

SUMO Tutorial

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Demo Simulation: <https://www.traffic-simulation.de/>

Lesson 1: Download and Installation and Configuration



1. Download and Installation

Sumo:

1. <https://eclipse.dev/sumo/>
2. <https://sourceforge.net/projects/sumo/>

Netedit:

****** the network edit software can be found in the bin folder:

File Explorer window showing the contents of the directory: This PC > Local Disk (C:) > Program Files (x86) > Eclipse > Sumo > bin

Name	Date modified	Type	Size
libtraci-1.17.0.jar	4/25/2023 1:17 AM	JAR File	250 KB
libtraci-1.17.0-sources.jar	4/25/2023 1:17 AM	JAR File	253 KB
libtracipc.dll	4/25/2023 1:17 AM	Application extension	672 KB
libtracipc.lib	4/25/2023 1:17 AM	VisualStudio.lib.dl9a5...	1,562 KB
libtracjni.dll	4/25/2023 1:17 AM	Application extension	2,229 KB
libxml2.dll	4/25/2023 1:17 AM	Application extension	1,406 KB
lisum-core.jar	4/25/2023 1:17 AM	JAR File	157 KB
lisum-gui.jar	4/25/2023 1:17 AM	JAR File	15,365 KB
marouter	4/25/2023 1:17 AM	Application	1,690 KB
msvcp140.dll	4/25/2023 1:17 AM	Application extension	558 KB
netconvert	4/25/2023 1:17 AM	Application	3,167 KB
netedit	4/25/2023 1:17 AM	Application	10,801 KB
netgenerate	4/25/2023 1:17 AM	Application	2,105 KB
od2trips	4/25/2023 1:17 AM	Application	582 KB

Python:

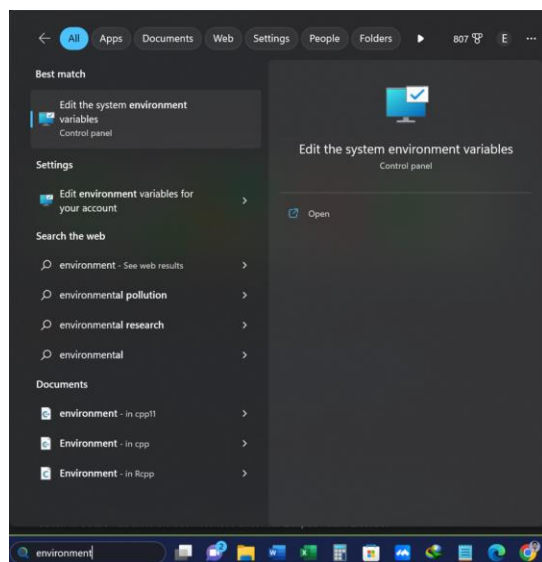
1. <https://www.python.org/downloads/>

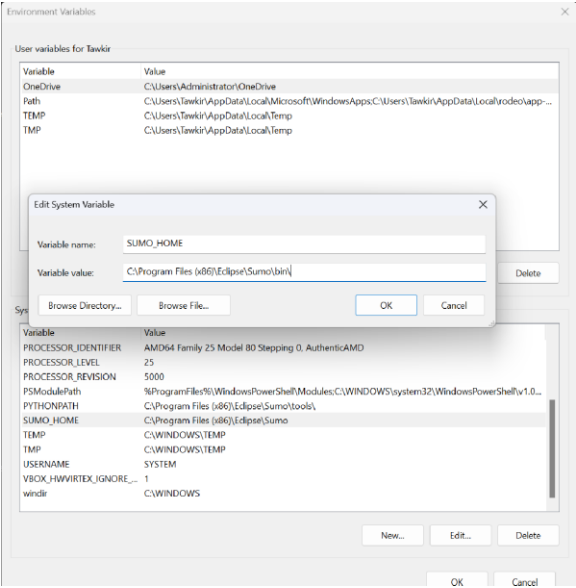
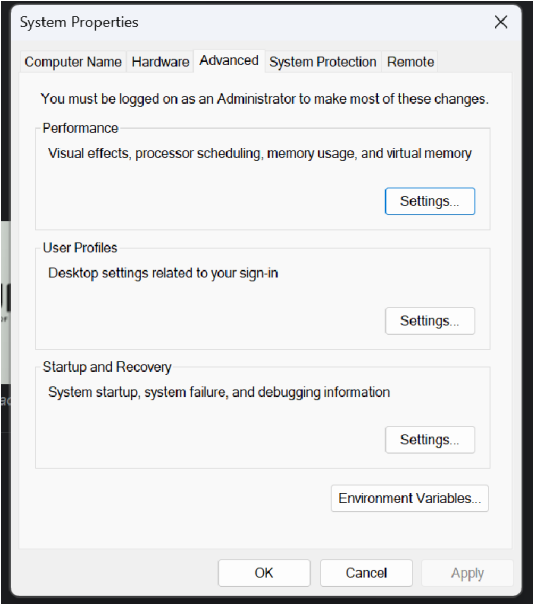
VSCode:

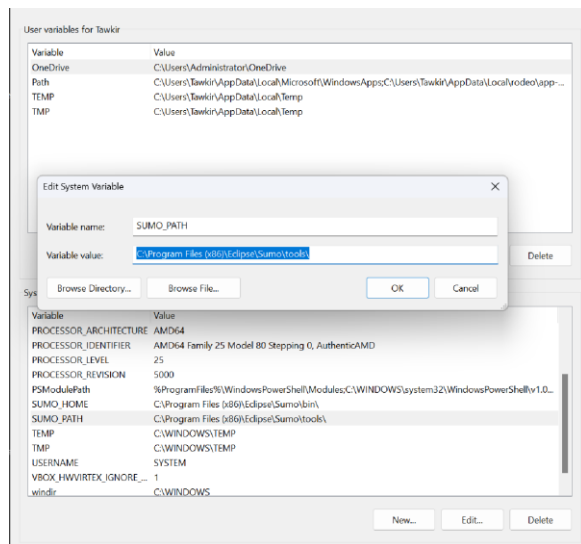
1. <https://code.visualstudio.com/download>

2. Configuration

Details: <https://sumo.dlr.de/docs/Downloads.php>







SUMO_HOME C:\Program Files (x86)\Eclipse\Sumo\bin\
 SUMO_PATH C:\Program Files (x86)\Eclipse\Sumo\tools\
 TEMP C:\WINDOWS\TEMP

```

Microsoft Windows [Version 10.0.22621.1992]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Tawkir>netconvert
Eclipse SUMO netconvert Version 1.17.0
Build features: Windows-10.0.17763 AMD64 MSVC 19.29.30133.0 Release FMI Proj GUI Intl SWIG
Copyright (C) 2001-2023 German Aerospace Center (DLR) and others; https://sumo.dlr.de
License EPL-2.0: Eclipse Public License Version 2 <https://eclipse.org/legal/epl-v20.html>
Use --help to get the list of options.

C:\Users\Tawkir>
  
