrastructure communication (roadside and central).
- The implementation of technical specifications applicable to operate the telematics link between vehicles and infrastructure.
- The implementation of technical specifications relating to standard and interoperable message formats.
- Drawing up access procedures for the exchange of V2V and V2I data and information.
- The integration of V2I systems with on-board equipment, preventive safety systems and black boxes.
- Improving the security of V2V and V2I/I2V communications.

Various countries have established test sites for C-ITS. The Dutch Integrated Test Site for Cooperative Mobility (DITCM) is a good example to gain more insight into the process towards implementation of C-ITS. DITCM is regarded as the leading Dutch testing ground for the development and testing of intelligent mobility services and systems.

4.3. ITS report from 2014

Reports reviewed

In total 20 ITS country reports from 2014 have been reviewed (i.e. AT, BG, CZ, DE, DK, FR, GR, HR, HU, IE, IT, LV, NL, PO, PT, SE, SL, SP and UK) as well as three of the other documents which to a certain extent discuss cooperative systems from a strategic perspective:

- USDOT's Intelligent Transportation Systems (ITS), ITS Strategic Plan 2015-2019 [62]
- ERTRAC - Automated Driving Roadmap [61](2015) [61]
- Amsterdam Group – Deployment is underway! (2015) [60]

Strategies 2014

From 2012 to 2014, the strategies concerning C-ITS have not changed much. Continuous developments are being made in research and testing facilities, although attention is shifting more and more towards feasibility of the introduction of such systems on an EU-wide scale. For example, Austria, which is responsible for a lot of research on cooperative systems, focuses on the importance of well-equipped infrastructure as a basis for C-ITS, and they have also put a lot of energy into the evaluation of the benefits of C-ITS for all concerned. Germany is investigating the feasibility of a national supported introduction of cooperative systems and wants to lay the foundations for an introduction decision. The Netherlands states that the knowledge and experience that has been jointly gained in this area by the business sector and the government can be used to upscale trials both in the Netherlands and in other European countries.

Policy areas 2014

The focus of most countries still lies on road safety improvement through driving aid systems and vehicle-to-infrastructure and vehicle-to-vehicle cooperative systems. Other policy areas are road efficiency and sustainability. An interesting example that combines several of these policy areas would be that individual priority and speed advice can be given to truck drivers, therefore saving fuel consumption, reducing emissions and heavy vehicle presence in urban areas. This is brought forward by Greece.

Objectives and measures 2014

The ITS reports from 2014 focus far less on strategies, objectives and issues and more on what progress has been made on projects. Unfortunately, not many C-ITS projects are discussed in these reports. Because of this the objectives and measures are very comparable to the objectives and measures found in the 2012 reports.

Objectives and/or measures concerning the future introduction of cooperative systems include:

- Development of reference architecture for cooperative and connected mobility
- Creating a common framework for ITS planning & design
- Providing guidance for the development of ITS solutions
- To designate a national interoperable ITS structure
- To yield applications that ensure interoperability & seamlessness
- To establish open interfaces to support the exchange of information
- Determining which technological innovations are best suited to deploy with regards to cooperative systems
- The integration of driver assistance systems into vehicles and road infrastructure
- Integration of different ITS in an open-in vehicle platform

- Open in-vehicle platform architecture including standard interfaces for the provision of ITS services

Technical objectives and/or measures mentioned in the reports include:

- Availability of 5.8 and 5.9 GHz for traffic and mobility purposes, with no interference.
- Specifications for communication between road users and between road users and roadside infrastructure (I2I, V2V, V2I) for ITS services
- Development of flexible open in-car platform (Cooperative Mobility Device) using smartphone and tablet technology.
- Ensure compatibility of the existing systems with the new, emerging ones.

France is coordinating a pilot deployment project of cooperative intelligent transport systems, which was launched in February 2014. This project, SCOOP@F, will perform tests in 2016 on a large scale and in various configurations (highways, rural roads and urban streets). This is the prelude to the spread of these innovations. The project plans to equip more than 3,000 vehicles and 2,000 km of roads and streets.

In line with this project, the French actors are involved in the European COMPASS4D project which pre-deploys cooperative systems on seven local pilot sites. This project started in January 2013 and should be completed in late 2015, with the testing phase taking place from July 2014 to June 2015. This project enables testing services beneficial to traffic participants, such as alert sites, embedded speed signalling, on-board signalling of hazardous events such as the end of traffic jams, accidents and contraflow driving and the location and availability of interchange points allowing car drivers to take public transport.

Other deployment activities that are planned or in preparation, according to the Amsterdam Group, include the following:

- C-ITS corridor Austria-Germany-The Netherlands
- French corridor pilot project Paris-Strasbourg
- Corridor project in Sweden
- Corridor project in Portugal
- City projects in accordance with the EC supported COMPASS4D project
- City projects under consideration within the POLIS organisation.

5. Transition paths

This section summarises to what extent the reports of 2011, 2012 and 2014 give an insight into the foreseen transition paths (see section 3) with respect to:

- From collective influence to a smart mix of collective and individual services

- The changing role of roadside systems

- From local/regional to national coverage for road traffic/travel information and traffic management

- From business to government (B2G) to business to consumer (B2C) and business to business (B2B)

- From ownership of data to maximum openness and availability of data (public *and* private)

- From government supervision to public-private collaboration and alliances.

Before discussing the information on transition paths gathered throughout the reports from 2011, 2012 and 2014, for each path CODECS will explain the expected transition route (from collective, to individual services for example) and what such a transition might entail in a box. This is based on a document called 'Better informed on the road' [37], which discusses the roadmap of 2013 to 2023 for cooperative systems according to the Netherlands.

From collective influence to a smart mix of collective and individual services

Explanation:

- The huge growth in private information services (smartphones/apps, navigation systems, use of the PC at home) means that the collective influence (by means of DRIPs, matrix signs) has less influence and is therefore less necessary.

- The development perspective is a consistent mix of collective and individual information services.

- This signifies a change in the distribution of roles and tasks between the market and public authorities.

- This mix will look differently on the urban road network than on the motorways and will continue to change.

The reviewed reports show a clear trend from collective influence to a smart mix of collective and individual services. These services are mostly focused on improving road safety; the possibilities offered by global satellite navigation systems are used to pinpoint accidents and to warn drivers approaching them.

Individual services that do not specifically aim to improve road safety are Cooperative Adaptive Cruise Control (C-ACC) and Dynamic Speed Limits.

The changing role of roadside systems

Explanation

- The above change is expected to lead to fewer stand-alone systems on the roadside. After all, some of the functionality of the roadside systems will overlap with that of systems in vehicles and hand-helds.

- Cooperative systems also make it possible to introduce new functionalities such as shock wave attenuation and platooning. This type of functionality requires a reliable supervision function from the roadside. In addition, a change will come about in the way traditional functions are introduced. For example, the function of loops in the road surface for the collection of traffic data and automatic incident detection may be taken over in the long term by direct communication between vehicles and the infrastructure.

- The emergence of cooperative systems will make roadside systems for the traditional functions simpler, more maintenance-friendly and less expensive.

There are several projects and experiments with in-vehicle systems (including C-ITS and in-vehicle sensor systems) that could make roadside systems lose their purpose in the future. For example, the Italian `Infonebbia Project´, which focuses on driving safely in case of poor visibility, would make certain roadside signs redundant, as the car itself will warn the driver and give appropriate information on visibility.

Another example is to bring a dynamic speed limit into the vehicle, thus showing the recommended speed and/or maximum speed limit for that specific vehicle. This could reduce the need for some traditional visual roadside systems, as the speed limit eventually will be shown for everyone in the car.

The introduction of the provisioning by road users of information about their state (e.g. road user type, time, location, direction, speed and active state (e.g. emergency, public transport)) can be immediately used by the road infrastructure to identify states of the overall traffic situation to manage the traffic instantly and locally.

The introduction of complementary signs on the status of the road infrastructure that can be immediately used by drivers by means of visual signals or I2V and V2V information exchange is also being promoted. Cooperative Advanced Driver Assistance Systems (ADAS) are one of these ITS solutions.

Since 2012, the focus in the reports has shifted towards trialling several cooperative roadside systems. For these systems to be functioning properly, there is a need for open communication standards.

The reports show that in the coming years a shift in focus is foreseen from trialling systems to actually equipping many roadside systems with C-ITS functionalities so they can facilitate cooperative tests, and support the realisation of cooperative services that will be implemented in the future.

When existing roadside systems need to be replaced, it should be anticipated that cooperative systems could be needed in the future. Therefore, the roadside systems should be able to support such systems. Even though developments are not yet sufficiently advanced to allow C-ITS modules to be incorporated when replacing roadside systems, the Dutch government for example is actively adapting the roadside systems' architecture so that it will be able to communicate with vehicles in the (near) future.

With regards to urban mobility, local authorities play an important role in C-ITS deployment by extending existing traffic-light systems with C-ITS functionalities by paying the associated costs of installation, operation and maintenance.

From local/regional to national coverage for road traffic/travel information and traffic management

Explanation
- The road user travels from door to door and in doing so experiences the road network as one cohesive whole.   - He/she will not notice that different road operators are responsible for different parts of the road network.   - Increasingly, traffic management will be configured/designed regionally and, where necessary, nationally. Different road operators will jointly implement network-wide regulation strategies.   - Given this development, it is important to explore the consequences, opportunities and possibilities that the enhanced collaboration of road operators and private parties offer for the use and organisation of traffic control centres, for example.

