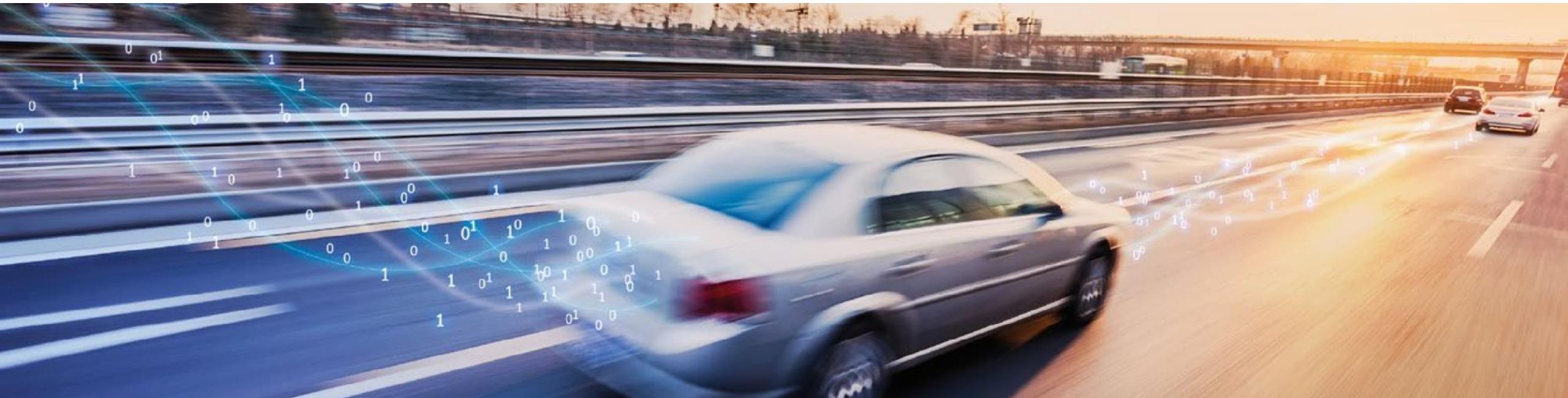# ASAM OpenDRIVE Transfer Project

First Meeting

Moderator
Dr. Sebastian Tuttas
3D Mapping Solutions GmbH

Co-Moderator
Nicco Dillmann
Global Technology Manager
ASAM e.V.

August 28, 2019
Höhenkirchen/Germany

ASAM Association for Standardization of Automation and Measuring Systems

Welcome & Agenda

Agenda

| Time	Topic	Speaker
10:00	Welcome & Agenda	Sebastian Tuttas (3DMS)
10:10	Introduction of Participants	All
10:25	Introduction to ASAM Projects • Process • Tools • Roles & Responsibilities • Deliverables • Templates	Nicco Dillmann (ASAM)
11:15	Election of Project Leader	Nicco Dillmann (ASAM)
11:30	Features and Requirements	Sebastian Tuttas (3DMS)
12:30	Lunch	
13:30	Technical Discussion	Sebastian Tuttas (3DMS)
15:30	Roadmap and Responsibilities	Nicco Dillmann (ASAM)
17:00	End	

ASAM

Welcome & Agenda

OpenCRG

- Current version 1.1.2 hosted by Vires from April 7th

- CRG = "Curved Regular Grid„
  - Developed by Daimler AG
  - open source C-API for data handling and evaluation
  - open source MATLAB® API for data manipulation and generation

- Usage
  - Vehicle dynamics
  - Tire simulation
  - Driving simulation
    (Combination with OpenDRIVE !)
  - Vibration simulation

