

OpenDrive 的地图制作和路径规划使用手册

需要使用到如下模块。

编号	模块	功能	所属目录	备注
1	CAN 驱动	采集 Mobileye 原始数据	driver	
2	driver_gps_hcp2	采集惯导数据	driver	
3	driver_camera_usb	采集环境参考信息	driver	
4	detection_mobileye	解析 mobileye 数据	detection	
5	adciv_record	记录数据	tool	
6	adciv_replay	回放数据	tool	
7	map_mobileye	生成车道点数据	tool	
8	map_lanetoxodr	地图制作工具	tool	
9	driver_map_xodrload	路径规划程序	driver	

一 地图制作

1.1 采集数据

采集数据会用到如下设备。

使用惯导采集 GPS 数据。



使用 Mobieye 采集 GPS 数据到左右车道的距离，用来推算左右车道点的数据。



使用 usb 相机采集车前信息，用于回放时用来提取车道点进行参考。



用到的模块如下。

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1	CAN 驱动	采集 Mobieye 原始数据	driver	
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3	driver_camera_usb	采集环境参考信息	driver	
4	adciv_record	记录数据	tool	

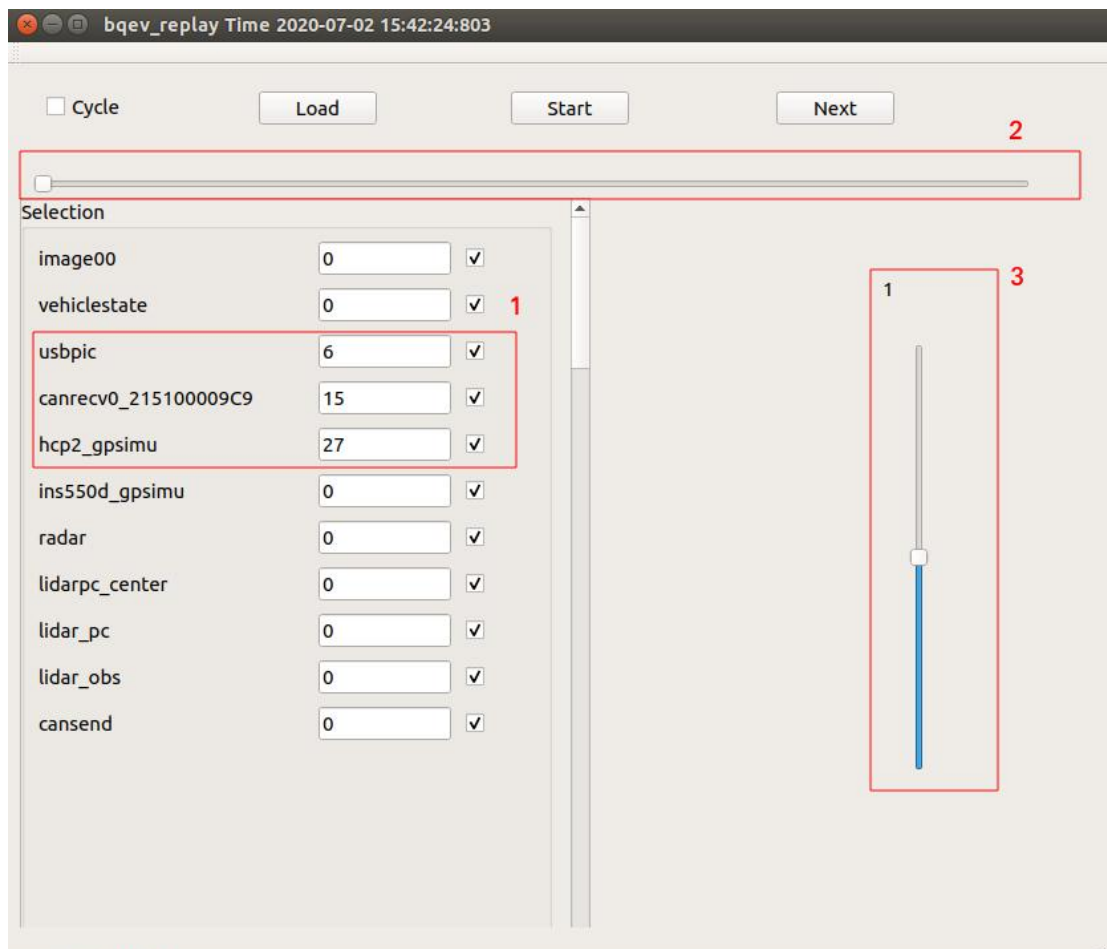
采集后的数据为.ivd 格式，保存有 gps 数据、can 总线数据、图片数据。

1.2 提取车道点

提取车道点用到的模块有 .

编号	模块	功能	所属目录	备注
1	detection_mobileye	解析 mobileye 数据	detection	
2	adciv_replay	回放数据	tool	
3	map_mobileye	生成车道点数据	tool	

回放工具如下调所示 .



回放工具支持查看数据消息列表(1)，调节进度(2)，调节回放速度(3)。

detection_mobileye 的 can 消息需要和回放的那个 can 消息对应上。没有界面，运行即可。

map_mobileye 的界面如下图所示

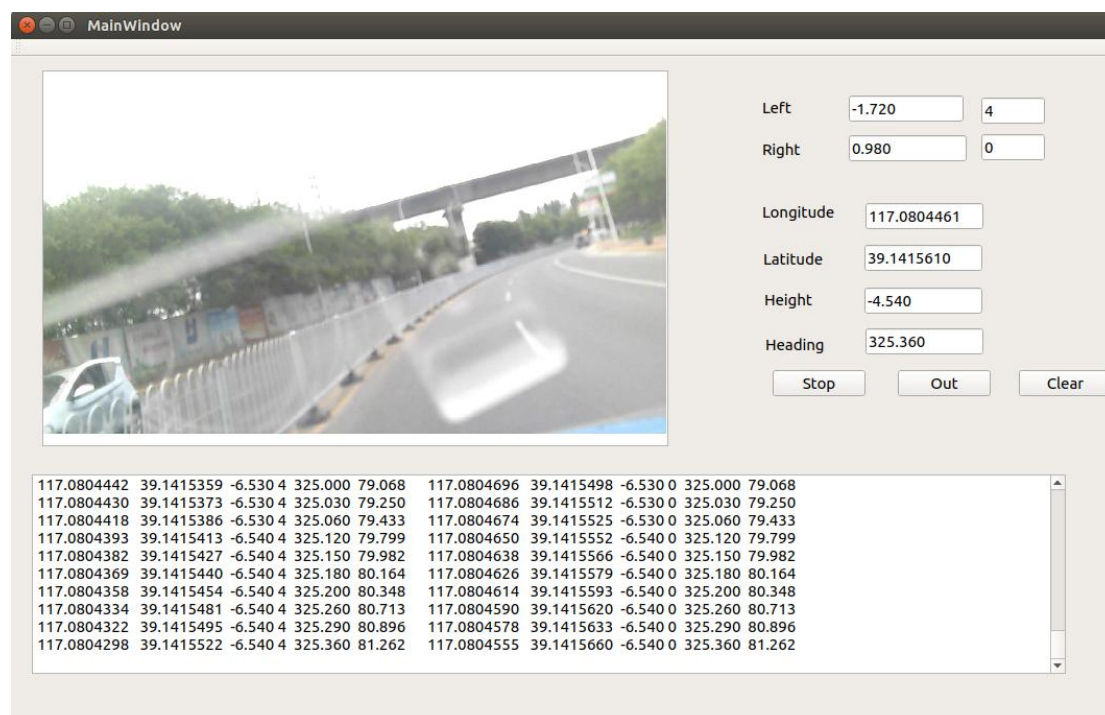


- 1 摄像头数据
- 2 到左右车道线的距离
- 3 左右车道线类型
- 4 G P S 数据
- 5 开始推算车道点
- 6 输出车道点
- 7 清除车道点数据
- 8 车道点数据