Although many country reports mention the need for a national interoperable ITS structure, it remains unclear what this will entail. Austria and The Netherlands seem most advanced in this field, as they have included several cooperative aspects into their traffic management architectures. The Netherlands for example has included a 'Cooperative Traffic Controller' (CTC) which intervenes, 'Intelligent Cooperative Intersection Safety' (CIS) which warns, a 'Cooperative Traveller Assistant' (CTA) which advices and 'Cooperative ACC' which instructs, into their reference architecture traffic management (which is a roadmap that has been developed in the Netherlands).

From business to government (B2G) to business to consumer (B2C) and business to business (B2B)

Explanation
- Public authorities are aiming for more cost-effective traffic management.   - Due to the changing perspective for private earning models for road traffic/travel information services, there will be less need for these services to be structurally funded by public authorities.   - This change requires an understanding of how market parties can create balanced earning models and the requisite pre-conditions. It will also require market parties to focus their services (for example, parking navigation in the cities) particularly on (road) users (consumers) and the business sector (business).   - This also requires a trustworthy long-term perspective on which the parties concerned can base their own investment strategies.

In countries where the developments on cooperative systems are profound, the reports show that the private sector is of great importance. Private parties are involved in every step of the process when it comes to ITS innovations and implementations.

For example, EsriUK, Citi Logik, Vodafone, TomTom and Transport for London worked together to prepare and operate a service for the Co-Operative System Trial. The explicit aim was to explore co-operative methodologies to reduce infrastructure costs, improve data granularity and increase data availability; and to put the traveller at the centre of the journey. Private parties are clearly an important factor in the development of cooperative systems.

From ownership of data to maximum openness and availability of data

Explanation

- Openness and availability of data is an important enabler for innovations in road traffic/travel information and traffic management.

- On a European level, open data is now mandatory for public authorities and, in principle, public authorities must make all of their data about road traffic/travel information and traffic management openly available.

- This change requires all the parties involved in road traffic/travel information and traffic management to have access to as much data as possible and requires all owners to make as much of their data as possible available to others, preferably openly but if necessary under certain conditions and on payment of a fee.

In 2011 and 2012, with regards to data availability, the main focus lies on using floating car data. This is used to fill the data gaps, with regards to data that is used for traffic management, in a cost effective way, particularly in the underlying road networks. Floating car data is also considered as a potential source for the detection of abnormalities in the road network.

From 2014 onwards there is a clear trend from ownership of data to maximum openness and availability of data. The initiative comes from both government organisations and market parties. Government organisations create frameworks by making data available and accessible, while the market parties are deciding how to use the data.

In the future a large quantity of data is continuously pushed by service providers towards their clients who want to have certainty of delivery for a fee based on the full cost price. This is expected to result in the creation of more innovative services and the social benefits will increase. The chances of this happening will be greater if other European countries also make their public data available in a similar way so that European services can be developed.

From government supervision to public-private collaboration and alliances.

Explanation

- The interaction between public authorities (city, provincial, federal) and private service providers (navigation companies, the automotive industry, geo-business, the transport industry, and the developers of services and applications) and the end users is changing, as are the underlying earning models.

- Mutual dependency means that no single party can dominate and exercise overall control. Structural consultation platforms are necessary in which agreements can be made, for example, about standardisation and data availability and quality.

In the 2011 reports Open In-Vehicle Platforms are sometimes kept as a matter for the ITS industry, and sometimes seen as a matter for both public and private parties. Cooperation between public and private parties is more common among countries with more advanced strategies on C-ITS. In fact, many countries that are advancing in the field of cooperative systems value the input of private parties; however there is a need for coordination. The Easyway programme provides an environment for assessing and determining the roles and responsibilities of road operators in connection with private sector stakeholders, with regards to the evolution of cooperative systems.

With regards to coordination, it has been noted that the deployment perspective of cities is very important for the governmental bodies. However, this perspective and subsequent priorities are still deviating somehow from that of vehicle manufacturers. One challenge therefore is to bridge this gap.

The 2014 reports show that there is a trend from government control to public-private cooperation and alliances. Good public-private cooperation in the deployment of cooperative systems for example will ensure that the desired systems become available in vehicles and can be used in the desired manner. Next to the coordination of public and private stakeholders at the national level, there is cooperation with neighbouring countries with respect to information exchange and seamless and interoperable cross-border services.

With regards to safety related traffic information, it is questioned whether the public bodies should take responsibility for the availability and/or dissemination of safety-related information and what role the private sector can be expected to play.

5.1. Reflection on transition paths from the C-ITS Platform report

In January 2016, the first report of the C-ITS platform phase I [67] was released. In this chapter a reflection is written with respect to the six transition paths that have been identified and that report. It can be used to see the progress or stance on the deployment of cooperative services from different perspectives:

1. From collective influence to a smart mix of collective and individual services
2. The changing role of roadside systems
3. From local/regional to national coverage for road traffic/travel information and traffic management
4. From business to government (B2G) to business to consumer (B2C) and business to business (B2B)
5. From ownership of data to maximum openness and availability of data (public *and* private)
6. From government supervision to public-private collaboration and alliances.

The C-ITS Platform report discusses the access to in-vehicle data in much detail in WG 6 – Technical Issues – Access to in-vehicle data and resources. Through the topics discussed in this WG, the C-ITS Platform report indicates that the C-ITS deployment is aimed towards maximum openness and availability of both public and private data. Although this is not addressed specifically, the WG has set up four Tasks forces in order to develop the following items:

- On-board application platform
- In-vehicle interface
- Data server platform
- Definition of a reference dataset

Again these are technical topics, but there is a number of related issues aiming for openness and availability of data. An example is given with regards to the eCall in-vehicle systems, for which they want to ensure open choice for customers and fair competition, as well as encourage innovation and boost the competitiveness of the Union's information technology industry on the global market. The general objective here is to identify the issues at stake and reach when possible a shared vision and common solutions on fair access to in-vehicle data and resources. This topic is also discussed from a legal standpoint (WG 3) and with regards to data protection (WG 4). Thus it can be concluded that the fifth transition path is covered to a certain extent.

In addition, as stated in the paragraph above, the C-ITS Platform aims at ensuring open choice for customers and fair competition. This also relates to the first transition path 'From collective influence to a smart mix of collective and individual services'. WG 6 states that: "Independently of the model/solution retained to give access to in-vehicle data and resources, the main objective should be to allow customers the freedom to choose which service they desire, meeting their specific needs, in order to ensure open choice for customers. This goes through an open and undistorted competition for the provision of these services." It is clear that the C-ITS Platform agrees with the focus of this transi-

tion path and aims at providing open and undistorted competition for the provision of a mix of different types of services. However, it should be noted that the C-ITS Platform does not explicitly mention the diminishing role of collective services.

With regards to the fourth transition path, the B2B marketplace is proposed with regards to the setup of the data platform. This would be the central platform for all C-ITS stakeholders. No further information on the topic of B2C and B2B is provided in the C-ITS Platform report.

The focus of C-ITS deployment with regards to the second and third transition path also remains unclear. Although it can be assumed that the role of roadside systems will change and become less important, the report does not discuss how this change will occur and what implications this will have. The change from local/regional to national traffic management is also not addressed specifically.

Lastly, there is a clear change from government supervision towards public-private collaboration and alliances, as discussed in transition path six. The C-ITS Platform report states that deployment requires the involvement of stakeholders from different industries and public-sector actors. Throughout the report collaboration between both public and private actors is proposed, which seems to be a key aspect to successful C-ITS deployment.

WG 9 of the C-ITS Platform discusses a series of implementation issues addressing the situation in which equipped and non-equipped vehicles will share the same roads. As the report states: "The deployment of such systems will be gradual, which means that cars with very different levels of equipment will inevitably circulate at the same time. This situation is likely to be prolonged for a very long time." Implementation of C-ITS systems should be able to cope with this situation without increasing safety risks. At the same time road operators will have to invest in C-ITS, while the legacy systems have to be kept operational. Also, the concrete benefits are difficult to calculate in hard figures, especially during this transition phase. WG 9 provides some recommendations but compared to the attention paid in the C-ITS Platform report on technical issues, more research on the transition path from traditional ITS to C-ITS equipped vehicles and infrastructure should help to get a better understanding of the deployment phase and will help to identify possible strategies for a smooth transition.

6. Strategic issues from the review of reports

This chapter presents the strategic issues regarding C-ITS that have been identified throughout the reports from 2011, 2012 and 2014, and from the nine other reports analysed in chapter 5. Afterwards, the strategic issues as identified by the Amsterdam Group in the document called 'Deployment is underway!' [60] will be discussed, as this document specifically focuses on deployment of C-ITS, based on knowledge gained until the year of 2015.

Technical

1. Communication technologies need to be tested and services have to be continuously improved.

2. Challenges of reliable operation of cooperative systems and services in ITS networks using heterogeneous access technologies need to be addressed.

3. Developments in advanced wireless systems with more flexible bandwidth and/or direct reciprocal communication ('mesh') are continuing. It is conceivable that these developments will result in new business cases. Therefore, it is desirable for these developments to be monitored actively.

