

Terrain Generation for Driving Simulations

Kick-Off Workshop ASAM OpenDRIVE, 9.10.2018





Overview

Overview

- Introduction
- Generation
 - Terrain / Road network
- Export
 - Terrain / OpenDrive





Terrain Generation - Database Generation System



Flight

Create vast databases for flight simulations including fully-featured airports



Maritime

Databases from nautical charts, can be combined with ground databases



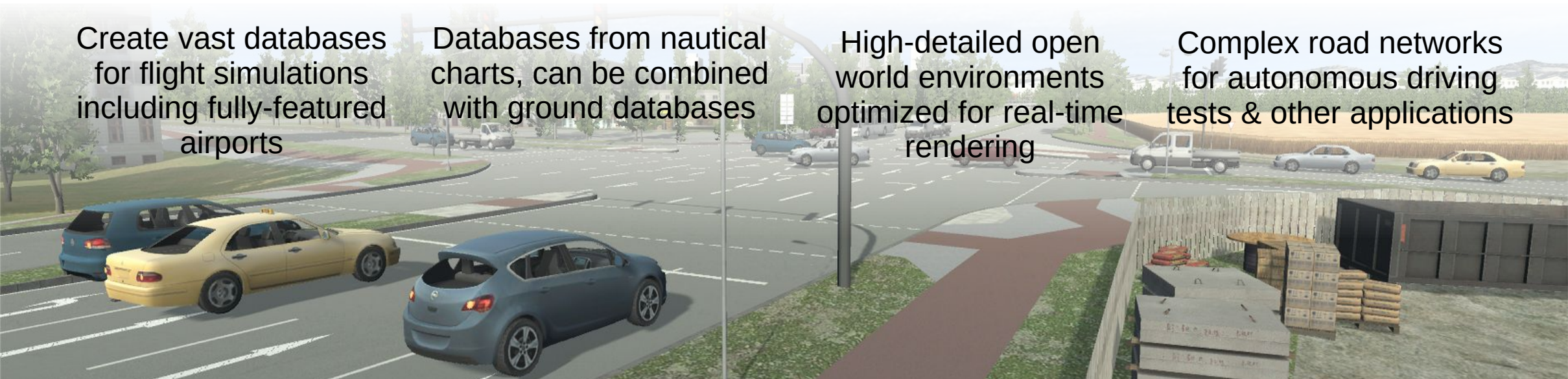
Ground

