TRIANGRAPHICS
Intelligent Terrain Solutions

# Terrain Generation for Driving Simulations

Kick-Off Workshop ASAM OpenDRIVE, 9.10.2018

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# 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

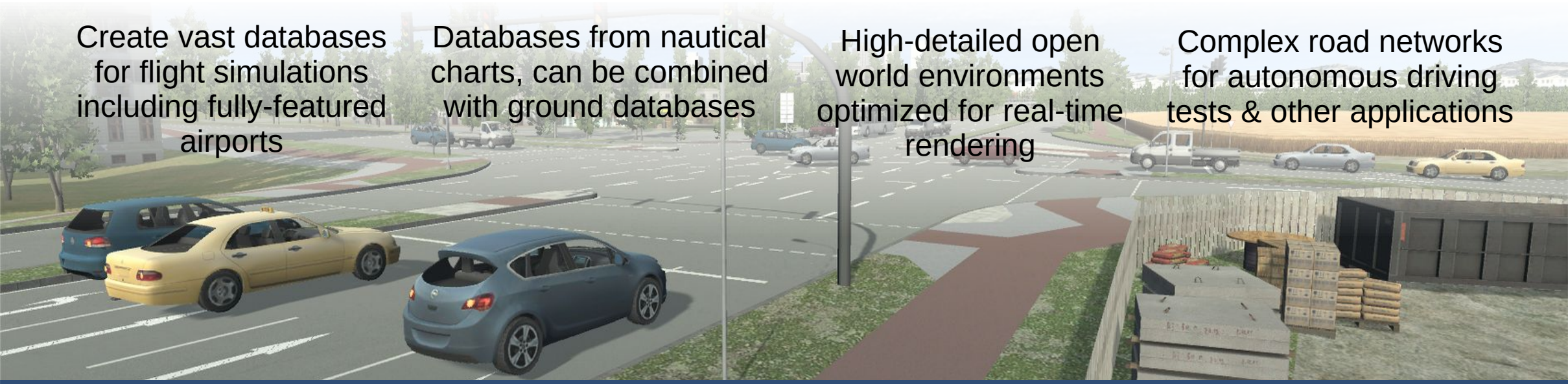
Databases from nautical charts, can be combined with ground databases

## Ground

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

## Automotive

Complex road networks for autonomous driving tests & other applications



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# Terrain Generation - Multitude of Use-Cases