$\times$ = Measurements
$\times$ = regularized grid ponts
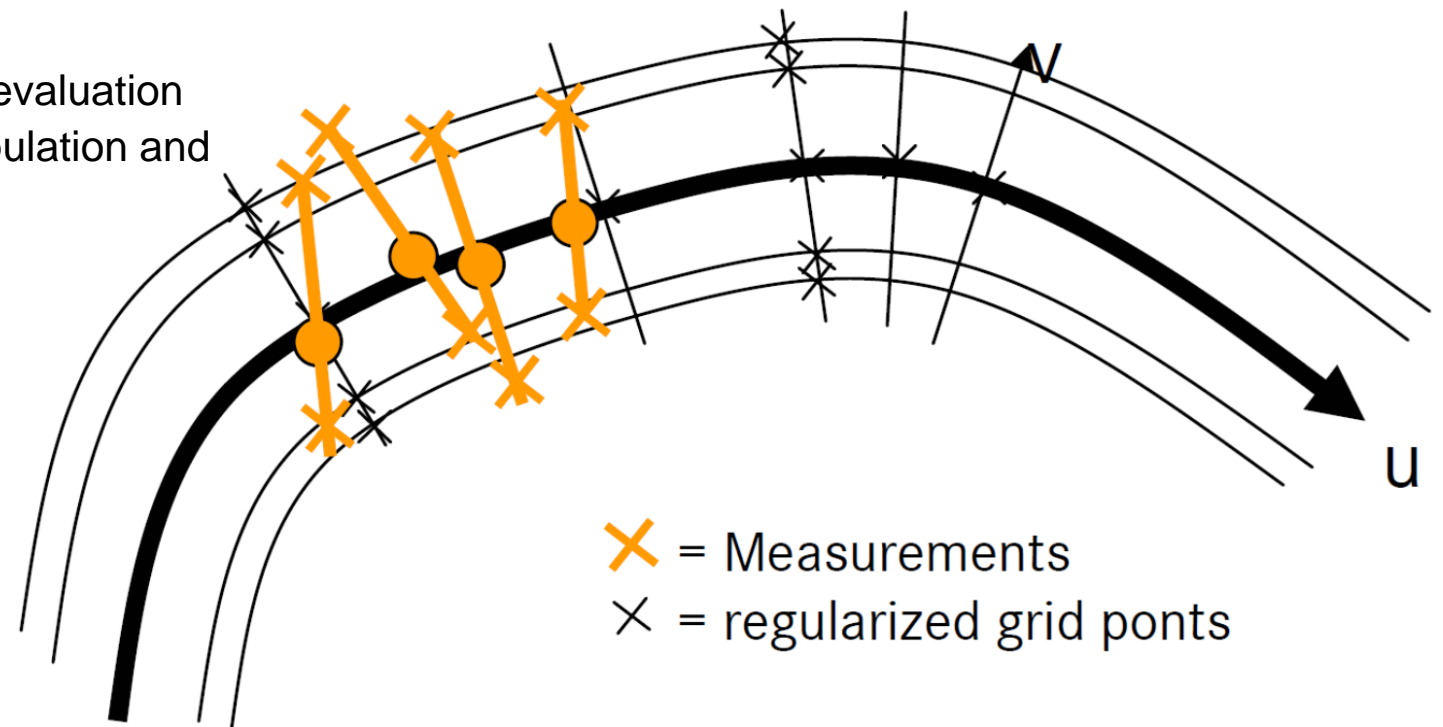
ASAM

Welcome & Agenda

Tasks in this project

- Creation of the ASAM OpenCRG standard document:
  - Extraction of normative parts.
  - Creation of a second document which incorporates the „user manual"-parts of the originally document.

- OpenCRG Code
  - Transfer to ASAM style (e.g. adjust headers)
  - Requirements and Features

- Outcome (Deliverables):
  - OpenCRG specification document
  - OpenCRG User Manual
  - Version 1.2 Source Code M + C

CRG road XYZ map (in curved XY grid)