```

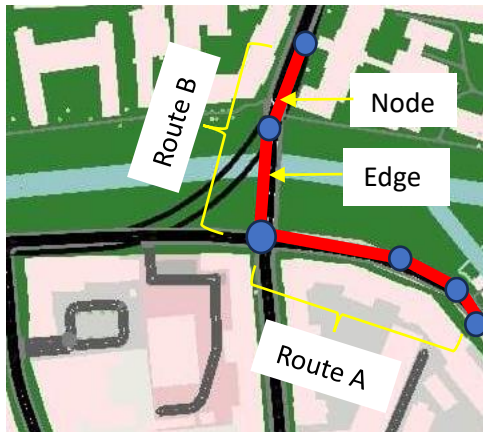
SUMO Documentation: <https://sumo.dlr.de/docs/index.html>

SUMO Tutorial:

Lesson 2: Simple network build and simulation in SUMO

1. Basic Idea:

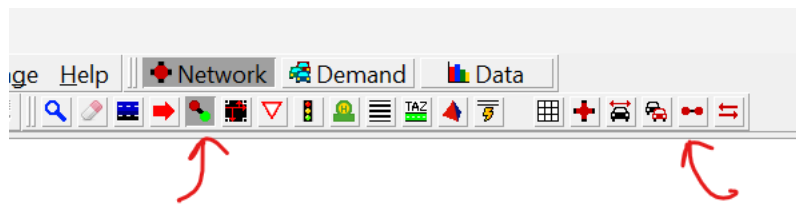
In order to perform a very basic simulation in SUMO, it is required to have at least the following elements (files):



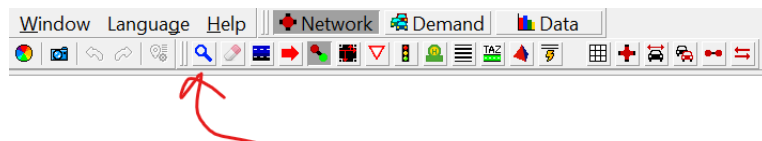
1. Network (edge, node/junction)
2. Route (route A, B)
3. Configuration file (net.xml, edg.xml, rou.xml, sumocfg)

1. Using netedit and SUMO Gui:

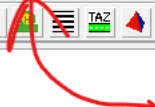
1. Creating the network in netedit:



2. Edit or rename: junctions and edge and position

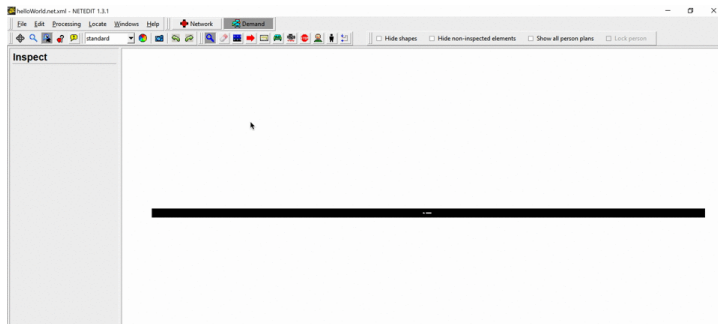


id		pos
1		-100,50
2		0,50
3		100,50

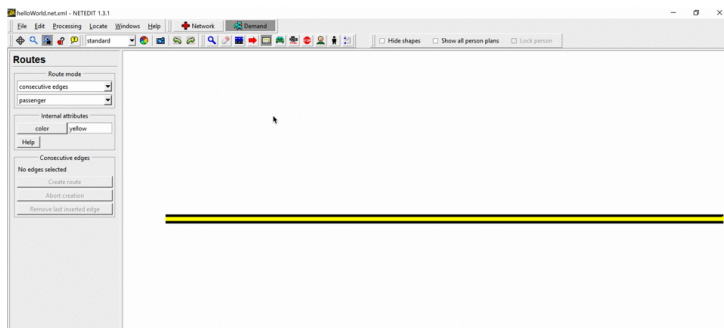
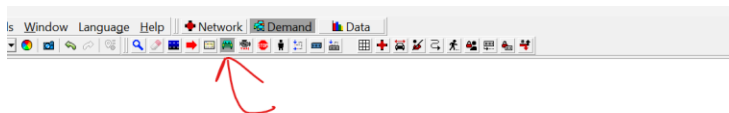


← 3





4. Adding Vehicle



5. Save the Demand (route + vehicle)

e.g., helloWorld.rou.xml

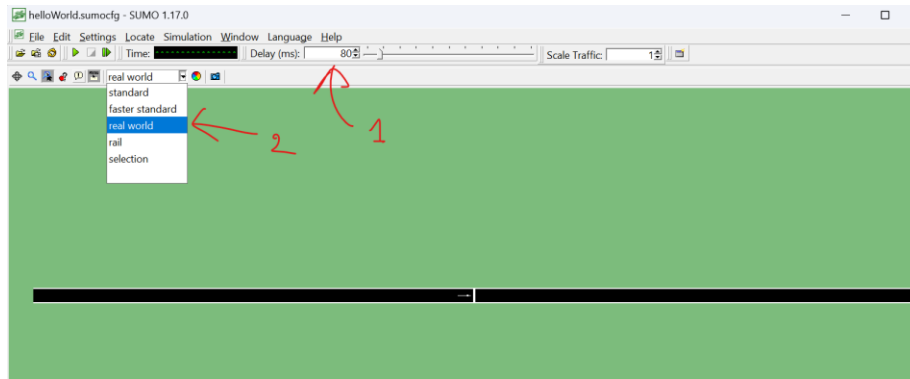
Do not close the netedit yet

6. Visualizing in sumo-gui:

From netedit: go to Edit -> Open in sumo-gui (Ctrl + T). This will open sumo-gui and load our recently created network and demand files.

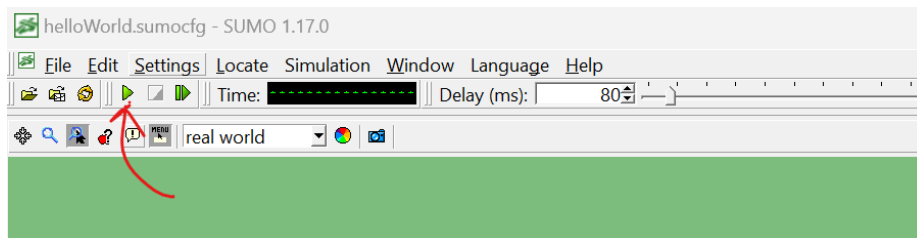
Save in the sumo file as helloWorld.sumocfg

Now you can close netedit if you wish.