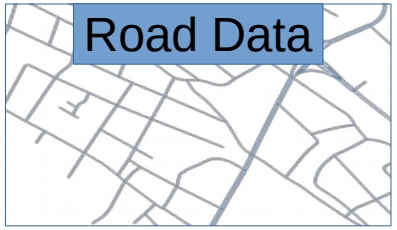
# Terrain Generation - Content

Elevation

Ground Texture

Vector Data

Road Data



Environment Data

Libraries

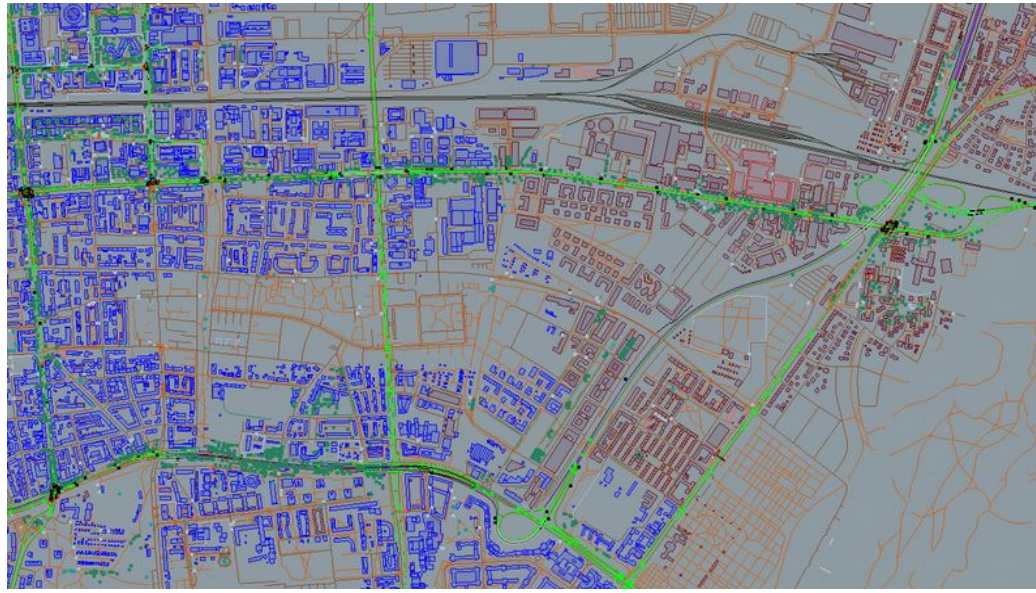
Textures

3D Models

# 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



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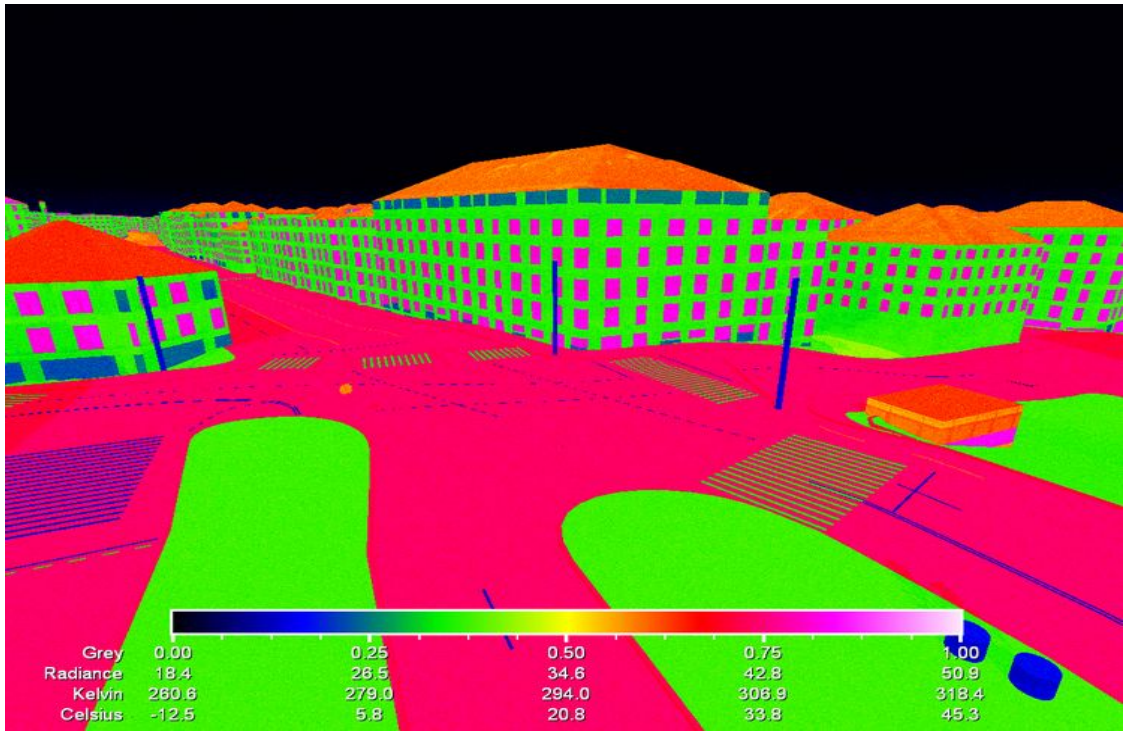
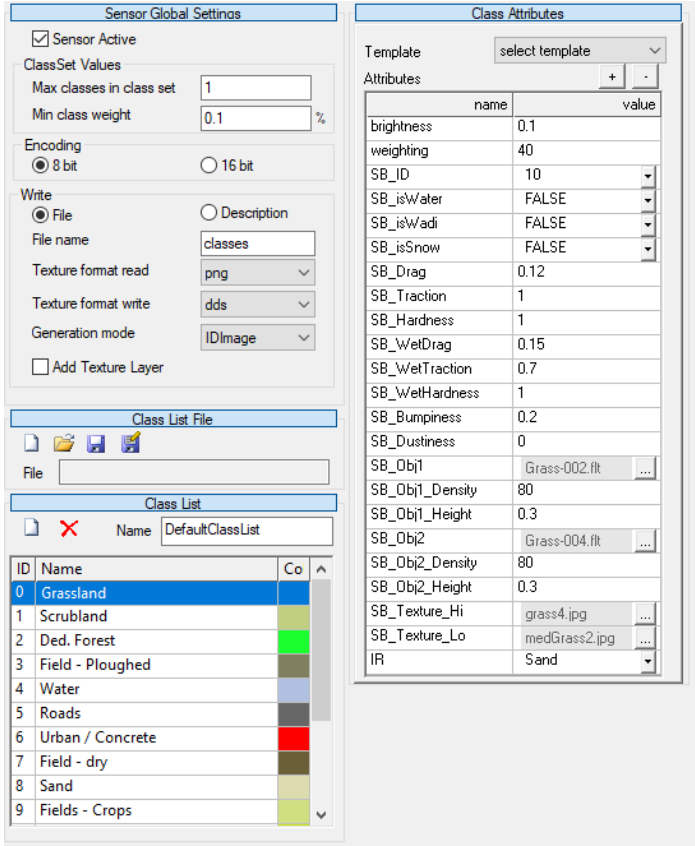
# Sensor Data