High-detailed open world environments optimized for real-time rendering



Automotive

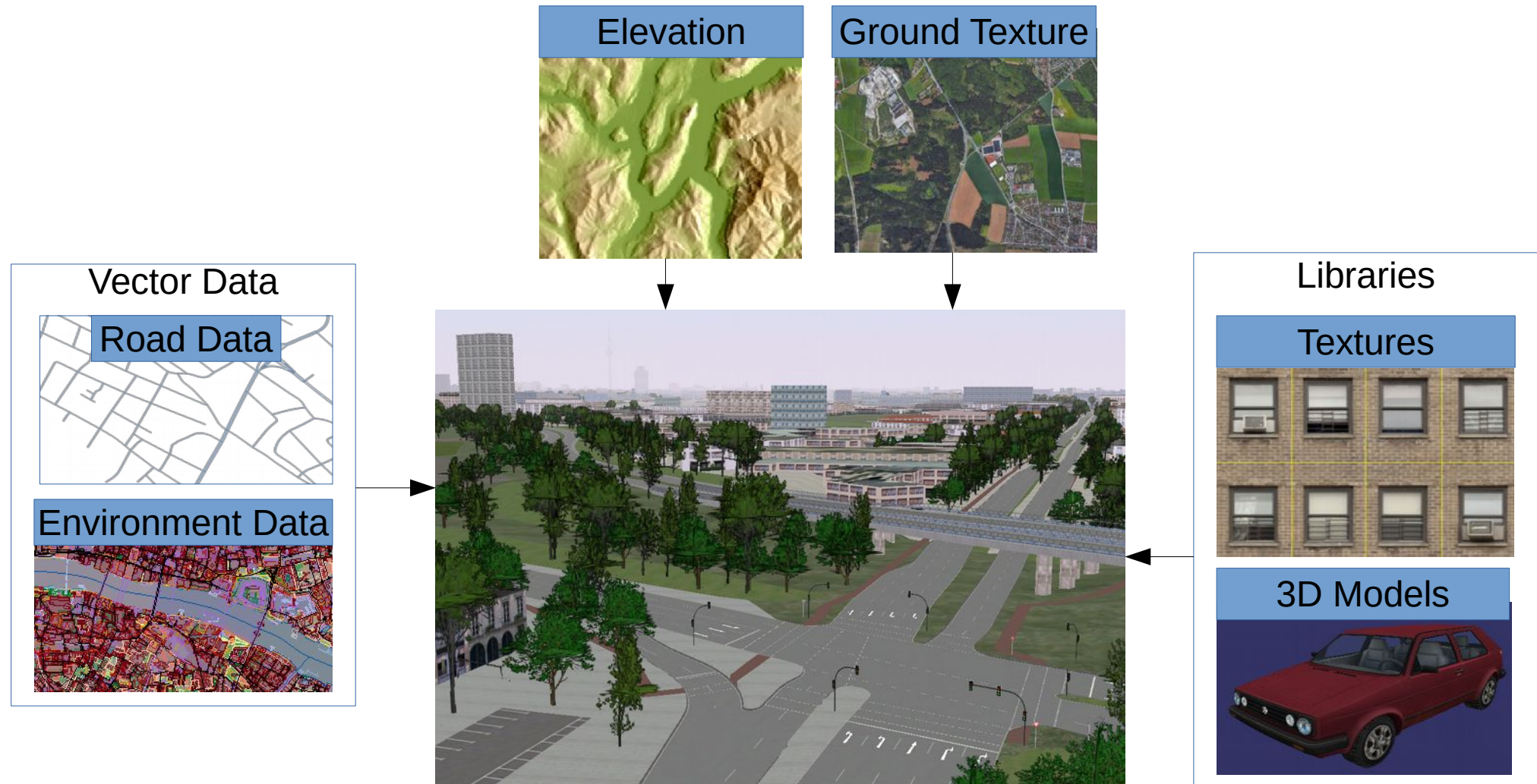
Complex road networks for autonomous driving tests & other applications



Terrain Generation - Multitude of Use-Cases



Terrain Generation - Content



Import of Real-World Road Data

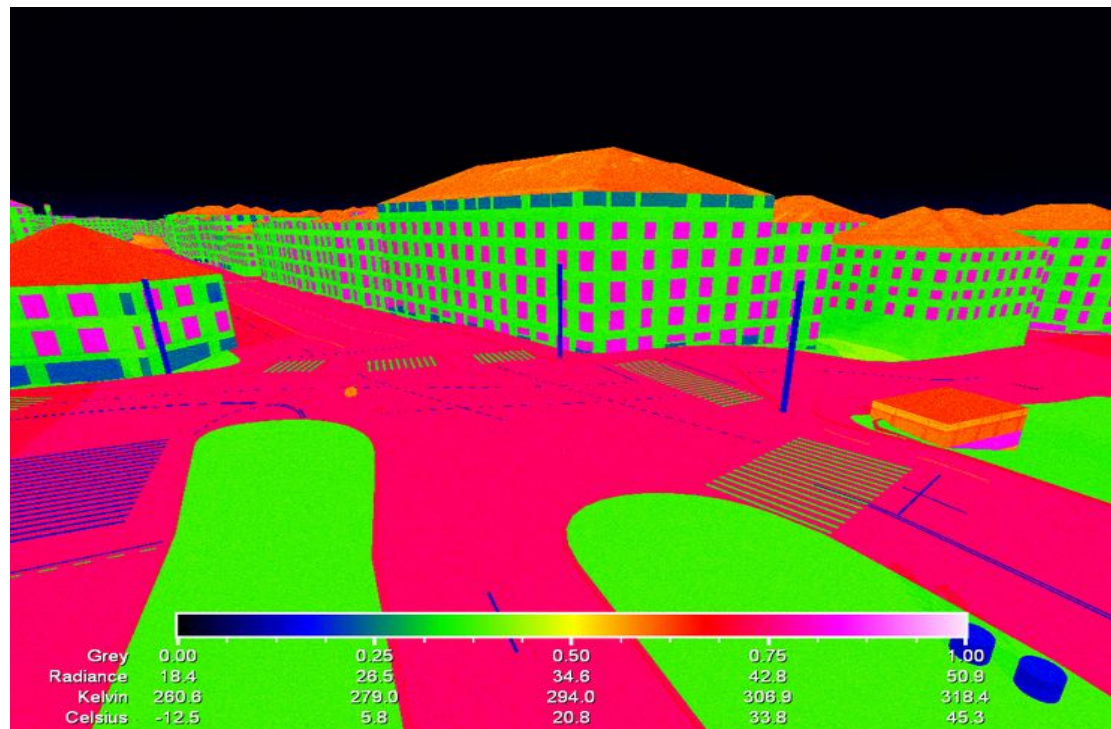
- Center line based
 - OpenStreetMap
 - HERE RDF
 - ESRI Shapefile etc.
- Lane based
 - HERE HD Live Maps
 - OpenDrive
 - Lane based shapefile data
 - Customer formats