**set to at least 80 ms, as otherwise the simulation would happen very quickly and we would not be able to see our only vehicle in our tiny network

7. Start the Simulation



2. Using Sumo code to create it:

1. Nodes:

```
<nodes>
```

```
  <node id="1" x="-250.0" y="0.0" />
```

```
  <node id="2" x="+250.0" y="0.0" />
```

```
  <node id="3" x="+251.0" y="0.0" />
```

```
</nodes>
```

Save: hello.nod.xml

2. Edges:

```
<edges>
```

```
  <edge from="1" id="1to2" to="2" />
```

```
  <edge from="2" id="out" to="3" />
```

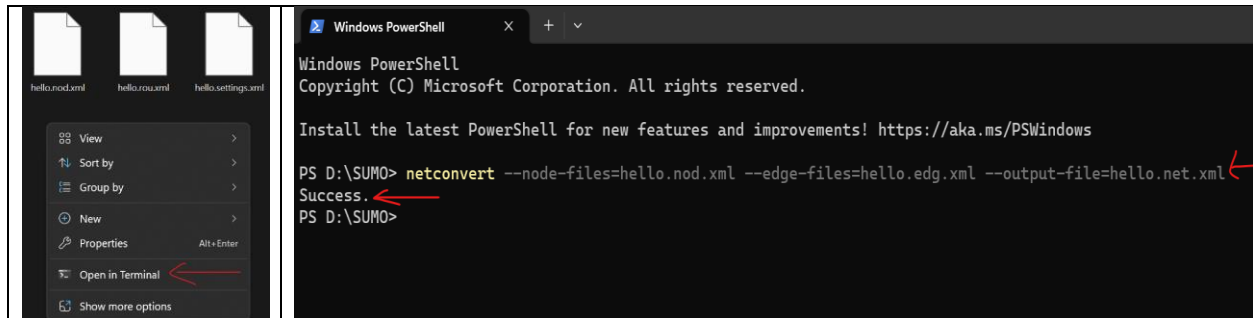
```
</edges>
```

Save: hello.edg.xml

3. Connect nodes and edges:


```
netconvert --node-files=hello.nod.xml --edge-files=hello.edg.xml --output-file=hello.net.xml
```

****The two files need to be present in the same folder then right click on your mouse and click 'open terminal'**



4. Routes and Traffic Characteristics:

```
<routes>
```

```
<vType accel="1.0" decel="5.0" id="Car" length="2.0" maxSpeed="100.0" sigma="0.0" />
```

```
<route id="route0" edges="1to2 out"/>
```

```
<vehicle depart="1" id="veh0" route="route0" type="Car" />
```

```
</routes>
```

Save: hello.rou.xml

5. Configuration: Connect Net and Route file

```
<configuration>
```

```
<input>
```

```
<net-file value="hello.net.xml"/>
```

```
<route-files value="hello.rou.xml"/>
```

```
</input>
```

```
<time>
```

```
<begin value="0"/>
```

```
<end value="10000"/>
```

```
</time>
```

```
</configuration>
```

Save: hello.sumocfg

Open the sumo soft and open the hello.sumocfg and run simulation

Lesson 3: Complex Network creation using Netedit

Aim: use of basic application and essential functions of SUMO for traffic analysis using an example network.

1. Specifications:

Origin: 4

Destination: 4

Intersection: unsignalized

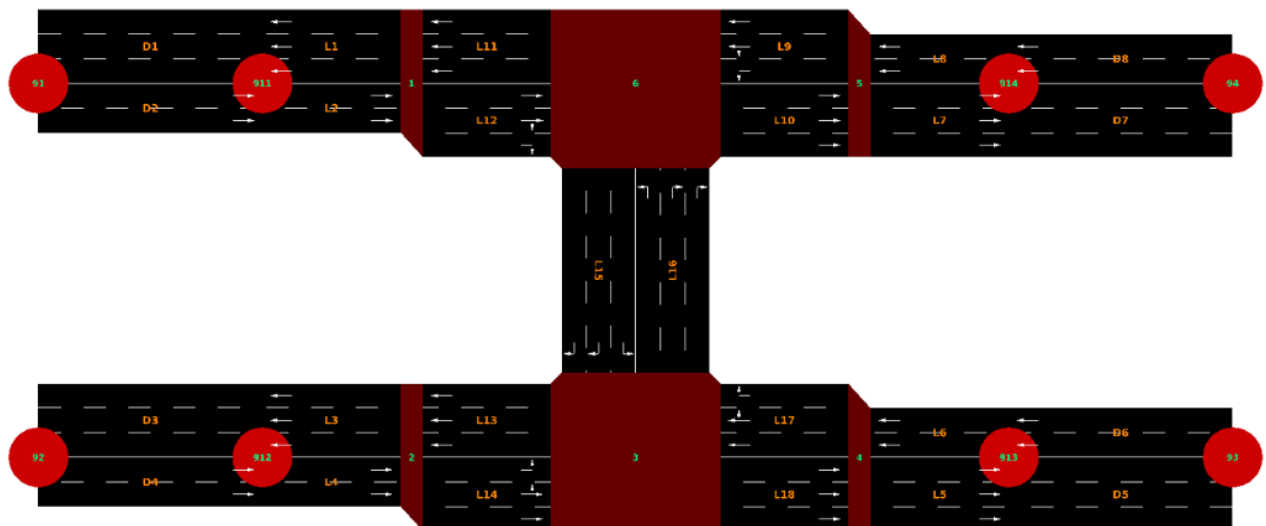
Intersection number: 2

Lane: Outbound traffic: 3

2. Traffic Rules and Regulation:

1. Allowed traffic movements on each lane are restricted
2. U-term behaviors are prohibited at all intersections
3. Traffic priority: eastbound & westbound

3. Network Layout:



4. Data Preparation:

node name	x-coordinate	y-coordinate
91	-1000.0	+1000.0
92	-1000.0	0.0
93	+3000.0	0.0
94	+3000.0	+1000.0
911	-500.0	+1000.0
912	-500.0	0.0
913	+2500.0	0.0
914	+2500.0	+1000.0
1	0.0	+1000.0
2	0.0	0.0
3	+1000.0	0.0
4	+2000.0	0.0
5	+2000.0	+1000.0
6	+1000.0	+1000.0

5. Example Network Creation

Step 1: create 91 to 911 network

Net: edge

Internal attributes

id	E1
from	91
to	J1
speed	13.89
priority	-1
numLanes	1
type	
allow	all
disallow	
shape	
length	1323.53
spreadType	right
name	
width	default

lane:E1_0

- Center
- Copy parent edge name to clipboard
- Copy name to clipboard
- Copy typed name to clipboard
- Add Lane To Selected
- Add Edge To Selected
- Show Parameter
- Copy cursor position to clipboard
- Reset edge end points

edge operations

- Split edge here
- Split edge in both directions here (no opposite edge)
- Set geometry endpoint here (shift-click)
- Restore geometry endpoint (shift-click)
- Reverse edge
- Add reverse direction for edge
- Add reverse disconnected direction for edge
- Reset lengths for edge
- Straighten edge
- Smooth edge
- Straighten elevation of edge
- Smooth elevation of edge

