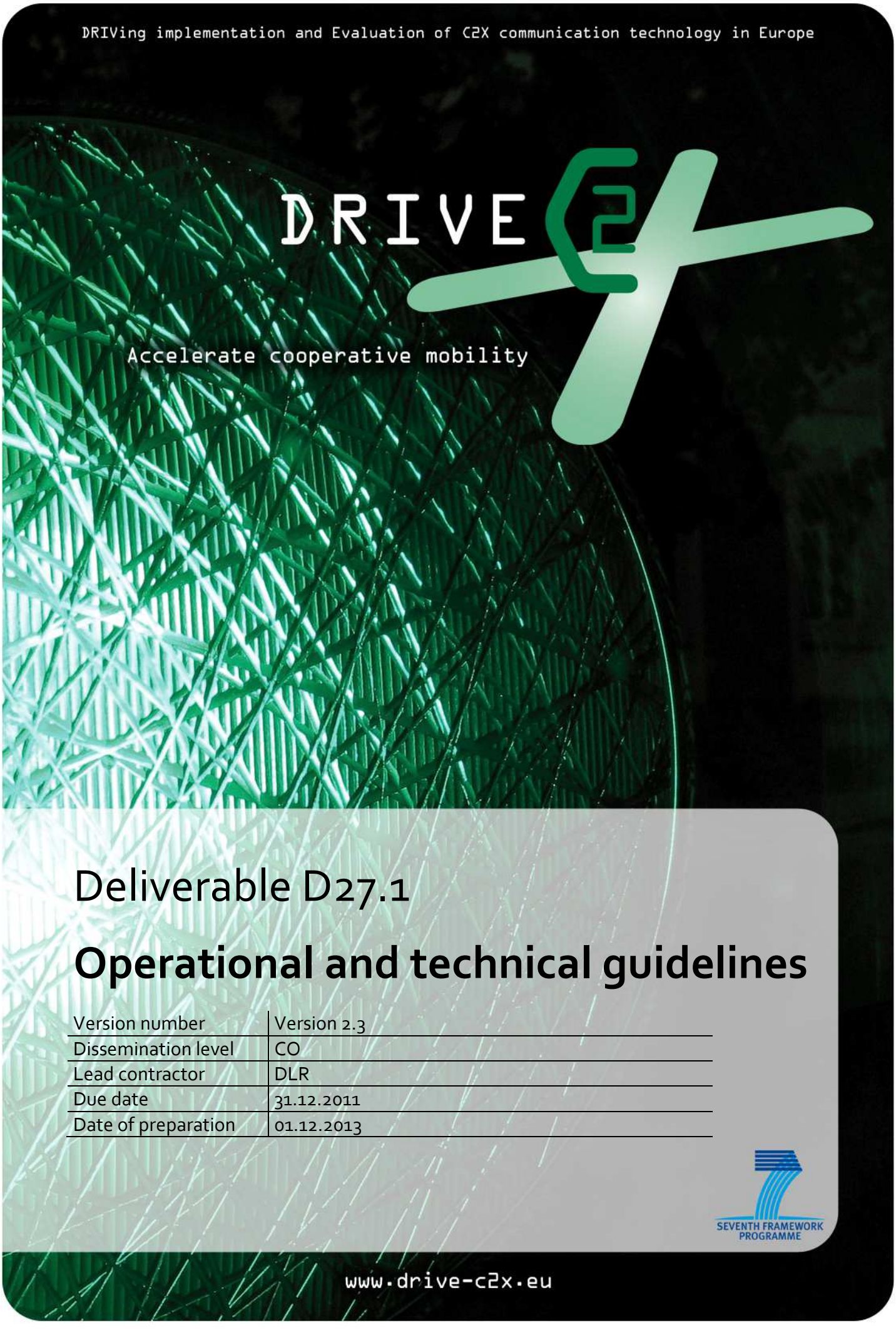
DRIVing implementation and Evaluation of C2X communication technology in Europe



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Operational and technical guidelines

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SEVENTH FRAMEWORK PROGRAMME

www.drive-c2x.eu

Authors

Henning Mosebach, (DLR)
Dirk Beckmann, (DLR)
Mohamed Mahmod, (DLR)
Florian Häusler (FHG)
Andras Csepinszky (ERT)
Francois Fischer (ERT)
Ion Giosan (UTC)
Sami Koskinen (VTT)

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Project co-ordinator

Matthias Schulze
Daimler AG
HPC 050 – G003
71059 Sindelfingen
Germany

Phone +49 7031 4389 603
Mobile +49 160 86 33308
Fax +49 7031 4389 210
E-mail matthias.m.schulze@daimler.com

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Executive summary

The DRIVE C2X project carries out comprehensive assessments of cooperative systems through Field Operational Tests (FOT). The tests will be deployed at several european test sites in Finland, France, Germany, Italy, Netherlands, Spain and Sweden. Each test site has a particular road infrastructure, so that the implementation of the cooperative functions is likely to be different from one test site to another. In addition to their heterogeneous appearance the test sites will be operated by different operating personnel and with different types of vehicles.

This deliverable provides operational and technical guidelines for the DRIVE C2X test sites. The document is needed to make sure that the quality of the data collected at the different test sites and the comparability of the FOT with different system setup is acceptable and of high quality. It also gives aligned instructions for operating the tests and for the execution of data analysis procedures.

In setting up the operational and technical guidelines, the FESTA methodology was closely followed. Accordingly, this deliverable was divided in to the three main parts from the FESTA methodology: FOT preparation, FOT operation and data handling.