ASAM
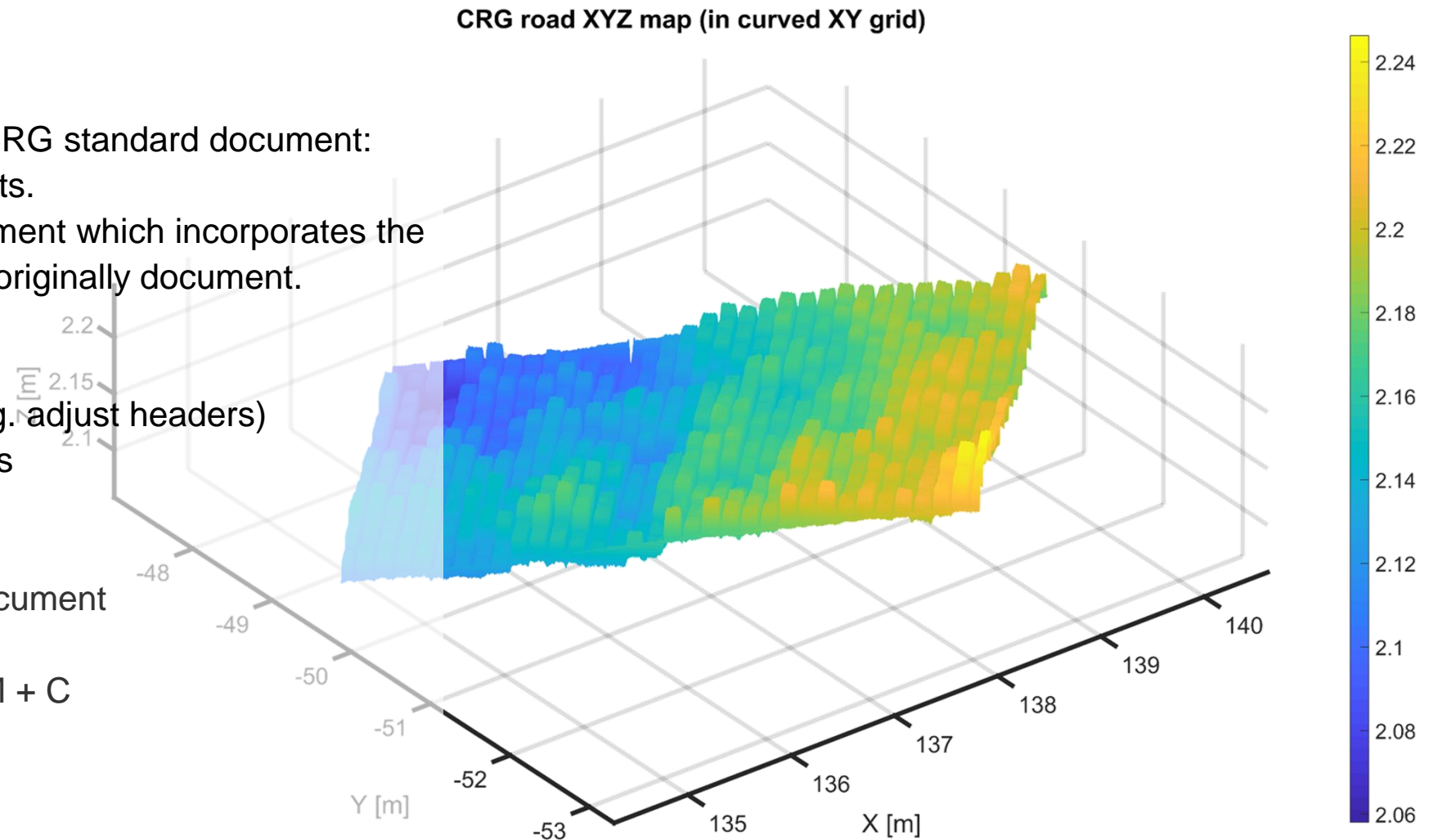
Introduction of Participants

Participants

Registrations

- Sebastian Tuttas   3D Mapping Solutions GmbH
- Marius Dupius   Vires Simulationstechnologie GmbH
- Arben Parduzi   BMW AG
- Günther Preschany   Porsche AG
- Jelle van Doornik   cruden
- Takahiro Yanagi   OTSL

Moderator

Sebastian Tuttas

Host & Co-Moderator

Nicco Dillmann   ASAM

Email Distribution List: opencrg@asam.net

SVN Link: https://svn.asam.net/Projects/Standard/P2019-05_OpenCRG_Transfer_and_Development_Project

Github Repositiory: t.b.d

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Introduction of Participants

Questions

- For what do you use OpenCRG?

- How do you use OpenCRG?
  - Matlab / C
  - Simulation Software (Which?)

- How experienced are you?

- Are you also interested in OpenDrive and OpenScenario?

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ASAM Processes

Standard Development

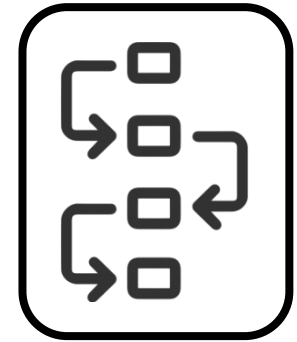> **Standards are developed in projects by experts.**

What does this mean?

- Projects are proposed by ASAM members[*].

- Projects are approved, controlled and released by the TSC (technical steering committee).

- Content of the standard is worked out in detail in project group meetings by the project members.
    - Meetings are <u>work</u>shops, i.e. they require active work participation of project group members.
    - "Passive" or "information-only" participation does not make sense and is not allowed by ASAM.

- Projects may be supported by a service provider paid from an ASAM budget.

- Project groups are given a lot of freedom to organize their own work.

- Project members make all decisions with respect to the technical content of the standard.

- The TSC makes a release decision after the project is finished.

[*] members in "executive" membership class only

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ASAM Development Process for Standards

I — Ideation
- Ideation Initiatives
- ASAM Concept Projects
- Topical Workshops
- Market Surveys
- ASAM Study Groups
- Transfer of Public Specifications

P — Proposal Phase
- P1: Proposal Workshop
- P2: Proposal Writing
- P3: Proposal Submission
- P4: Proposal Publication
- P5: Proposal Decision

D — Development Phase
- D1: Standard Development

C — Review Phase
- C1: Draft Release
- C2: Public Draft Review
- C3: Feedback Deadline
- C4: Feedback Processing

R — Release Phase
- R1: Candidate Release
- R2: Release Candidate Review
- R3: Release Decision
- R4: Publication Preparation
- R5: Publication

Project Types

Standard Development Projects

New Standard Development

⇨ Develop new standard

Major Version Development

⇨ Add major content

Minor Version Development

⇨ Make smaller additions and changes, should be backward-compatible

Revision Version Development

⇨ Fix issues, must be backward-compatible

Other Projects

- Implementation Project
  - ⇨ Create supplementary products that support the application of ASAM standards

- Concept Project
  - ⇨ Preparation of standard development projects
  - ⇨ Allow international members to influence existing ASAM standards via local concept development projects