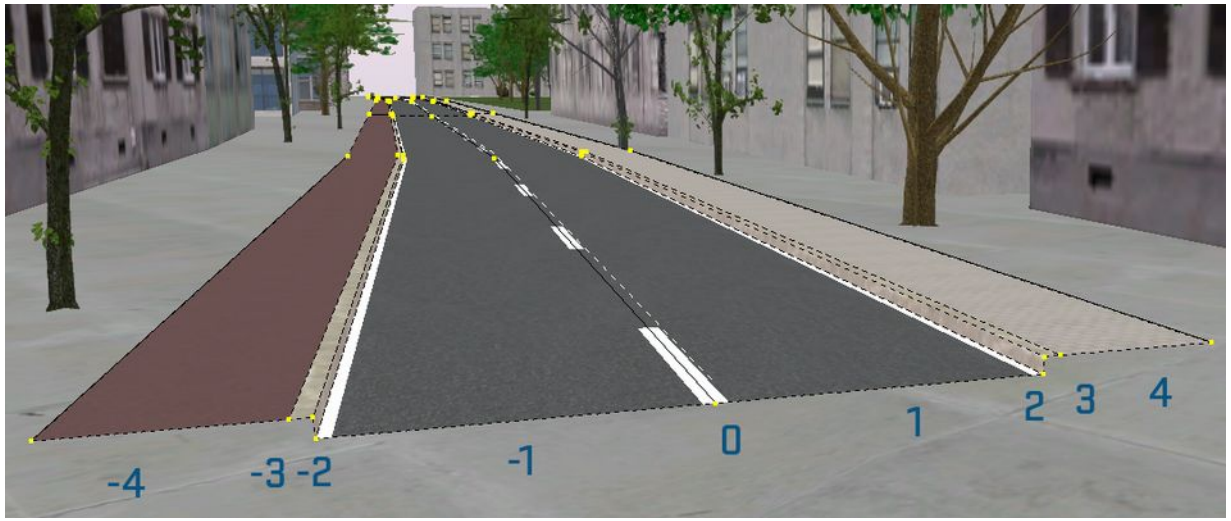
- Definition of physical surface attributes
- Flexible generation of sensor images with reference to attributes
- Support of night vision, material classification, ...