In the FOT preparation part, first we present the organization of the test sites in the DRIVE C2X project. In general there are two types of test sites: System Test Sites (STS) and Function Test Sites (FTS). On a System Test Site the full DRIVE C2X system will be installed prototypically allowing implementation, test and evaluation of all use cases selected for DRIVE C2X. The only System Test Site is the test site in Helmond, Netherlands. Functional Test Sites are test sites that do not necessarily comply with the full DRIVE C2X spectrum. The purpose of the Functional Test Sites is primarily to deliver data for the evaluations. Besides they will also serve for interoperability test and for demonstration of the Europe-wide operation of the DRIVE C2X systems and components. All other test sites, except the Helmond site, are considered as Functional Test Sites.

Second, we explain the general architecture of the DRIVE C2X enhanced system. The architecture focuses on three main components: Vehicle ITS Station (VIS), Roadside ITS Station (RIS) and Central ITS Station (CIS). A VIS is equipped with communication hardware for information exchange with other vehicles or with RISs following the IEEE 802.11p standard. The communication hardware is connected to the vehicle on-board network to collect data within the vehicle and exchanged it between vehicles. A typical example of an RIS based function is the Variable Message Sing (VMS) or traffic lights equipped with communication hardware. Accordingly, the RIS can communicate with vehicles, or connected to the Internet to communicate with central component. A CIS is typically an organizational entity, where centrally managed applications and services are operated.

Third, we provide the necessary information to prepare the test sites and the vehicle fleet for the FOT. This includes both technical and non-technical process. Technical processes include information about setting up different ITS stations (e.g. RIS, VIS and CIS) as well as information about the use of the Test Management Centre (TMC) to manage the field operational tests. Non-technical processes include advices regarding legal and ethical issues as well as insurance issues and liability. In Appendix 8.2, we give a list of activities that are recommended to be done before the vehicle arrives at each test site.

In the FOT operation part, we give a comprehensive guideline to enable test sites to execute efficient FOT operations. Frist, we present the experimental procedure which was designed by the sub-project 4. The experimental procedure provides a consistent evaluation methodology to be used by all test sites for the FOT operation, as well as for collecting and processing the assessment data. Two different test approaches will be used within DRIVE C2X: controlled and naturalistic approach. In the controlled approach, the test drivers are called into the test and they are asked to drive the test route with some arrangements. In the naturalistic approach, the test drivers' behaviour is monitored in their daily driving, and the routes and driving times are based on drivers' needs. To able to evaluate the impact of cooperative systems, both baseline and treatment test phases are needed. Under treatment condition, the considered application/system is active and will provide assistance to the driver in situations according to the use case. In the baseline condition, the test person drives the same route under the same conditions as during the treatment – but without the assistance of the application or the possibility to use the function.

Second, we give recommendations for drivers' selection and sample size. In general, drivers should be between 20 to 50 years old and have more than 2 years driving experience. Most importantly is to avoid professional drivers and ITS experts as well as have a reasonable sharing among male and female (at least 30% of each). With regard to sample size, it is assumed that at least 1000 events should be collected from all test sites to ensure statistically significant results.

Third, we present test scenario tables for the choices to be made regarding test execution of controlled and naturalistic tests. The test scenario tables were given for nine functions which were selected by SP4. The functions include: traffic jam ahead warning, road works warning, car breakdown warning, weather warning, emergency electronic brake light, approaching, approaching emergency vehicle warning, post-crash warning, in-vehicle signage and green-light optimal speed advisory.

Finally, we provide information about test execution; in particular, the use of the Test Management Center (TMC) to execute scenario based tests. Moreover, relevant information about driver management was given. For example, before starting the FOT operation, drivers need to be properly informed about the project, its goal and scope, system principles as well as risk and liabilities. Furthermore, an agreement needs to be sign between the test site and drivers. Drivers' feedbacks should be collected through questionnaires. The feedbacks will be used to provide complement information to add to the collected data as well as to assess user acceptance. Using local language is

recommended for all types of questionnaires. The use of CODAR viewer tool for test monitoring was explained. During FOT execution, two maintenance aspects need to be considered: test site ITS infrastructure maintenance and test driver hot line. The hotline is intended to address test driver need to answer question about the vehicles and the systems, as well as resolving issues encountered by users while using the systems.

It should be noted that the FOT operation part is likely to be updated with the inputs from the validation activities within WP32.

In the data handing part, we give guidelines for the main steps that should be followed in data handling. First, we start with a description of data collection and organization from all test sites considering all possible test scenarios. Data should be collected as automatically as possible in ways that don't burden the participants or test site managers. The exception for this automatic collection is the small amount of manually retrieved data that can't be collected in any automatic way. Logging data will be recorded at multiple sources (ITS stations, and other sources). Then it is transferred to the test management centre and validated before being locally stored.

Second, we give specifications for data access defining the rights for all users and how users can interact with the data. Moreover, we present the ways that the users can access the data through GUI of all software modules and how these software can be used from the operators' point of view.

Third, we give information about data processing and analysis with the needed tools that can be used by the analysers. In the process of data analysis one has to follow some strategic rules and apply the required techniques such as applying appropriate statistical tests or using data mining to uncover hidden patterns in the data. Due to the large amount of collected data it is necessary to create separate software tools for processing and summarizing the data. The main purpose for this processing is to clean and validate the data, to perform map matching and enrich the data with additional information and to calculate various derived variables and summary files for analysts. A set of analysis tools that could be used for data analysis process were proposed and presented in **Fehler! Verweisquelle konnte nicht gefunden werden.**.

Finally, we define privacy and agreements related to the protection of private data. It should be ensured by all test sites that personal information of the test users will not be collected to the central database. The user agreements will define the use and protection of private data for example by using unique user ID.