4. Especially from the perspective of urban mobility, the added benefits gained from floating vehicle data will create additional challenges for the management of extensive real-time data for network management and traffic and travel information.

5. Austroads [63], the association of Australasian road transport and traffic agencies, has identified the strategic issues of 'digital mapping and positioning': Different types of C-ITS applications require different levels of accuracy from positioning technologies and on-board digital maps. It is probable that current GPS alone could not deliver the degree of accuracy required for more stringent cooperative systems. However, if used in conjunction with other data sources and methods, sufficient accuracy could be attained. Irrespective of accuracy, it may not be prudent to rely solely on one approach. Road agencies, including local government, will be responsible for maintaining the currency of certain data for digital maps, as well as managing the provision of that data to third party providers and/or end users. This may involve a significant cultural change for many of the agencies involved.

Functional

1. Interoperability of services and/or applications is necessary for EU-wide deployment and therefore this aspect should be included in a common strategic framework for deployment. Similar observations are brought forward by the Austroads report [63].

2. European standardisation is necessary for large-scale deployment of cooperative systems, for example when wanting to transmit traffic information fast and comprehensively to vehicles. Services must be designed, tested and deployed alongside technological standards, specifications and open interfaces at the trans-European level.

3. It is important to avoid fragmentation and to give the necessary attention to the compatibility, standardisation and integration of different subsystems into one system.

4. From the perspective of urban mobility, legacy and integration issues will arise. It is unclear how C-ITS can be integrated with legacy systems and investments that have already been made. How can this transition be done smoothly? What are the implications from a technical and financial perspective?

5. One problem many cities perceive with cooperative systems until now is that most suggested applications concentrate on the private car, but without enough consideration for public transport and non-motorised modes.

6. Austroads [63] has also identified a potential conflict between public and private objectives. There is a risk that advice provided by real-time commercial applications may conflict with the objectives of broader network management. This includes day-to-day management, such as the need to modify traffic flows around incidents and events. Such conflict would undermine the potential policy benefits of cooperative systems. The need for certification of commercial applications to ensure, among other things, that they do not run counter to public objectives but uphold good practice, should be considered when developing the regulatory and governance arrangements for C-ITS. It is also important that any regulatory framework does not stifle innovation. This issue highlights the importance of a collaborative approach between governments and industry, so that market developments contribute to key government objectives, and that government policy is informed by an awareness of market developments.

Organisational

1. Coordinated deployment of ITS in the EU calls for intensive and effective cooperation between all parties involved at European level:

    a. Between private and public actors

    b. Between automotive companies

    c. Between neighbouring countries

    d. Between national authorities and cities and regional authorities, including rural areas.

2. A long-term structural commitment is vital for the serious development of services that can make an effective contribution to European and local policy goals (by market players and/or public authorities). Engagement, influence and possible guidance from the European Commission are invaluable in this regard.

3. A common strategic framework for deployment is lacking. An open architecture and common European standards are needed, which should not limit the choice or development with regards to open in-vehicle platforms. This framework should take into account the various requirements of ITS services and systems, Member States, large and small companies, as well as differences between urban environments and main roads.

4. The feasibility of C-ITS can be regarded as proven, yet there are sometimes diverging views on the rights and obligations of stakeholders. One of the next important tasks is therefore a definition of roles, competencies and responsibilities along the entire service chain, because cooperative systems are still a strong technology-driven research topic, neglecting the socio-economic impacts.

Specifically from the perspective of urban mobility:

1. Deployment may be hindered if urban and regional authorities are not more actively engaged in the process.

2. Local authorities need clear standards for cooperative systems to ensure that any investment taken is future-proof. European and international standards are being developed, but still have some way to go before industry-wide standards are in place.

3. One of the challenges seen with deploying cooperative systems is that of multi-stakeholder cooperation, even with conflicting aims and objectives with regards to deployment. Local authorities need to be assured that other stakeholders contribute their share in deployment if they are expected to invest in cooperative infrastructure.

Legal

1. The use of ITS applications creates additional requirements in terms of liability. These issues can be a major barrier to wide market penetration of some ITS services if citizens' rights are not fully protected.

2. Local authorities need a clear picture of how cooperative systems will affect their liability structure.

Security

1. Concerning freight shipments there are commercial and security considerations with regards to open in-vehicle platforms. These need to be identified and dealt with.

2. Regarding the new driving aids that can lead to autonomous vehicles, in places where experiments take place, all precautions should be taken so that there is no decrease in the safety level compared to the usual traffic conditions.

3. Security, i.e. protection against unauthorised access to, or alteration of information and system resources, should be tackled at EU level.

Privacy

1. Potential problems concerning the safeguarding of privacy need to be clarified.

2. Cooperative systems require the transfer of location data that can be considered as personal data, and this is both a security issue as well as a user acceptance issue. Clear rules and procedures to handle these issues need to be in place for all stakeholders to deploy cooperative systems on a large scale.

3. Austroads [63] states that from their overseas experience, privacy and security are issues that need to be addressed from an early stage in the design, development and regulation of C-ITS applications.

Business case

1. Development towards a dominant position for vehicle systems is being exploited. This requires focused investments by the government, urban and regional authorities in basic conditions and also stimulating the innovative potential of the market.

2. All actors need to take their responsibility with respect to financing of cooperative services and applications among all the actors participating and having an interest (road operators, insurers, automotive industry, etc.).

3. In general, there is uncertainty of financing and the business cases concerning cooperative services and applications.

4. For the implementation of C-ITS the market parties need better basic conditions, which improve the various individual business cases. A characteristic of these prerequisites is that standardisation means that the same technical platform makes multiple return-on-investment options possible simultaneously, greatly reducing the cost per business case.

5. For local authorities to engage in cooperative systems deployment, the business case must be spelled out and must be part of the existing policy framework.

6. Policy makers and the general public need to be sensitised about the contributions of ITS.

7. It should be highlighted that some promised benefits of cooperative systems will be very difficult to deliver on oversaturated urban networks.

Financial risks

1. Administrative, organisational and financial problems of road operators prevent the adoption of successful 'case studies' on a broader scale.

2. Many countries claim the financial situation is not stable enough to invest in cooperative systems.

Evaluation

1. Agreements on common assessment methods and uniform tools for decision support are crucial to make EU-wide deployment a reality. Guidance and technical support should be provided to facilitate and underpin consensus building and decision-making processes.

2. Evaluation of cooperative tests is needed: Impact studies should be used to quantify the effects of the applications, e.g. on throughput, comfort, safety and the environment.

3. Explore feasibility of introducing cooperative systems.

4. Expand general Cost Benefit Analysis (CBA) with 'administrative burden' to allow for analysis on meta level and with 'business case' to win support of private sector.

Roadmap

1. Stepwise increase of a broad societal support for such systems is needed.

2. Deployment scenarios should be developed.

3. Liaison (roadmaps) between stakeholders such as the various road managers, the automotive industry and service providers is crucial.

4. There is uncertainty of market penetration rates: benefits will only be felt provided if enough vehicles are equipped and roadside ITS systems are installed. A local authority may choose not to invest in ITS stations if they cannot reap the benefits of the investment because not enough vehicles are equipped with the requisite technology.

5. Austroads [63] sees as a potential risk that the aftermarket sector may introduce problems not occurring in the more controlled environment of the original equipment manufacturers sector, such as impediments to interoperability and data harmonisation, privacy, security and compliance with HMI (e.g. how aftermarket applications integrate with the vehicle and driver including with any HMI in the vehicle). However, this risk can be managed by some form of regulation of the aftermarket sector, such as ensuring adherence to appropriate standards and protocols, and quality control through certification of equipment and software.

6. According to the Austroads [63] report, once vehicles with C-ITS are on the road, the issues of on-going maintenance and roadworthiness become important to ensure that applications continue to function effectively. The responsibility for in-service vehicle roadworthiness and registration is a matter for states and territories.

Other

1. There is a need for tests on complex systems to be conducted permanently.

2. The human factors of in-car systems/services need to be further explored.

3. European research and development efforts on cooperative systems to date have tended to focus on developing and testing applications to make car driving more efficient and safe with insufficient consideration of the urban transport policy dimension.

7. The Amsterdam Group, EU C-ITS Deployment Platform and C-Roads

The strategic issues discussed until now in the present report have been brought forward by different countries and show a strong focus on organisational issues like cooperation, coordination and harmonisation.

Since CODECS supports the Amsterdam Group, especially in the areas road map beyond Day One and system specification profiling, as well as the EU C-ITS Deployment Platform, it is important to give a brief overview of the strategic issues covered by the Amsterdam Group and in the EU C-ITS Deployment Platform Working Groups. An important milestone was the publication by the European Commission of "A European strategy on Cooperative Intelligent Transport Systems" [69] by the end of 2016 where specific strategic issues and were described and further emphasized. Also the C-Roads initiative was started in December 2016 to work on specific strategic issues to come to a concerted deployment of C-ITS in Europe. These issues are summarised also in this chapter.

Then, in chapter 9, these are mapped with the strategic issues resulting from the review of the ITS reports to gather a full overview of where strategic C-ITS issues are addressed in Europe.