- Study Project
  - ⇨ Joint learning and application of ASAM standards
  - ⇨ Feedback to standard development group

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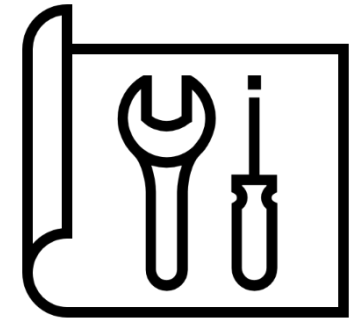
Best Practices
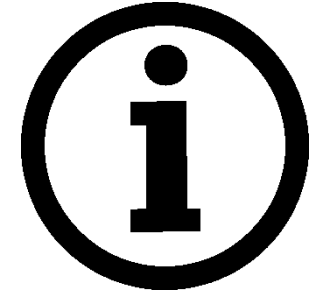
Most productive project format:

- Regular (monthly) on-site meetings to discuss standardization concepts and review new/revised sections of the standard.
- Use online conferencing for groups with international participants.
- Remote meetings (WebEx, Teams etc.) for organizational or easy technical topics.
- Project leader manages the group's work.
- Document owner writes the standards.

Start of technical work:

- Define or confirm use-cases, top-level requirements and features to be considered for the development of the standards.
- Determine chapter structure of the standard.
- Start to define the terminology (terms, acronyms, abbreviations).
- Then proceed with feature standardization.

Consent building and voting:

- Project leaders shall drive the group to 100% consent decision.
- If unanimous consent cannot be reached, then voting is carried out. One company = one vote.

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Mandatory Rules

ASAM project groups have a lot of latitude to organize their work.
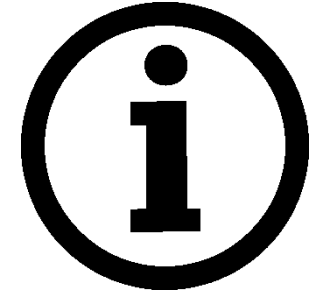
Some rules are mandatory to guarantee an orderly and fair execution of projects.

- Each project has an elected project leader.

- Each meeting is documented via meeting minutes.

- The business language is English.

- One company = one vote.

- The ASAM standards template must be used for standard documents.

- No "passive" or "info-only" project group members, or permanent guests.
  (members must actively participate in the project or can not participate at all)

- ASAM does not accept "confidential" information and limited IP.
  (information and IP is open to all, or can not be brought into ASAM)

- No pre-publication of project IP.
  (exceptions: public review or majority decision by the project members)

- The ASAM IT infrastructure must be used.
  (no file exchange via email, no use of external tools or servers)

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ASAM Tools

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Tools

|			
File sharing:		Subversion & Github	svn.asam.net t.b.d
Bug reports:		Bugzilla	bugzilla.asam.net
Feature requests:		Bugzilla	bugzilla.asam.net
Draft document reviews:		Adobe Shared Review & Word	webdav.asam.net
Online conferencing:		WebEx	asam-online.webex.com
Collaboration:		Microsoft Teams	OpenCRG Team

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Roles and Responsibilities

ASAM

What is Expected from Project Group Members?

Task

Develop the standard as defined in the project proposal.
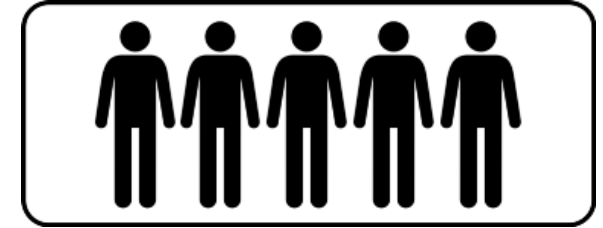
Members (= Experts)

- Provide use-cases, application & process knowledge and requirements.
  (typically OEMs and Tier-1s)

- Provide technical expertise on solutions and implementations.
  (typically tool vendors)

- May write parts of the standard and contribute other artefacts.

- Review the work of the standard author.

- Vote on the acceptance of individual proposals and technical release of the standard.

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Project Leader

Tasks

- Is elected by the project group members.
- Organizes and manages the work group.
- Sets the meeting agendas.
- Moderates project group meetings.
- Manages service provider(s).
- Represents the group towards the TSC and ASAM Office.

Rights & Resources

- Can invite guests to meetings.
- Approves access to project IT resources.
- Obtains WebEx-account from ASAM.
- Uses the service provider as a resource within the limits of project group and TSC decisions.
- Approves deliverables from the service provider.
- Speaks on behalf of the group to external parties.

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Other Roles

Document Author

- Writes (parts of) the standards.
- Integrates written contributions into the standard documents.
- Typical: Is done by a paid service provider.

Note Taker

Each meeting must have minutes, stored in SVN.

- Writes the meeting minutes.
- Obtains presentations and other meeting materials and puts them in SVN.

Host

Meetings shall be held at alternating locations. Each members shall host a meeting once.