当车辆进入需要制作地图的路段后，点击 start 开始推算车道点，推算结果会输出到车道点数据框内。接近某一个道路点（比如红绿灯）后停止记录，并将车道点数据保存为文本文件，比如 lane00.txt，对向车道点数据保存为 laneo01.txt。保存后，点击 clear 清除数据，在 adviv_record 里控制进度到下一个车道采集。

一段道路，比如双向 4 车道，可以保存为 lane00.txt lane01.txt，代表右侧车道，laneo00.txt，laneo01.txt 代表对向车道。

车道点数据包含左右车道的经度 纬度 高度 车道点特征 航向 距离信息。



1.3 地图生成和编辑

地图制作工具为 map_lanetoxodr，如下图所示。

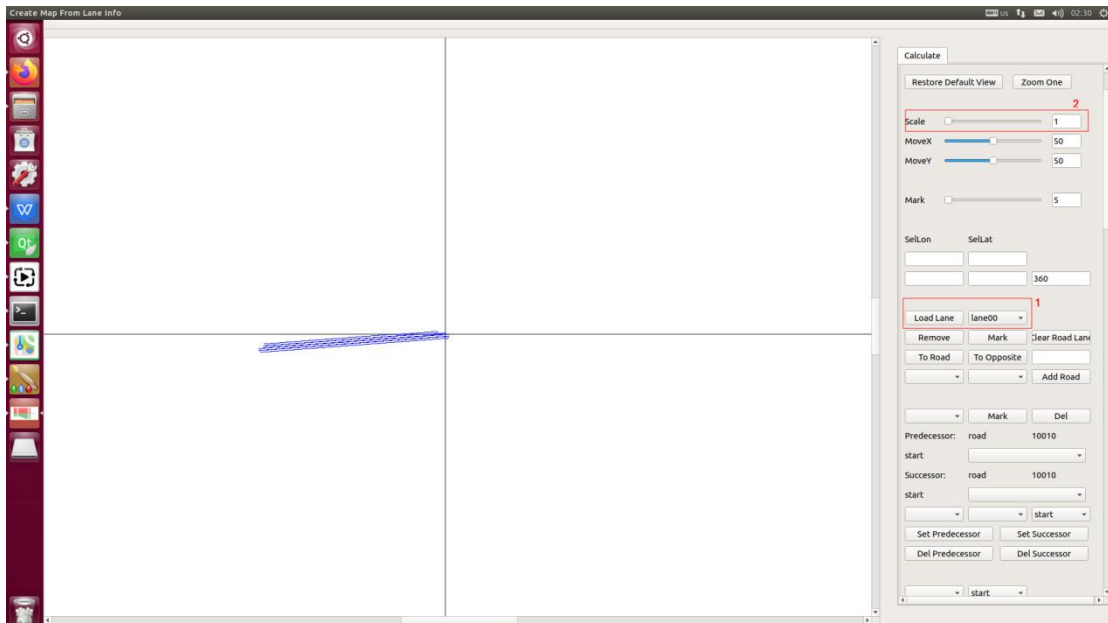


地图制作工具的图标是一个高精度地图。

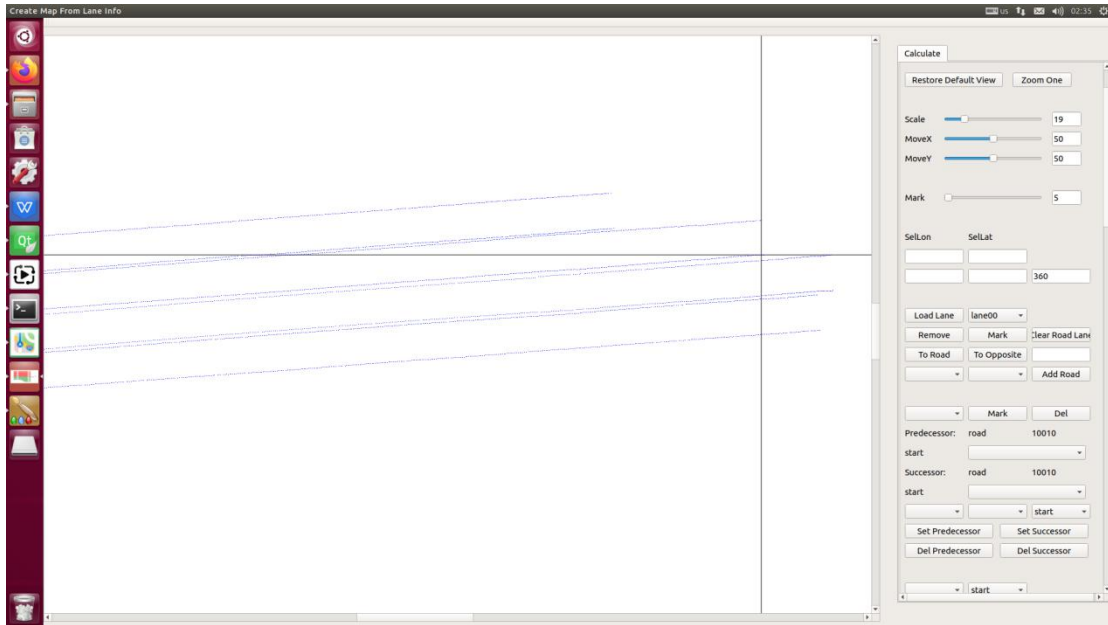
地图制作工具可以随时保存正在制作的 OpenDrive 地图，也可以随时加载其它 OpenDrive 地图进来，进行编辑和连接。Load 的逻辑是增加。

1.3.1 从车道点数据到道路

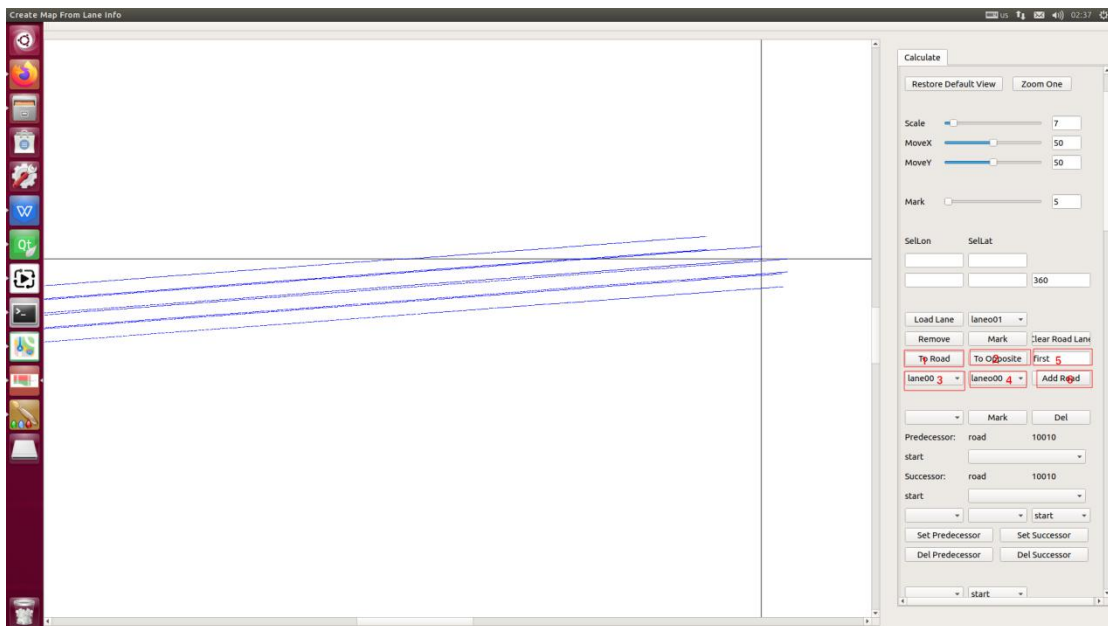
点击 Load 导入车道点数据。



调节 Scale 进行放大。



双向各 2 条车道，我们可以看到车道之间的间隙。



将右侧车道按车道顺序依次 To Road 到右侧车道列表内。

将左侧车道按车道顺序依次 To Opposite 到左侧车道列表内。

右侧车道是必须的。左右是相对参考线的说法，参考线会在 Add Road 这一步进行生成。

Add Road 会将车道线数据进行拟合。

A) 计算车道之间的宽度差(车道分割线的宽度)，

B) 根据右侧第一车道的左边界线进行拟合，拟合过程是自动的，首先查看特征，决定哪些区域是直线，哪些区域是圆弧，每个区域内都是迭代拟合，如果拟合后的误差超过 5 cm 并且拟合用的车道点足够，拟合区域进一步划分为两个拟合区域直到拟合误差能控制到 5cm 或者区域车道点不足，区域之间采用贝塞尔曲线相连。