7.1. Amsterdam Group

The open issues as identified by the Amsterdam Group focus more on the technical and practical aspects of deployment. It is important to keep in mind that both perspectives are important if EU-wide deployment of C-ITS should be successful.

The Amsterdam Group has identified the following ten open issues, or subjects, that different working groups already are and will further be focusing on in the coming years:

1. Security
2. System specification profiling
3. Consistency of legal framework
4. Radio spectrum & frequencies
5. Deployment / roll-out, Day One
6. Roadmap beyond Day One
7. Conformance Assessment
8. Hybrid communication concept
9. Backend services
10. Use-cases, applications

For a more detailed description of these issues, please refer to the summary of the workshop C-ITS Deployment is underway! [60], organised by the Amsterdam Group and CODECS in September 2015.

7.2. EU C-ITS Deployment Platform

The objective of the EU C-ITS Deployment Platform (C-ITS Platform) is to develop a shared vision and a roadmap for the deployment of cooperative systems in the EU. It is a public-private partnership on content, process development and ownership of final outcome. The C-ITS Platform has carried out an analysis of cross-cutting blocking factors and enablers:

- Technical
- Legal
- Organisational
- Policy
- Administrative.

The report of the first phase of the C-ITS Deployment Platform has been published in January 2016[3]. The C-ITS Platform Phase I consisted of 10 working groups, each focusing on specific aspects of C-ITS deployment:

- WG 1: Cost Benefit Analysis
- WG 2: Business Cases for Deployment
- WG 3: Legal issues
- WG 4: System's Governance & Privacy
- WG 5: Security & Certification
- WG 6: Technical issues
- WG 7: Standardisation issues
- WG 8: Public Acceptance
- WG 9: Implementation issues
- WG 10: International cooperation

The C-ITS Platform Phase II[4] has continued supporting C-ITS deployment through implementing the recommendations of the final report of C-ITS Platform Phase I. In addition, the Platform has converged onto connectivity and automation through extending the range of issues to new areas: C-ITS and automation in urban areas. The C-ITS Platform Phase II consists of the following working groups[5]:

- Phase I continued – support for deployment of C-ITS
    - WG Security
    - WG Data Protection & Privacy
    - WG Compliance Assessment
    - WG Cooperative-ITS and Automation in Urban Areas
    - WG Business Models

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[3] C-ITS Platform. (2016). *C-ITS Platform: Final report*. http://ec.europa.eu/transport/themes/its/doc/c-its-platform-final-report-january-2016.pdf

[4] C-ITS Platform (2017). C-ITS Platform Phase II: Final report. https://ec.europa.eu/transports/sites/transport/files/2017-09-c-its-platform-final-report.pdf

[5] These working groups differ from the working groups mentioned in the initial report from C-ITS Platform Phase II.

- Beyond C-ITS, towards Connected, Cooperative and Automated Mobility
    - WG Road Safety
    - WG Physical and Digital Infrastructure
    - WG Enhanced Traffic Management

7.3. C-ITS Strategy and C-Roads

On November 30, 2016, the European Commission issued "A European strategy on Cooperative Intelligent Transport Systems" [69] where the strategy on Deployment of C-ITS was laid out and specific strategic issues were further detailed with specific actions and emphasized:

- The priorities for deployment of C-ITS Services is focused on the joint and harmonised implementation of Day 1 (and 1.5) services

- Security of C-ITS communications

- Privacy and data protection safeguards

- Communication technologies and frequencies

- Interoperability at all levels

- Compliance assessment

- Legal framework

- International cooperation

In December 2016, Member States and the Commission formally launched the C-Roads Platform to link C-ITS deployment activities, jointly develop and share technical specifications and to verify interoperability through cross-site testing. Initially created for C-ITS deployment initiatives co-funded (CEF) by the EU, C-Roads is open to all deployment activities for interoperability testing. It follows a bottom-up approach in which national pilots represent the foundation for a later pan-European C-ITS implementation (www.c-roads.eu).

The C-Roads platform consists of the following Working Groups and Task Forces:

- WG 1 Organisational Aspects

- WG 2 Technical Aspects
    - TF 1 Security
    - TF 2 Service Harmonisation
    - TF 3 Infrastructure Communication

- WG 3 Evaluation and Assessment

8. Strategic issues in relation to the Amsterdam Group, C-ITS Platform and C-ROADS

8.1. General observations from the reports

This report contains the results and findings of the state-of-the-art inventory, which is the first activity of Work Package 4. In total, 61 reports have been analysed for this purpose, from several European countries from the years of 2011, 2012 and 2014, and also ten other reports that discuss C-ITS from a strategic perspective.

Throughout the different reports from 2011 to 2014 analysed in this study, there is a clear trend towards more interest in the actual deployment of cooperative systems. While in 2011 the focus was on research and testing, in 2014 more and more countries are drawing up national strategies that involve C-ITS, and are implementing or planning pilots and/or projects that involve the deployment of cooperative systems.

There are several front runners in this development, namely Austria, Germany and the Netherlands, who strive for EU-wide deployment of cooperative systems through implementing several projects where deployment of cooperative systems is the focus, such as the C-ITS corridor Austria-Germany-The Netherlands.

In terms of policy areas, the front-runners focus on several fields such as traffic safety, traffic efficiency and sustainability. Countries that are less focused on cooperative systems see C-ITS mainly as a means to improve traffic safety.

In the reports from 2011, strategies on C-ITS are limited to research, while frontrunners are planning or have implemented testing facilities. From 2012 and especially in 2014, the strategies show a clear trend towards interest in the actual deployment of C-ITS, with more countries testing several C-ITS services and applications. The frontrunners occupy themselves with setting up roadmaps for the deployment of C-ITS and testing deployment by updating roadside systems to make sure they can support cooperative systems. This change is also evident in the objectives that have been identified throughout the documents.

The analysis of C-ITS using the six transition paths again shows a clear trend towards more interest in C-ITS, although the transitions towards for example more individual services remained unclear. Roadside systems are changing as frontrunners are updating these systems to be able to evaluate C-ITS services, applications and systems, and private parties are more and more involved in the innovation, evaluation, testing and deployment of C-ITS services, applications and systems. The scale of traffic information and management has clearly shifted towards a nationally focused approach, with more and more countries aiming to set up a framework for C-ITS including national architectures for traffic management. More openness of data is a trend which is becoming more apparent from 2014 onwards, however, this transition is far from mature. With regards to the role of public and private parties, frontrunners are showing that cooperation between all stakeholders is a necessity to successfully deploy C-ITS. This development is also apparent in the strategic issues that have been identified.

Many strategic issues have been identified throughout the analysis of the documents. A strong focus lies on organisational issues, where the topic of cooperation and coordination is the most important among all countries. Next to organisational issues, standardisation is called for by many countries, and interoperability is also seen as a major concern. Other issues include security and privacy aspects of C-ITS deployment, and concerns with regards to the business case and the roadmap.

In comparison with the strategic issues identified by the Amsterdam Group, the issues brought forward through the C-ITS platform reports have a clear focus on organisational issues, while the issues identified by the Amsterdam Group are more focused on the technical aspects of the deployments. This can be explained by the fact that the Amsterdam Group is a major frontrunner, and is thus more focussed on the actual deployment and the practical issues that come with this goal. In the meantime, most

countries are still focused on bringing together public and private parties before they can start thinking about deployment activities.

8.2. Mapping CODECS Strategic issues with AG strategic issues, C-ITS platform WGs and C-Roads

The CODECS project supports both the Amsterdam Group and the C-ITS Deployment Platform of the European Commission in coming to a concerted C-ITS deployment approach. Therefore, the strategic issues identified in this report have been mapped with the strategic issues of the Amsterdam Group as well as with the working groups of the EU C-ITS Deployment Platform and the C-Roads initiative. This should reveal whether the issues identified in this CODECS report are already covered by the above-mentioned initiatives, and whether new strategic issues have been found, which should be picked up by the stakeholders.

Issues found in the inventory of reports and not covered by the Amsterdam Group, C-ITS Platform or C-Roads

Based on the mapping shown in table 1 it can be concluded that 20 strategic issues have been identified through the review of the reports that are not (yet) covered by the Amsterdam Group. These are mainly found in the domains 'business case', 'financial risks' and 'evaluation'. The Amsterdam Group started in the early phases of the development of C-ITS. After their start, more stakeholders got involved and on a larger scale through the C-ITS Platform and C-Roads. And due to the developments new strategic issues emerged.

Based on the mapping shown in table 1 it can be concluded that only one strategic issue has been identified through the review of the reports that is not (yet) covered by the Amsterdam Group, the C-ITS Platform or the C-Roads initiative. This strategic issue is described as follows:

- Especially from the perspective of urban mobility, the added benefits gained from floating vehicle data will create additional challenges for the management of extensive real-time data for network management and traffic and travel information.

In the previous version of this report also concerns on the financial situation to invest in C-ITS was mentioned as a strategic issue, but this issue was later (partially) covered through the C-IST Deployment Platform Phase II. With respect to this issue, the EU funding programs (CEF) support the member states in overcoming this issue. The inventory of strategic issues was based on reports of 2011, 2012 and 2014, so perhaps reflected the financial capabilities at that time shortly after the financial crisis that started in 2008.

In addition, several Working Groups are identified that only partially discuss the issues that were identified. These can be found in table 1.