- Provides meeting room and catering.
- Provides phone and Internet access.

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Deliverables and Templates

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Election of Project Lead

Result: <Name>
voted: x/6

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Features and Requirements

ASAM

Features and Requirements

Overview

Estimated effort and difficulty for implementation:
+++ high to + low

- F001: Improved Georeferencing (+)

- R003: Show reference line on maps from multiple map-providers (+)

- R002: Allow wide roads with high curvature (++)

- F002: Multiple Data Layers (++)

- F003: Special Areas (optional) (++)

- R001: Harmonize the refence line definition with OpenDRIVE (+++)

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Features and Requirements

Improved Georeferencing

Used for

- Header information
- Html-overview
- More ??

Tasks:

- Include transformation parameter in Header
- Update all wgs84 related functions

Questions:

- Allow only UTM or arbitrary projections?
- Transformation from projected system to lat/lon sufficient?

2018ff:
upcoming contribution by Jochen Rauh

Forward/backward transformation GEO-coordinates (lon/lat) <-> CRG-coordinates (x/y) from meter accuracy to centimeter accuracy by simply adding some projection information, e.g.

```
pro.proj.nm = 'TM_6';
pro.proj.f0 = 0.9996;
pro.proj.e0 = 500000;
```

(will soon be available in Matlab reference implementation of OpenCRG)

Daimler AG

OpenCRG / Jochen Rauh / 2018-10-10 Seite 11

Features and Requirements

Show reference line on maps from multiple map-providers

Used for

- Html-overview

Tasks:

- adapt
  crg_wgs84_crg2html and
  map_wgs2html.m + ???

Questions:

- Which map provider? OpenStreetMap?
- Allow different providers including Google?

OpenCRG road overview
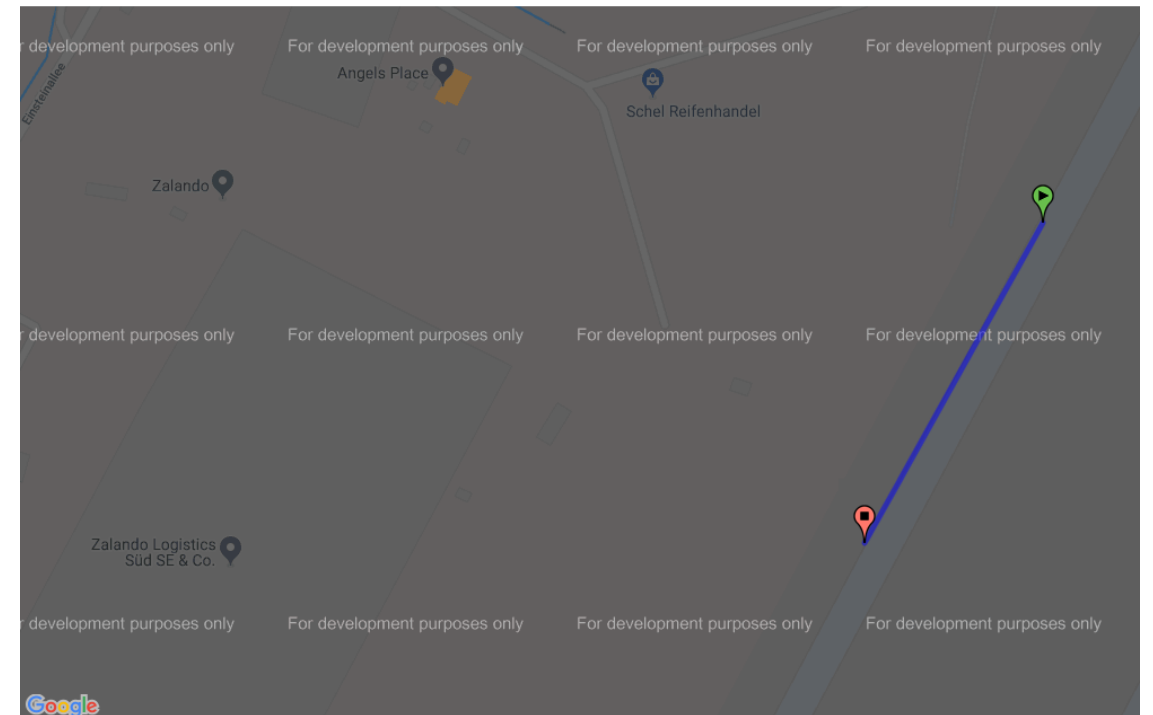
Open*CRG*®- managing the road surface ahead.

generated by crg_wgs84_crg2html at 2017-09-26 12:05:59
visit http://www.opencrg.org to get latest news

Features and Requirements

Allow wide roads with high curvature

Problem Statement

- Global check for curvature vs. road width

Tasks:

- Update crg_check

Questions:

- Difficulties in other software which use crg?