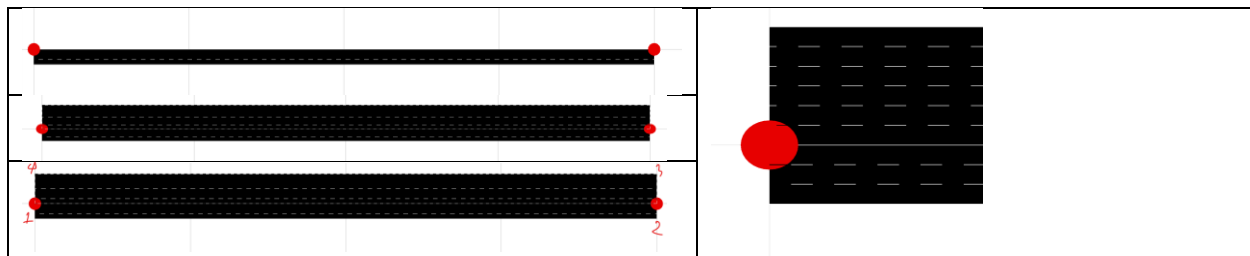
lane operations

template operations

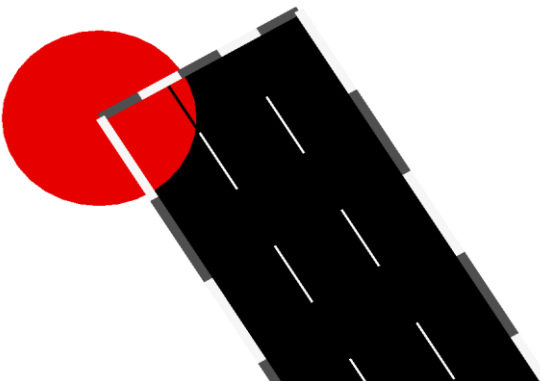
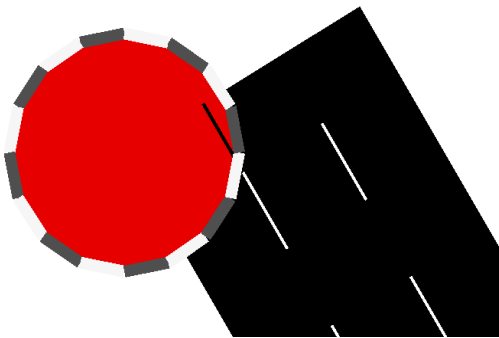
Select reachable

Shape pos: 15.64
Length pos: 15.64
Height: 0.00
Angle: 225.45

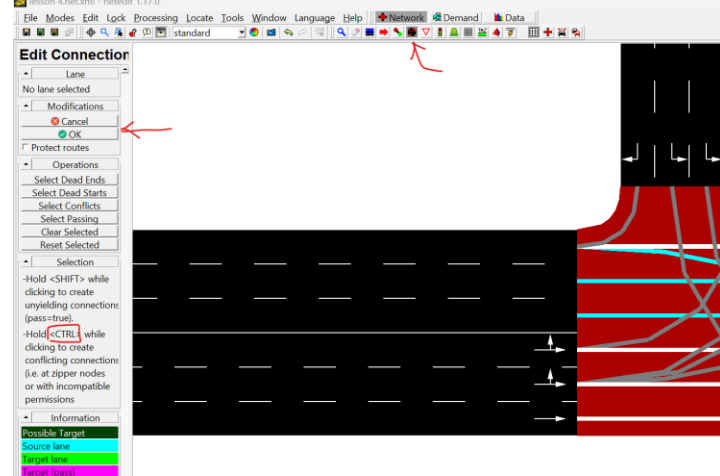
Two Way Route Creation

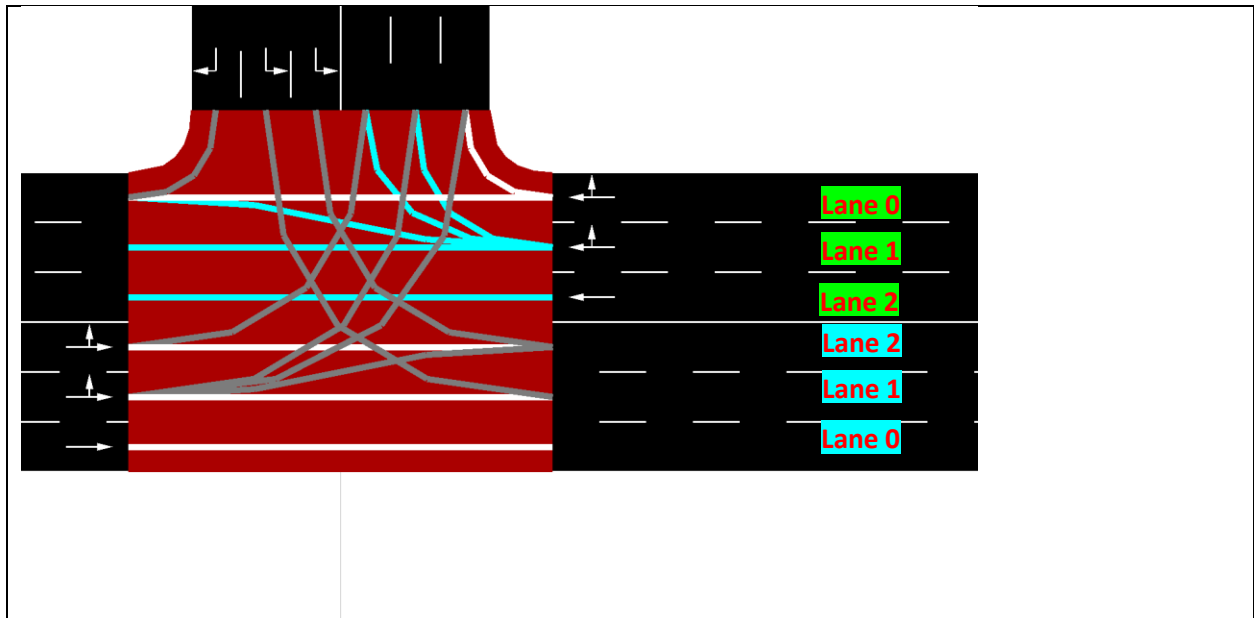


Step 2: Edit the information

Edge	Net: edge Internal attributes id qneE1 from 91 to 911 speed 13.89 priority 1 numLanes 3 type allow all disallow shape length 500.00 spreadType right	
Node	Net: junction Internal attributes id 911 pos -500.00,1000.00 type dead end shape radius default keepClear <input type="checkbox"/> false rightOfWay default fringe default name tlType No TLS tlLayout No TLS tl No TLS Help Parameters	