New issues from the Amsterdam Group, C-ITS Platform WGs and the C-Roads WGs

Next to the issues that were identified in the review of country document that have not been discussed by the C-ITS Platform, also issues were identified by the Amsterdam Group, C-ITS Platform WGs and C-Roads WGs that were not brought forward in the reviewed reports. This report will not describe all new issues in detail but will point out categories of issues that were not discussed in the reviewed reports as well as some examples of more detailed issues.

In addition, the mapping brought forward a number of issues that were not mentioned in the reviewed reports from 2011, 2012 and 2014:

- Strategic issues brought forward by the reviewed reports do discuss some technical aspects, however not in the level of detail of the C-ITS Platform or C-Roads WGs. In future updates of national ITS reports it is recommended that member states give a more elaborate description on how these aspects are taken care of and how the member state is connected to EU initiatives on these topics

- Public acceptance was hardly mentioned in the reviewed reports, but in the C-ITS Platform (Phase I) a specific Working Group was dedicated to the topic.

- With regards to legal issues, data protection & privacy and security & certification, the strategic issues brought forward by the reviewed reports only discussed the need to cover these areas, but do not focus on more detailed aspects whereas the C-ITS Platform WGs discuss such issues from a variety of standpoints and offers solutions to a number of issues identified in these fields.

- From the perspective of the reviewed reports, the strategic issues focus on implementation issues, international cooperation, standardisation and business cases. This means that the Working Groups discussing these areas cover the majority of issues proposed throughout the reviewed reports.

In addition, there are some examples of strategic issues that did not arise from the review of the 2011, 2012 and 2014 reports, for example in the WG on Business Cases and the WG on Implementation Issues:

- In the WG Business Cases two major issues were identified i.e. "Infrastructure Investments" and "Access to data"

  o The complexity of investments in *city-environments* was pointed out. In cities there does not seem to be one killer application but rather a set of applications that would make C-ITS a success. Facilitating procurement and providing guidance to city authorities are some of the actions that need to be taken in order to facilitate C-ITS investments in cities.

  o How should initial C-ITS infrastructure investments be triggered?

  o The need to have low barriers to entry in terms of access to data - and more specifically to in-vehicle data - in order to allow for the deployment of new C-ITS enabled services and applications.

- Implementation issues can be categorized into "traffic safety and efficiency" related implementation issues and other implementation issues. The latter category was recognized through the reviewed reports, but the "traffic safety and efficiency" related implementation issues were not. According to WG 9, these "traffic safety and efficiency" related implementation issues are about the human machine interactions, the non-equipped user and training & awareness.

The C-ITS Platform Phase II addressed several strategic issues in the field of C-ITS and Automation. As has been stated before in this report, many of the reviewed reports (2011, 2012 and 2014) show that most Member States were not yet focussing or working on C-ITS deployment initiatives. Due to this, the C-ITS Platform Phase II discusses many strategic issues that are not discussed in the reviewed reports. In addition, the platform also dedicated a WG to the enhancement of traffic management as well as to C-ITS and automation in urban areas. It is clear that the Platform focussed on more technical and practical aspects of the process towards C-ITS deployment.

A few examples of new strategic issues that are not mentioned in the reviewed reports are the following:

- The requirements imposed on the physical infrastructure by the introduction of connected and automated driving need to be identified and mapped.

- The requirements coming from connected and automated driving need to be identified and aligned.

- The roles and responsibilities in generating, maintaining, storing and providing of data need to be determined.

- It needs to be determined which datasets generated by connected and automated driving have potential to improve traffic management and how.

- Uncertainty about the timeframe of the development and arrival of automated vehicles makes it difficult for local authorities to effectively and confidently conduct planning for automated vehicles and incorporate it in their policies.

- In order to have a European-wide interoperable system, an enactment of an EU-legal instrument is needed. As the enactment of an EU instrument will require time, and the goal is to start deployment of C-ITS in 2019. Time could therefore be an issue.

C-Roads working groups / task forces and workshops

The C-Roads initiative was started late 2016 with a very specific goal. The aim of the C-Roads Platform is to develop harmonised specifications taking the EU C-ITS platform recommendations into account, linking all C-ITS deployments and planning intensive cross-testing. Through a bottom up approach, the working groups and taskforces of C-Roads address strategic issues coming out of the actual deployment.

As shown in the mapping, due to the nature of C-Roads the strategic issues that are addressed are mainly covered by the Technical, Functional and Organisational strategic issues. With regards to Security and Privacy strategic issues, C-Roads is guided by and implementing the outcomes of the C-ITS platform WGs and EC guidance on these issues.

The CODECS partners participated in various workshops and meetings and also discussed the overview of strategic issues. Specific strategic issues came from these discussions like:

- The management of use cases, a template was developed and a specific workshop on Use Cases was held on September 15, 2016 in Amsterdam.

- More in depth knowledge is needed on the hybrid Communication concept.

Also, some of the strategic issues were rewritten/rephrased based on the discussions.

8.3. Strategic issues

The strategic issues derived from the country reports, the Amsterdam Group, C-ITS Platform and C-Roads have been combined and a compressed overview of the strategic issues has been created. This means that overlapping issues have been combined into one issue. The strategic issues are the following:

Technical

- Challenges of reliable operation of cooperative systems and services in ITS networks using heterogeneous access technologies need to be addressed. Communication technologies need to be tested and services have to be continuously improved. (Hybrid Communications)

- For C-ITS and specifically for traffic safety and efficiency related services, applications and information exchange, bandwidth has been allocated according to European decisions. For initial deployment of these safety and efficiency related services, applications and information exchange this bandwidth is sufficient. New ITS research and innovation indicate however that the current bandwidth allocation will not be sufficient to realize new services and applications. Therefore, it is needed to investigate the needs, not only specifically for safety and efficiency related services, but also for non-safety related services, applications and information exchange. Such an investigation should lead to extended European ITS bandwidth policies, recommendations and decisions (Bandwidth)

- It has been recognized that the large variation of ITS applications have different technologic needs and different technologies provide different functional possibilities and support different business cases. To ensure European wide interoperability and conformity between the different services, applications and information exchange it is needed to initially agree which tech-

nology to use for which service, application and information exchange. For the first few cases these steps have been taken, but a continuing process is needed to ensure this also happens for new cases and new situations

- Especially from the perspective of urban mobility, the added benefits gained from floating vehicle data will create additional challenges for the management of extensive real-time data for network management and traffic and travel information. There is a need to identify these challenges and to deal with them accordingly.

- Digital Infrastructure: The roles and responsibilities in generating, maintaining, storing and providing of data need to be determined. It needs to be determined which minimum datasets are required to support C--ITS. It needs to be determined which datasets generated by C-ITS have potential to improve traffic management and how.

- An average vehicle has a considerable longer lifetime than electronic consumer devices. To make sure that all vehicles can communicate with each other and with the infrastructure, backwards interoperability is needed.

Functional

- Interoperability of services and/or applications is necessary for EU-wide deployment and therefore this aspect should be included in a common strategic framework for deployment

- Compliance of ITS services, applications and their technical C-ITS supporting system is necessary for a robust and qualitative EU-wide C-ITS deployment and therefore this aspect should be included in a common strategic framework for deployment. To ensure that all products and systems being part of the C-ITS system can work properly and do not interfere with each other certification is needed based on compliance and End2End interoperability test validations

- European standardisation is necessary to enable large-scale deployment of C-ITS. For example, in order to transmit traffic information fast and comprehensively to vehicles. Services, applications, ITS stations must be designed based on these standards and defined interfaces in a commonly agreed way (profiling), be tested and deployed at the trans-European level.

- It is important to avoid fragmentation and to give the necessary attention to the compatibility, standardisation and integration of different subsystems into one system.

- To achieve a common understanding of services by road users throughout Europe it is necessary to establish a common understanding of services / use cases amongst all stakeholders and develop these together with all stakeholders and agree on how to manage the continuously expanding library of potential services / use cases.

- From the perspective of urban mobility, legacy and integration issues will arise. It is unclear how C-ITS can be integrated with legacy systems and investments that have already been made. How can this transition be done smoothly? What are the implications from a technical and financial perspective? How can a technology lock-in be prevented?

- One problem many cities perceive with cooperative systems until now is that most suggested applications concentrate on the private car, but without enough consideration for public transport and non-motorised modes.

Organisational

- Coordinated deployment of ITS in the EU calls for intensive and effective cooperation between all parties involved at European level:

    o Between private and public actors

    o Between automotive companies

    o Between neighbouring countries

- Between national authorities and cities and regional authorities, including rural areas.

- A long-term structural commitment is vital for the serious development of services that can make an effective contribution to European and local policy goals (by market players and/or public authorities). Engagement, influence and possible guidance from the European Commission are invaluable in this regard.

- The feasibility of C-ITS can be regarded as proven, yet there are sometimes diverging views on the rights and obligations of stakeholders. One of the next important tasks is therefore a definition of roles, competencies and responsibilities along the entire service chain, because cooperative systems are still a strong technology-driven research topic, neglecting the socio-economic impacts.

Urban mobility

- Deployment may be hindered if urban and regional authorities are not more actively engaged in the process.

- Local authorities need clear standards for cooperative systems to ensure that any investment taken is future-proof. European and international standards are being developed, but still have some way to go before industry-wide standards are in place.