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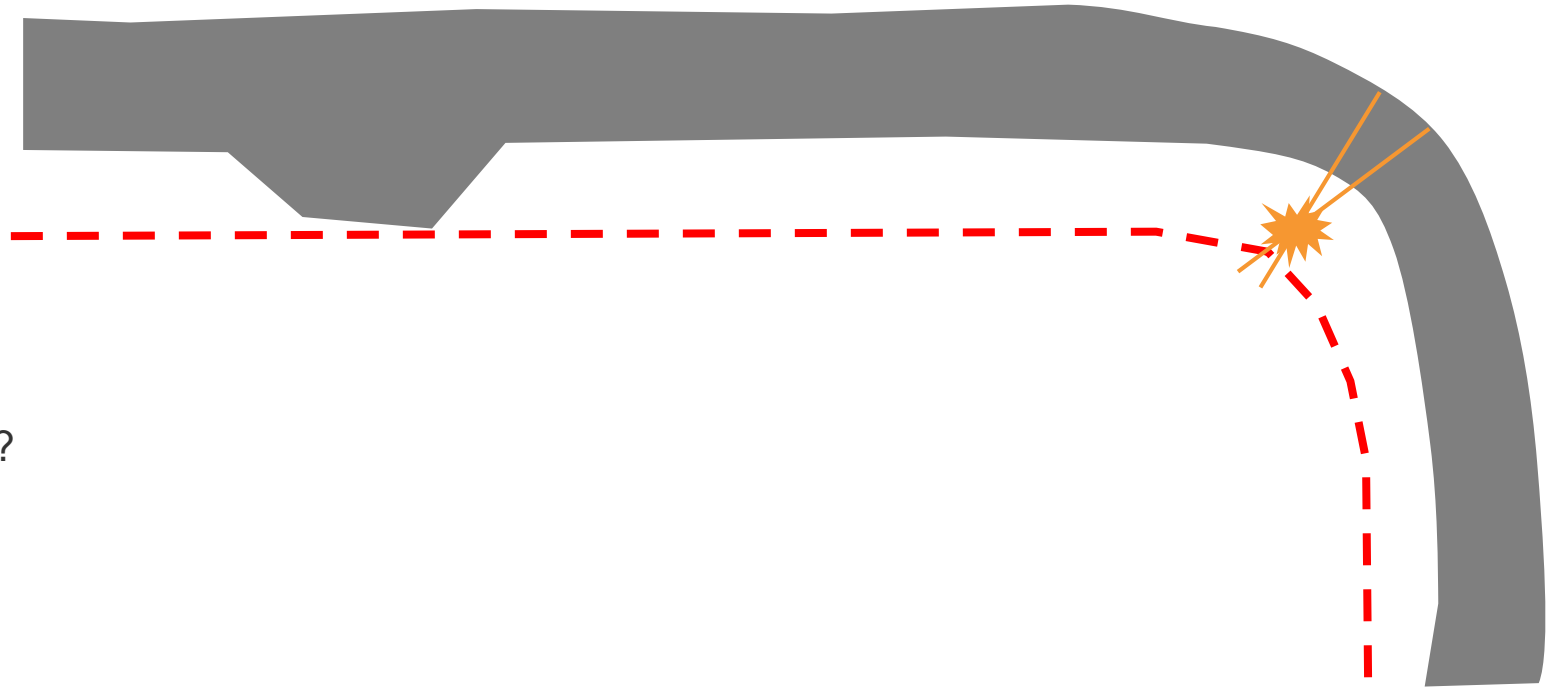
Features and Requirements

Multiple Data Layers

Problem Statement

- CRG can only handle one layer

- Additional layers for friction, road quality or luminance/gray values needed

- At the moment: Duplicate crg and change the values in the raster grid.

Questions:

- How to integrate in data format, Matlab data structure

- How is the usage of simulation tools?

- Existing implementation of Daimler available?

- How to handle different resolutions for different layers.

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Features and Requirements

Special Areas

Problem Statement

- Allow holes in CRG grid by filling it with NaN or special key-values for indicating non-drivable areas in the CRG data.

Questions:

- Need for this feature?
- Valuable for OpenDrive integration?

