ASAM OpenDRIVE Intro

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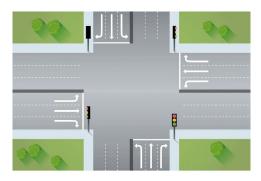




An Overview of ASAM OpenX...

8 individual standard initiatives

ASAM OpenDRIVE®



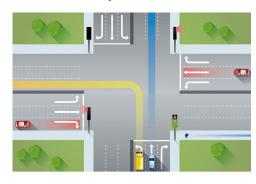
Static Road Network Desription

ASAM OpenCRG®



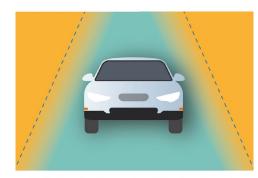
Static Road Surface Desription

ASAM OpenSCENARIO®



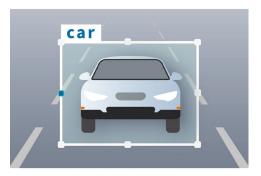
Dynamic Scenario Desription

ASAM OpenODD



Defining the Operational Design Domain for Automated Vehicles

ASAM OpenLABEL



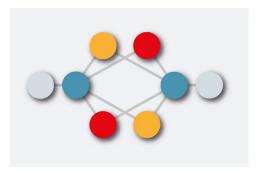
Standardized Labeling for objects and Scenarios

ASAM OSI®



Interface for Simulation

ASAM OpenXOntology



Core Domain Model for the ASAM Simulation Domain

ASAM Study Project Test Specification

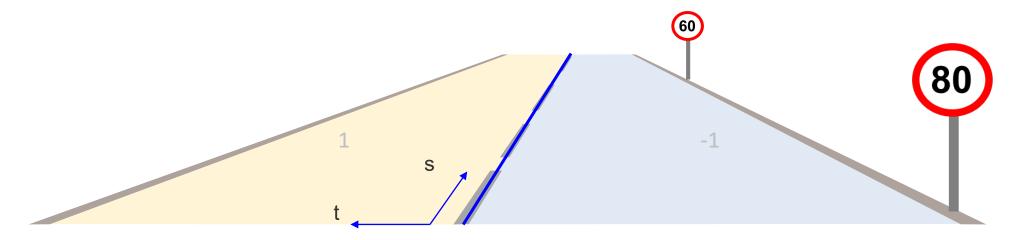


Analysis and harmonization of automotive testing techniques and standards



ASAM OpenDRIVE: Hierarchy







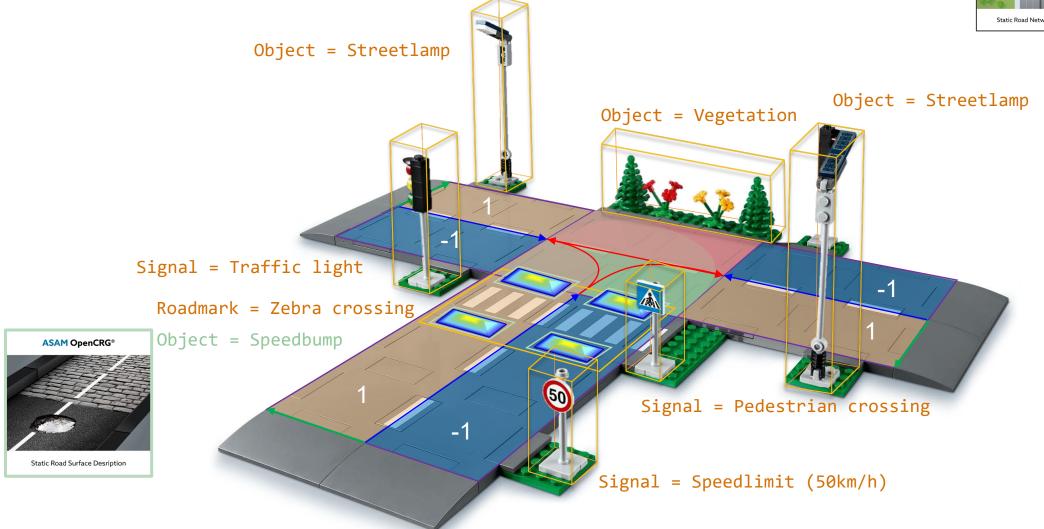
ASAM OpenDRIVE Example: T-Junction





ASAM OpenDRIVE Example: T-Junction

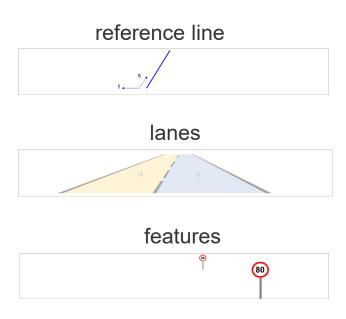






ASAM OpenDRIVE: XML Sturcture

```
<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>
```