C) 根据车道点右侧点到左侧点的宽度加上车道分割线的宽度拟合车道宽度方程。拟合成三次方程。

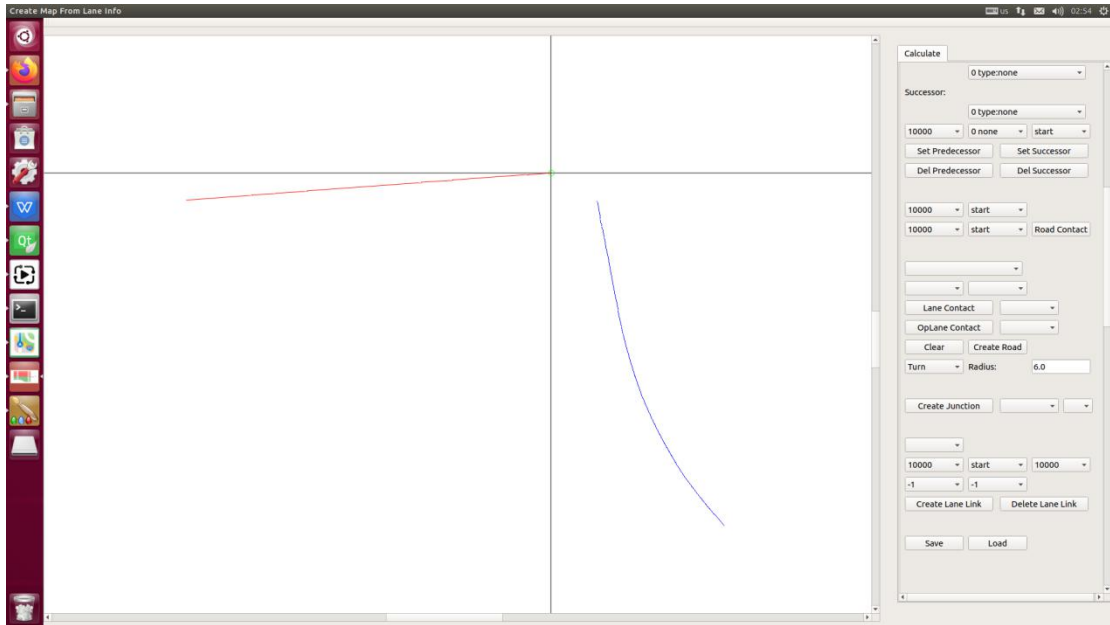
D) 拟合道路高度信息

E) 分析车道点特征，加入车道实线虚线信息。

Add Road 后可以点击 Remove 将车道点数据 Remove 掉。



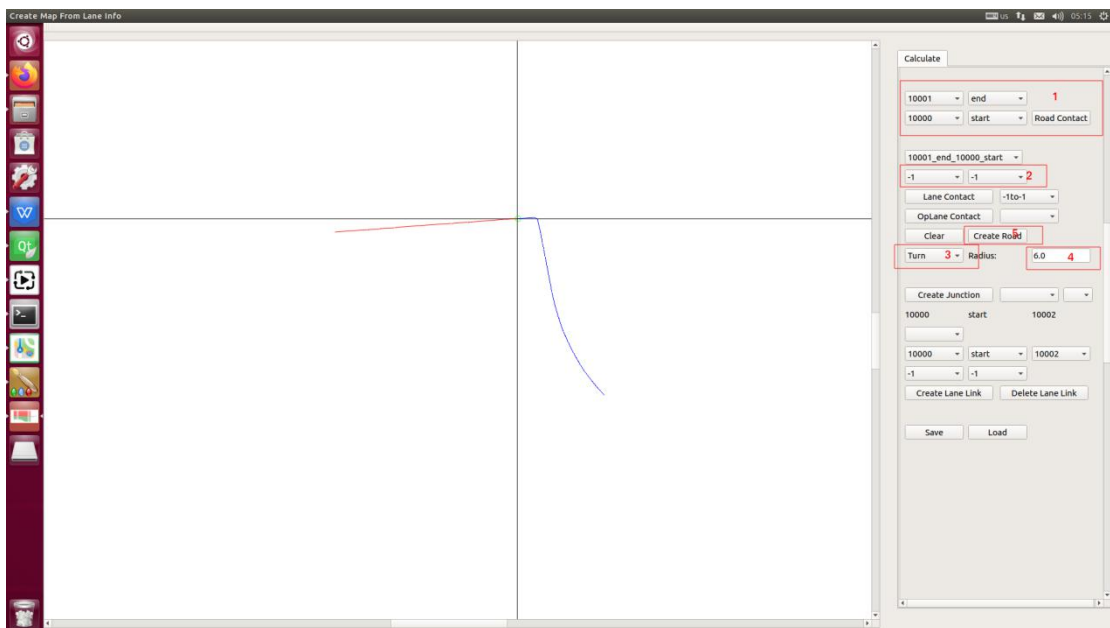
依次拟合其它道路。



在任何时候都可以点击 Save 暂存地图。

1.3.2 创建连接道路

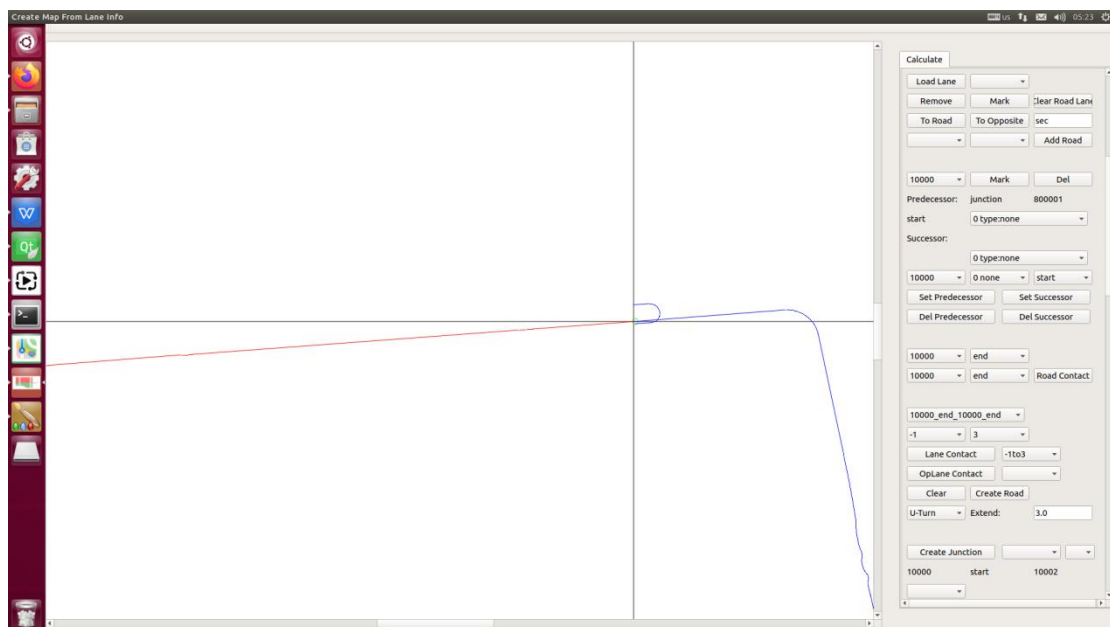
比如左转，右转，路口直行，U型弯这些没有车道线的区域需要使用连接道路的方法进行创建。可以提前准备一些这些地方的车道点（后面会加入手动设置左右边界而非 Mobileye 的方式）作为创建参考。