e.g. traffic island

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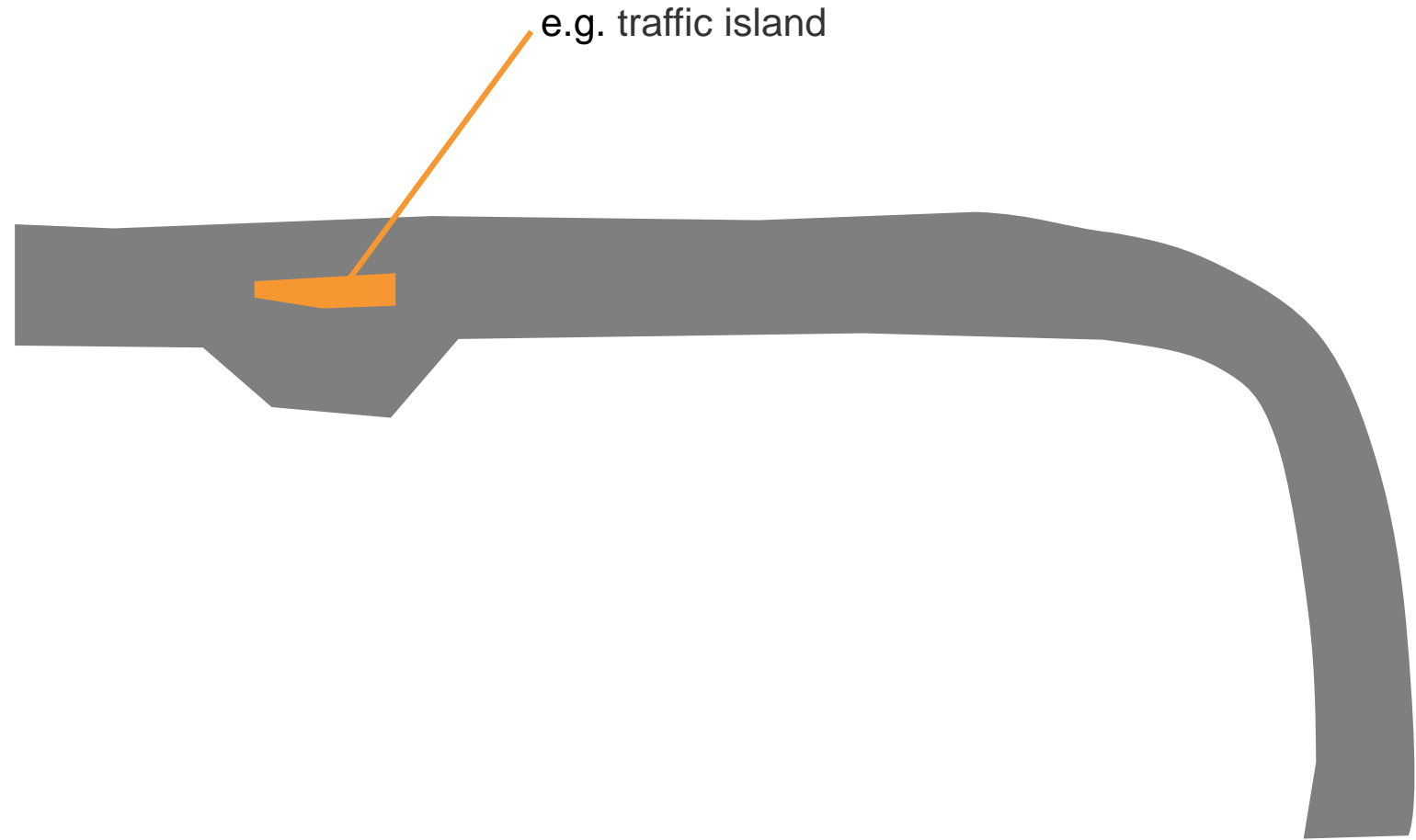
Features and Requirements

Harmonize the refence line definition with OpenDRIVE

Problem Statement

- openCRG and openDrive follow different road axis (reference line) representations. Especially for axes with high curvatures and with larger grid size (i.e. axis increment) this leads to inconsistencies in the axis length and consequently to errors in the resulting heights for a query on a certain axis position. This is especially relevant, when the mode "attached" is used where the reference line of the CRG data is replaced with the OpenDRIVE road's reference line.

- openDrive: length of spline
- openCRG: length is sum of polygon length

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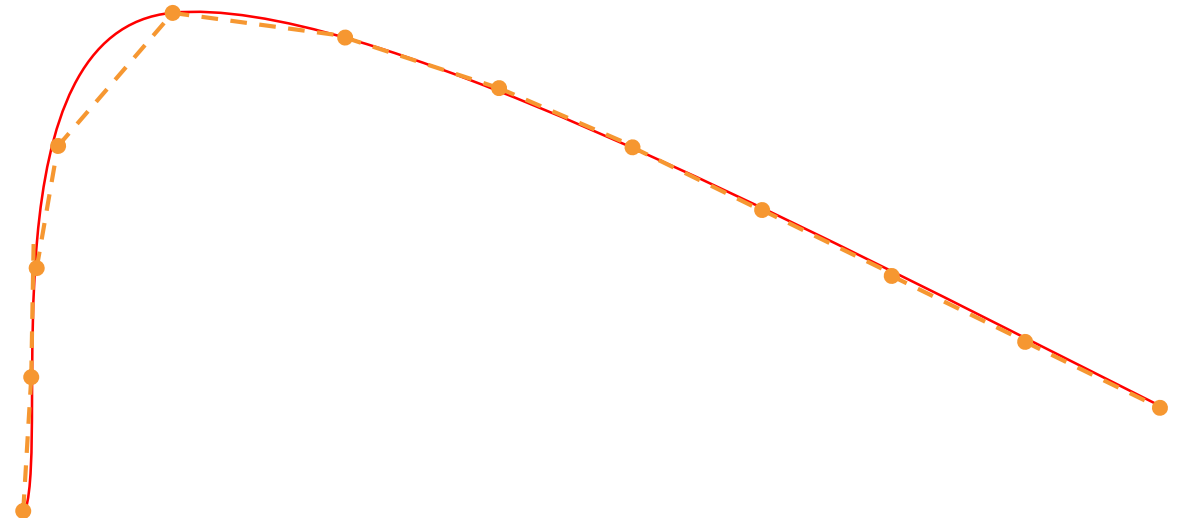
Features and Requirements