Terrain Generation - Sensor

Sensor Data

- Definition of physical surface attributes
- Flexible generation of sensor images with reference to attributes
- Support of night vision, material classification, ...



Sensor Global Settings

☒ Sensor Active

ClassSet Values

Max classes in class set

Min class weight %

Encoding

☒ 8 bit ☐ 16 bit

Write

☒ File ☐ Description

File name

Texture format read

Texture format write

Generation mode

☐ Add Texture Layer

Class List File

File

Class List

ID	Name	Co
0	Grassland	
1	Scrubland	
2	Ded. Forest	
3	Field - Ploughed	
4	Water	
5	Roads	
6	Urban / Concrete	
7	Field - dry	
8	Sand	
9	Fields - Crops	

Class Attributes

Template

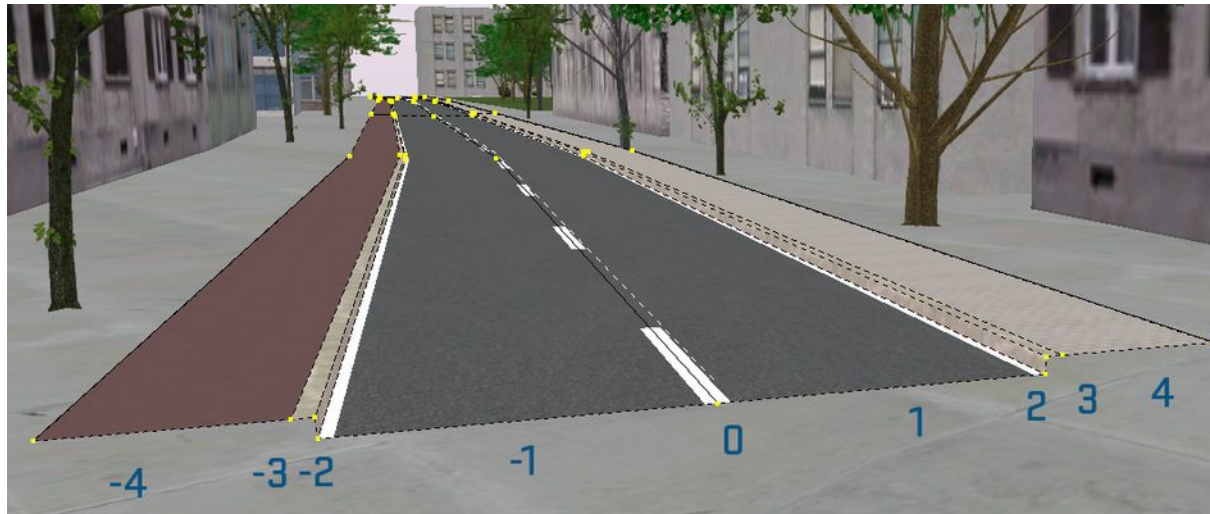
Attributes

name	value
brightness	0.1
weighting	40
SB_ID	10
SB_isWater	FALSE
SB_isWadi	FALSE
SB_isSnow	FALSE
SB_Drag	0.12
SB_Traction	1
SB_Hardness	1
SB_WetDrag	0.15
SB_WetTraction	0.7
SB_WetHardness	1
SB_Bumpiness	0.2
SB_Dustiness	0
SB_Obj1	Grass-002.tif
SB_Obj1_Density	80
SB_Obj1_Height	0.3
SB_Obj2	Grass-004.tif
SB_Obj2_Density	80
SB_Obj2_Height	0.3
SB_Texture_Hi	grass4.jpg
SB_Texture_Lo	medGrass2.jpg
IR	Sand