创建顺序如下：

- A . 选择前后道路 .
- B . 选择车道连接
- C . 选择左转 \ 直行 \ U型弯
- D . 左转的设置转弯半径，U型弯设置直线段延长距离 .
- E . 点击 Create Road 进行创建

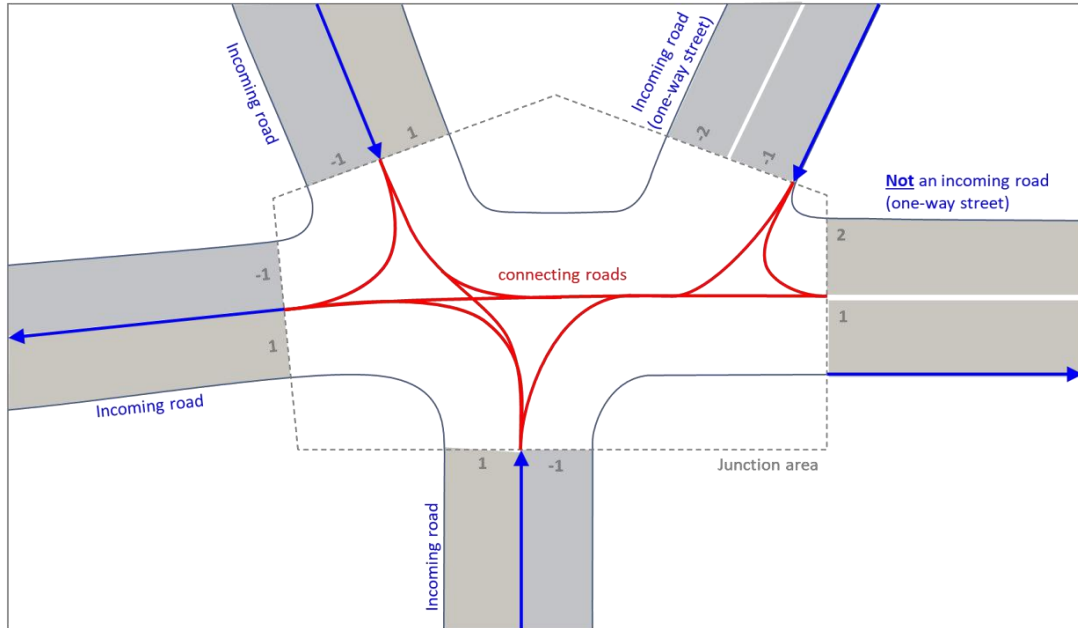
依次创建U型弯用于调头道路 .



1.3.3 创建 Junction

Junction 用于道路连接比较模糊的区域 .

如下图所示 .



Junction 区域外为 Incoming road , 内部为 Connecting road.

点击 Create Junction 创建 Junction .

接着创建车道连接 .



如上图

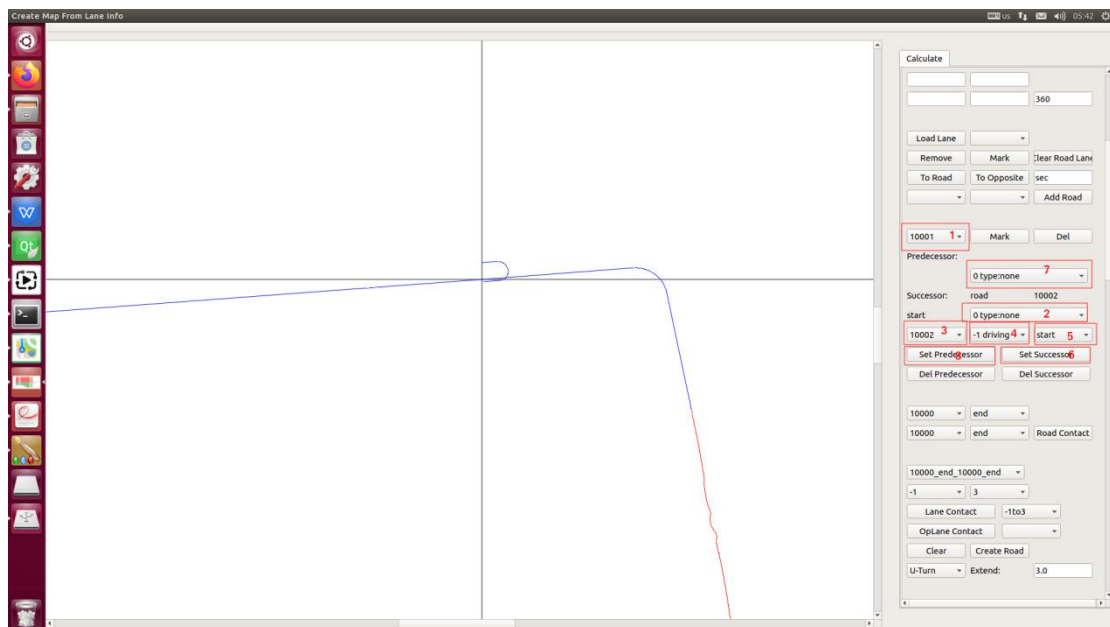
- 1 Incoming Road
- 2 Incoming Road 的 Contact point
- 3 Connecting Road
- 4 IncomingRoad 的车道
- 5 Connecting Road 的车道
- 5 创建车道连接

依次创建 Junction 连接 .



1.3.4 道路连接

道路连接界面如下图所示 .

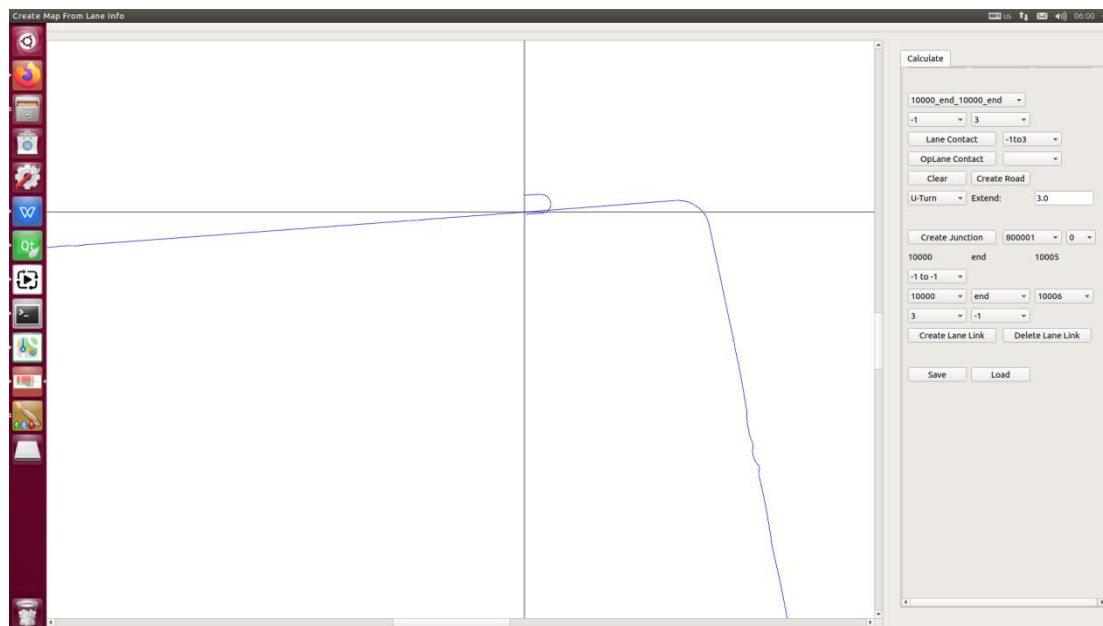


- 1 当前道路
- 2 当前道路需要进行连接的车道
- 3 关联道路
- 4 关联道路的车道
- 5 关联车道的连接点
- 6 设为后继
- 7 当前道路需要进行连接的车道
- 8 设为前驱