Harmonize the refence line definition with OpenDRIVE

Extract: From OpenDRIVE Format Description:

Mode `attached`:

The reference line of the CRG data set is replaced with the OpenDRIVE road's reference line, taking into account the `tOffset` and the `sOffset` parameters

The CRG local elevation values (calculated by evaluating the CRG grid and applying `zOffset` and `zScale`) will be added to the surface elevation data of the OpenDRIVE road (as derived from the combination of elevation, super-elevation and crossfall).

With this mode, the surface information relative to the original CRG data's reference line is transferred from an arbitrary CRG road to an OpenDRIVE road without having to make sure that the overall geometries of the road match. The original position, heading, curvature, elevation and superelevation of the CRG road are disregarded. The CRG grid is evaluated along the OpenDRIVE reference line instead of the CRG reference line.

$$\begin{pmatrix} u \\ v \end{pmatrix}_{CRG} = \begin{pmatrix} s - s_{Offset} \\ t - t_{Offset} \end{pmatrix}_{OpenDrive}$$
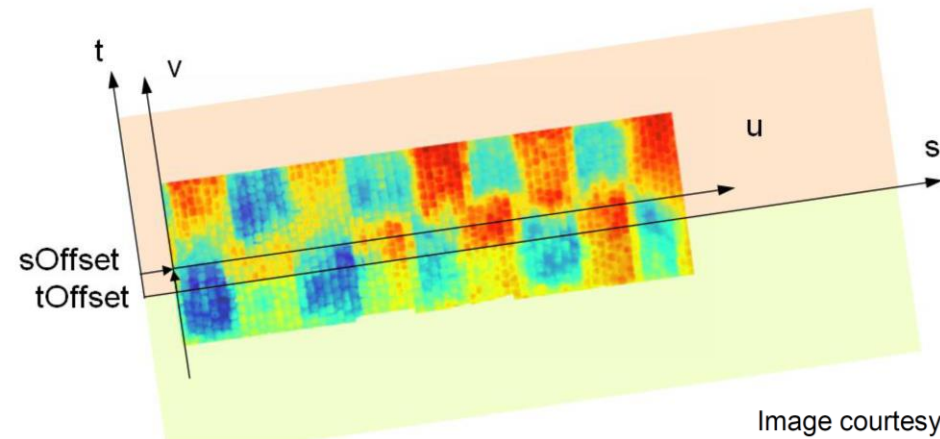
Image courtesy of Daimler AG

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Agenda

Time	Topic	Presenter
10:00	Welcome & Agenda	Sebastian Tuttas (3DMS)
10:10	Introduction of Participants	All
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15:30	Roadmap and Responsibilities	Nicco Dillmann (ASAM)
17:00	End	

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Discussion

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Discussion

Implementation of Features and Requirements

- Possibilities
  - Implementation in 1.2 by Project Group
  - Implementation in 1.2 by Service Provider
  - No Implementation
  - Implementation in later release
  - Definition in Standard but no implementation

- Features and Requirements
  - R001 (Reference Line)
  - R002 (Curvature)
  - R003 (Map-Provider)
  - F001 (Georeferencing)
  - F002 (Multiple Data Layers)
  - F003 (Special Areas)

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Discussion

Further Issues

- A
- B
- C

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Discussion

OpenX Coordination

- Harmonize Terms and definitions with other OpenX-Standards
- B
- C

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Discussion

Standard and Manual

- A
- B
- C

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Discussion

CRG 2.0 Ideas

- Octave Support
- "Simple CRG"
- C

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Discussion

Open CRG Hosting and Contribution

- Bugfixes etc.
- B
- C

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Roadmap and Responsibilities

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Roadmap and Responsibilities

Schedule (from Proposal)

TABLE: TIME SCHEDULE

WP-No.	Title / Description	2019											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	Specification creation	☐	☐	☐	☐	☐	☐	☐	☐	☒	☒	☒	☐
2	Concepts for feature implementation	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☒	☐
3	Standard implementation review	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4	Feature implementation review	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

TABLE: TIME SCHEDULE

WP-No.	Title / Description	2020											
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4	Feature implementation review	☐	☐	☐	☐	☐	☒	☒	☒	☐	☐	☐	☐

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Next Meetings / Recurrent Meetings

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Thank you!

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