Road Generation - Roads

Profiled Roads

- Different lane types
- Individual height for each lane
- Lane markings
- Driving direction and speed limit for AI traffic
- Bridges and Tunnel constructions



Profiler	
Road Type	Motorway
Profiler Type	Normal Road
<input type="checkbox"/> Crossing Internal Road	
Max Superelevation	0
Radius	80
Curve Length	100 m
Lanes	<input type="button" value="+ Left"/> <input type="button" value="+ Right"/> <input type="button" value="- Selected"/>
	<div> <div>-4</div> <div>-3</div> <div>-2</div> <div>-1</div> <div>0</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> </div>

Lane	
UniqueID	18295
Height	0 m
Width	1.5 m
HighPrio	<input type="checkbox"/> front <input type="checkbox"/> back
Speed limit	50
Type	Biking
Turn	
Texture	asphal...cle.png 
--- Marking ---	
Type	none
Width	0.1 m
Marking Texture	mark_solid.rgb 

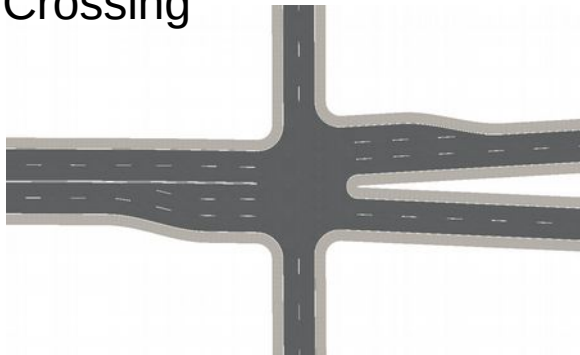
Road Generation - Crossings

Automatic Generation of Crossings

- Arbitrary number of lane and road constellations
- Merging of close crossings
- Height adaption
- Crossing Types:



Crossing



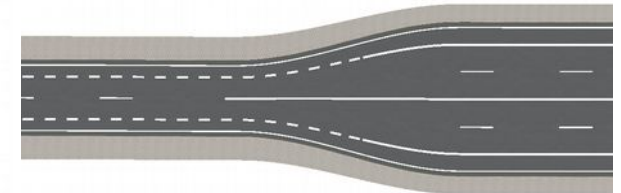
DriveUp



Forking



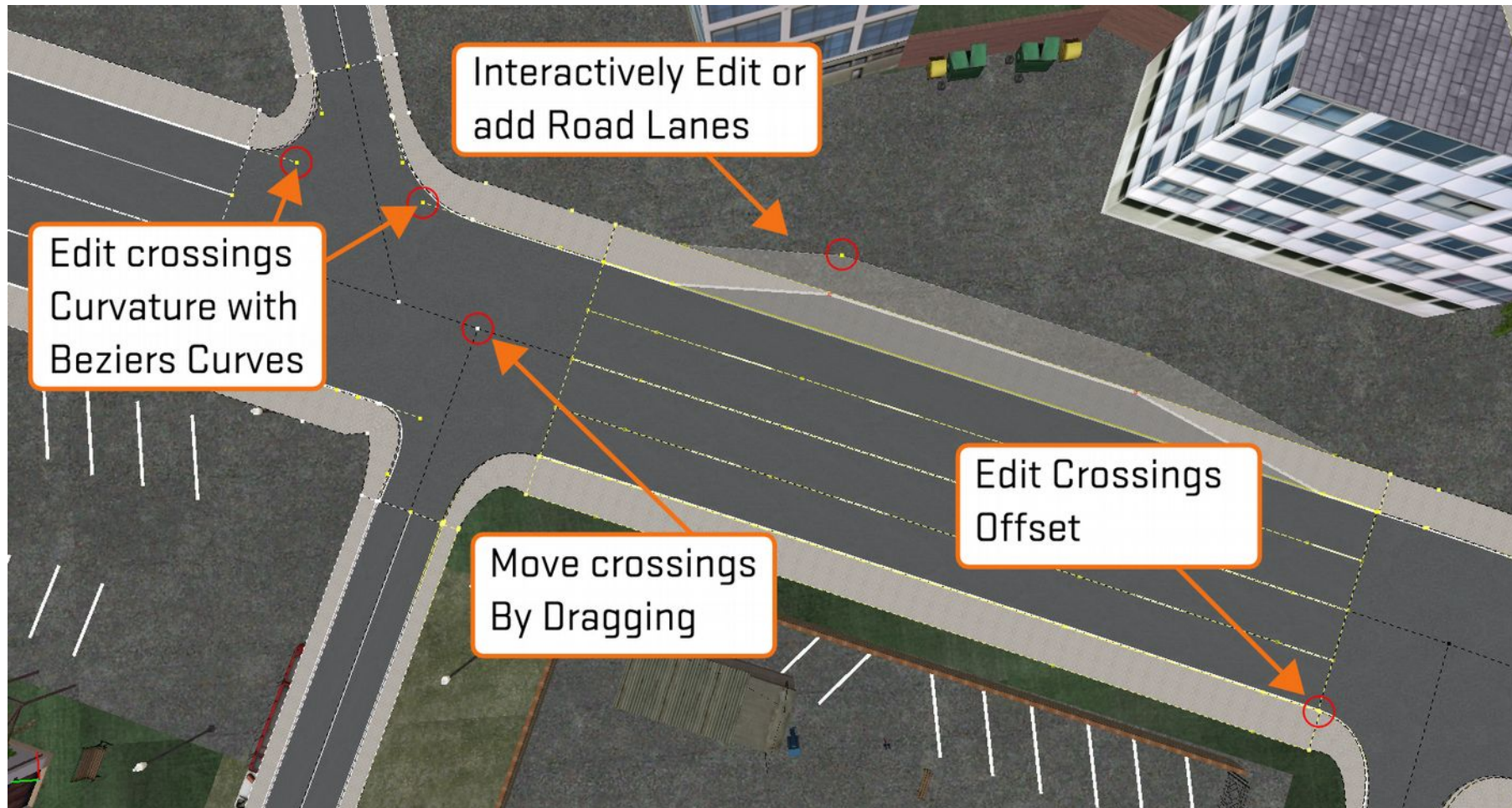
Transition





WYSIWYG Roads Editing

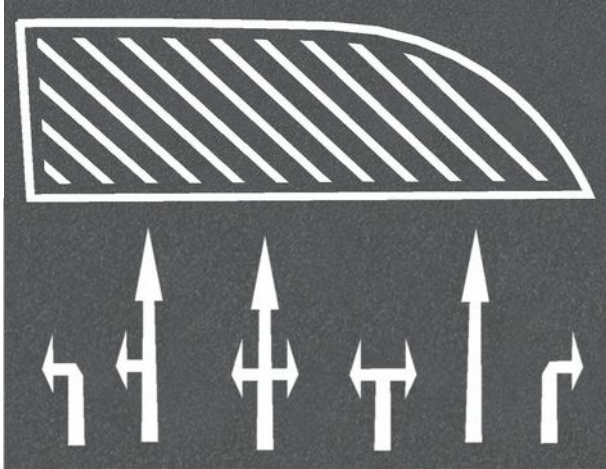
Edit Roads & Crossings in 2D or 3D View



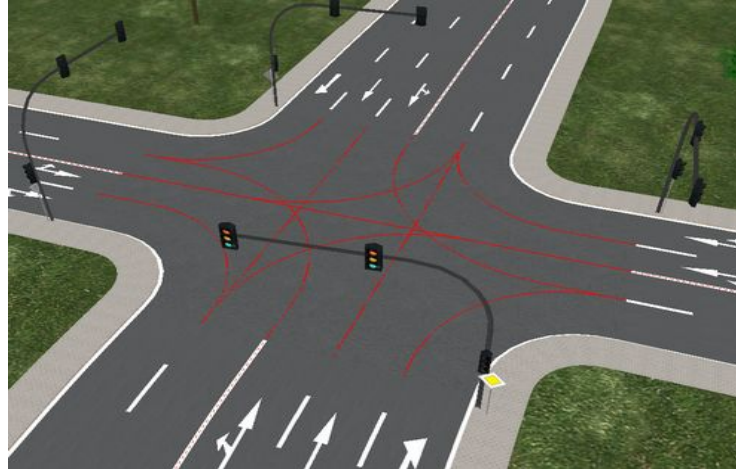


Additional Elements

Markings



Automatic, editable AI-Lanes



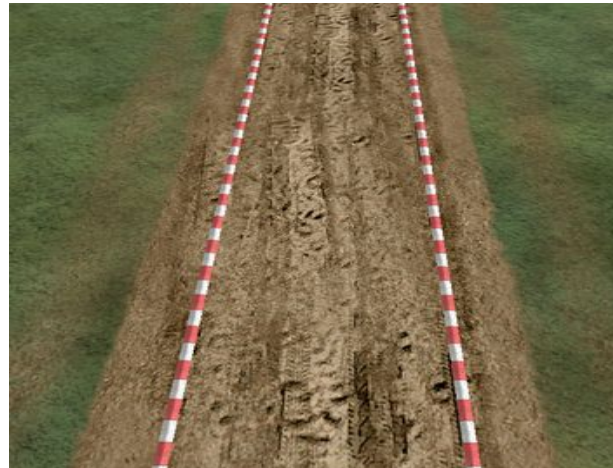
Rail and Streetcar Support



Height Adjustment



Multi-Texturing



Guard Rails and Barriers



Export Terrain

Supported Formats

- OpenSceneGraph (ive, osgb)
- Unity3D (fbx)
- OpenFlight (flt)
- Various serious game engines





Export Terrain - Unity3D



Export OpenDrive

OpenDrive

- Version 1.4
- Import and export
- Road
