

ASAM OpenDRIVE Intro

Nicco Hagedorn
ASAM e.V.

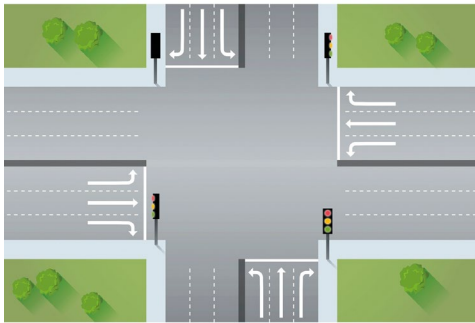
26.01.2022
Online



An Overview of ASAM OpenX...

8 individual standard initiatives

ASAM OpenDRIVE®



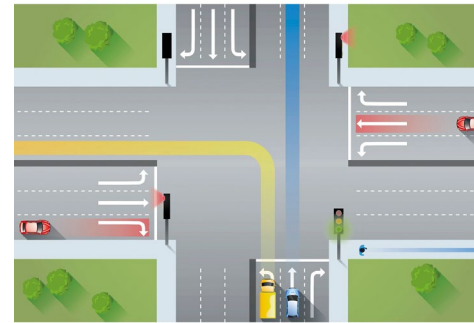
Static Road Network Description

ASAM OpenCRG®



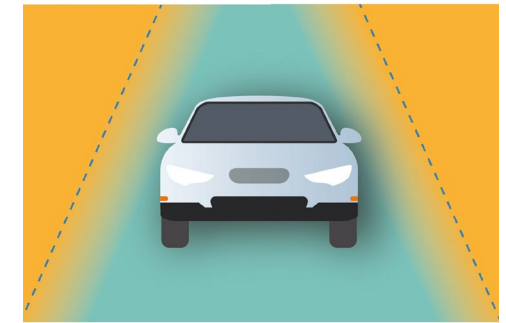
Static Road Surface Description

ASAM OpenSCENARIO®



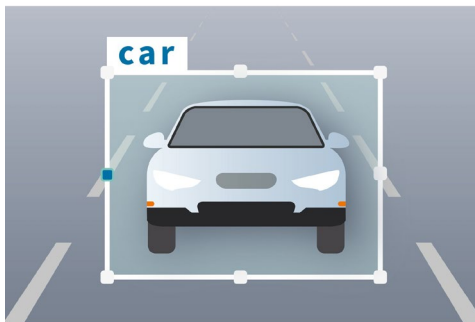
Dynamic Scenario Description

ASAM OpenODD



Defining the Operational Design Domain for Automated Vehicles

ASAM OpenLABEL



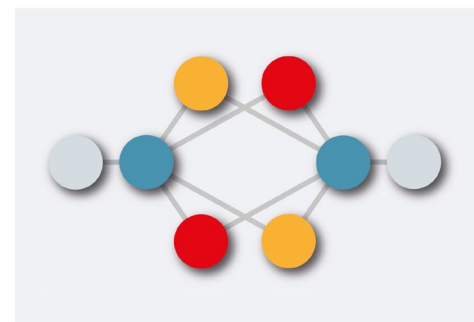
Standardized Labeling for objects and Scenarios

ASAM OSI®



Interface for Simulation

ASAM OpenXOntology



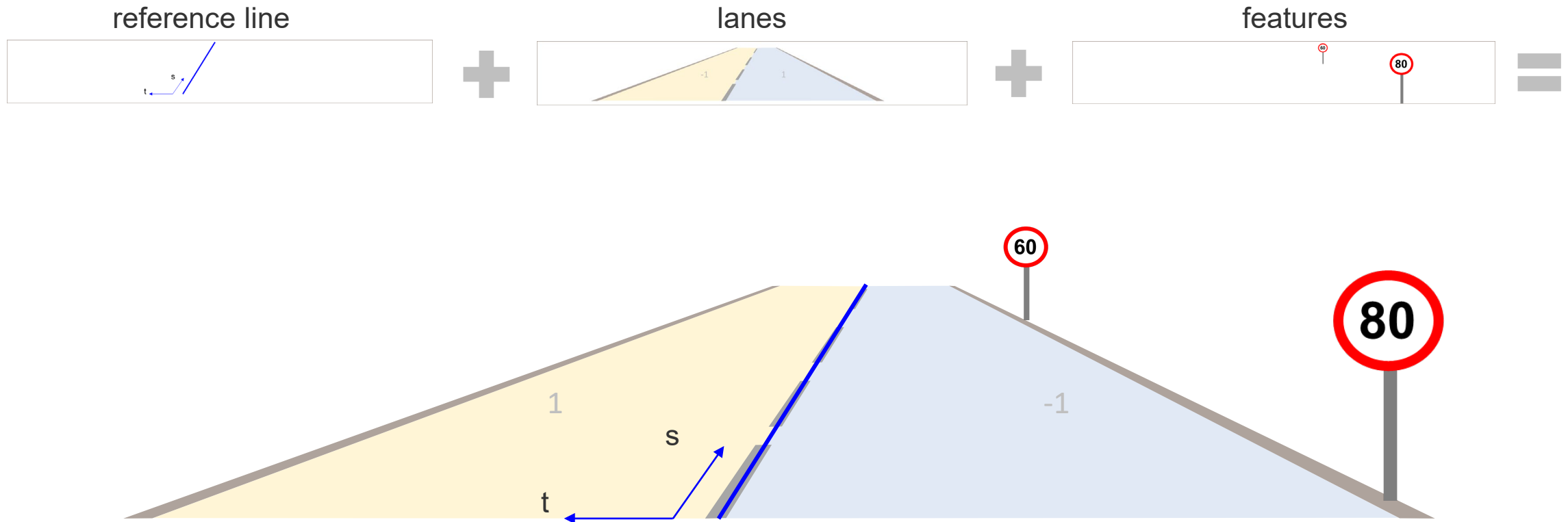
Core Domain Model for the ASAM Simulation Domain