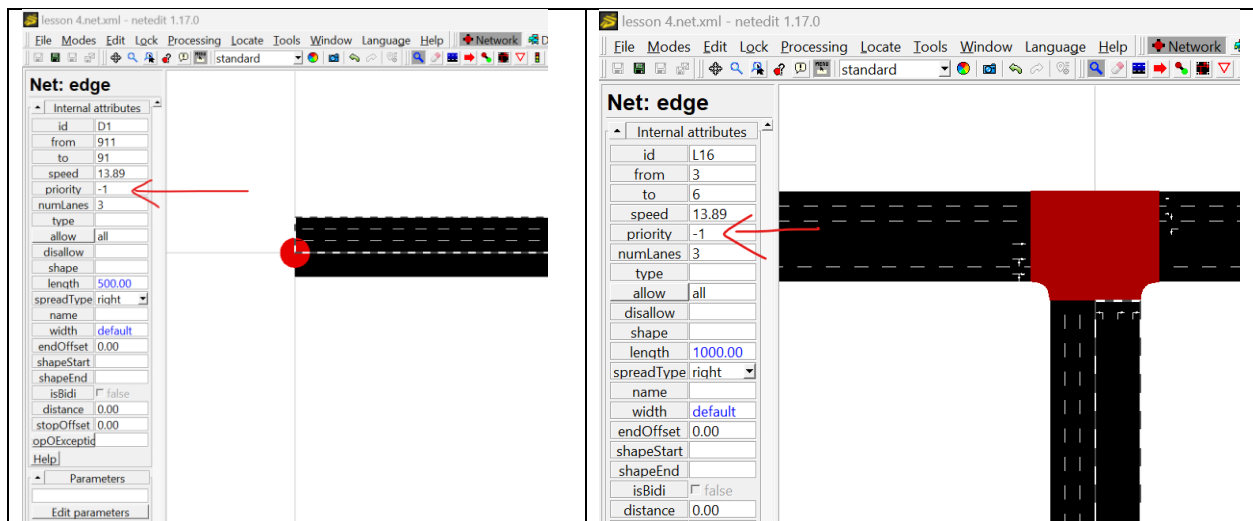
Step 3: Edge Connection Modification:

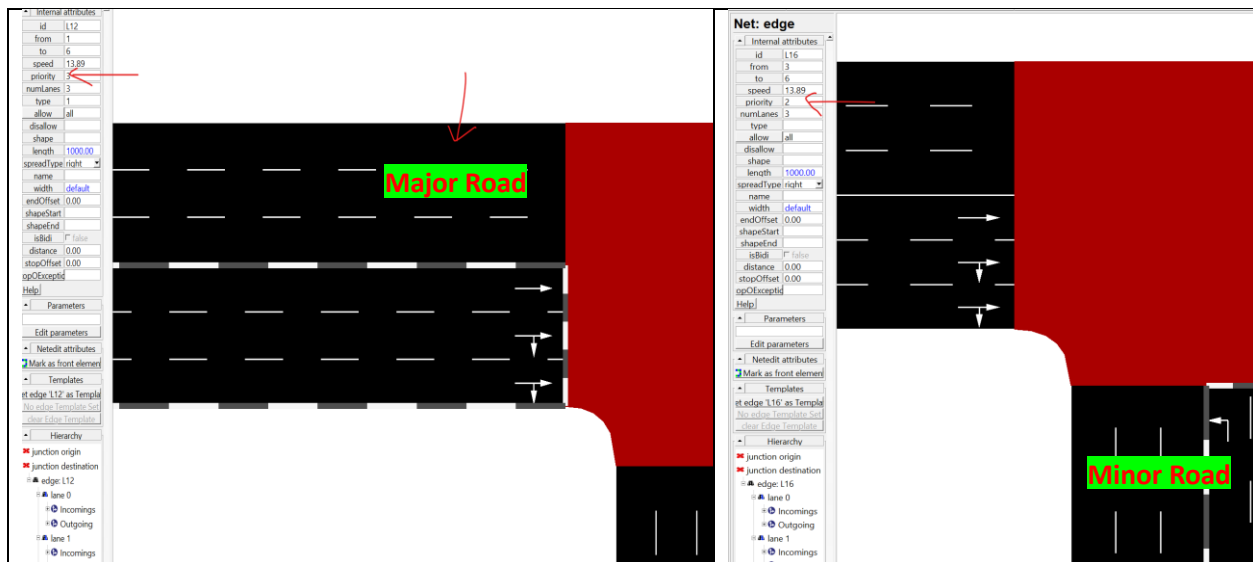
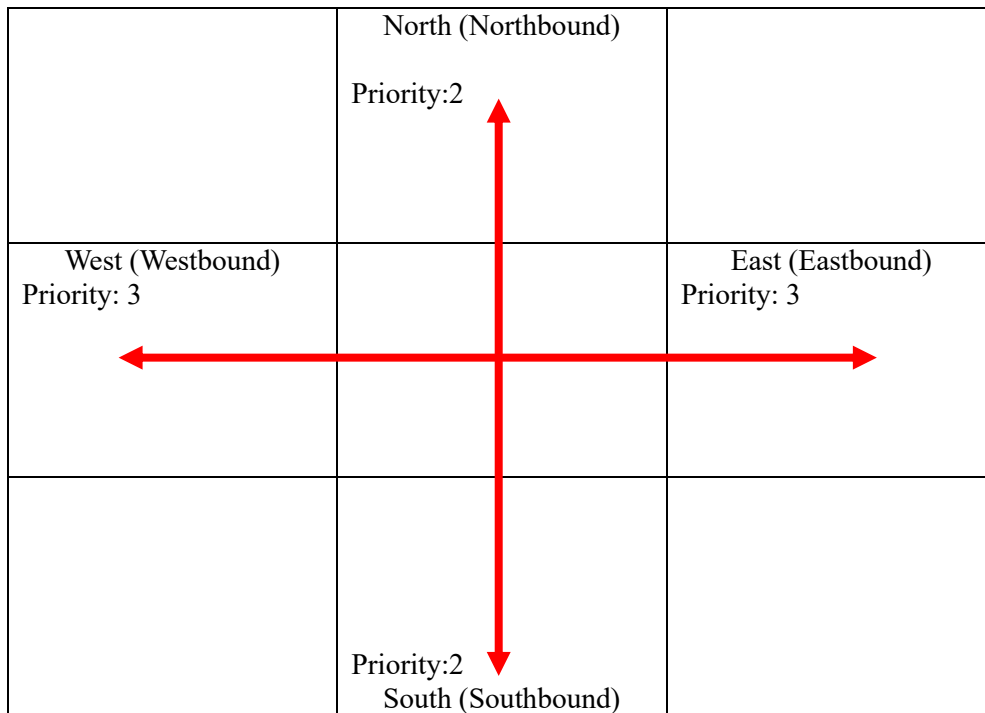
	<p>Possible Target</p> <p>Source lane</p> <p>Target lane</p> <p>Target (pass)</p> <p>Conflict</p>
---	---