对所有连接进行操作，建立连接关系。

1.3.5 保存地图

选择 Save 保存地图数据。



OpenDrive 地图数据如下图所示。

```
<?xml version="1.0" ?>
<OpenDRIVE>
  <header revMajor="1" revMinor="1" name="adcmap" version="1.1"
date="2020-07-31" north="0.0000000000000000e+00"
south="0.0000000000000000e+00" east="0.0000000000000000e+00"
west="0.0000000000000000e+00" lat0="3.9143909999999998e+01"
lon0="1.1707910200000001e+02" hdg0="3.6000000000000000e+02" />
  <road name="first" length="3.1751380228949864e+02" id="10000"
junction="80000">
    <link>
      <predecessor elementType="junction" elementId="80000"
contactPoint="start" />
      <successor elementType="junction" elementId="800001"
contactPoint="end" />
    </link>
    <planView>
      <geometry s="0.0000000000000000e+00"
```

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x="2.9994315761769841e-01"          y="4.1857735865017502e-02"
hdg="3.2200968252064355e+00" length="1.9891887651316274e+01">
  <line />
  </geometry>
  <geometry          s="1.9891887651316274e+01"
x="-1.9530680060755763e+01"          y="-1.5181349254947434e+00"
hdg="3.2200968252064355e+00" length="1.1135631489695863e+00">
  <paramPoly3          aU="0.0000000000000000e+00"
bU="1.0483650026570639e+00"          cU="-1.3563490484199384e-01"
dU="8.1543566528802944e-02"          aV="0.0000000000000000e+00"
bV="0.0000000000000000e+00"          cV="-1.4148152701379790e-01"
dV="8.6892539299634891e-02" />
  </geometry>
  <geometry          s="2.1005450800285860e+01"
x="-2.0643433948781041e+01"          y="-1.5500440153730608e+00"
hdg="3.2278602921162038e+00" length="5.2061045694072283e-01">
  <arc curvature="1.9383917593173764e-05" />
  </geometry>
  <geometry          s="2.1526061257226583e+01"
x="-2.1162108161546140e+01"          y="-1.5949027814666863e+00"
hdg="3.2278602921162038e+00" length="1.2021516752023389e+00">
  <paramPoly3          aU="0.0000000000000000e+00"
bU="1.0499668101562012e+00"          cU="-1.2472232028174310e-01"
dU="6.9152293552250652e-02"          aV="0.0000000000000000e+00"
bV="0.0000000000000000e+00"          cV="2.2754484210039824e-02"
dV="-1.5477750102534302e-02" />
  </geometry>
  <geometry          s="2.2728212932428921e+01"
x="-2.2359233896509153e+01"          y="-1.7044618853865365e+00"
hdg="3.2160649353167909e+00" length="6.2851690129337086e+01">
  <line />
  </geometry>
  <geometry          s="8.5579903061766004e+01"
x="-8.5036713033183545e+01"          y="-6.3808452300189131e+00"
hdg="3.2160649353167909e+00" length="2.4433567852439855e+00">
  <paramPoly3          aU="0.0000000000000000e+00"
bU="1.0499902508928005e+00"          cU="-6.1393154066918879e-02"
dU="1.6751419002677539e-02"          aV="0.0000000000000000e+00"
bV="0.0000000000000000e+00"          cV="-5.1480909674899399e-03"
dV="1.4737768251921195e-03" />
  </geometry>
  <geometry          s="8.8023259847009996e+01"
x="-8.7473961966140365e+01"          y="-6.5534270026340034e+00"
hdg="3.2172440459757849e+00" length="2.5426803484505925e+01">
```

```
<line />
</geometry>
<geometry s="1.1345006333151592e+02"
x="-1.1282803965431147e+02" y="-8.4751658043099845e+00"
hdg="3.2172440459757849e+00" length="2.4611633819648073e+00">
  <paramPoly3 aU="0.0000000000000000e+00"
bU="1.0497274874183393e+00" cU="-6.1020438139550409e-02"
dU="1.6541004734310465e-02" aV="0.0000000000000000e+00"
bV="0.0000000000000000e+00" cV="2.5585897115579882e-02"
dV="-7.0078954798293118e-03" />
</geometry>
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x="-1.1527770932748200e+02" y="-8.7114938773452568e+00"
hdg="3.2159057330837073e+00" length="9.6825429534449228e+01">
  <line />
</geometry>
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x="-2.1183590586567439e+02" y="-1.5900268864949387e+01"
hdg="3.2159057330837073e+00" length="2.4277343190891525e+00">
  <paramPoly3 aU="0.0000000000000000e+00"
bU="1.0498470118668424e+00" cU="-6.1828088432812234e-02"
dU="1.6985283177926577e-02" aV="0.0000000000000000e+00"
bV="0.0000000000000000e+00" cV="-1.9383690557969582e-02"
dV="5.3726826383363995e-03" />
</geometry>
<geometry s="2.1516439056701910e+02"
x="-2.1425936144635162e+02" y="-1.6043223416166448e+01"
hdg="3.2167449589651609e+00" length="2.4235253387158718e+01">
  <line />
</geometry>
<geometry s="2.3939964395417780e+02"
x="-2.3842620827035120e+02" y="-1.7862844619914551e+01"
hdg="3.2167449589651609e+00" length="2.4191837577176893e+00">
  <paramPoly3 aU="0.0000000000000000e+00"
bU="1.0494837365832963e+00" cU="-6.2139759587403171e-02"
dU="1.7147020505153321e-02" aV="0.0000000000000000e+00"
bV="0.0000000000000000e+00" cV="3.6609290867982404e-02"
dV="-1.0350800573570516e-02" />
</geometry>
<geometry s="2.4181882771189549e+02"
x="-2.4083229405929822e+02" y="-1.8111906191169147e+01"
hdg="3.2123602911410702e+00" length="1.8363698844251864e+01">
  <line />
</geometry>
```

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                <geometry                                s="2.6018252655614737e+02"
x="-2.5915002885163960e+02"                            y="-1.9410377338258378e+01"
hdg="3.2123602911410702e+00" length="2.4970820185279377e+00">
                <paramPoly3                            aU="0.0000000000000000e+00"
bU="1.0499947442496806e+00"                            cU="-6.0061493482198518e-02"
dU="1.6034003801736720e-02"                            aV="0.0000000000000000e+00"
bV="0.0000000000000000e+00"                            cV="4.4431396585871553e-05"
dV="3.6589731982594140e-04" />
            </geometry>
            <geometry                                s="2.6267960857467529e+02"
x="-2.6164042581790090e+02"                            y="-1.9592900833762798e+01"
hdg="3.2190903245158675e+00" length="5.4834193714823357e+01">
                <line />
            </geometry>
        </planView>
        <elevationProfile>
            <elevation                                s="0.0000000000000000e+00"
a="-6.7807468916776319e+00"                            b="1.0745770552870065e-03"
c="1.2894843765024466e-06" d="-1.0709360559268355e-08" />
        </elevationProfile>
        <lateralProfile />
        <lanes>
            <laneSection s="0.0000000000000000e+00">
                <left>
                    <lane id="1" type="shoulder" level="false">
                        <link />
                        <width                            sOffset="0.0000000000000000e+00"
a="5.0555122262845231e-01"                            b="-1.6822406648304945e-03"
c="1.2656092630159569e-05" d="-2.6819847567691979e-08" />
                        <roadMark                    sOffset="0.0000000000000000e+00"
type="solid"                            weight="standard"                            color="standard"
width="1.4999999999999999e-01" laneChange="false" />
                    </lane>
                    <lane id="2" type="driving" level="false">
                        <link />
                        <width                            sOffset="0.0000000000000000e+00"
a="3.1752255220990868e+00"                            b="6.9813075067775838e-05"
c="1.6205624371994570e-06" d="-4.7345357245578450e-09" />
                        <roadMark                    sOffset="0.0000000000000000e+00"
type="solid"                            weight="standard"                            color="standard"
width="1.4999999999999999e-01" laneChange="false" />
                        <roadMark                    sOffset="1.2597000000000000e+01"
type="broken"                            weight="standard"                            color="standard"
width="1.4999999999999999e-01" laneChange="false" />
                    </lane>
                </left>
            </laneSection>
        </lanes>
    </elevationProfile>
</planView>
</road>