ASAM Study Project Test Specification

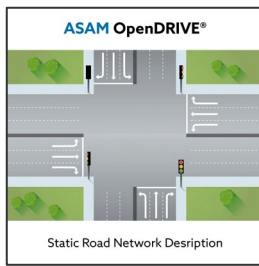


Analysis and harmonization of automotive testing techniques and standards

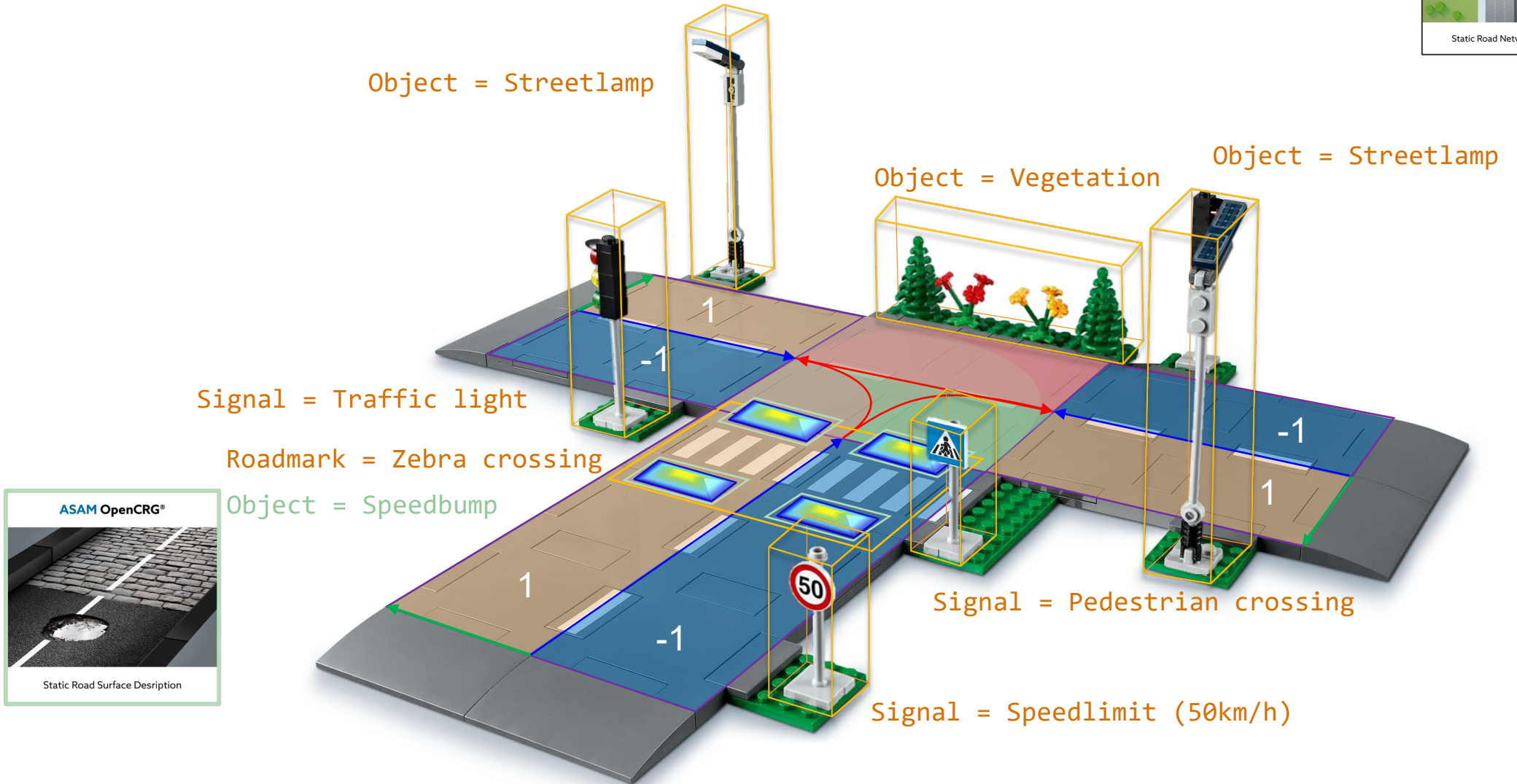
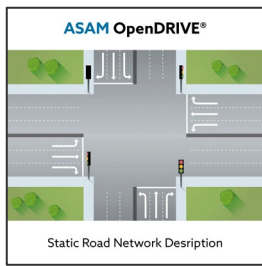
ASAM OpenDRIVE: Hierarchy



ASAM OpenDRIVE Example: T-Junction



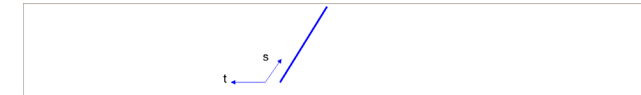
ASAM OpenDRIVE Example: T-Junction



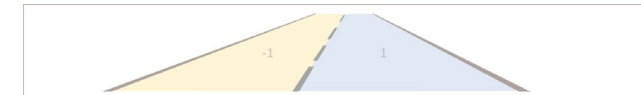
ASAM OpenDRIVE: XML Structure

```
<OpenDRIVE>
  <header></header>
  <road>
    <planView>
      <geometry></geometry>
    </planView>
    <elevationProfile></elevationProfile>
    <lateralProfile></lateralProfile>
    <lanes></lanes>
    <objects></objects>
    <signals></signals>
  </road>
  <junction>
    <connection ...>
  </junction>
  <controller></controller>
  <junctionGroup></junctionGroup>
</OpenDRIVE>
```