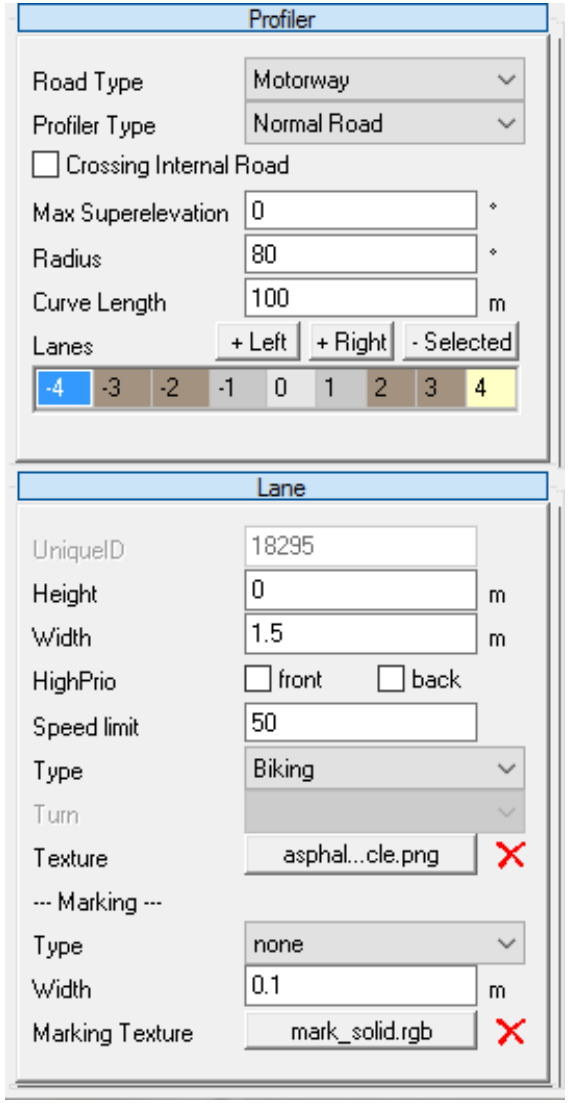


## Profiled Roads

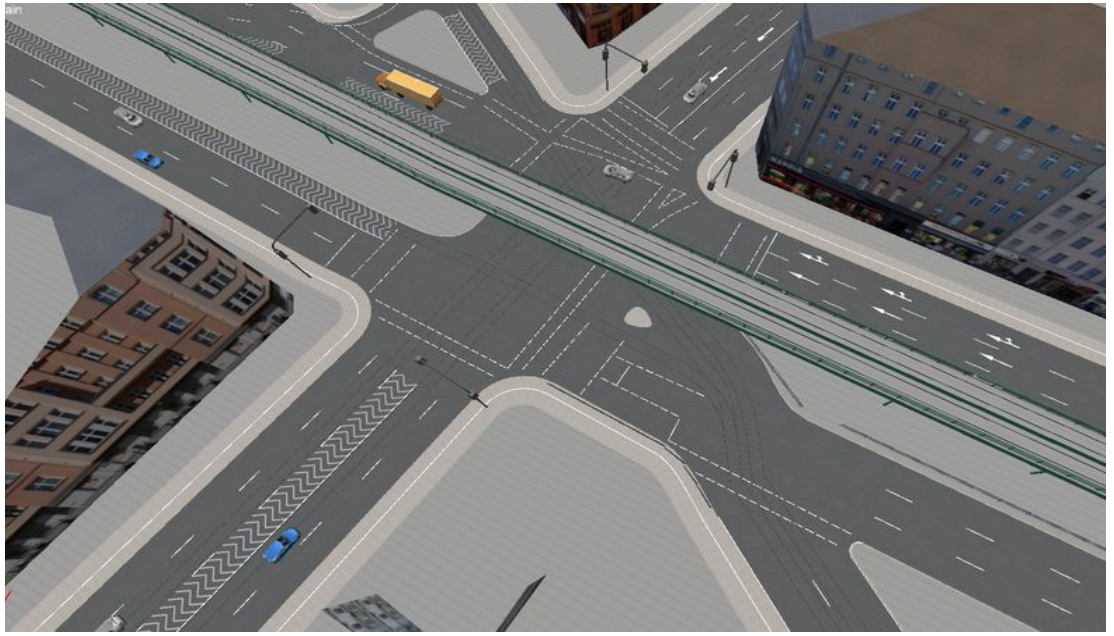
- Different lane types
- Individual height for each lane
- Lane markings
- Driving direction and speed limit for AI traffic
- Bridges and Tunnel constructions