Step 4: Priority of Each Nodes:

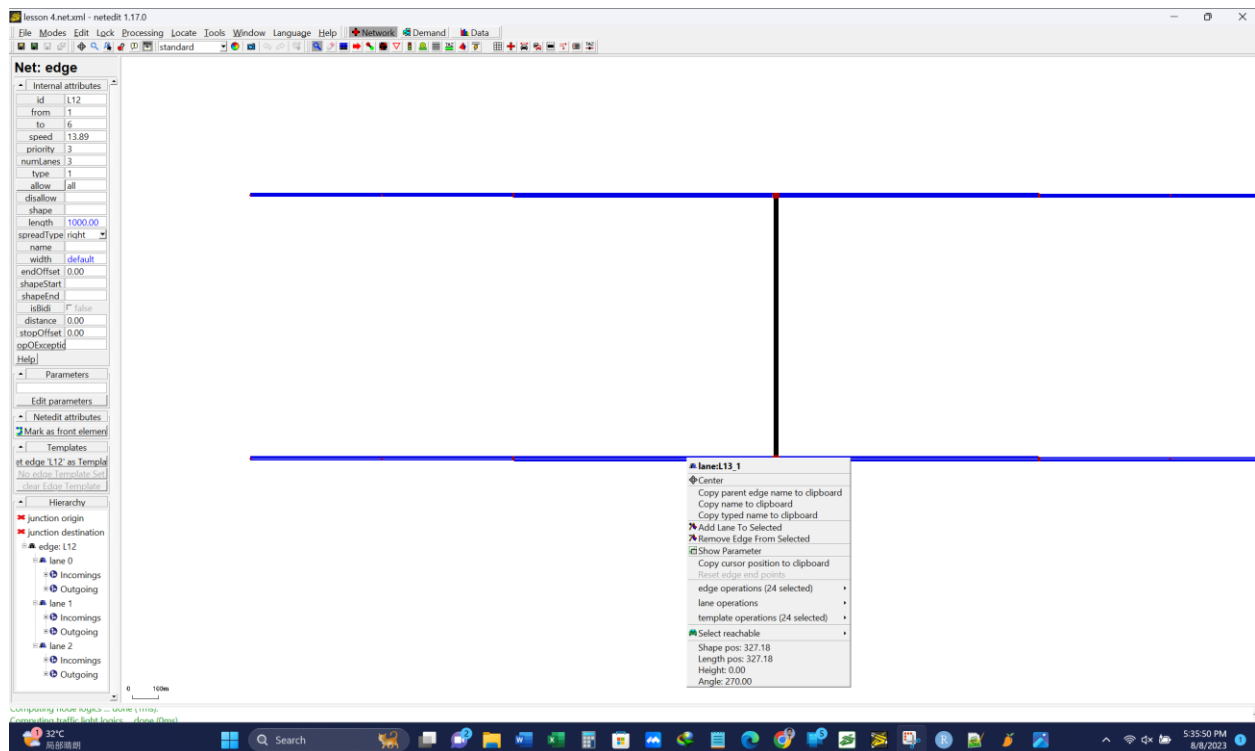
The default priority is 1 so need to change





Select: Ctrl + Left Click

De-select: Ctrl + Left Click



Step 5: Traffic Demand

Vehicle type: Cars A, B, C, and D

Driving perfectness: 50%

Origin-Destination: 30s

Ratio: 15:00 to 15:15

Vehicle type	Max. acceleration(m/s)	Max. deceleration(m/s)	Length(m)	Max. speed(m/s)
Car A	3.0	6.0	5.0	50.0
Car B	2.0	6.0	7.5	50.0
Car C	1.0	5.0	5.0	40.0
Car D	1.0	5.0	7.5	30.0

*for real-world simulation the data must take from a field traffic survey

Using Sumo Code:

```
<?xml version="1.0" encoding="UTF-8"?>
<routes>
  <vType accel="3.0" decel="6.0" id="CarA" length="5.0" minGap="2.5" maxSpeed="50.0"
sigma="0.5" />
  <vType accel="2.0" decel="6.0" id="CarB" length="7.5" minGap="2.5" maxSpeed="50.0"
sigma="0.5" />
  <vType accel="1.0" decel="5.0" id="CarC" length="5.0" minGap="2.5" maxSpeed="40.0"
sigma="0.5" />

```

```

    <vType accel="1.0" decel="5.0" id="CarD" length="7.5" minGap="2.5" maxSpeed="30.0"
sigma="0.5" />
    <route id="route01" edges="D2 L2 L12 L10 L7 D7"/>
    <route id="route02" edges="D2 L2 L12 L15 L18 L5 D5"/>
    <route id="route03" edges="D2 L2 L12 L15 L13 L3 D3"/>
    <route id="route04" edges="D4 L4 L14 L18 L5 D5"/>
    <route id="route05" edges="D4 L4 L14 L16 L10 L7 D7"/>
    <route id="route06" edges="D4 L4 L14 L16 L11 L1 D1"/>
    <route id="route07" edges="D6 L6 L17 L13 L3 D3"/>
    <route id="route08" edges="D6 L6 L17 L16 L11 L1 D1"/>
    <route id="route09" edges="D6 L6 L17 L16 L10 L7 D7"/>
    <route id="route10" edges="D8 L8 L9 L11 L1 D1"/>
    <route id="route11" edges="D8 L8 L9 L15 L13 L3 D3"/>
    <route id="route12" edges="D8 L8 L9 L15 L18 L5 D5"/>
    <vehicle depart="54000" id="veh0" route="route01" type="CarA" color="1,0,0" />
    <vehicle depart="54000" id="veh1" route="route02" type="CarA" />
    <vehicle depart="54000" id="veh2" route="route03" type="CarA" />
    <vehicle depart="54000" id="veh3" route="route04" type="CarA" />
    <vehicle depart="54000" id="veh4" route="route05" type="CarA" />
    <vehicle depart="54000" id="veh5" route="route06" type="CarA" />
    <vehicle depart="54000" id="veh6" route="route07" type="CarA" />
    <vehicle depart="54000" id="veh7" route="route08" type="CarA" />
    <vehicle depart="54000" id="veh8" route="route09" type="CarA" />
    <vehicle depart="54000" id="veh9" route="route10" type="CarA" />
    <vehicle depart="54000" id="veh10" route="route11" type="CarA" />
    <vehicle depart="54000" id="veh11" route="route12" type="CarA" />
    <vehicle depart="54000" id="veh12" route="route01" type="CarB" color="1,0,0" />
    <vehicle depart="54000" id="veh13" route="route02" type="CarB" />
    <vehicle depart="54000" id="veh14" route="route03" type="CarB" />
    <vehicle depart="54000" id="veh15" route="route04" type="CarB" />
    <vehicle depart="54000" id="veh16" route="route05" type="CarB" />
    <vehicle depart="54000" id="veh17" route="route06" type="CarB" />
    <vehicle depart="54000" id="veh18" route="route07" type="CarB" />
    ...
</routes>