reference line



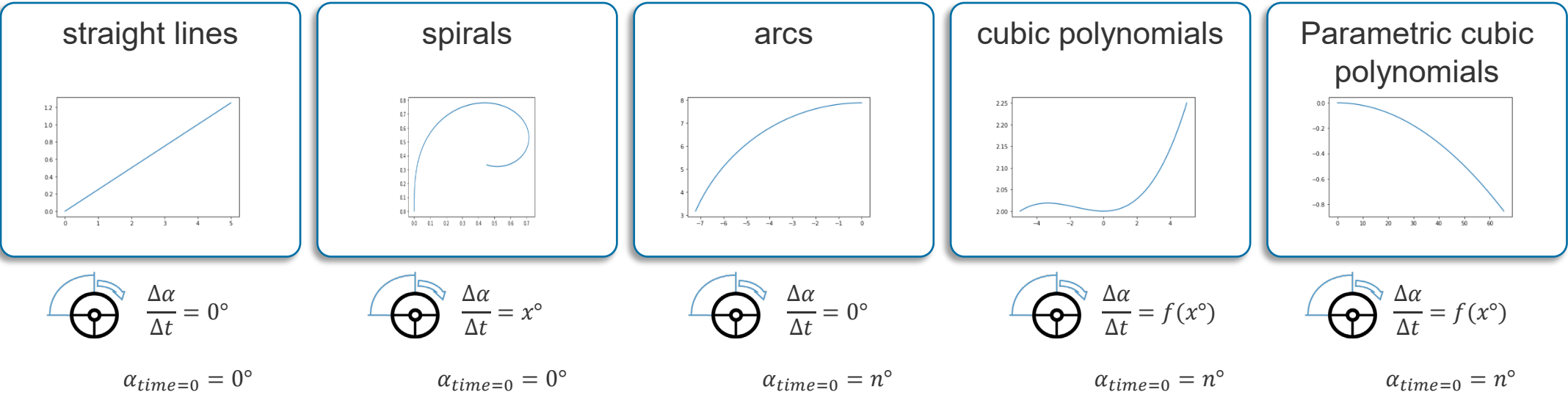
lanes



features



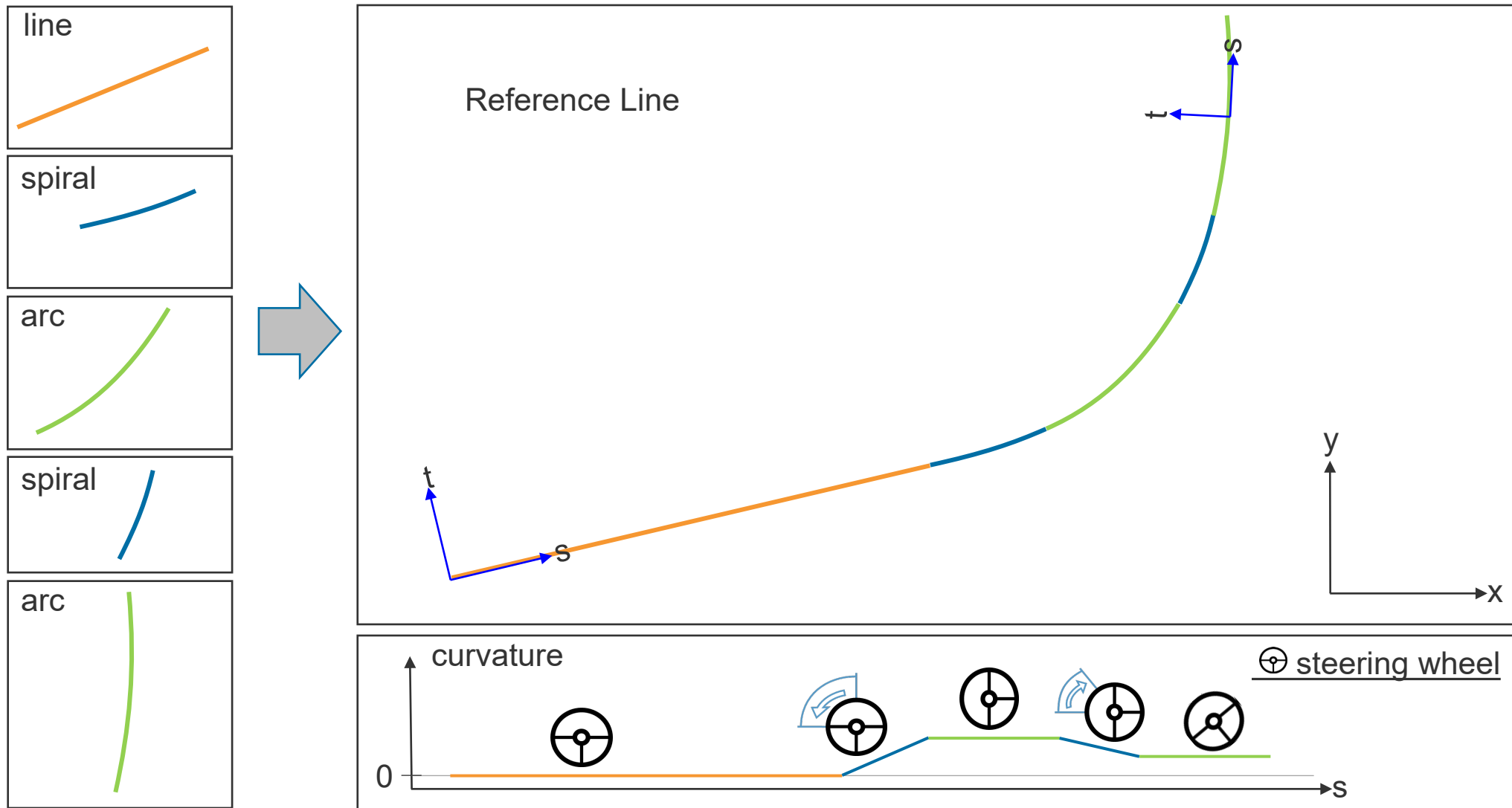
Referenc Line Elements



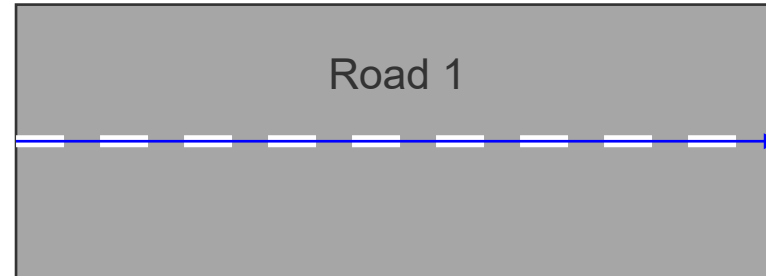
delimiters: <geometry>...</geometry>
parent: <planView>
instances: 1+
attributes:

name	type	unit	value	description
s	double	m	[0, ∞[
x	double	m] − ∞, ∞[
y	double	m] − ∞, ∞[
hdg	double	rad] − ∞, ∞[
length	double	m	[0, ∞[

ASAM OpenDRIVE: Reference Line - Primitives

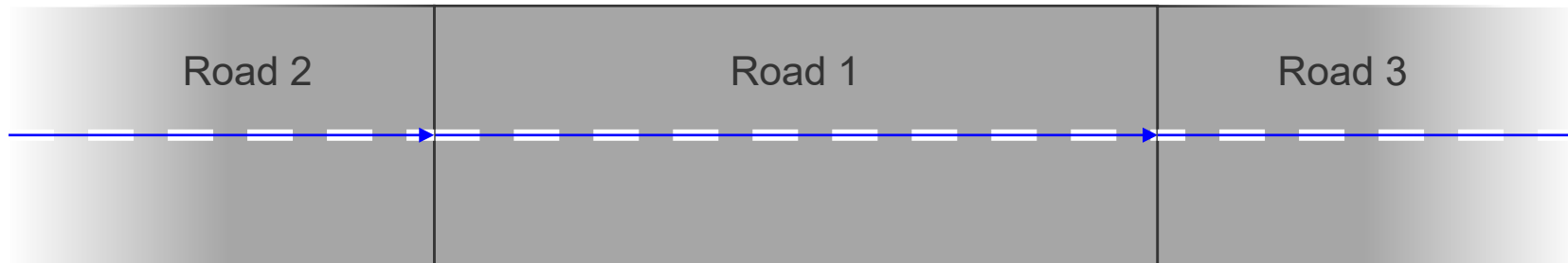


Road Definition



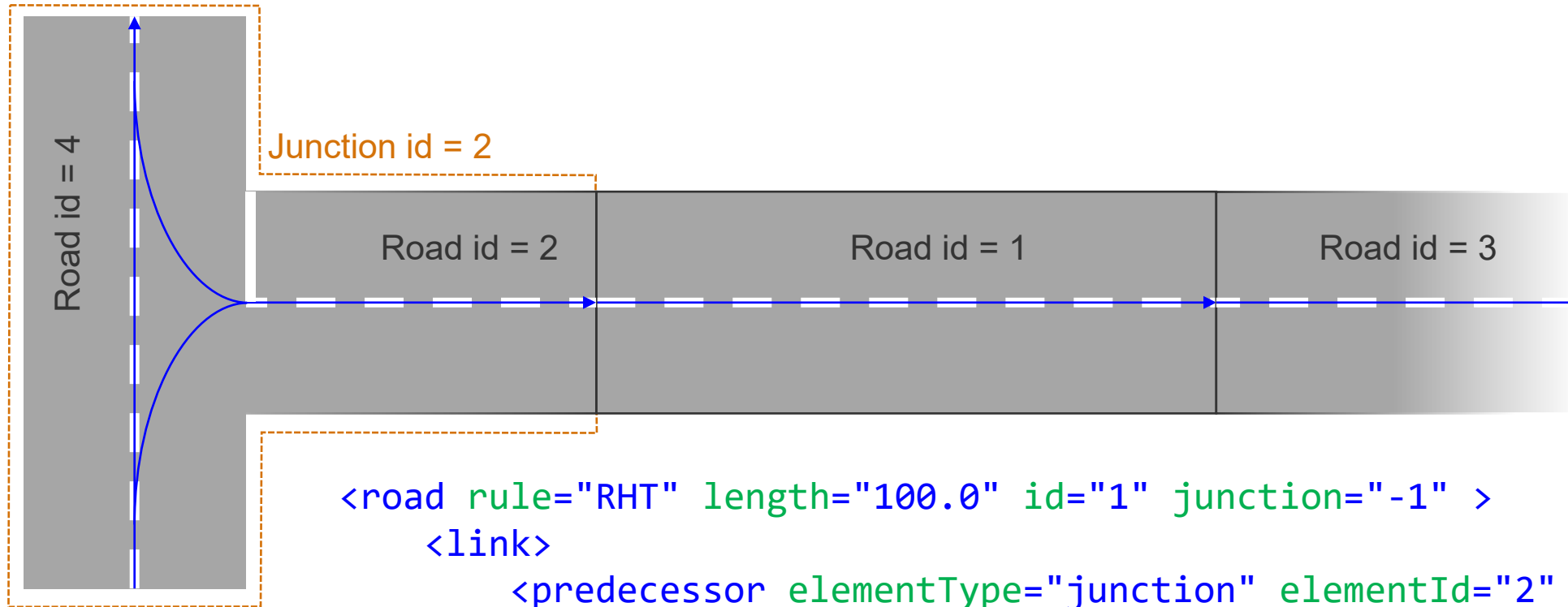
```
<road rule="RHT" length="100.0" id="1" junction="-1" >
  <link>...</link>
  <type s ="0.0" type="town" country="DE"/>
  <planView>... </planView>
  <elevationProfile>...</elevationProfile>
  <lateralProfile>...</lateralProfile>
    <lanes>...</lanes>
    <objects>...</objects>
    <signals>...</signals>
    <surface>...</surface>
```

ASAM OpenDRIVE: Road Linkage



```
<road rule="RHT" length="100.0" id="1" junction="-1" >  
  <link>  
    <predecessor elementType="road" elementId="2" />  
    <successor elementType="road" elementId="3" />  
  </link>  
</road>
```