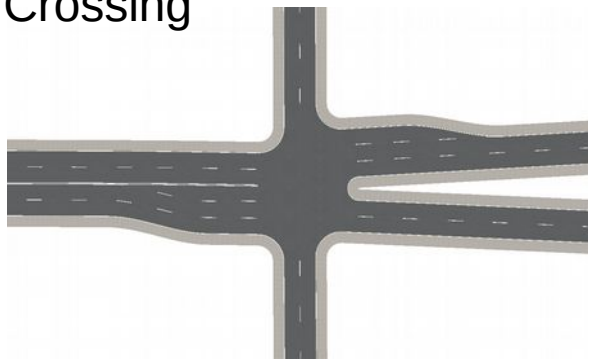
## Automatic Generation of Crossings

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

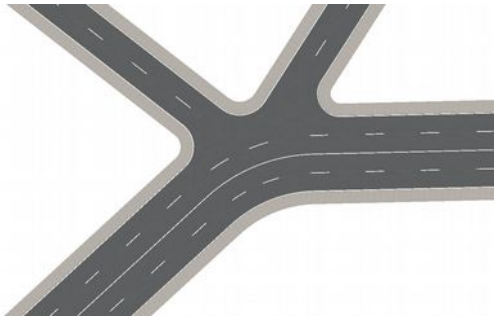


- Crossing Types:

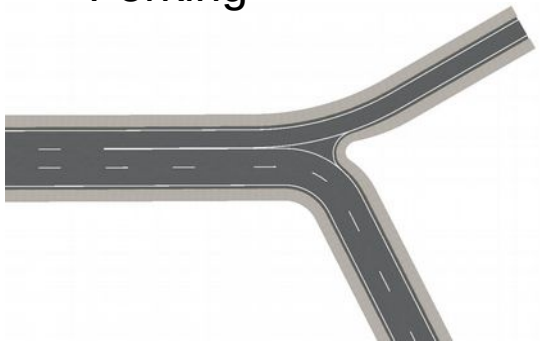
Crossing



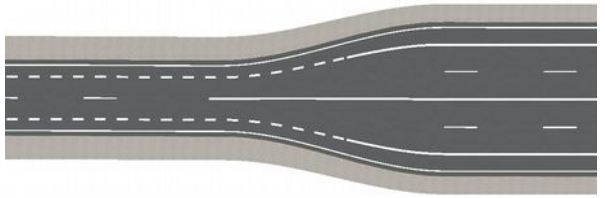
DriveUp



Forking



Transition



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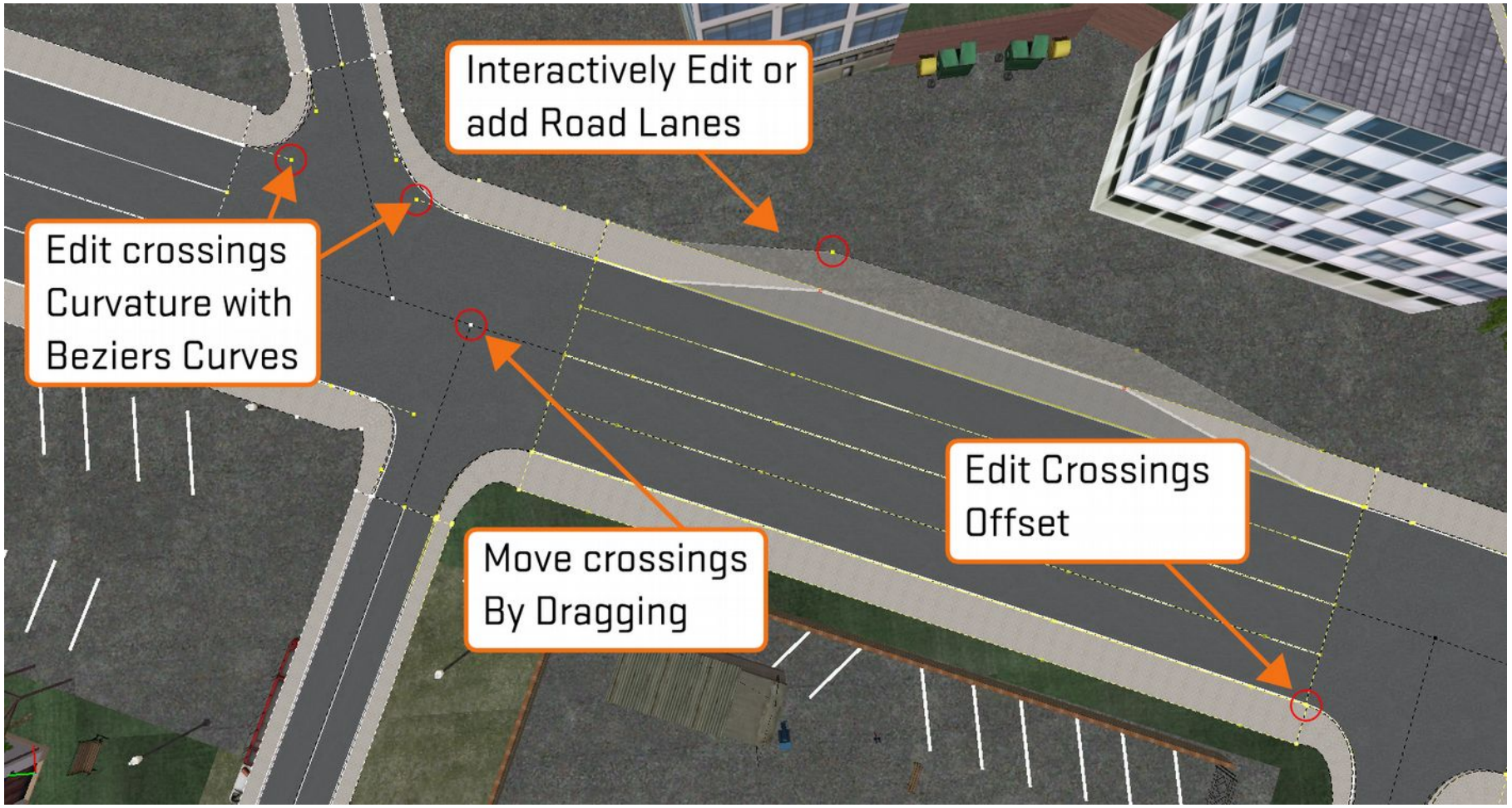
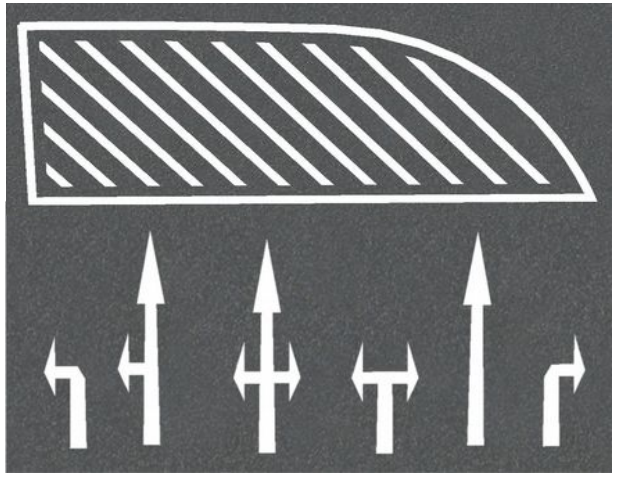
# Edit Roads & Crossings in 2D or 3D View