```

Save: quickstart.rou.xml

Code Explanation:

Sigma: driver imperfection in deriving: 0 to 1: 50% means the driver has 50% chance to drive unusual behavior

Depart: in second the depart time

Color: 1,0,0=red, 0,1,0=green, 0,0,1=blue

Combined with sumo file:

```

<?xml version="1.0" encoding="iso-8859-1"?>
<configuration xmlns:xsi="https://www.w3.org/2001/XMLSchema-instance"
  xsi:noNamespaceSchemaLocation="https://sumo.dlr.de/xsd/sumoConfiguration.xsd">
  <input>
    <net-file value="quickstart.net.xml"/>
    <route-files value="quickstart.rou.xml"/>
  </input>
  <time>
    <begin value="54000"/>

```



```
<end value="54900"/>
</time>
<time-to-teleport value="-1"/>
</configuration>
```

Save: quickstart.sumocfg

Explanation:

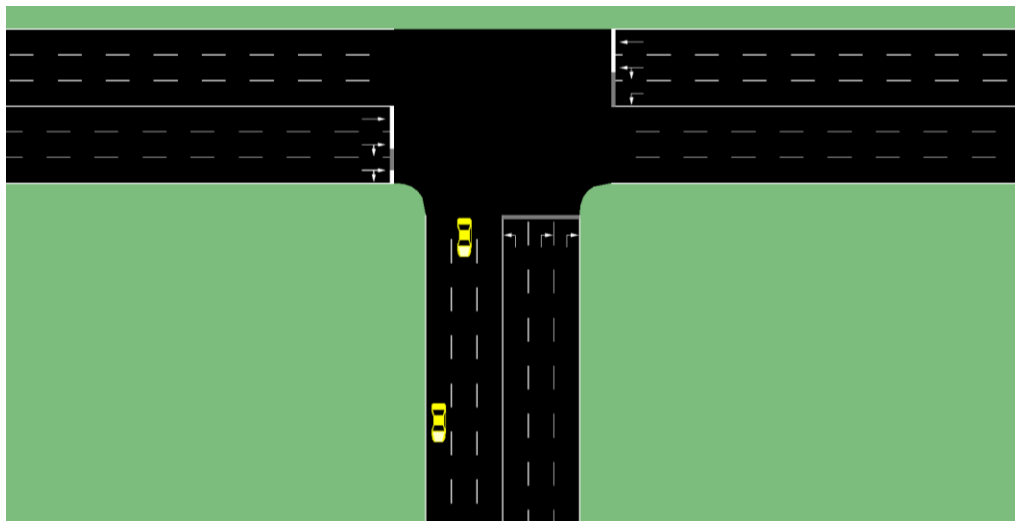
Duration: $54000 - 54900 = 900$ sec = 15 min simulation

Time-to-teleport: to disable the automatic removal of vehicles with wait for long in front of an intersection.

Step 6: Run in sumo GUI

`sumo -c quickstart.sumocfg`

Output scenario



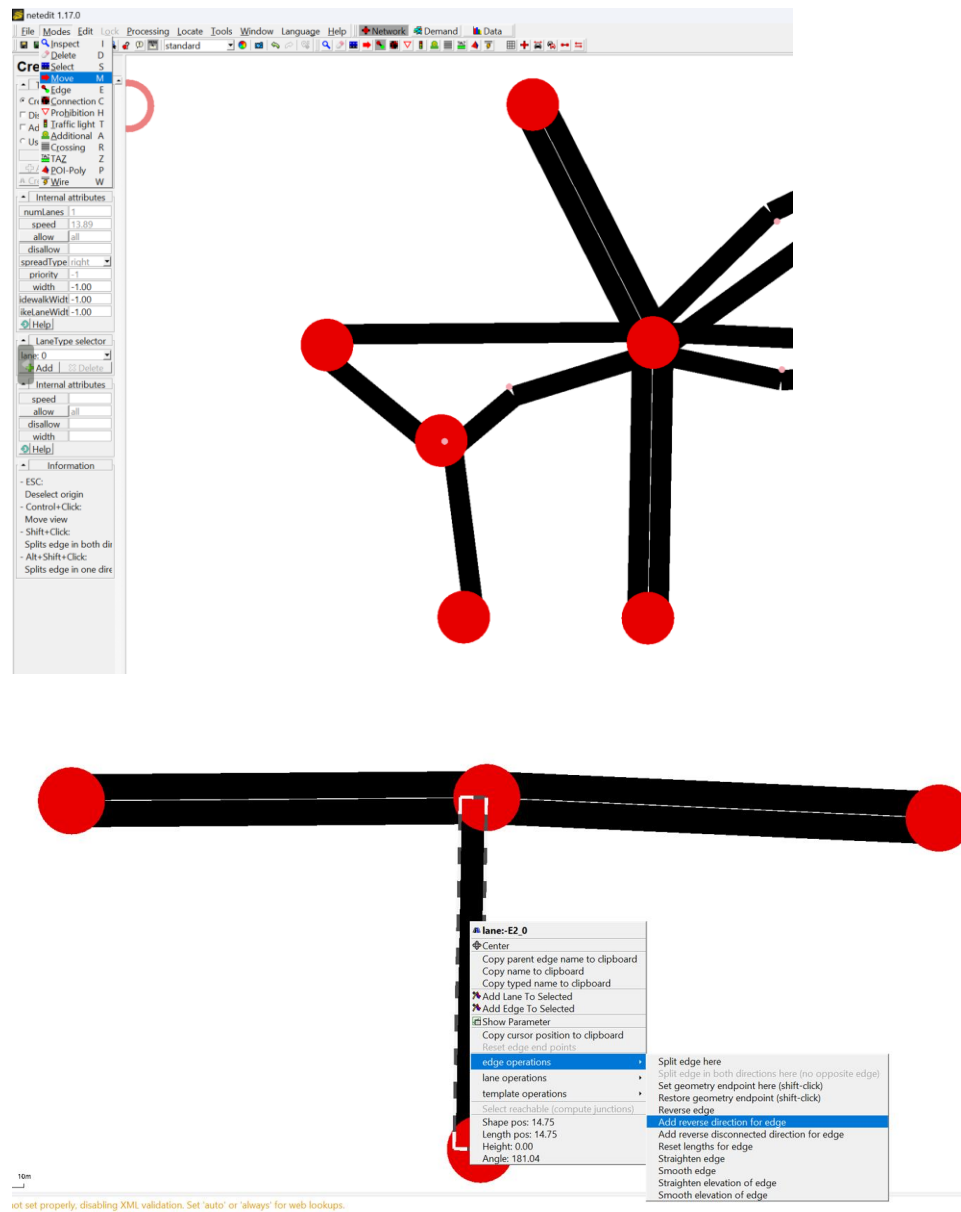
Delay: 100 sec

Lesson 4: Shared Mobility: Bus, Taxi (Public Transport)