- One of the challenges seen with deploying cooperative systems is that of multi-stakeholder cooperation, even with conflicting aims and objectives with regards to deployment. Local authorities need to be assured that other stakeholders contribute their share in deployment if they are expected to invest in cooperative infrastructure.

- European research and development efforts on cooperative systems to date have tended to focus on developing and testing applications to make car driving more efficient and safe with insufficient consideration of the urban transport policy dimension.

- Uncertainty about the timeframe of the development and arrival of automated vehicles makes it difficult for local authorities to effectively and confidently conduct planning for automated vehicles and incorporate it in their policies.

Legal

- The use of ITS applications creates additional requirements in terms of liability. These issues can be a major barrier to wide market penetration of some ITS services if citizens' rights are not fully protected.

- Local authorities need a clear picture of how cooperative systems will affect their liability structure.

- In order to have a European-wide interoperable system, an enactment of an EU-legal instrument is needed. As the enactment of an EU instrument will require time, and the goal is to start deployment of C-ITS in 2019. Time could therefore be an issue.

Security

- Concerning freight shipments there are commercial and security considerations with regards to open in-vehicle platforms. These need to be identified and dealt with.

- Regarding the new driving aids that can lead to autonomous vehicles, in places where experiments take place, all precautions should be taken so that there is no decrease in the safety level compared to the usual traffic conditions.

- Security, i.e. protection against unauthorised access to, or alteration of information and system resources, should be tackled at EU level.

Privacy

- Potential problems concerning the safeguarding of privacy need to be clarified.

- Cooperative systems require the transfer of location data that can be considered as personal data, and this is both a security issue as well as a user acceptance issue. Clear rules and procedures to handle these issues need to be in place for all stakeholders to deploy cooperative systems on a large scale.

Business Case / Models

- Development towards a dominant position for vehicle systems is being exploited. This requires focused investments by the government, urban and regional authorities in basic conditions and also stimulating the innovative potential of the market.

- All actors need to take their responsibility with respect to financing of cooperative services and applications among all the actors participating and having an interest (road operators, insurers, automotive industry, etc.).

- For the implementation of C-ITS the market parties need better basic conditions, which improve the various individual business cases. A characteristic of these prerequisites is that standardisation means that the same technical platform makes multiple return-on-investment options possible simultaneously, greatly reducing the cost per business case.

- Policy makers and the general public need to be sensitised about the contributions of ITS.

- A limited number of test cases using Day 1 services needs to be developed to discuss Business Models involving stakeholders concerned in their implementation

- For local authorities to engage in cooperative systems deployment, the business case must be spelled out and must be part of the existing policy framework.

- It should be highlighted that some promised benefits of cooperative systems will be very difficult to deliver on oversaturated urban networks.

Financial risks

- Potential administrative, organisational and financial problems of road operators prevent the adoption of successful 'case studies' on a broader scale.

- Many countries claim the financial situation is not stable enough to invest in cooperative systems, based on inventory of 2011, 2012, 2014 documents

- There is uncertainty of market penetration rates: benefits will only be felt provided if enough vehicles are equipped and roadside ITS systems are installed. A local authority may choose not to invest in ITS stations if they cannot reap the benefits of the investment because not enough vehicles are equipped with the requisite technology.

Evaluation

- Agreements on common assessment methods and uniform tools for decision support are crucial to make EU-wide deployment a reality. Guidance and technical support should be provided to facilitate and underpin consensus building and decision-making processes.

- Evaluation of cooperative tests is needed: Impact studies should be used to quantify the effects of the applications, e.g. on throughput, comfort, safety and the environment. It should be assessed what the impact of the foreseen situation of mixed traffic is on these topics. Also, specific attention is needed for the different traffic regulations throughout Europe in this respect

- Impact on physical infrastructure: The requirements imposed on the physical infrastructure by the introduction of C-ITS need to be identified, mapped and aligned. Does C-ITS impact the physical infrastructure that is maintained by the road operator (asset management).

- Public Acceptance: what are the challenges with regards to public acceptance of C-ITS services (Reliability of information/service, what problem is solved, non-technical messages, optional/mandatory, technology resistance, equity, accessibility and more)

- The human factors of in-car systems/services need to be further explored.

Roadmap

- Deployment scenarios should be developed.

- Liaison (roadmaps) between stakeholders such as the various road managers, the automotive industry and service providers is crucial.

8.4. Elaborated mapping of strategic issues

In table 1, chapter 9, an overview of the strategic issues is presented. The table also shows which strategic issues are covered by which platform (AG, C-ITS Platform, C-Roads) or paper (more specifically. In this table, each strategic issue is linked to the relevant WG/taskforce/paper from the platforms mentioned above.

9. Mapping strategic issues with Amsterdam Group, C-ITS Platform and C-ROADS

9.1. Explanation of the table

In chapter 8 the strategic issues retrieved from the country reports were combined with the strategic issues from the AG, C-ITS Platform and C-Roads. This resulted in the overview of strategic issues in 8.3. A table has been made that shows which strategic issues are covered by which platform (AG, C-ITS Platform, C-Roads). In this table, each strategic issue is linked to the relevant WG/taskforce/paper from the platforms mentioned above.

If a WG/taskforce/paper is mentioned, this means one or more of the following things:

- The issue is being addresses.
- The issue is being elaborated/explored.
- Recommendations on the issue are proposed.
- The issue is being solved or there is a reference to the solution.

Sometimes, the word 'partially' has been added. If so, this means only a part of the issue is addressed/solved or that the issue is getting little attention.

9.2. Complete overview of strategic issues and where they are being addressed

	Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
A	*Technical*				
1	Challenges of reliable operation of cooperative systems and services in ITS networks using heterogeneous access technologies need to be addressed. Communication technologies need to be tested and services have to be continuously improved. **(Hybrid Communications)**	WG 7: Conformance assessment WG 8: Hybrid Communication Concept	WG 2: Business Cases (not yet discussed) WG 6: Technical Issues - Hybrid Communications and Spectrum allocation (partially)	WG not continued - Summary Pp.11-12	TF 3: Infrastructure Communication WG 3: Evaluation and Assessment Position paper on 5.9 GHz (C-Roads, 2017)
2	For C-ITS and specifically for traffic safety and efficiency related services, applications and information exchange, bandwidth has been allocated according to European decisions. For initial deployment of these safety and efficiency related services, applications and information exchange this bandwidth is sufficient. New ITS research and innovation indicate however that the current bandwidth allocation will not be sufficient to realize new services and applications. Therefore, it is needed to investigate the needs, not only specifically for safety and efficiency related services, but also for non-safety related services, applications and information exchange. Such an investigation should lead to extended European ITS bandwidth policies, recommendations and decisions. **(Bandwidth)**	WG 4: Radio spectrum & frequencies	WG 6: Technical Issues - Hybrid Communications and Spectrum allocation (partially) WG 10: International Cooperation (partially)	WG not continued	Position paper on 5.9 GHz (C-Roads, 2017)

Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
3	It has been recognized that the large variation of ITS applications have different technological needs and different technologies provide different functional possibilities and support different business cases. To ensure European wide interoperability and conformity between the different services, applications and information exchange it is needed to initially agree **which technology to use for which service**, application and information exchange. For the first few cases these steps have been taken, but a **continuing process is needed** to ensure this also happens for new cases and new situations.	WG 8: Hybrid Communication Concept	WG 6: Technical Issues - Hybrid Communications and Spectrum allocation (partially)	WG: Compliance Assessment (Partially) – Pp.33-34	WG 2: Technical Aspects Position paper on 5.9 GHz (C-Roads, 2017) TF 3: Infrastructure Communication (partially)
4	Especially from the perspective of **urban mobility**, the added benefits gained from floating vehicle data will create additional challenges for the management of **extensive real-time data** for network management and traffic and travel information. There is a need to identify these challenges and to deal with them accordingly.	-	-	-	-
5	Digital Infrastructure: The roles and responsibilities in generating, maintaining, storing and providing of **data need** to be determined. It needs to be determined which minimum datasets are required to support C--ITS. It needs to be determined which datasets generated by C-ITS have potential to improve traffic management and how.			WG: Physical and digital Infrastructure - Pp.93-94, 96-103	WG 3: Evaluation and Assessment
	An average vehicle has a considerable longer lifetime than electronic consumer devices. To make sure that all vehicles can communicate with each other and with the infrastructure, **backwards interoperability** is needed.			Summary – Pp.11-12	Position paper on 5.9 GHz (C-Roads, 2017)

Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
B *Functional*				
1 **Interoperability** of services and/or applications is necessary for EU-wide deployment and therefore this aspect should be included in a common strategic framework for deployment	WG 2: System specification profiling WG 5: Deployment / roll-out Day One WG 6: Roadmap beyond Day One	WG 1: Cost Benefit Analysis WG 7: Standardisation WG 10: International Cooperation	Objective of the C-ITS platform – P.20 WG: Security - Pp.22-26 WG: Compliance Assessment (Partially) – Pp.32-34 WG: Cooperative-ITS and Automation in Urban Areas - Pp.49-50 WG: Physical and Digital Infrastructure Pp.98	Overall goal of C-Roads
2 **Compliance** of ITS services, applications and their technical C-ITS supporting system is necessary for a robust and qualitative EU-wide C-ITS deployment and therefore this aspect should be included in a common strategic framework for deployment. To ensure that all products and systems being part of the C-ITS system can work properly and do not interfere with each other certification is needed based on compliance and End2End interoperability test validations			WG: Compliance Assessment – Pp.32-34	WG 2: Technical Aspects

Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
3 European **standardisation** is necessary to enable large-scale deployment of C-ITS. For example, in order to transmit traffic information fast and comprehensively to vehicles. Services, applications, ITS stations must be designed based on these standards and defined interfaces in a commonly agreed way (profiling), be tested and deployed at the trans-European level.	WG 2: System specification profiling WG 10: Use cases	WG 7: Standardisation	WG: Security – Pp.26 WG: Compliance Assessment (partially) – Pp.32-34 WG: Cooperative-ITS and Automation in Urban Areas (Partially) - Pp.49-50 WG: Physical and Digital Infrastructure – Pp.99-103 WG: Enhanced Traffic Management – Pp.126	WG 2: Technical Aspects TF 1: Security TF 2: Service Harmonisation TF 3: Infrastructure Communication

	Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Plat-form Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
4	It is important to avoid fragmentation and to give the necessary attention to the compatibility, standardisation and **integration of different subsystems into one system**.	WG 8: Hybrid Communication Concept (partially)	WG 1: Cost Benefit Analysis WG 7: Standardisation WG 9: Implementation issues	WG: C-ITS Compliance Assessment (partially) – Pp.32-34 WG: Cooperative-ITS and Automation in Urban Areas (Partially) - Pp.49-50	WG 1: Organisational Aspects (partially) WG 2 Technical Aspects
5	To achieve a **common understanding of services** by road users throughout Europe it is necessary to establish a common understanding of services / use cases amongst all stakeholders and develop these together with all stakeholders and agree on how to manage the continuously expanding library of potential services / use case	WG 10: Use Cases (partially)	WG 7: Standardisation WG 8: Public Acceptance (partially)	WG: Cooperative-ITS and Automation in Urban Areas – Pp. 52	TF 2: Service Harmonisation (partially)
6	From the perspective of **urban** mobility, legacy and integration issues will arise. It is unclear how C-ITS can be **integrated with legacy systems** and investments that have already been made. How can this transition be done smoothly? What are the implications from a technical and financial perspective? How can a technology lock-in be prevented?	-	WG 9: Implementation issues	WG: Cooperative-ITS and Automation in Urban Areas - Pp.49-50	-
7	One problem many cities perceive with cooperative systems until now is that most suggested applications concentrate on the private car, but without enough consideration for **public transport and non-motorised** modes.	-	WG 9: Implementation issues	WG: Cooperative-ITS and Automation in Urban Areas - Pp.34-64	-

	Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
C	*Organisational*				
1	Coordinated deployment of ITS in the EU calls for **intensive and effective cooperation between all parties** involved at European level: • Between private and public actors • Between automotive companies • Between neighbouring countries • Between national authorities and cities and regional authorities, including rural areas.	Goal of Amsterdam Group	Goal of C-ITS Platform	Goal of C-ITS Platform	WG 1: Organisational Aspects
2	A **long-term structural commitment** is vital for the serious development of services that can make an effective contribution to European and local policy goals (by market players and/or public authorities). Engagement, influence and possible guidance from the European Commission are invaluable in this regard.	Goal of Amsterdam Group	WG 9: Implementation issues	-	Reason to start C-Roads initiative
3	The feasibility of C-ITS can be regarded as proven, yet there are sometimes diverging views on the rights and obligations of stakeholders. One of the next important tasks is therefore a definition of roles, competencies and responsibilities along the entire service chain, because cooperative systems are still a strong technology-driven research topic, neglecting the socio-economic impacts.	-	WG 2: Business Cases	WG: Cooperative-ITS and Automation in Urban Areas - Pp.54-56	WG 1: Organisational Aspects
D	*Urban mobility*				
1	Deployment may be hindered if urban and regional authorities are not more actively engaged in the process.	(POLIS is part of the Amsterdam Group)	WG 9: Implementation issues (partially)	WG: Cooperative-ITS and Automation in Urban Areas - Pp.43-63	-

	Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
2	Local authorities need clear standards for cooperative systems to ensure that any investment taken is future-proof. European and international standards are being developed, but still have some way to go before industry-wide standards are in place.	WG 2: System specification profiling	WG 7: Standardisation (partially)	WG: Cooperative-ITS and Automation in Urban Areas - Pp.45-46 WG: C-ITS Compliance Assessment – Pp.32-34	-
3	One of the challenges seen with deploying cooperative systems is that of multi-stakeholder cooperation, even with conflicting aims and objectives with regards to deployment. Local authorities need to be assured that other stakeholders contribute their share in deployment if they are expected to invest in cooperative infrastructure.	-	WG 9: Implementation issues (partially)	WG: Business Models (Partially) – Pp.68-78	-
4	European research and development efforts on cooperative systems to date have tended to focus on developing and testing applications to make car driving more efficient and safe with insufficient consideration of the urban transport policy dimension.	(POLIS is part of the Amsterdam Group)	WG 9: Implementation issues	WG: Cooperative-ITS and Automation in Urban Areas - Pp.50-52, 61-64	-
5	Uncertainty about the timeframe of the development and arrival of automated vehicles makes it difficult for local authorities to effectively and confidently conduct planning for automated vehicles and incorporate it in their policies.			WG: Cooperative-ITS and Automation in Urban Areas – Pp.57	
E	*Legal*				
1	The use of ITS applications creates additional requirements in terms of liability. These issues can be a major barrier to wide market penetration of some ITS services if citizens' rights are not fully protected.	WG 3: Consistency of legal framework	WG 3: Legal issues	WG: Cooperative-ITS and Automation in Urban Areas (Partially) – Pp.47	-

	Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
2	Local authorities need a clear picture of how cooperative systems will affect their liability structure.	WG 3: Consistency of legal framework	WG 3: Legal issues	WG: Cooperative-ITS and Automation in Urban Areas (Partially) – Pp.47	-
3	In order to have a European-wide interoperable system, an enactment of an EU-legal instrument is needed. As the enactment of an EU instrument will require time, and the goal is to start deployment of C-ITS in 2019. Time could therefore be an issue.			WG: Data protection & Privacy – Pp.28 Art 29 WP	
F	*Security*				
1	Concerning freight shipments there are commercial and security considerations with regards to open in-vehicle platforms. These need to be identified and dealt with.	WG 1: Security (partially)	WG 5: Security and Certification (partially: not related to freight shipments) WG 6: Technical issues - Access to in-vehicle data and resources (partially)	WG: Data Protection and Privacy (partially) – Pp. 28-32 Art 29 WP (partly)	TBD
2	Regarding the new driving aids that can lead to autonomous vehicles, in places where experiments take place, all precautions should be taken so that there is no decrease in the safety level compared to the usual traffic conditions.	-	-	WG: Road Safety – Pp.79-85	WG 3: Evaluation and Assessment
3	Security, i.e. protection against unauthorised access to, or alteration of information and system resources, should be tackled at EU level.	WG 1: Security	WG 10: International Cooperation	WG: Security – Pp.22-26	TF 1 Security

		Overall Overview of Strategic Issues	**Amsterdam Group open issues**	**EU C-ITS Deployment Plat-form Phase I WGs**	**EU C-ITS Deployment Platform Phase II WGs**	**C-ROADS**
G		*Privacy*				
	1	Potential problems concerning the safeguarding of privacy need to be clarified.	WG 3: Consistency of legal framework	WG 4: Data protection & Privacy	WG: Data protection & Privacy – Pp.27-32 Art 29 WP	adopting outcome C-ITS WG
	2	Cooperative systems require the transfer of location data that can be considered as personal data, and this is both a security issue as well as a user acceptance issue. Clear rules and procedures to handle these issues need to be in place for all stakeholders to deploy cooperative systems on a large scale.	WG 1: Security WG 3: Consistency of legal framework	WG 4: Data protection & Privacy	WG: Security – Pp.22-26 WG: Data protection & Privacy – Pp.27-32 Art 29 WP	adopting outcome C-ITS WG
H		*Business Case / Models*				
	1	Development towards a dominant position for vehicle systems is being exploited. This requires focused investments by the government, urban and regional authorities in basic conditions and also stimulating the innovative potential of the market.	WG 6: Roadmap beyond Day One (partially)	WG 9: Implementation issues	WG: Cooperative-ITS and Automation in Urban Areas (Partially) – Pp.45-49	WG1: Organisational Aspects (TBD)
	2	All actors need to take their responsibility with respect to financing of cooperative services and applications among all the actors participating and having an interest (road operators, insurers, automotive industry, etc.).	WG 6: Roadmap beyond Day One (partially)	-	WG: Business Models – Pp.77	WG1: Organisational Aspects (partially, TBD) WG 3: Evaluation and Assessment (TBD)

	Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
3	For the implementation of C-ITS the market parties need better basic conditions, which improve the various individual business cases. A characteristic of these prerequisites is that standardisation means that the same technical platform makes multiple return-on-investment options possible simultaneously, greatly reducing the cost per business case.	WG 6: Roadmap beyond Day One (partially)	WG 1: Cost Benefit Analysis WG 2: Business Cases	WG: Cooperative-ITS and Automation in Urban Areas (Partially) – Pp.45-49	WG 2: Technical Aspects (partially)
4	Policy makers and the general public need to be sensitised about the contributions of ITS.	-	WG 8: Public Acceptance (partially)	WG: Business Models – Pp.74-77	WG 3 Evaluation & Assessment (TBD)
5	A limited number of test cases using Day 1 services needs to be developed to discuss Business Models involving stakeholders concerned in their implementation	-	WG: Business Cases	WG: Cooperative-ITS and Automation in Urban Areas (Partially) – Pp.45-46	WG 3 Evaluation & Assessment (TBD)
6	For local authorities to engage in cooperative systems deployment, the business case must be spelled out and must be part of the existing policy framework.	-	WG 2: Business Cases WG 9: Implementation issues	WG: Business Models – Pp.77	-
7	It should be highlighted that some promised benefits of cooperative systems will be very difficult to deliver on oversaturated urban networks.	-	WG 9: Implementation issues	WG: Cooperative-ITS and Automation in Urban Areas - Pp. 56	-

Overall Overview of Strategic Issues		Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
I	*Financial risks*				
1	Potential administrative, organisational and financial problems of road operators prevent the adoption of successful 'case studies' on a broader scale.	-	10: WG International Cooperation	WG: Cooperative-ITS and Automation in Urban Areas (Partially) - Pp. 48-49	WG 1: Organisational Aspects WG 3: Evaluation and Assessement
2	Many countries claim the financial situation is not stable enough to invest in cooperative systems, based on inventory of 2011, 2012, 2014 documents	-	-	WG: Cooperative-ITS and Automation in Urban Areas (Partially) - Pp. 43-44, 48-49	-
3	There is uncertainty of market penetration rates: benefits will only be felt provided if enough vehicles are equipped and roadside ITS systems are installed. A local authority may choose not to invest in ITS stations if they cannot reap the benefits of the investment because not enough vehicles are equipped with the requisite technology.	-	WG 1: Cost Benefit Analysis	WG: Physical and Digital Infrastructure – Pp.90-91 WG: Cooperative-ITS and Automation in Urban Areas (Partially) – Pp.42, 45-49	-
J	*Evaluation*				
1	Agreements on common assessment methods and uniform tools for decision support are crucial to make EU-wide deployment a reality. Guidance and technical support should be provided to facilitate and underpin consensus building and decision-making processes.	-	WG 9: Implementation issues	WG: Cooperative-ITS and Automation in Urban Areas (Partially) – Pp.47	WG 2: Technical Aspects WG 3: Evaluation and Assessment

	Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
2	Evaluation of cooperative tests is needed: Impact studies should be used to quantify the effects of the applications, e.g. on throughput, comfort, safety and the environment. It should be assessed what the impact of the foreseen situation of mixed traffic is on these topics. Also specific attention is needed for the different traffic regulations throughout Europe in this respect	-	WG 9: Implementation issues	WG: Cooperative-ITS and Automation in Urban Areas (Partially) – Pp.47, 60 WG: Business Models (Partially) – Pp.76 WG: Enhanced Traffic Management (Partially) – Pp.104	WG 3: Evaluation and Assessment
3	Impact on physical infrastructure: The requirements imposed on the physical infrastructure by the introduction of C-ITS need to be identified, mapped and aligned. Does C-ITS impact the physical infrastructure that is maintained by the road operator (asset management).	-	-	WG: Physical and Digital Infrastructure – Pp.85-87, 94-100	WG 3: Evaluation and Assessment (TBD)
4	Public Acceptance: what are the challenges with regards to public acceptance of C-ITS services (Reliability of information/service, what problem is solved, non-technical messages, optional/mandatory, technology resistance, equity, accessibility and more)			-	WG 3: Evaluation and Assessment (TBD)
5	The human factors of in-car systems/services need to be further explored.	-	WG 9: Implementation issues	WG: Road Safety – Pp.83-84	WG 3: Evaluation and Assessment (TBD)

	Overall Overview of Strategic Issues	Amsterdam Group open issues	EU C-ITS Deployment Platform Phase I WGs	EU C-ITS Deployment Platform Phase II WGs	C-ROADS
K	*Roadmap*				
1	Deployment scenarios should be developed.	WG 5: Deployment / Roll-out Day 1 WG 6: Roadmap beyond Day One	WG 1: Cost Benefit Analysis	WG: Cooperative-ITS and Automation in Urban Areas (Partially) - Pp. 45, 61	WG2 Technical Aspects wrt Day 1 Use Cases
2	Liaison (roadmaps) between stakeholders such as the various road managers, the automotive industry and service providers is crucial.	WG 5: Deployment / Roll-out Day 1 WG 6: Roadmap beyond Day One	-	WG: Cooperative-ITS and Automation in Urban Areas (Partially) - Pp. 61, 107	-

Table 1: New overall overview of strategic issues mapping

9.3. Conclusions and related developments

As shown in the previous section, most strategic issues are being addressed, some very extensively, others only partially. Only the strategic issue on urban mobility and the challenges related to extensive real-time data is not dealt with.

To ensure a smooth deployment of C-ITS in Europe, it is important to keep the strategic issues in mind and address them. However, with the completion of the 2nd Phase of the C-ITS Deployment Platform, in which many strategic issues were addressed, there is a potential risk that these activities might not be continued on such a scale or platform.

A logical candidate for following up a subset of these activities is the C-Roads Platform established in 2016, but this Platform focusses on a limited number of topics:

- WG 1 Organisational Aspects
- WG 2 Technical Aspects, including Task Forces on Security, Service Harmonisation and Infrastructure Communication
- WG 3 Evaluation and Assessment

As the table with strategic issues in section 9.2 shows, currently the C-Roads Platform covers approximately 65% of all strategic issues, which means that 35% of the issues are not covered by the C-Roads Platform. Furthermore, the C-Roads Platform is now seen sometimes as a project financed instrument, which has the risk of a limited time horizon and discontinuity after 2020, when the project finishes. The participation takes considerable effort and reimbursement of the participation is now guaranteed by the project financed approach. As this work in C-Roads demands a continuous host or entity for a sustainable future deployment of C-ITS, it is worthwhile to start thinking about the future environment where this work can be done.

From the analysis of the final report of the ITS Deployment Platform it can also be concluded that many strategic issues are dealt with in more than one WG. It shows that the complexity of the issues are high and close collaboration between potential future Working Groups/Task Forces, EU-financed projects and C-Roads is required. It is therefore proposed to have a closer collaboration between the various WGs/TFs, for example in four clusters proposed by the EU EIP project sub-activity 4.4:

1. Harmonization Cluster: covers a range of technical and functional strategic issues, such as hybrid communication, bandwidth, spectrum, digital infrastructure, interoperability, compliance, standardization and integration;
2. Horizontal Cluster: focusses on topics such as organization, urban mobility, financial risk, public acceptance and international cooperation;
3. Legal Cluster: addresses strategic issues in relation to the C-ITS legal framework, data protection, privacy, security and certification
4. Assessment and roadmap Cluster: focusses on the assessment of (among others) safety challenges, non-equipped users, cross-site testing, identification of use cases and roadmaps.

It is recommended that the EU EIP project sub-activity 4.4 is seen as an exchange point for knowledge and experience for Road Authorities. A challenge is, as CODECS has tried in the runtime of the project, is to bring all the stakeholders (not only Road Authorities) together and to facilitate the more in depth discussion on strategic issues.

The European Commission is working on a Delegated Regulation on C-ITS, which is expected to be adopted in 2018. The main objective of this initiative is to establish clear framework conditions to improve the interoperability and continuity of C-ITS across Europe with the aim to significantly improve road safety and traffic efficiency. This Delegated Regulation aims to:

- establish common rules to ensure security of C-ITS communications

- ensure the practical application of the General Data Protection Regulation in the area of C-ITS

- ensure a forward looking hybrid communication approach

- establish common rules on interoperability and compliance assessment

- clearly define a set of priority C-ITS services to ensure continuity of C-ITS services.

This initiative will be restricted to services included in the Day 1 C-ITS Services List defined in the EU Strategy on C-ITS.

Input to this Delegated Regulation comes from among others the C-ITS Platform Phase II, which released the following two documents to steer the development of a common security and certificate policy and other accompanying documents needed for the deployment and operation of C-ITS in Europe:

- Certificate Policy for Deployment and Operation of European Cooperative Intelligent Transport Systems (C-ITS), Release 1, June 2017

- Security Policy & Governance Framework for Deployment and Operation of European Cooperative Intelligent Transport Systems (C-ITS), Release 1, December 2017

The Delegated Regulation will be a good starting point for tackling a range of strategic issues. However, in order to ensure that all strategic issues will be dealt with in the future and experiences are being shared, it is recommended that some sort of organisational structure is set up at EU level, in which it is ensured that all the strategic aspects necessary for the successful deployment of C-ITS are dealt with in an integral way, with sufficient resources and a long-term focus.

9.4. Disclaimer

Although a considerable effort was put into this report, it does not in any way pretend to be an exhaustive overview of all possible strategic issues with respect to C-ITS implementation. More issues will be identified once a full deployment of C-ITS will be on going. This report has tried to give an overview of the most important strategic issues and can be seen as the photo of this point in time.

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