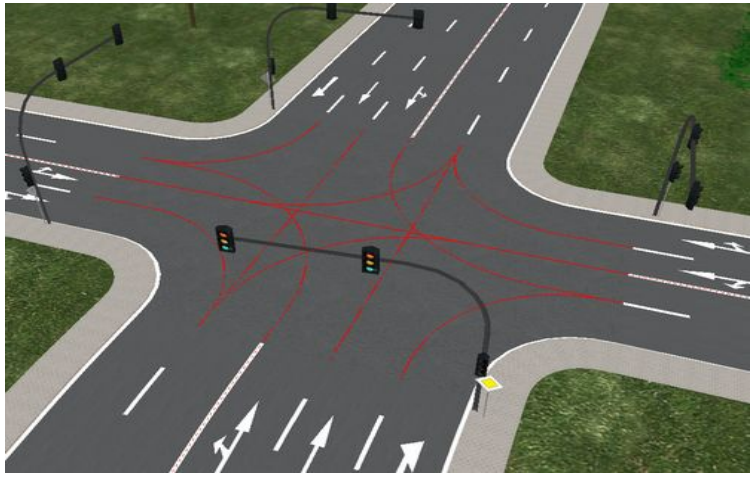


# Additional Elements

## Markings



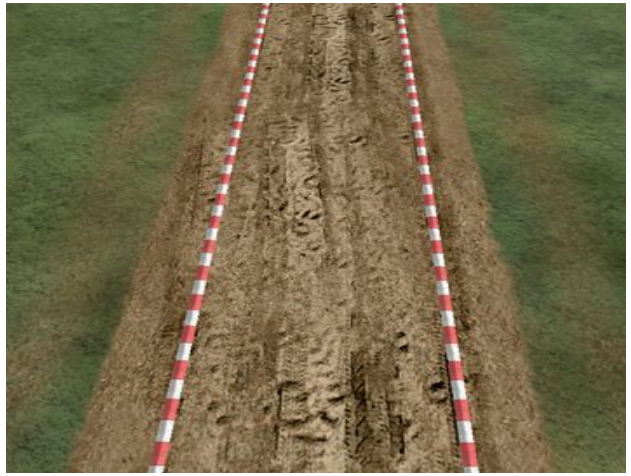
## Automatic, editable AI-Lanes



## Rail and Streetcar Support

## Height Adjustment

## Multi-Texturing



## Guard Rails and Barries

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# Export Terrain

## Supported Formats

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

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# Export Terrain - Unity3D

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## 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

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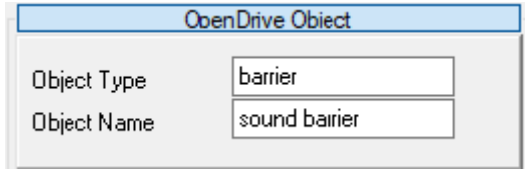
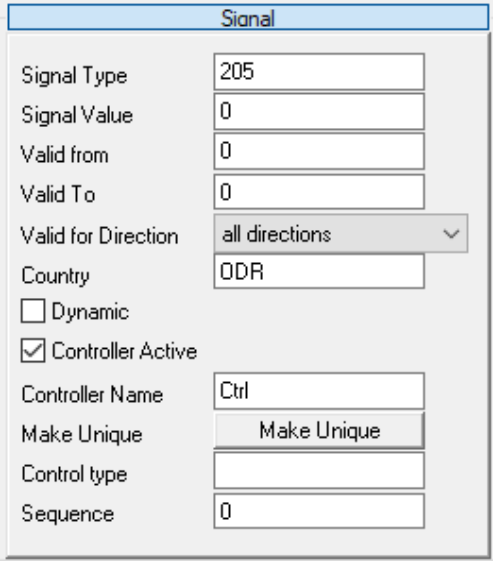
# Export OpenDrive

## OpenDrive

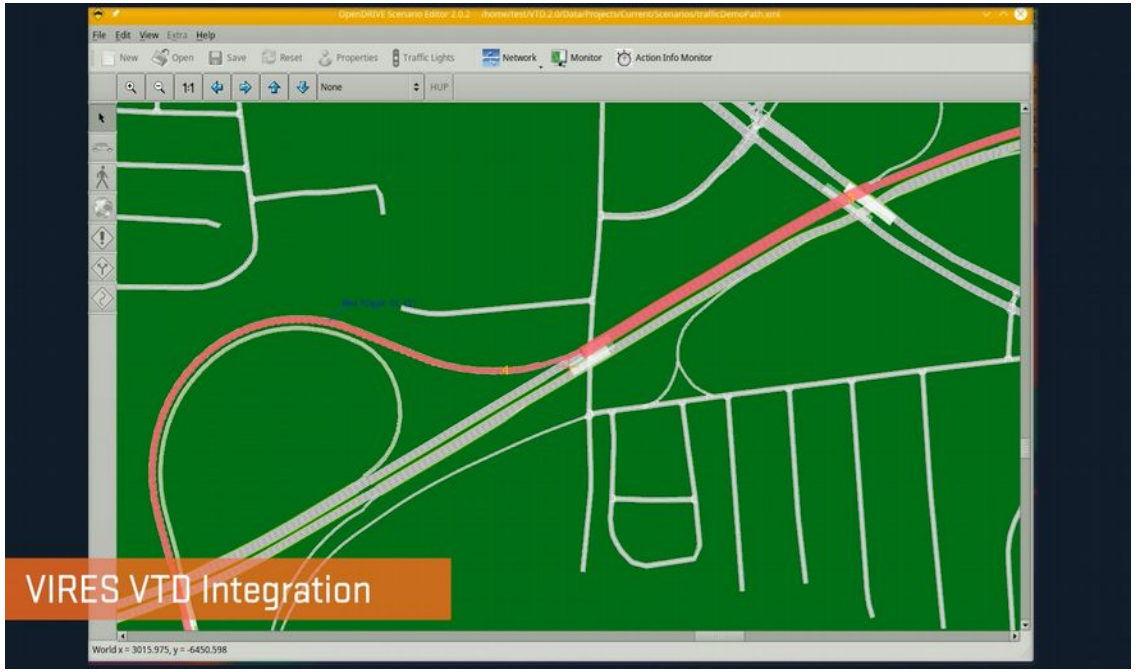
- Objects
  - repeating, continuous objects,
  - Outline Objects
  - Parking spaces
- Signals with controllers
- Misc
  - AI-path for pedestrians
  - Support of rail networks