ASAM OpenDRIVE: Road Linkage

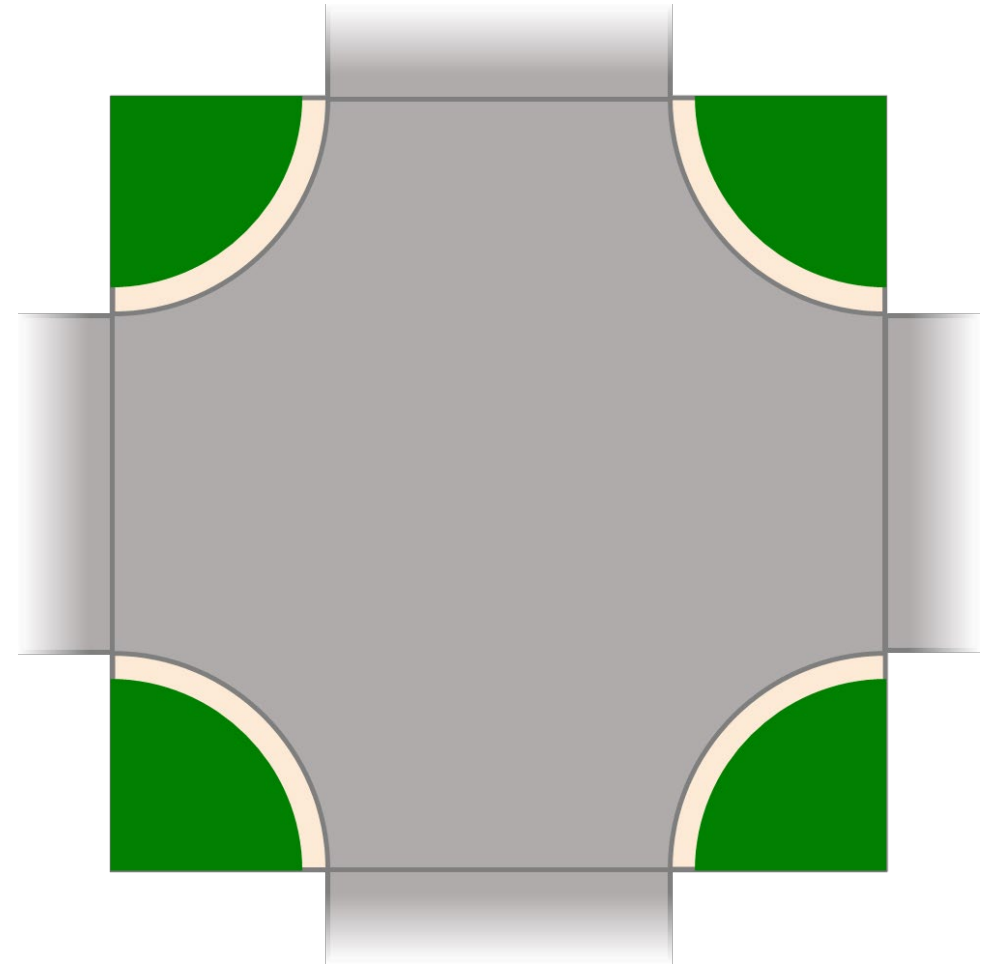


```
<road rule="RHT" length="100.0" id="1" junction="-1" >  
  <link>  
    <predecessor elementType="junction" elementId="2" />  
    <successor elementType="road" elementId="3" />  
  </link>
```

OpenDRIVE: Junctions

Example: Cross Junction,

- Very simple junction without traffic lights
- Right hand Traffic



ASAM OpenDRIVE: Junctions

```
<OpenDRIVE>
  <header revMajor="1" revMinor="6" name="" version="1.00" date="Mon Oct 21 13:17:23 2019"
  </header>
  <road rule="RHT" length="1.0300000000000000e+02" id="0" junction="-1" >
  <road rule="RHT" length="1.0300000000000000e+02" id="1" junction="-1">
  <road rule="RHT" length="2.8435719942688948e+01" id="2" junction="1">
  <road rule="RHT" length="2.8435719942685569e+01" id="3" junction="1">
  <road rule="RHT" length="2.9925740939669190e+01" id="4" junction="1">
  <road rule="RHT" length="2.9925740939679464e+01" id="5" junction="1">
  <road rule="RHT" length="1.0300000000000000e+02" id="6" junction="-1">
  <road rule="RHT" length="3.4000000000000000e+01" id="7" junction="1">
  <road rule="RHT" length="3.4000000000000000e+01" id="8" junction="1">
  <road rule="RHT" length="2.8435719942619844e+01" id="9" junction="1">
  <road rule="RHT" length="2.8435719942705987e+01" id="10" junction="1">
  <road rule="RHT" length="3.4000000000000000e+01" id="11" junction="1">
  <road rule="RHT" length="3.4000000000000001e+01" id="12" junction="1">
  <road rule="RHT" length="1.0300000000000000e+02" id="13" junction="-1">
  <road rule="RHT" length="2.9925740939671819e+01" id="14" junction="1">
  <road rule="RHT" length="2.9925740939663818e+01" id="15" junction="1">
  <junction name="" id="1" type="default">
    <connection id="0" incomingRoad="6" connectingRoad="2" contactPoint="start">
    <connection id="1" incomingRoad="6" connectingRoad="5" contactPoint="start">
    <connection id="2" incomingRoad="6" connectingRoad="12" contactPoint="start">
    <connection id="3" incomingRoad="0" connectingRoad="3" contactPoint="start">
    <connection id="4" incomingRoad="0" connectingRoad="8" contactPoint="start">
    <connection id="5" incomingRoad="0" connectingRoad="15" contactPoint="start">
    <connection id="6" incomingRoad="1" connectingRoad="4" contactPoint="start">
    <connection id="7" incomingRoad="1" connectingRoad="7" contactPoint="start">
    <connection id="8" incomingRoad="1" connectingRoad="10" contactPoint="start">
    <connection id="9" incomingRoad="13" connectingRoad="9" contactPoint="start">
    <connection id="10" incomingRoad="13" connectingRoad="11" contactPoint="start">
    <connection id="11" incomingRoad="13" connectingRoad="14" contactPoint="start">
  </junction>
</OpenDRIVE>
```

Define all the roads

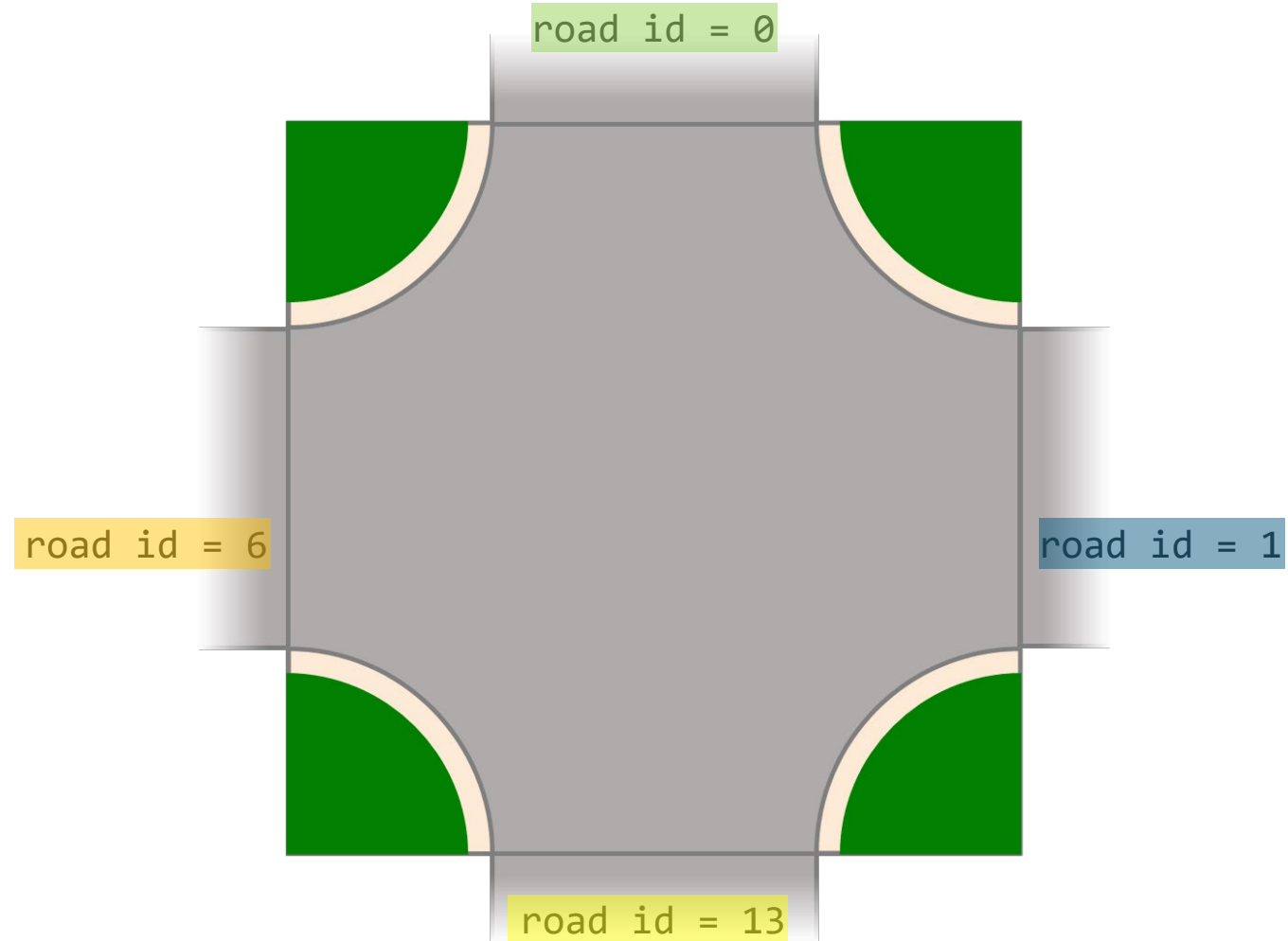
Road is part of a junction ?