```



```
</lane>
<lane id="3" type="driving" level="false">
  <link />
  <width          sOffset="0.0000000000000000e+00"
a="3.5150843000908258e+00"          b="5.3522155129082365e-04"
c="-3.1567051568156481e-06" d="4.8982140628461470e-09" />
  <roadMark      sOffset="0.0000000000000000e+00"
type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
  <roadMark      sOffset="1.5254000000000000e+01"
type="broken"        weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
</lane>
</left>
<center>
  <lane id="0" type="none" level="false">
    <link />
    <roadMark      sOffset="0.0000000000000000e+00"
type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
  </lane>
</center>
<right>
  <lane id="-1" type="driving" level="false">
    <link />
    <width          sOffset="0.0000000000000000e+00"
a="3.2289168495156177e+00"          b="3.7881035253928464e-04"
c="-2.6889488857053353e-06" d="5.4557064082963586e-09" />
    <roadMark      sOffset="0.0000000000000000e+00"
type="broken"        weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
    <roadMark      sOffset="2.9425500000000000e+02"
type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
  </lane>
  <lane id="-2" type="driving" level="false">
    <link />
    <width          sOffset="0.0000000000000000e+00"
a="3.4817905658392934e+00"          b="1.0959723210129943e-04"
c="-4.8434921536190063e-07" d="2.0831729384407132e-10" />
    <roadMark      sOffset="0.0000000000000000e+00"
type="broken"        weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
    <roadMark      sOffset="2.9350299999999999e+02"
```

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type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
    </lane>
  </right>
</laneSection>
</lanes>
<objects />
<signals />
</road>
<road name="sec" length="3.0725555046934255e+02" id="10001"
junction="-1">
  <link>
    <successor          elementType="road"          elementId="10002"
contactPoint="start" />
  </link>
  <planView>
    <geometry          s="0.0000000000000000e+00"
x="1.5036110667755906e+02"          y="-3.0582874908493267e+02"
hdg="2.2871094557772427e+00" length="1.1810360185281320e+01">
      <line />
    </geometry>
    <geometry          s="1.1810360185281320e+01"
x="1.4260632513835759e+02"          y="-2.9692100127836909e+02"
hdg="2.2871094557772427e+00" length="1.2598286760536519e+00">
      <paramPoly3          aU="0.0000000000000000e+00"
bU="1.0493251969192032e+00"          cU="-1.1942914443911687e-01"
dU="6.3315525419547714e-02"          aV="0.0000000000000000e+00"
bV="0.0000000000000000e+00"          cV="-7.4611283763747815e-02"
dV="3.8532520916212940e-02" />
    </geometry>
    <geometry          s="1.3070188861334973e+01"
x="1.4181084719412235e+02"          y="-2.9594424366830503e+02"
hdg="2.2828022517412068e+00" length="3.9324553096410703e+01">
      <arc curvature="-2.1443224828772639e-03" />
    </geometry>
    <geometry          s="5.2394741957745680e+01"
x="1.1740290289759997e+02"          y="-2.6512612215014809e+02"
hdg="2.1984777284074726e+00" length="2.3804333475276893e+00">
      <paramPoly3          aU="0.0000000000000000e+00"
bU="1.0484524469157757e+00"          cU="-6.2908303278926977e-02"
dU="1.7616406802488306e-02"          aV="0.0000000000000000e+00"
bV="0.0000000000000000e+00"          cV="7.3594072058048063e-02"
dV="-2.3312572234410526e-02" />
    </geometry>

```



```

hdg="1.8087650669230753e+00" length="8.6106049039010433e+00">
  <arc curvature="-5.8720262988468021e-03" />
  </geometry>
  <geometry
    s="2.1057513044717356e+02"
    x="5.8289416257062463e+01" y="-1.1967906700376784e+02"
hdg="1.7582033684783891e+00" length="2.4557301099517943e+00">
  <paramPoly3
    aU="0.0000000000000000e+00"
    bU="1.0362591197172080e+00" cU="-6.4496757785091785e-02"
    dU="1.8081247332641846e-02" aV="0.0000000000000000e+00"
    bV="0.0000000000000000e+00" cV="-1.8799852619927013e-01"
    dV="5.2816868290592206e-02" />
  </geometry>
  <geometry
    s="2.1303086055712535e+02"
    x="5.8183268151007248e+01" y="-1.1723241121222989e+02"
hdg="1.7889659805424563e+00" length="3.1003563971801682e+01">
  <arc curvature="-1.5307493906512391e-03" />
  </geometry>
  <geometry
    s="2.4403442452892705e+02"
    x="5.2193401600269816e+01" y="-8.6815934166439320e+01"
hdg="1.7415072938846041e+00" length="2.5226222774234222e+00">
  <paramPoly3
    aU="0.0000000000000000e+00"
    bU="1.0475015504523943e+00" cU="-5.9938918153908845e-02"
    dU="1.5922096822342281e-02" aV="0.0000000000000000e+00"
    bV="0.0000000000000000e+00" cV="8.1299014548262494e-02"
    dV="-2.2837280379961074e-02" />
  </geometry>
  <geometry
    s="2.4655704680635046e+02"
    x="5.1617312847373242e+01" y="-8.4361505102635732e+01"
hdg="1.7169091965476964e+00" length="1.9735965986416570e+01">
  <arc curvature="4.6649841931467066e-03" />
  </geometry>
  <geometry
    s="2.6629301279276700e+02"
    x="4.7849731973547527e+01" y="-6.4995591073458257e+01"
hdg="1.8089771659108107e+00" length="2.3518102722681555e+00">
  <paramPoly3
    aU="0.0000000000000000e+00"
    bU="1.0452333986181981e+00" cU="-6.3221839992557080e-02"
    dU="1.7883302670689511e-02" aV="0.0000000000000000e+00"
    bV="0.0000000000000000e+00" cV="-7.0683512318412259e-02"
    dV="1.4007166649996053e-02" />
  </geometry>
  <geometry
    s="2.6864482306503515e+02"
    x="4.7500230478939081e+01" y="-6.2671299258910786e+01"
hdg="1.7134929878020257e+00" length="1.1967608846975597e+01">
  <arc curvature="8.0183272429623642e-03" />

```

```

        </geometry>
        <geometry
x="4.5232958276010343e+01"
hdg="1.8094531918528476e+00" length="2.4421280779621362e+00">
            <paramPoly3
bU="1.0177656903559877e+00"
dU="-3.8735796976945088e-03"
bV="0.0000000000000000e+00"
dV="1.2225878905520102e-01" />
            s="2.8061243191201078e+02"
y="-5.0925097004318289e+01"
aU="0.0000000000000000e+00"
cU="-1.0385632214804985e-02"
aV="0.0000000000000000e+00"
cV="-3.4650996649430349e-01"
        </geometry>
        <geometry
x="4.4951168018585562e+01"
hdg="2.3133677677224931e+00" length="3.4170413219835325e+00">
            <arc curvature="-2.7019359436831192e-01" />
            s="2.8305455998997292e+02"
y="-4.8557447448311251e+01"
        </geometry>
        <geometry
x="4.4037055013671598e+01"
hdg="1.3901050908307142e+00" length="2.4021447285508861e+00">
            <paramPoly3
bU="9.3983055814264194e-01"
dU="1.7242733872182118e-02"
bV="0.0000000000000000e+00"
dV="-7.3045002323026881e-02" />
            s="2.8647160131195642e+02"
y="-4.5389740200262111e+01"
aU="0.0000000000000000e+00"
cU="-6.0050324831351622e-02"
aV="0.0000000000000000e+00"
cV="3.5056258401577628e-01"
        </geometry>
        <geometry
x="4.3429531002298248e+01"
hdg="1.8062068138891441e+00" length="2.6341733578584248e+00">
            <arc curvature="-3.4443698215901881e-02" />
            s="2.8887374604050729e+02"
y="-4.3093067975583601e+01"
        </geometry>
        <geometry
x="4.2932097799737207e+01"
hdg="1.7154761417026996e+00" length="2.2650356293167433e+00">
            <paramPoly3
bU="1.0435226989570163e+00"
dU="2.0383778733756287e-02"
bV="0.0000000000000000e+00"
dV="4.0713683553621885e-02" />
            s="2.9150791939836569e+02"
y="-4.0507208215625340e+01"
aU="0.0000000000000000e+00"
cU="-6.8108517294397361e-02"
aV="0.0000000000000000e+00"
cV="-1.3622978090970664e-01"
        </geometry>
        <geometry
x="4.2830988077700809e+01"
hdg="1.7245347507926680e+00" length="1.2203286655970064e+01">
            <arc curvature="5.0845016876304048e-03" />
            s="2.9377295502768243e+02"
y="-3.8247109583857863e+01"
        </geometry>
        <geometry
            s="3.0597624168365252e+02"

```