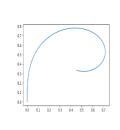




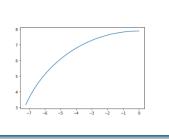
Referenc Line Elements

straight lines

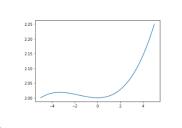
spirals



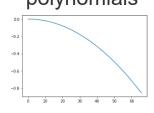
arcs



cubic polynomials



Parametric cubic polynomials





$$\frac{\Delta \alpha}{\Delta t} = 0$$

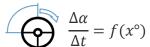
$$\alpha_{time=0}=0^{\circ}$$



$$\alpha_{time=0}=0^{\circ}$$



$$\alpha_{time=0} = n^{\circ}$$



$$\alpha_{time=0} = n^{\circ}$$

$$\frac{\Delta \alpha}{\Delta t} = f(x^{\circ})$$

$$\alpha_{time=0} = n^{\circ}$$

delimiters: <geometry>...</geometry>

parent: <planView>

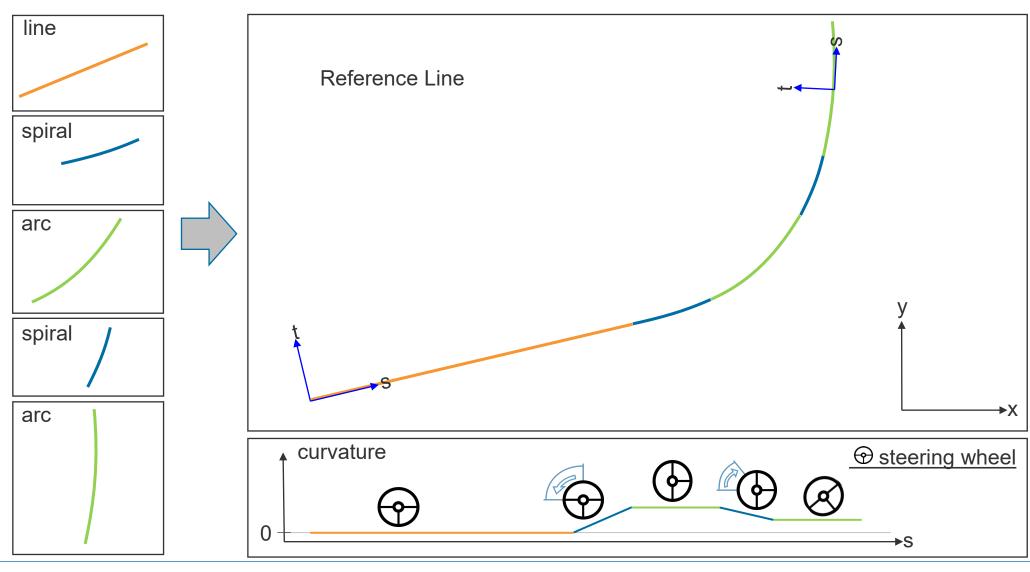
instances: 1-

attributes:

name	type	unit	value	description
S	double	m	[0,∞[
X	double	m] − ∞, ∞[
у	double	m] − ∞, ∞[
hdg	double	rad] − ∞, ∞[
length	double	m	[0,∞[