Establish connections

ASAM OpenDRIVE: Junctions

Identify the incoming roads of a junction

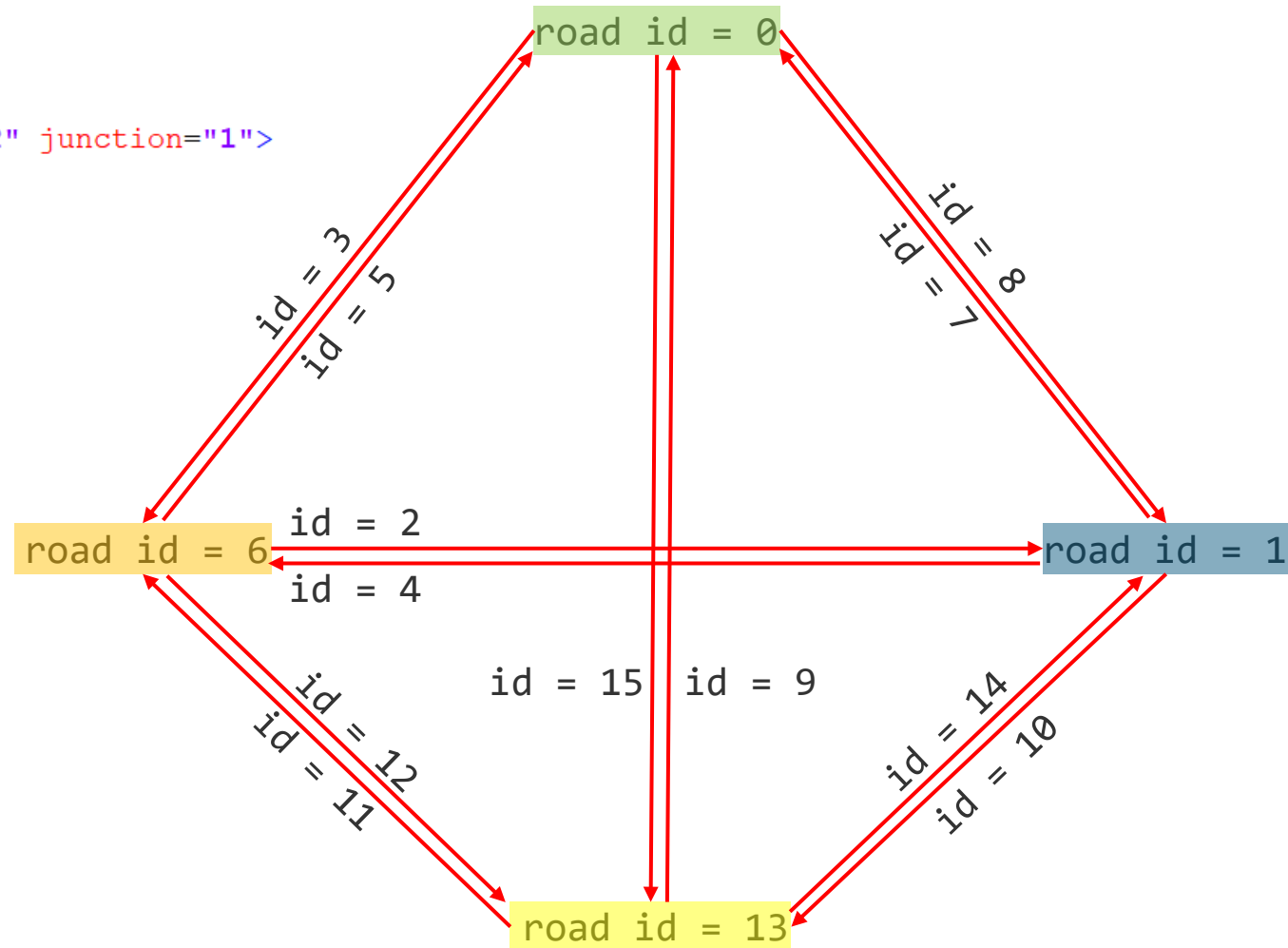
```
<junction name="" id="1" type="default">
  <connection id="0" incomingRoad="6">
  <connection id="1" incomingRoad="6">
  <connection id="2" incomingRoad="6">
  <connection id="3" incomingRoad="0">
  <connection id="4" incomingRoad="0">
  <connection id="5" incomingRoad="0">
  <connection id="6" incomingRoad="1">
  <connection id="7" incomingRoad="1">
  <connection id="8" incomingRoad="1">
  <connection id="9" incomingRoad="13">
  <connection id="10" incomingRoad="13">
  <connection id="11" incomingRoad="13">
</junction>
```



ASAM OpenDRIVE: Junctions

Identify all the connections within the junction

```
<road rule="RHT" length="2.8435719942688948e+01" id="2" junction="1">  
  <link>  
    <predecessor elementType="road" elementId="6">  
    <successor elementType="road" elementId="1">  
  </link>  
</road>
```



ASAM OpenDRIVE: Junctions

Shape of the connecting roads

x = 103,00 m; y = 119,99m

road id = 2

x = 119,99 m; y = 103,52m

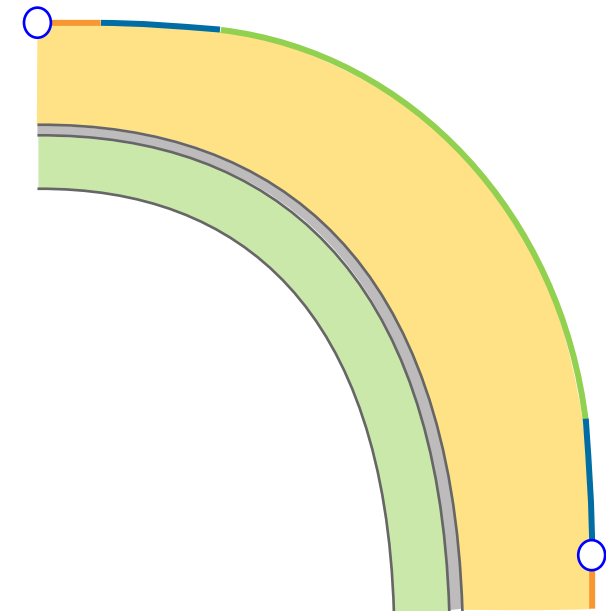
```
<road rule="RHT" length="2.8435719942688948e+01" id="2" junction="1">
  <link>
    <predecessor elementType="road" elementId="6" contactPoint="start" />
    <successor elementType="road" elementId="1" contactPoint="start" />
  </link>
  <type s="0.0000000000000000e+00" type="town" country="DE"/>
  <planView>
    <geometry s="0.0000000000000000e+00" x="1.030000000003085e+02" y="1.199999999995786e+02" hdg="3.8356854067442034e-12" length="5.1868687057341845e-01">
      <line/>
    </geometry>
    <geometry s="5.1868687057341845e-01" x="1.0351868687060427e+02" y="1.199999999995985e+02" hdg="-6.1026739217595605e-12" length="8.9414893617021267e+00">
      <spiral curvStart="-0.0000000000000000e+00" curvEnd="-8.5106382978723402e-02"/>
    </geometry>
    <geometry s="9.4601762322755452e+00" x="1.1233159338882540e+02" y="1.1887762726397237e+02" hdg="-3.8048890901346244e-01" length="9.5153674781379021e+00">
      <arc curvature="-8.5106382978723402e-02"/>
    </geometry>
    <geometry s="1.8975543710413447e+01" x="1.1887762085662244e+02" y="1.1233159979616045e+02" hdg="-1.1903074177911561e+00" length="8.9414893617021267e+00">
      <spiral curvStart="-8.5106382978723402e-02" curvEnd="-0.0000000000000000e+00"/>
    </geometry>
    <geometry s="2.7917033072115572e+01" x="1.1999999359271642e+02" y="1.0351869327797370e+02" hdg="-1.5707963267960539e+00" length="5.1868687057337581e-01">
      <line/>
    </geometry>
  </planView>
```