# OpenDrive

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



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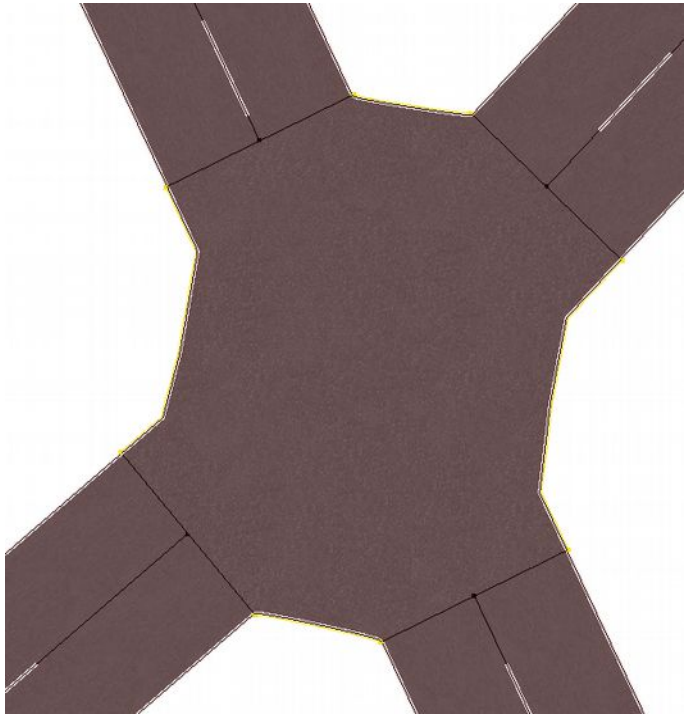
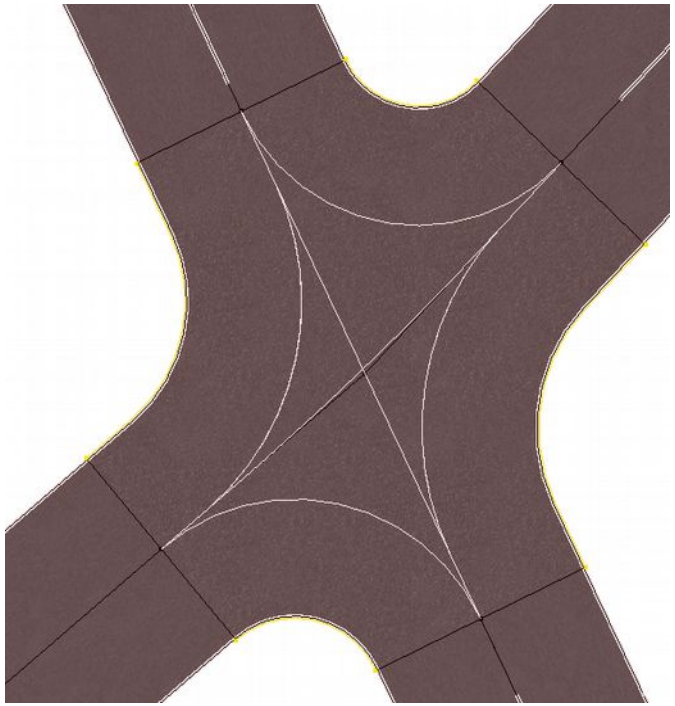
# OpenDrive Questions

- Definition of exact crossing areas?





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

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