ASAM OpenDRIVE: Reference Line - Primitives

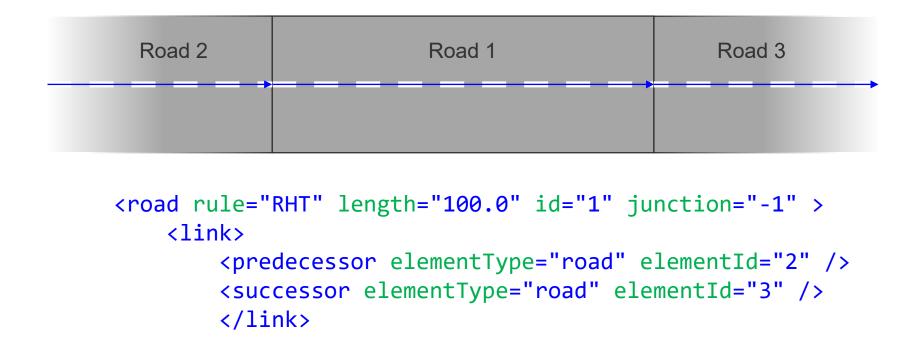


Road Definition

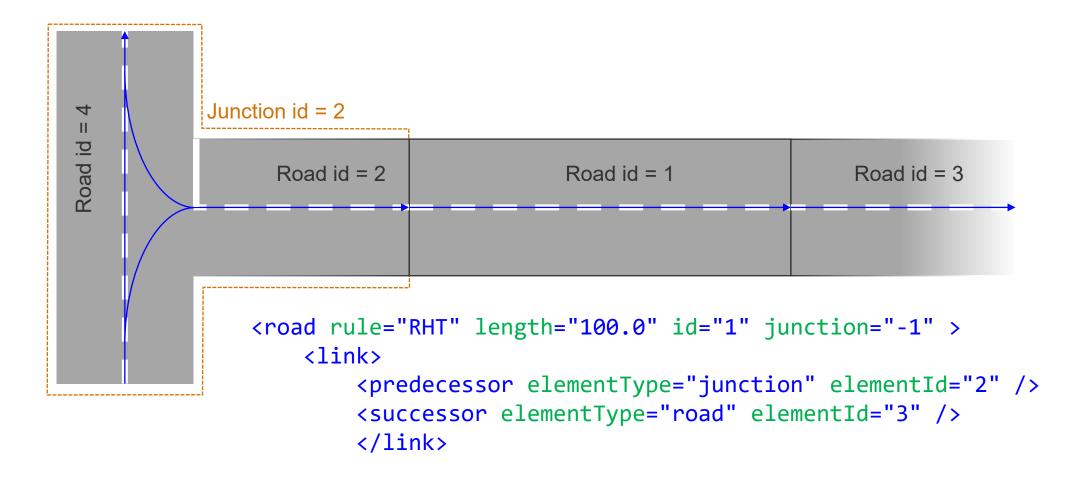




ASAM OpenDRIVE: Road Linkage



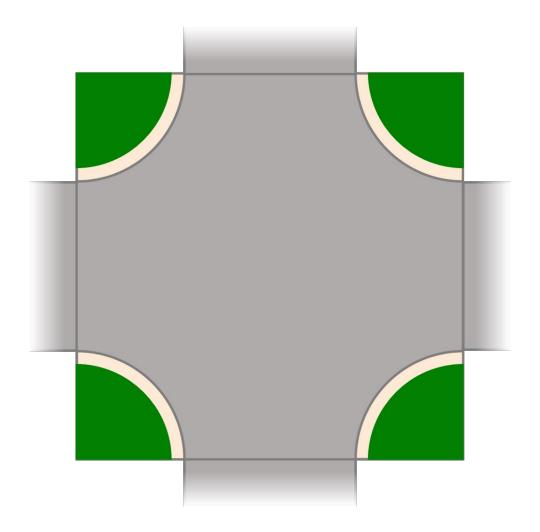
ASAM OpenDRIVE: Road Linkage



OpenDRIVE: Junctions

Example: Cross Junction,

- Very simple junction without traffic lights
- Right hand Traffic





```
□<OpenDRIVE>
     <header revMajor="1" revMinor="6" name="" version="1.00" date="Mon Oct 21 13:17:23 2019"</pre>
     </header>
     <road rule="RHT" length="1.03000000000000e+02" id="0" junction="-1" >
     <road rule="RHT" length="1.030000000000000e+02" id="1"</pre>
                                                               iunction="-1">
     <road rule="RHT" length="2.8435719942688948e+01" id="2"</pre>
                                                               iunction="1">
     <road rule="RHT" length="2.8435719942685569e+01" id="3"
                                                               junction="1">
     <road rule="RHT" length="2.9925740939669190e+01" id="4"</pre>