ASAM OpenDRIVE: Junctions

<right>

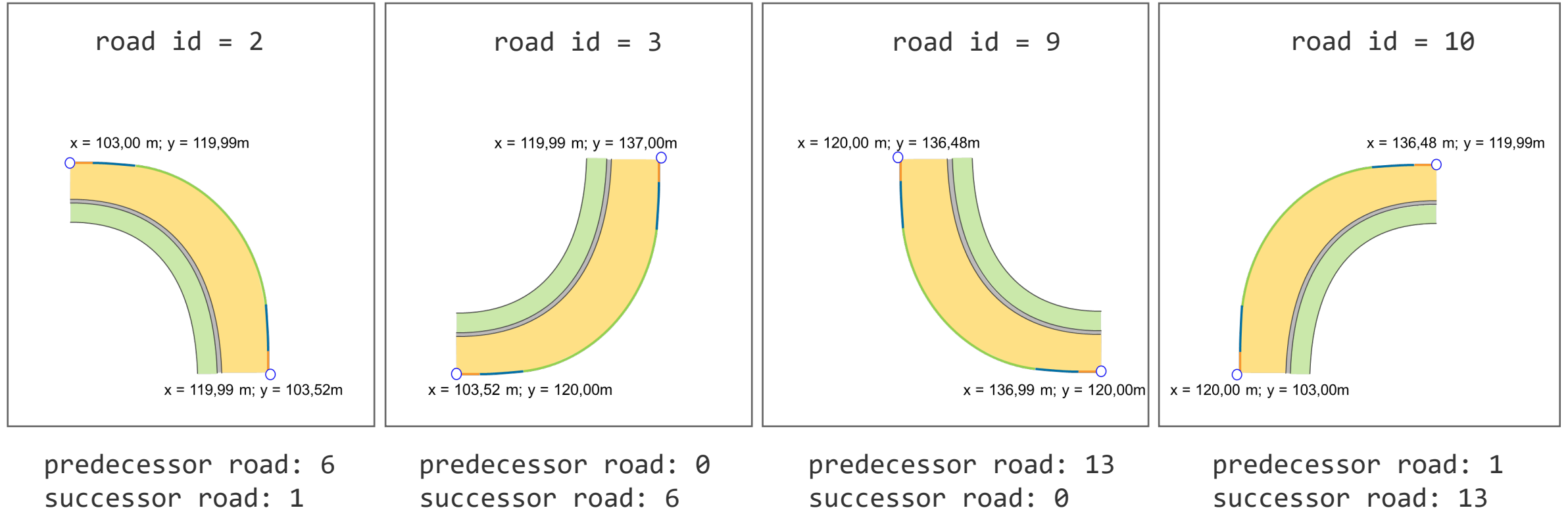
```
<lane id="-1" type="driving" level="false">
  <link>
    <predecessor id="1"/>
    <successor id="-1"/>
  </link>
  <width sOffset="0.000000000000000e+00" a="3.750000000000000e+00" b="0.00
</lane>
<lane id="-2" type="border" level="false">
  <link>
    <predecessor id="2"/>
    <successor id="-2"/>
  </link>
  <width sOffset="0.000000000000000e+00" a="3.499999999999998e-01" b="0.00
</lane>
<lane id="-3" type="sidewalk" level="false">
  <link>
    <predecessor id="3"/>
    <successor id="-3"/>
  </link>
```

