

OpenDRIVE[®] - managing the road ahead

OpenDRIVE[®] is the leading open format and de-facto standard for the description of road networks in driving simulation applications.

OpenDRIVE[®] is based on XML; it allows for the exact description of simulated roads using the same elements that are found in real roads (lines, curves, clothoids, (super-)elevation profiles, lanes, signals etc.). It is compatible with right- and left-hand driving rules and can be localized in terms of signaling features.

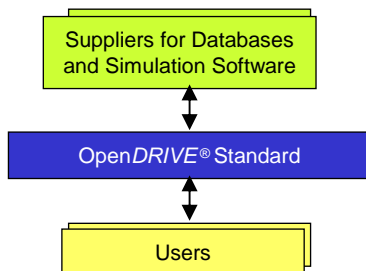
OpenDRIVE[®] started in 2005 as an initiative of Daimler AG Driving Simulator and VIRES Simulationstechnologie GmbH, Germany. It made its first public appearance in 2006 and is since supported by a constantly growing user community in the driving simulation industry.

OpenDRIVE[®] is a mature format which has proven its usability in numerous driving simulation solutions like vehicle dynamics, traffic simulation, scenario simulation etc. It is managed by a core team of international driving simulation experts who harmonize and translate incoming user requirements into regular updates of the format.

Further information and free downloads: www.opendrive.org

Drop us a line: opendrive@opendrive.org

A Simple Idea



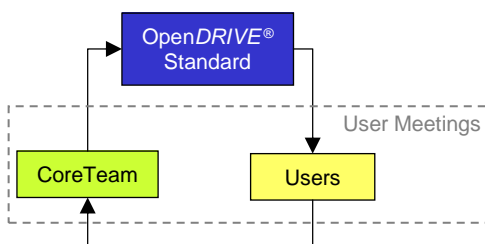
Benefits

- simplified exchange of road networks between simulators
- creation of database pools for multi-party projects
- selection from a broader range of suppliers

Elements

- road geometry (e.g. reference line, elevation, superelevation, lanes)
- signaling (e.g. signs, signals)
- road type and speed profile
- simplified road surface (e.g. materials, patches)
- infrastructure (e.g. tunnels, bridges)
- arbitrary objects
- variations (data sets)
- custom extensions (user data)

A Well Managed Format



Core Team

- Martin Strobl / BMW Forschung und Technik GmbH
- Hans Grezlikowski / Daimler AG
- Andreas Richter / Deutsches Zentrum für Luft- und Raumfahrt e.V.
- Dr. Günther Nirschl / Fraunhofer-Institut IVI
- Ekkehard Klärner / Krauss-Maffei Wegmann GmbH & Co. KG
- Dr. Bernhard Bock / Rheinmetall Defence Electronics GmbH
- Ingmar Stel / TNO
- Marius Dupuis / VIRES Simulationstechnologie GmbH
- Mats Lidström / VTI

An Established Format



Listed Users (on www.opendrive.org)

- Audi Electronics Venture
 - BMW Group Research and Technology
 - Daimler
 - Deutsches Zentrum für Luft- und Raumfahrt
 - Fraunhofer – IVI
 - Krauss-Maffei Wegmann
 - MBtech – Mercedes-Benz technology
 - Realtime technologies
 - TESIS DYNAware
 - Technische Universität München
 - TrianGraphics
 - VIRES Simulationstechnologie GmbH
 - VTI – Swedish National Road and Transport Research Institute
- and many more across the planet...

OpenCRG[®] - managing the road surface ahead

OpenCRG[®] is the leading open source data format and tool-suite for the creation, management and evaluation of detailed road surfaces.

OpenCRG[®] is based on a data format called "CRG" (Curved Regular Grid) and various tools which have been made available to the public by Daimler AG, Germany, within the OpenCRG initiative. Funded by five German automotive OEMs, VIRES Simulationstechnologie GmbH further developed the existing elements into the full tool-suite that is available now.

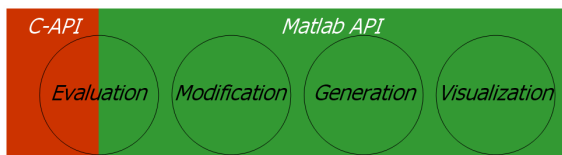
The OpenCRG[®] project started in October 2008. The full release of tools and documentation is available since April 2010.

Further information and free downloads: www.opencrg.org

Drop us a line: opencrg@opencrg.org

Tools

The OpenCRG[®] tool-suite contains a series of MATLAB[®] tools for the modification, generation, visualization and evaluation of CRG data sets. It is complemented by a C-API which provides evaluation-only functionality but which also guarantees maximum performance for real-time applications.



	C-API	Functionality	MATLAB-API	Remarks
BASICS	ANSI-C (C99)	Standard	Matlab Ver. R.14 ff.	MS Vis. C++ (mostly C90)
	+	Load	+	single, double – precision
	-	Store	+	binary, ascii – representation
EVALUATION	real-time	Performance	optimized	uv2z, uv2xy, xy2uv, uv2phi
	+	Continue track	+	OpenCRG ver. 1.0
	+	Options	+	smoothing, bordermodes ec.
	+	Modifier	+	rotate, translate ec.
GENERATION	-	Generate	+	create synthetical track
	-	Gen. Refline	+	xy2phi
MODIFICATION	-	Adder	+	concatenate tracks
	-	Comparator	+	compare crg-files
	-	Cutter	+	separate two tracks
	-	Extractor/Absorber	+	slope and banking
	-	Filter	+	simple filter (kernel)
	-	Limiter	+	limit z-value by threshold
	-	Mapping	+	inertial and global mapping
	-	Peakfinder	+	
	-	Re-render	+	
VISUALIZATION	-	Visualization tools	+	i.g. uv, xy, reference line

Data



OpenCRG[®] comes with an extensive set of data examples which allow the user to easily gain first experience in using the format. By means of the open source tool-suite, users may generate their own data sets or may rely on 3rd party suppliers which are available for detailed measurements of real roads.

Applications

Applications using OpenCRG[®] functionality today include but are not limited to various major tire models. Applications like *vehicle handling*, *ride comfort*, and *durability load simulations* are the typical use cases. Nevertheless, the data format may also be used for the evaluation of any other physical data within a location-based context.

Instead of storing elevation data of a road surface, one can also store measured or synthetic data about friction coefficients, temperature etc. Thus, OpenCRG[®] provides a more or less generalized approach of linking local properties of a road surface to the respective evaluation routines and provides all tools necessary for data generation and handling.