                                                               junction="1">
     <road rule="RHT" length="2.9925740939679464e+01" id="5"
                                                                iunction="1">
     <road rule="RHT" length="1.030000000000000e+02" id="6"
                                                                junction="-1">
     <road rule="RHT" length="3.400000000000000e+01" id="7"</pre>
                                                               junction="1">
     <road rule="RHT" length="3.400000000000000e+01" id="8"</pre>
                                                                iunction="1">
     <road rule="RHT" length="2.8435719942619844e+01" id="9"
                                                                iunction="1">
     <road rule="RHT" length="2.8435719942705987e+01" id="10"
                                                                junction="1">
     <road rule="RHT" length="3.400000000000000e+01" id="11"</pre>
                                                                iunction="1">
     <road rule="RHT" length="3.40000000000014e+01" id="12"</pre>
                                                                junction="1">
     <road rule="RHT" length="1.030000000000000e+02" id="13"</pre>
                                                                junction="-1">
                                                                junction="1">
     <road rule="RHT" length="2.9925740939671819e+01" id="14"</pre>
     <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

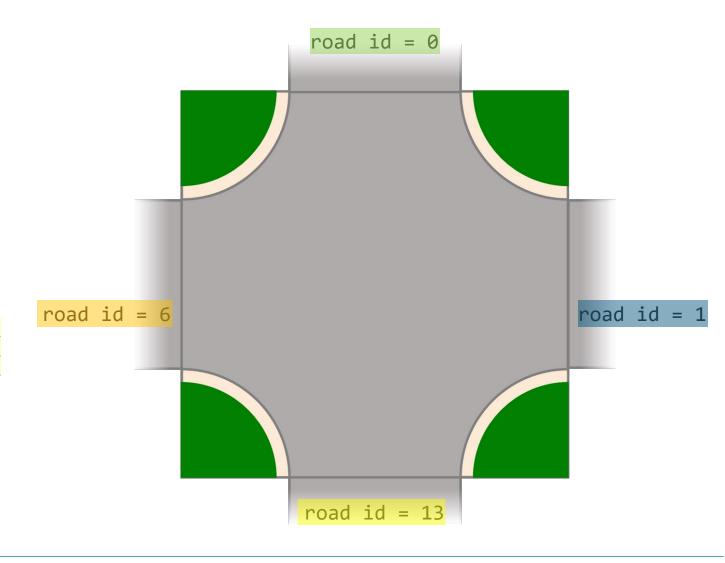
Road is part of a junction?

Establish connections



Identifiy the incoming roads of a junction

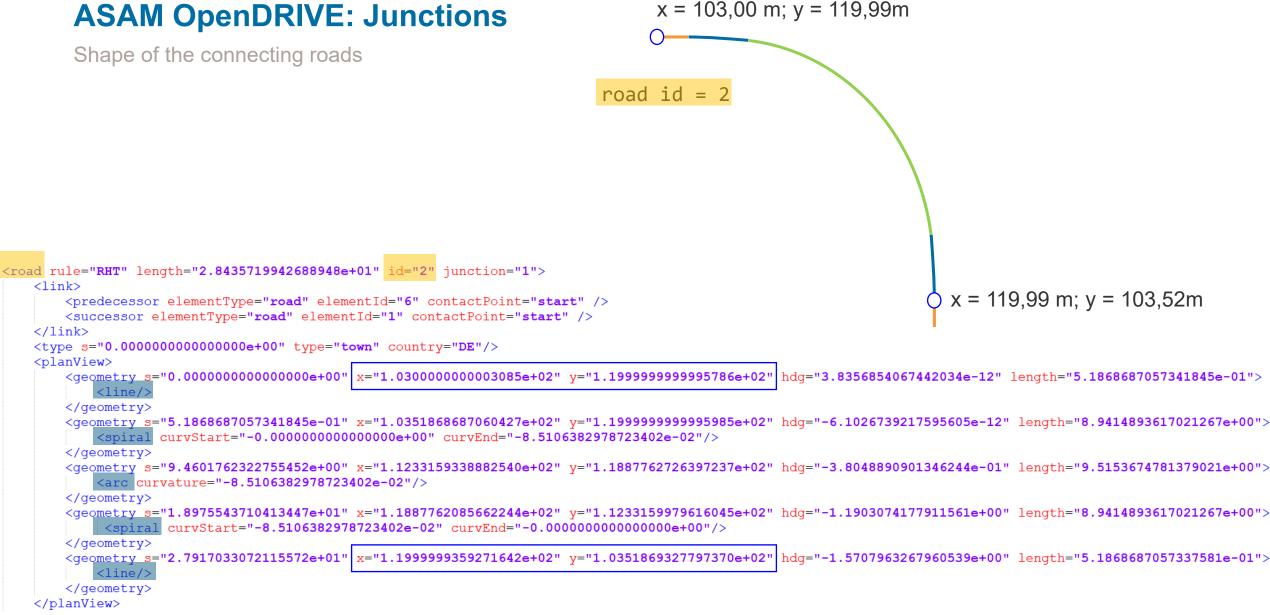
中	<pre><junction id="1" name="" type="default"></junction></pre>
+	<pre><connection <="" id="0" incomingroad="6" pre=""></connection></pre>
中	<pre><connection <="" id="1" incomingroad="6" pre=""></connection></pre>
中	<pre><connection <="" id="2" incomingroad="6" pre=""></connection></pre>
+	<pre><connection <="" id="3" incomingroad="0" pre=""></connection></pre>
中	<pre><connection <="" id="4" incomingroad="0" pre=""></connection></pre>