x = 103,00 m; y = 119,99m

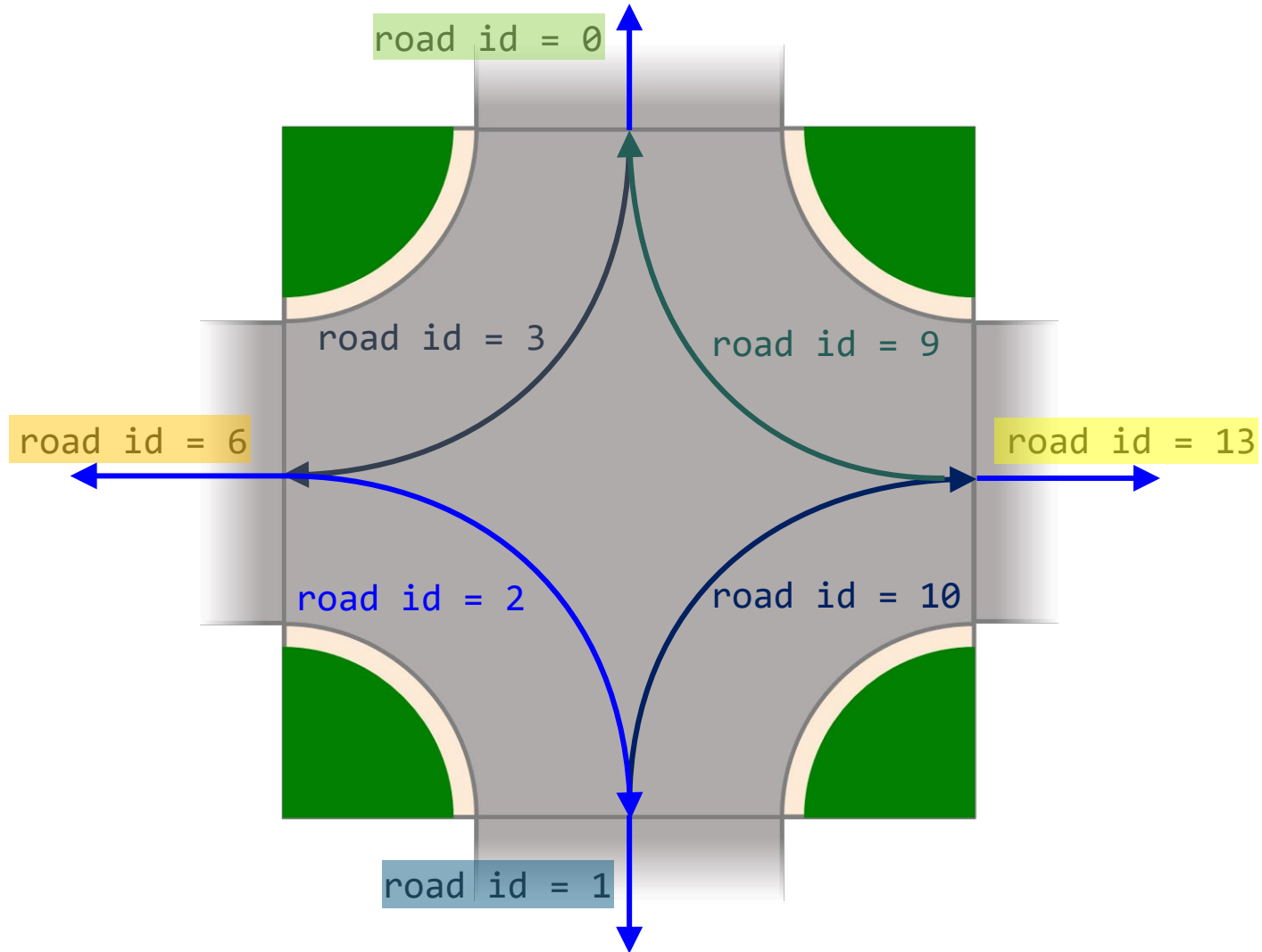


x = 119,99 m; y = 103,52m

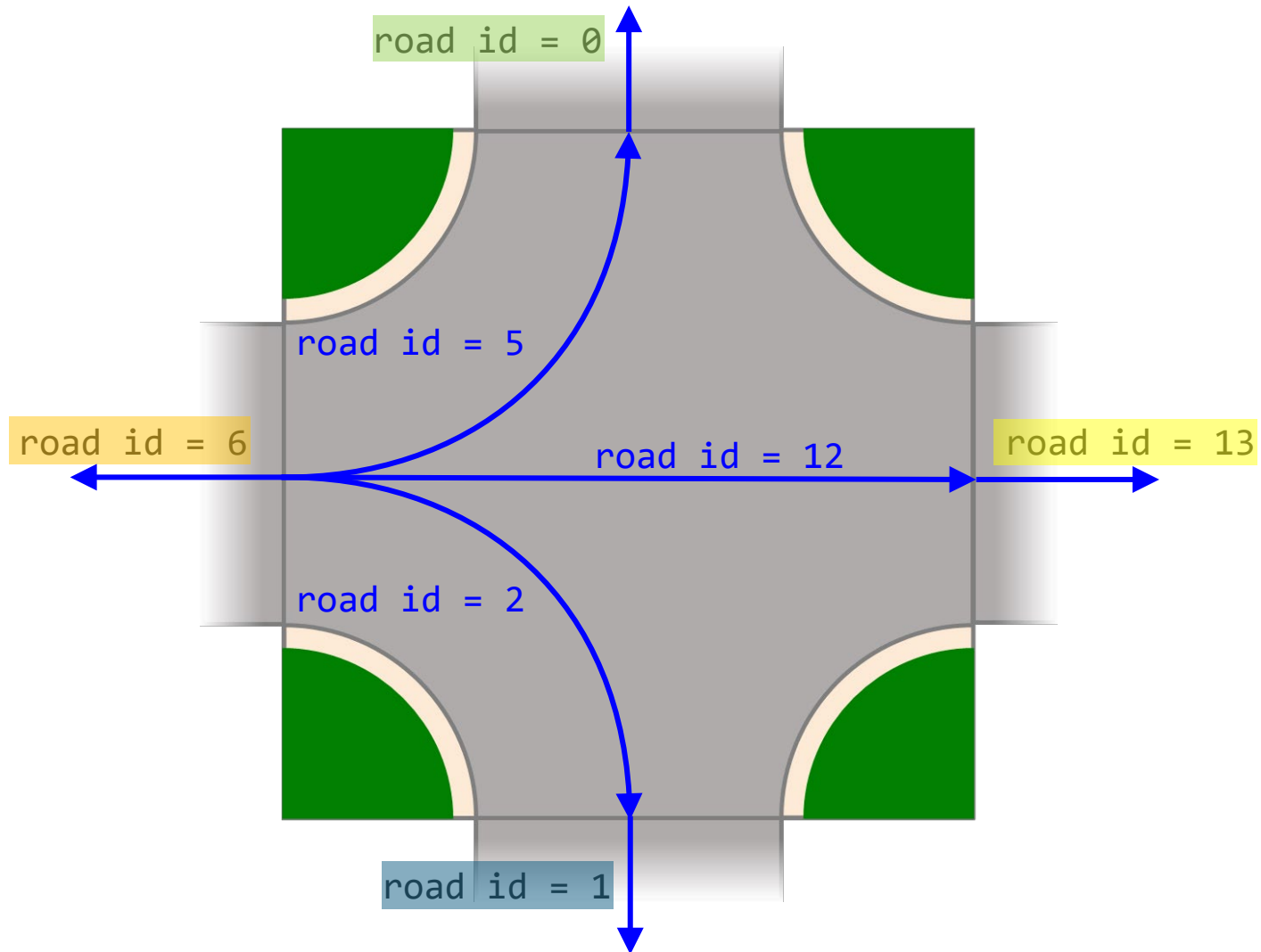
ASAM OpenDRIVE: Junction



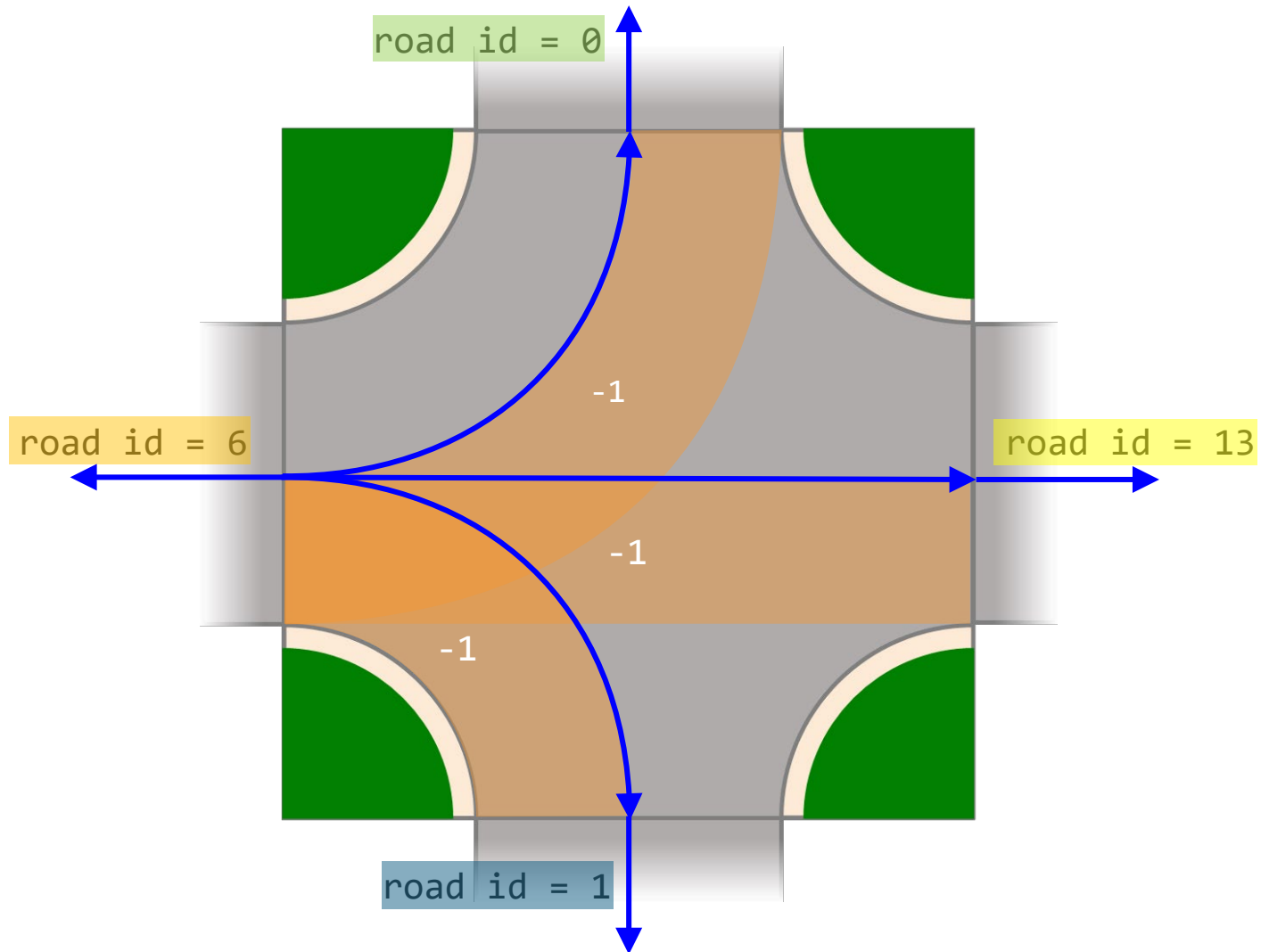
ASAM OpenDRIVE: Junctions