```

x="4.0589447421634937e+01"          y="-2.6253447532822214e+01"
hdg="1.7245347507926680e+00" length="1.1092238773211762e+00">
    <paramPoly3          aU="0.0000000000000000e+00"
bU="1.0498461481830537e+00"          cU="-1.3530430243621816e-01"
dU="8.1349082126060734e-02"          aV="0.0000000000000000e+00"
bV="0.0000000000000000e+00"          cV="-3.6144345005644958e-02"
dV="1.9596695890818652e-02" />
    </geometry>
    <geometry          s="3.0708546556097372e+02"
x="4.0369295617587603e+01"          y="-2.5166311626569790e+01"
hdg="1.7791056639539333e+00" length="1.7008490836885026e-01">
    <line />
    </geometry>
</planView>
<elevationProfile>
    <elevation          s="0.0000000000000000e+00"
a="-6.5189788709343430e+00"          b="-7.2815498353544304e-04"
c="1.4245171453168044e-05" d="-3.8869897410708111e-08" />
    </elevationProfile>
<lateralProfile />
<lanes>
    <laneSection s="0.0000000000000000e+00">
        <center>
            <lane id="0" type="none" level="false">
                <link />
            </lane>
        </center>
        <right>
            <lane id="-1" type="driving" level="false">
                <link>
                    <successor id="-1" />
                </link>
                <width          sOffset="0.0000000000000000e+00"
a="2.7611110263572085e+00"          b="-2.0540786751529288e-03"
c="2.1810331193471058e-05" d="-4.6063228434156299e-08" />
                <roadMark          sOffset="0.0000000000000000e+00"
type="broken"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
                <roadMark          sOffset="2.6626900000000001e+02"
type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
                <roadMark          sOffset="2.6700799999999998e+02"
type="broken"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />

```

```

        <roadMark      sOffset="2.6773899999999998e+02"
type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
        <roadMark      sOffset="2.6904800000000000e+02"
type="broken"         weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
        <roadMark      sOffset="2.6962500000000000e+02"
type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
        <roadMark      sOffset="2.7048300000000000e+02"
type="broken"         weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
        <roadMark      sOffset="2.8300099999999998e+02"
type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
        <roadMark      sOffset="3.0191399999999999e+02"
type="broken"         weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
    </lane>
</right>
</laneSection>
</lanes>
<objects />
<signals />
</road>
<road name="" length="6.0731615517052695e+01" id="10002"
junction="800000">
    <link>
        <predecessor elementId="10001"
contactPoint="end" />
        <successor elementId="10000"
contactPoint="start" />
    </link>
    <planView>
        <geometry s="0.0000000000000000e+00"
x="4.0334121024049161e+01" y="-2.4999903621881778e+01"
hdg="1.7791056639539333e+00" length="2.3075031657127290e+01">
            <line />
        </geometry>
        <geometry s="2.3075031657127290e+01"
x="3.5562064130759261e+01" y="-2.4237091023301973e+00"
hdg="1.7791056639539333e+00" length="8.6459469675150125e+00">
            <arc curvature="1.6666666666666666e-01" />
        </geometry>
    </planView>

```

```

                <geometry                                s="3.1720978624642303e+01"
x="2.9221231052603716e+01"                                y="2.3169751830791454e+00"
hdg="3.2200968252064355e+00" length="2.9010636892410393e+01">
                <line />
            </geometry>
        </planView>
        <elevationProfile>
            <elevation                                s="0.0000000000000000e+00"
a="-6.5253690133495610e+00"                                b="-4.2050236298483432e-03"
c="0.0000000000000000e+00" d="0.0000000000000000e+00" />
        </elevationProfile>
        <lateralProfile />
        <lanes>
            <laneSection s="0.0000000000000000e+00">
                <center>
                    <lane id="0" type="none" level="false">
                        <link />
                    </lane>
                </center>
                <right>
                    <lane id="-1" type="driving" level="false">
                        <link>
                            <predecessor id="-1" />
                            <successor id="-1" />
                        </link>
                        <width                                sOffset="0.0000000000000000e+00"
a="2.8528645170976383e+00"                                b="6.1920357167575841e-03"
c="0.0000000000000000e+00" d="0.0000000000000000e+00" />
                            <roadMark                                sOffset="0.0000000000000000e+00"
type="solid"                                weight="standard"                                color="standard"
width="1.4999999999999999e-01" laneChange="false" />
                        </lane>
                    </right>
                </laneSection>
            </lanes>
            <objects />
            <signals />
        </road>
        <road name="" length="5.9330443651283611e+00" id="10003"
junction="800000">
            <link>
                <predecessor elementType="road" elementId="10000"
contactPoint="start" />
                <successor elementType="road" elementId="10004"

```



```

contactPoint="start" />
  </link>
  <planView>
    <geometry
      s="0.0000000000000000e+00"
      x="3.3959028468105956e-01"
      y="-4.6213645459430175e-01"
      hdg="7.8504171616642360e-02" length="3.0000000000000000e+00">
      <line />
    </geometry>
    <geometry
      s="3.0000000000000000e+00"
      x="3.3303506739387232e+00"
      y="-2.2686577208722411e-01"
      hdg="7.8504171616642360e-02" length="2.9330443651283611e+00">
      <arc curvature="5.3555150596099232e-01" />
    </geometry>
  </planView>
  <elevationProfile>
    <elevation
      s="0.0000000000000000e+00"
      a="-6.7807468916776319e+00"
      b="0.0000000000000000e+00"
      c="0.0000000000000000e+00" d="0.0000000000000000e+00" />
  </elevationProfile>
  <lateralProfile />
  <lanes>
    <laneSection s="0.0000000000000000e+00">
      <center>
        <lane id="0" type="none" level="false">
          <link />
        </lane>
      </center>
      <right>
        <lane id="-1" type="driving" level="false">
          <link>
            <predecessor id="2" />
            <successor id="-1" />
          </link>
          <width
            sOffset="0.0000000000000000e+00"
            a="3.1752255220990868e+00"
            b="2.5835391147759776e-02"
            c="0.0000000000000000e+00" d="0.0000000000000000e+00" />
          <roadMark
            sOffset="0.0000000000000000e+00"
            type="solid"
            weight="standard"
            color="standard"
            width="1.4999999999999999e-01" laneChange="false" />
        </lane>
      </right>
    </laneSection>
  </lanes>
</objects />

```

```

    <signals />
  </road>
  <road name="" length="5.9330443651283611e+00" id="10004"
junction="800000">
    <link>
      <predecessor elementType="road" elementId="10003"
contactPoint="end" />
      <successor elementType="road" elementId="10000"
contactPoint="start" />
    </link>
    <planView>
      <geometry s="5.9330443651283611e+00"
x="5.0453987294356715e+00" y="1.7810525674544657e+00"
hdg="1.6493004984115387e+00" length="2.9330443651283611e+00">
        <arc curvature="5.3555150596099232e-01" />
      </geometry>
      <geometry s="8.8660887302567222e+00"
x="3.0374803898939819e+00" y="3.4961006229514142e+00"
hdg="3.2200968252064355e+00" length="3.0000000000000000e+00">
        <line />
      </geometry>
    </planView>
    <elevationProfile>
      <elevation s="0.0000000000000000e+00"
a="-6.7807468916776319e+00" b="0.0000000000000000e+00"
c="0.0000000000000000e+00" d="0.0000000000000000e+00" />
    </elevationProfile>
    <lateralProfile />
    <lanes>
      <laneSection s="0.0000000000000000e+00">
        <center>
          <lane id="0" type="none" level="false">
            <link />
          </lane>
        </center>
        <right>
          <lane id="-1" type="driving" level="false">
            <link>
              <predecessor id="-1" />
              <successor id="-2" />
            </link>
            <width sOffset="0.0000000000000000e+00"
a="3.3285080439691903e+00" b="2.5835391147759776e-02"
c="0.0000000000000000e+00" d="0.0000000000000000e+00" />
          </lane>
        </right>
      </laneSection>
    </lanes>
  </road>

```