 - Support of Clothoids, ParamPoly3, linear geometry
 - Superelevation for clothoid roads
 - Polynomial elevation data
- Automatic generation of junction roads
- Support of roundabouts



Export OpenDrive

OpenDrive

- Objects
 - repeating, continuous objects,
 - Outline Objects
 - Parking spaces
- Signals with controllers
- Misc
 - AI-path for pedestrians
 - Support of rail networks

Signal	
Signal Type	205
Signal Value	0
Valid from	0
Valid To	0
Valid for Direction	all directions
Country	ODR
<input type="checkbox"/> Dynamic	
<input checked="" type="checkbox"/> Controller Active	
Controller Name	Ctrl
Make Unique	Make Unique
Control type	
Sequence	0

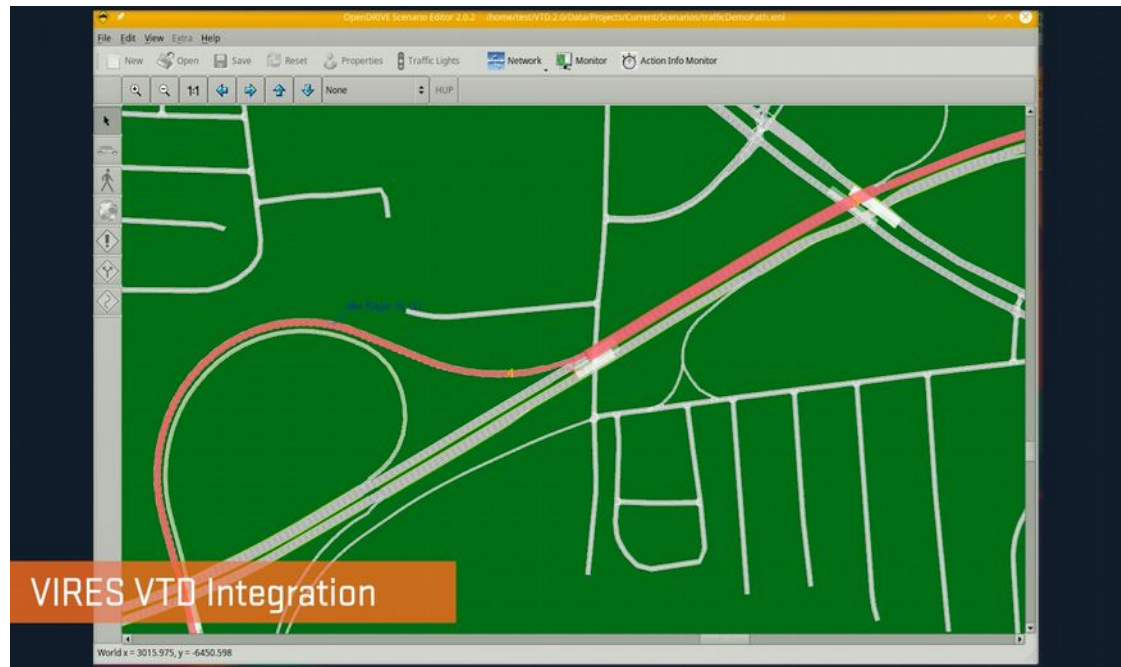
OpenDrive Object	
Object Type	barrier
Object Name	sound barrier