#	<pre><connection <="" id="5" incomingroad="0" pre=""></connection></pre>
中	<pre><connection <="" id="6" incomingroad="1" pre=""></connection></pre>
中	<pre><connection <="" id="7" incomingroad="1" pre=""></connection></pre>
中	<pre><connection <="" id="8" incomingroad="1" pre=""></connection></pre>
中	<pre><connection <="" id="9" incomingroad="13" pre=""></connection></pre>
中	<pre><connection <="" id="10" incomingroad="13" pre=""></connection></pre>
中	<pre><connection <="" id="11" incomingroad="13" pre=""></connection></pre>
-	





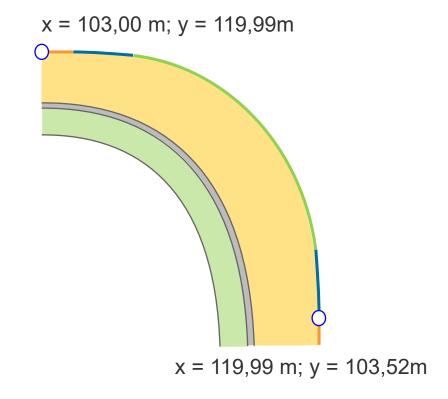
road id = 0 Identify all the connections within the junction <road rule="RHT" length="2.8435719942688948e+01" id="2" junction="1"> link> cpredecessor elementType="road" elementId="6" <successor elementType="road" elementId="1"</pre> </link> id = 2road id = 6 road id = 1id = 4id = 15 | id = 9 road id =

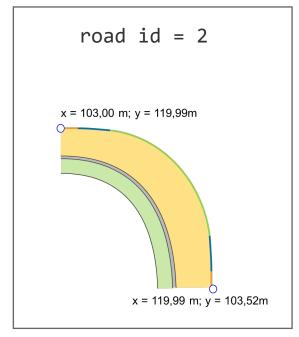


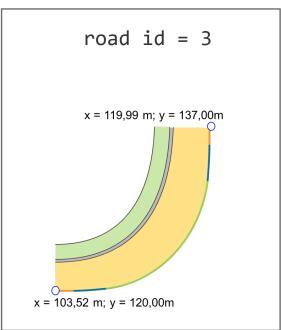


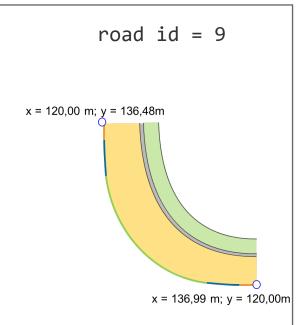


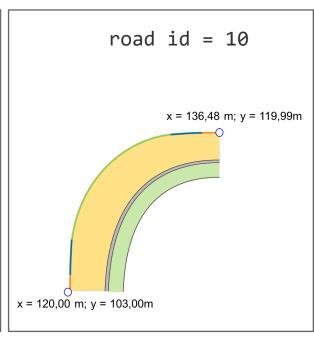
```