```

                <roadMark      sOffset="0.0000000000000000e+00"
type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
                </lane>
            </right>
        </laneSection>
    </lanes>
    <objects />
    <signals />
</road>
<road name="" length="5.8908752951850563e+00" id="10005"
junction="800001">
    <link>
        <predecessor      elementType="road"      elementId="10000"
contactPoint="end" />
        <successor      elementType="road"      elementId="10006"
contactPoint="start" />
    </link>
    <planView>
        <geometry          s="0.0000000000000000e+00"
x="-3.1631003788865684e+02"          y="-2.3838170717743193e+01"
hdg="3.2190903245158675e+00" length="3.0000000000000000e+00">
            <line />
        </geometry>
        <geometry          s="3.0000000000000000e+00"
x="-3.1930103356309365e+02"          y="-2.4070431079191678e+01"
hdg="3.2190903245158675e+00" length="2.8908752951850567e+00">
            <arc curvature="5.4336357206800490e-01" />
        </geometry>
    </planView>
    <elevationProfile>
        <elevation          s="0.0000000000000000e+00"
a="-6.6523627890019474e+00"          b="0.0000000000000000e+00"
c="0.0000000000000000e+00" d="0.0000000000000000e+00" />
    </elevationProfile>
    <lateralProfile />
</lanes>
    <laneSection s="0.0000000000000000e+00">
        <center>
            <lane id="0" type="none" level="false">
                <link />
            </lane>
        </center>
    </right>

```

```

        <lane id="-1" type="driving" level="false">
            <link>
                <predecessor id="-1" />
                <successor id="-1" />
            </link>
            <width          sOffset="0.0000000000000000e+00"
a="3.2527459711618891e+00"          b="2.2987067091653934e-02"
c="0.0000000000000000e+00" d="0.0000000000000000e+00" />
            <roadMark      sOffset="0.0000000000000000e+00"
type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
        </lane>
    </right>
</laneSection>
</lanes>
<objects />
<signals />
</road>
<road name="" length="5.8908752951850563e+00" id="10006"
junction="800001">
    <link>
        <predecessor      elementType="road"      elementId="10005"
contactPoint="end" />
        <successor      elementType="road"      elementId="10000"
contactPoint="end" />
    </link>
    <planView>
        <geometry          s="5.8908752951850563e+00"
x="-3.2099341502724468e+02"          y="-2.6047778722389911e+01"
hdg="4.7898866513107681e+00" length="2.8908752951850567e+00">
            <arc curvature="5.4336357206800490e-01" />
        </geometry>
        <geometry          s="8.7817505903701125e+00"
x="-3.1901606738404644e+02"          y="-2.7740160186540926e+01"
hdg="7.7497670926074846e-02" length="3.0000000000000000e+00">
            <line />
        </geometry>
    </planView>
    <elevationProfile>
        <elevation          s="0.0000000000000000e+00"
a="-6.6523627890019474e+00"          b="0.0000000000000000e+00"
c="0.0000000000000000e+00" d="0.0000000000000000e+00" />
    </elevationProfile>
    <lateralProfile />

```

```

<lanes>
  <laneSection s="0.0000000000000000e+00">
    <center>
      <lane id="0" type="none" level="false">
        <link />
      </lane>
    </center>
    <right>
      <lane id="-1" type="driving" level="false">
        <link>
          <predecessor id="-1" />
          <successor id="3" />
        </link>
        <width          sOffset="0.0000000000000000e+00"
a="3.3881599168008747e+00"          b="2.2987067091653934e-02"
c="0.0000000000000000e+00" d="0.0000000000000000e+00" />
        <roadMark      sOffset="0.0000000000000000e+00"
type="solid"          weight="standard"          color="standard"
width="1.4999999999999999e-01" laneChange="false" />
      </lane>
    </right>
  </laneSection>
</lanes>
<objects />
<signals />
</road>
<junction name="" id="800000">
  <connection id="0" incomingRoad="10000" connectingRoad="10002"
contactPoint="start">
    <laneLink from="-1" to="-1" />
  </connection>
  <connection id="1" incomingRoad="10000" connectingRoad="10003"
contactPoint="start">
    <laneLink from="2" to="-1" />
  </connection>
  <connection id="2" incomingRoad="10000" connectingRoad="10004"
contactPoint="start">
    <laneLink from="-2" to="-1" />
  </connection>
</junction>
<junction name="" id="800001">
  <connection id="0" incomingRoad="10000" connectingRoad="10005"
contactPoint="end">
    <laneLink from="-1" to="-1" />

```

```
</connection>
<connection id="1" incomingRoad="10000" connectingRoad="10006"
contactPoint="end">
  <laneLink from="3" to="-1" />
</connection>
</junction>
</OpenDRIVE>
```

二 路径规划

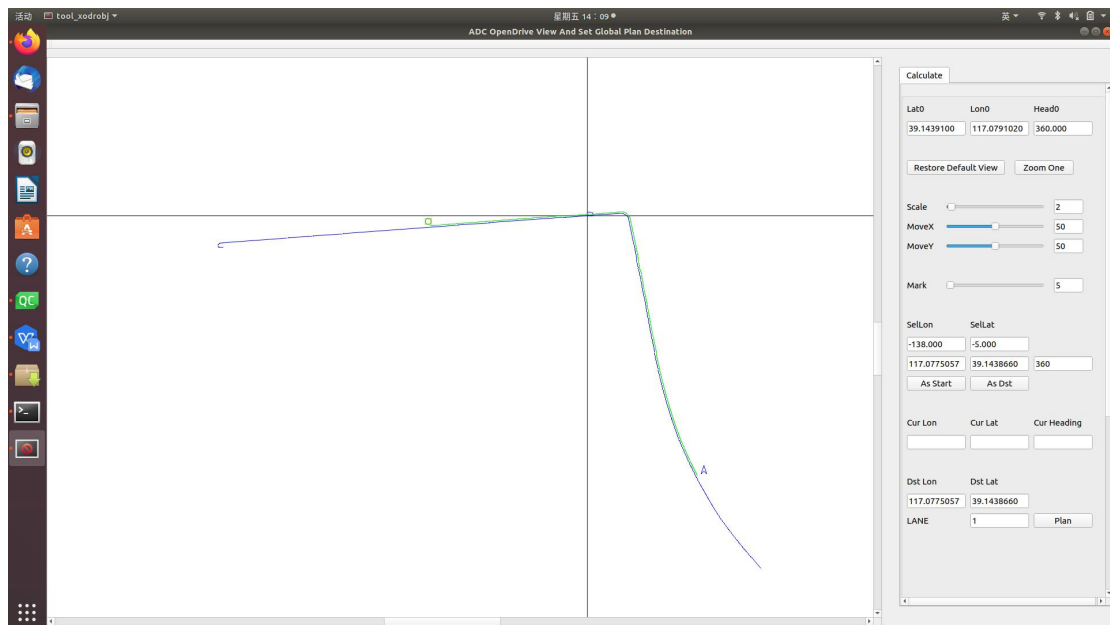
将地图放置到用户目录的 map 文件夹下，并修改为 map.xodr .

规划程序为 driver_map_xodrload .

我们可以使用 tool_xodrobj 来设置目标点 .

如下图所示 .

目标点在道路右侧。



目标点在道路左侧。