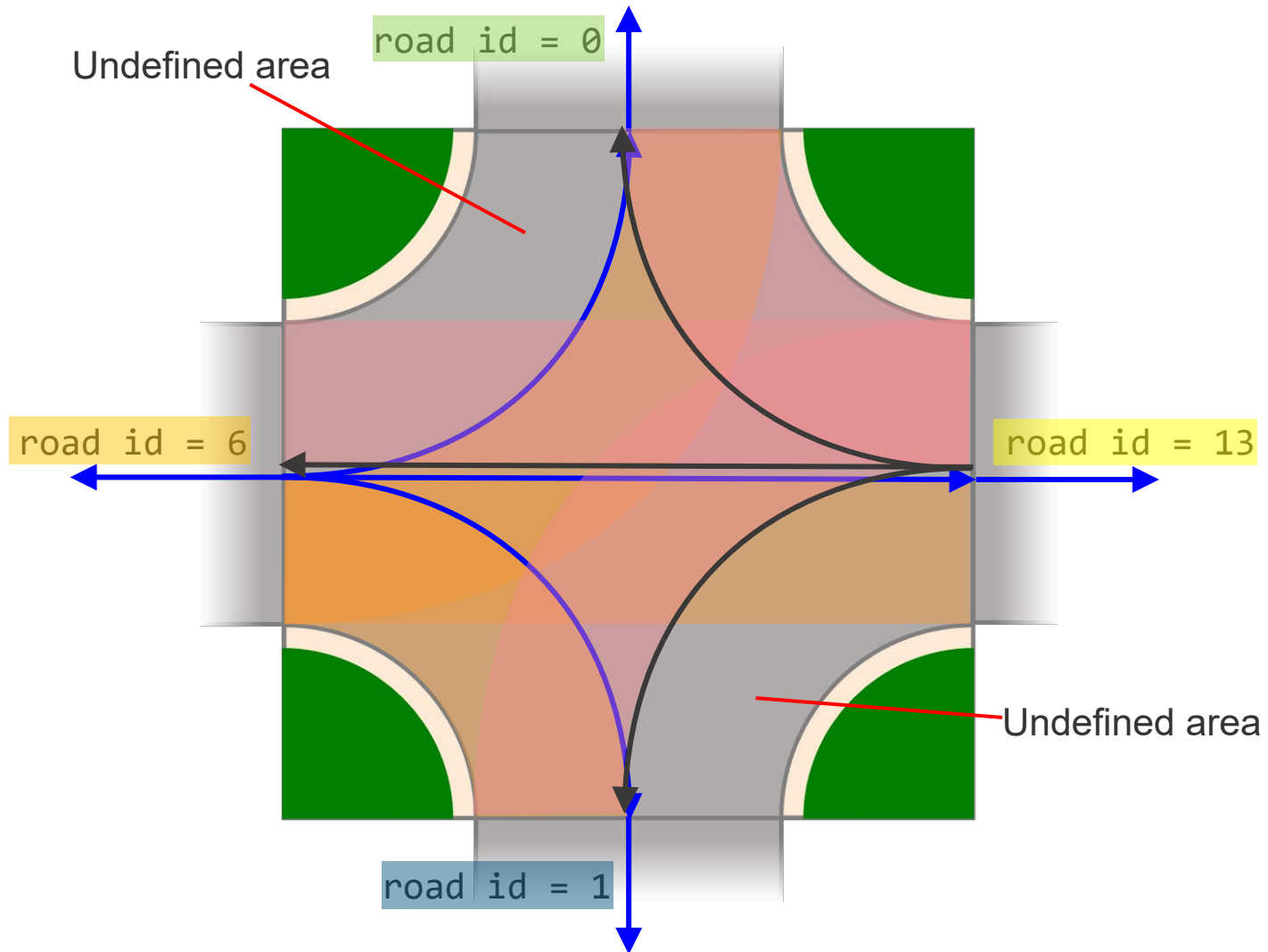
ASAM OpenDRIVE: Junctions



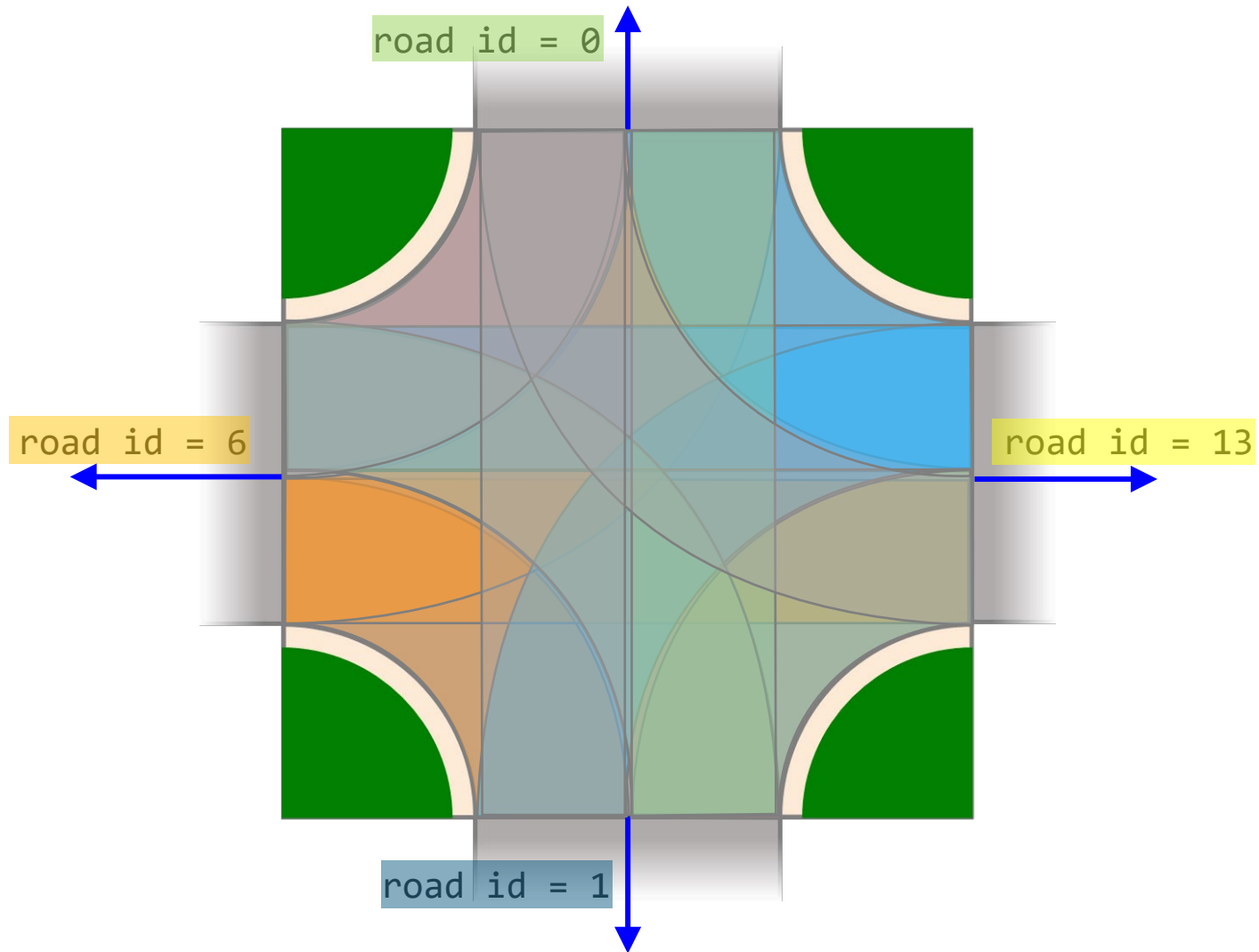
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Nicco Hagedorn
Global Technology Manager, ASAM e.V.

Phone: +49 60 9921 8048

Email: nicco.hagedorn@asam.net