<right>
    <lane id="-1" type="driving" level="false">
        link>
            cpredecessor id="1"/>
            <successor id="-1"/>
        </link>
       <width soffset="0.000000000000000e+00" a="3.75000000000000e+00" b="0.00</pre>
    </lane>
   <lane id="-2" type="border" level="false">
        link>
            cpredecessor id="2"/>
            <successor id="-2"/>
        </link>
       <width sOffset="0.0000000000000000e+00" a="3.499999999999998e-01" b="0.00</pre>
    </lane>
    <lane id="-3" type="sidewalk" level="false">
        link>
            cpredecessor id="3"/>
            <successor id="-3"/>
        </link>
```











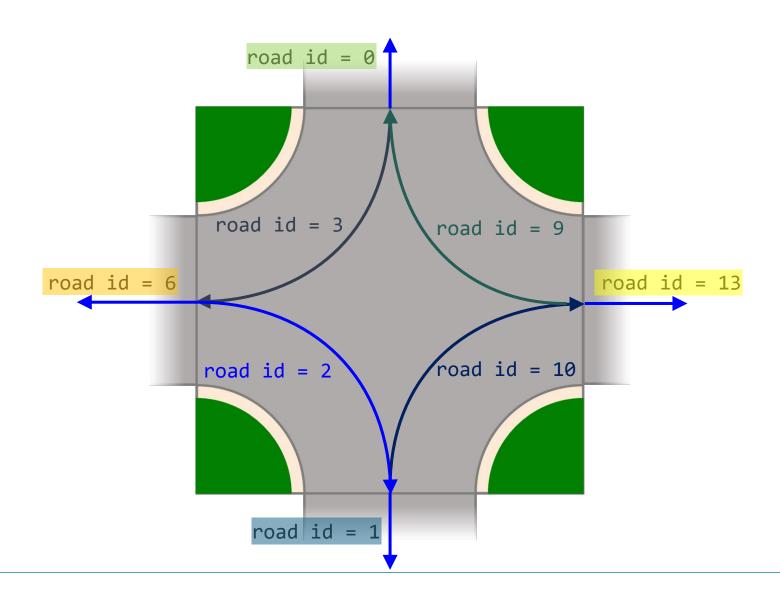
predecessor road: 6
successor road: 1

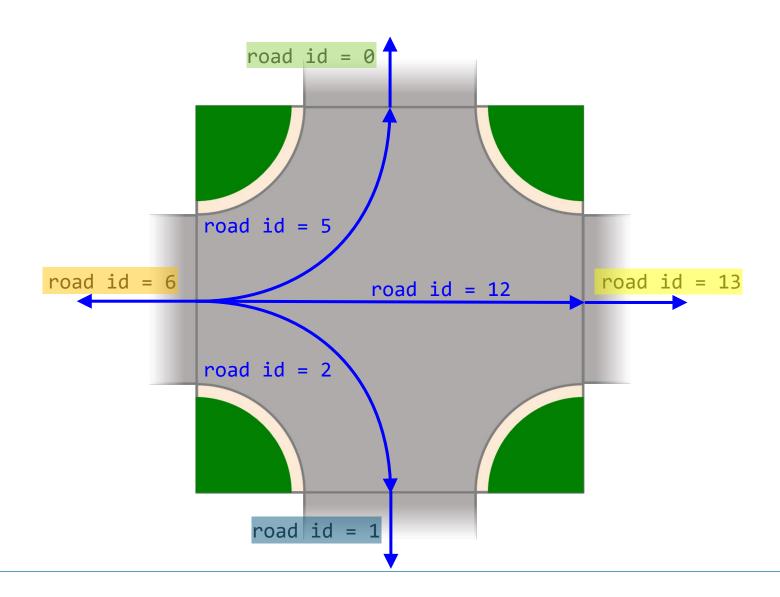
predecessor road: 0
successor road: 6

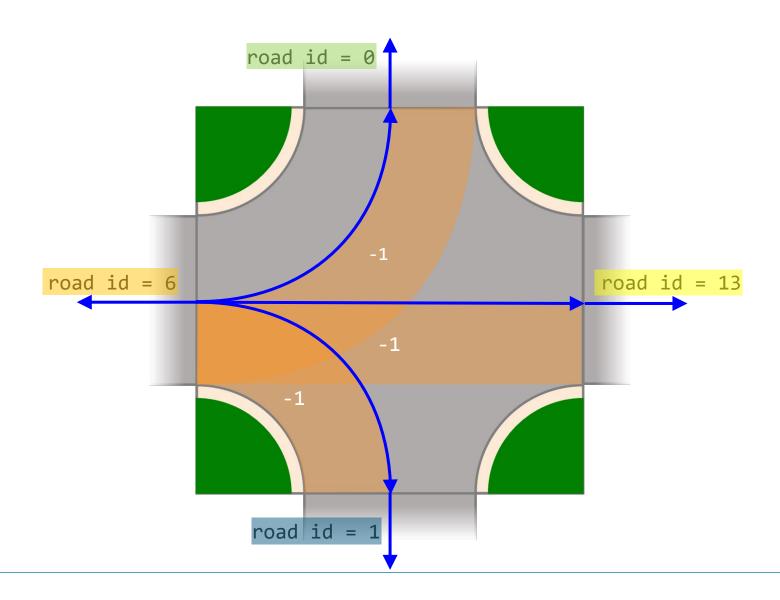
predecessor road: 13
successor road: 0

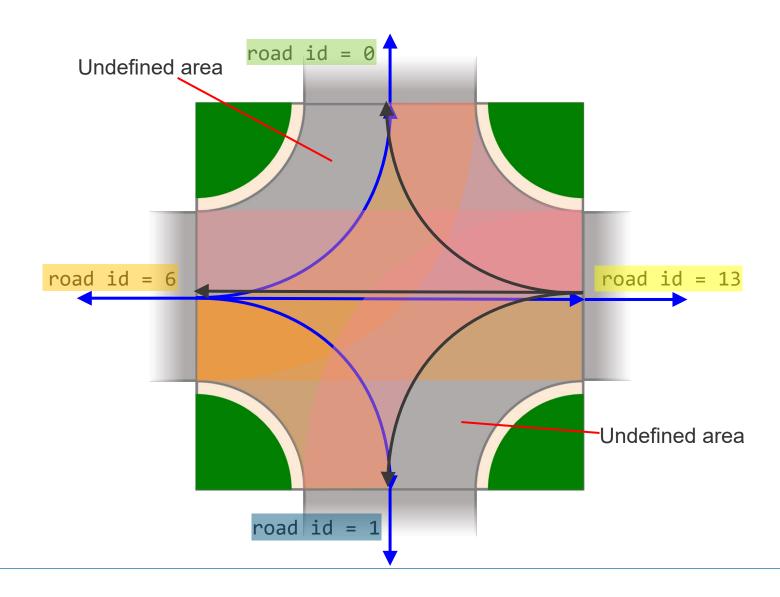
predecessor road: 1
successor road: 13

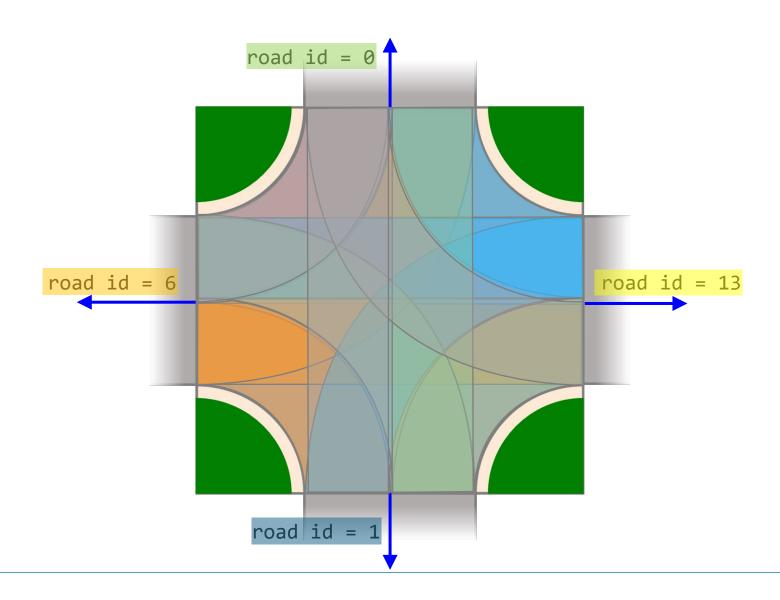












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