Export OpenDrive

OpenDrive

- Optimized for Vires VTD
- OpenDrive + correlated terrain as .osgb

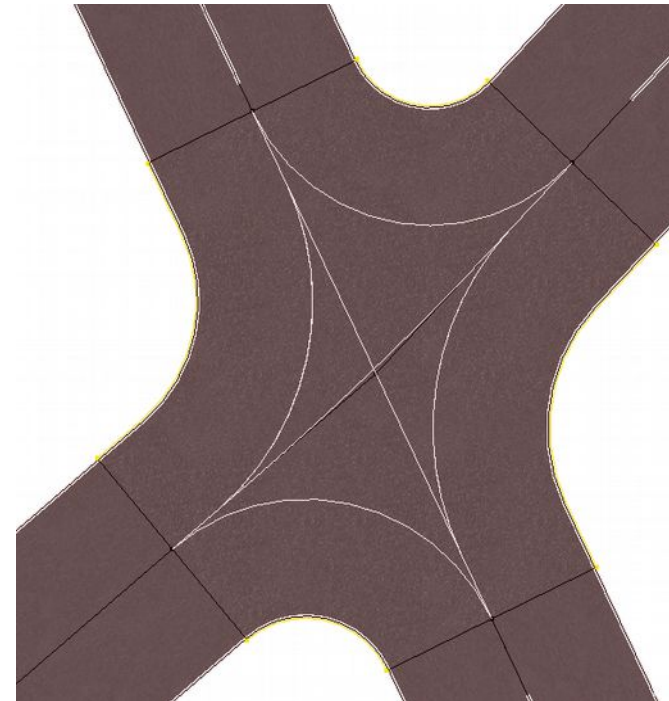
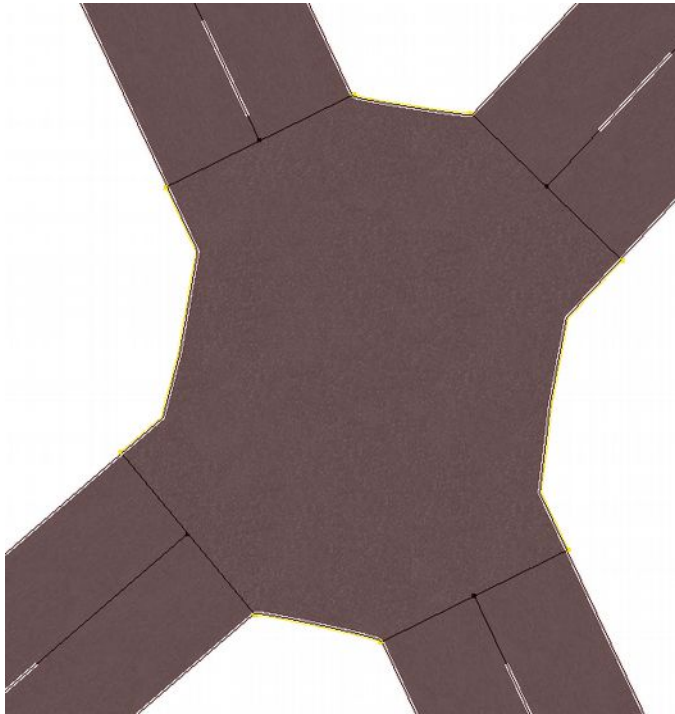




OpenDrive Questions

OpenDrive Questions

- Definition of exact crossing areas?



- Other option for Lane Width Record?
 - Width changes not definable in sharp curves



THANKS FOR YOUR INTEREST