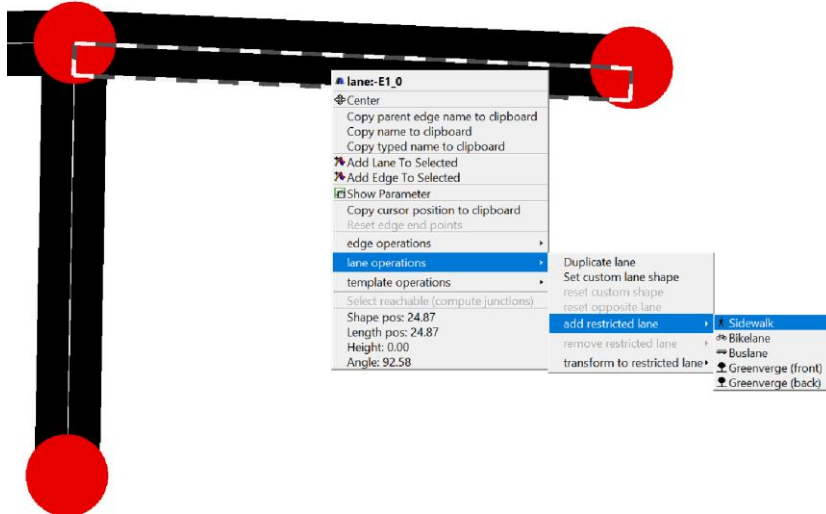
Main Topic: Vehicle-creation, Bus stops, taxi-reservations and pick up

<https://sumo.dlr.de/docs/Tutorials/TaxiService.html>

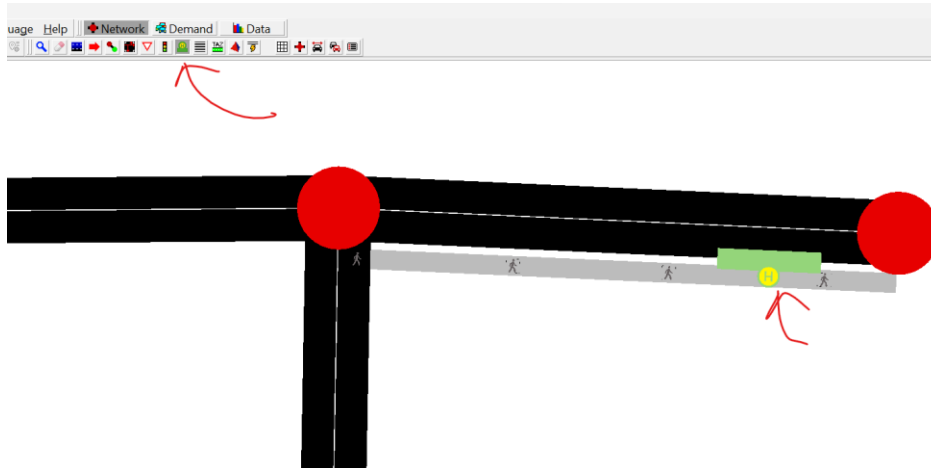
1. Network Cration and modification



2. Create Sidewalk



3. Creating Bus Stop



lane:E2_0

- Center
 - Copy parent edge name to clipboard
 - Copy name to clipboard
 - Copy typed name to clipboard
- Add Lane To Selected
- Add Edge To Selected
- Show Parameter
 - Copy cursor position to clipboard
 - Reset edge end points
- edge operations
- lane operations
 - Duplicate lane
 - Set custom lane shape
 - reset custom shape
 - reset opposite lane
 - add restricted lane
 - remove restricted lane
 - transform to restricted lane
- template operations
 - Select reachable (compute junctions)
- Shape pos: 19.70
- Length pos: 16.24
- Height: 0.00
- Angle: 1.04

Sidekick

Bikeline

Buslane

Greenverge

The screenshot displays the NetLogo environment with the 'Net: edge' patch editor on the left and the 'v: class' selection dialog on the right.

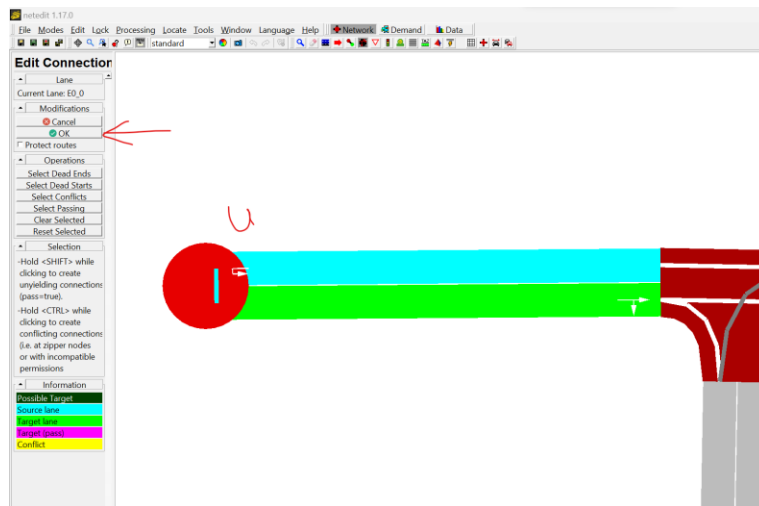
Net: edge patch editor:

- Internal attributes:**
 - id: -E2
 - from: J1
 - to: J3
 - speed: 13.89
 - priority: -1
 - numLanes: 1
 - type: allow
 - disallow: none
 - shape: none
 - length: 32.52
 - spreadType: right
 - name: none
 - width: default
 - endOffset: 0.00
 - shapeStart: none
 - shapeEnd: none
 - isBidi: false
 - distance: 0.00
 - stopOffset: 0.00
 - goOfOccupied: none
- Parameters:**
 - Edit parameters
 - Netedit attributes
 - Mark as front element
 - Templates
 - et edge -E2 as Template
 - NetLogo: Edge Template
 - Hierarchy
 - junction origin

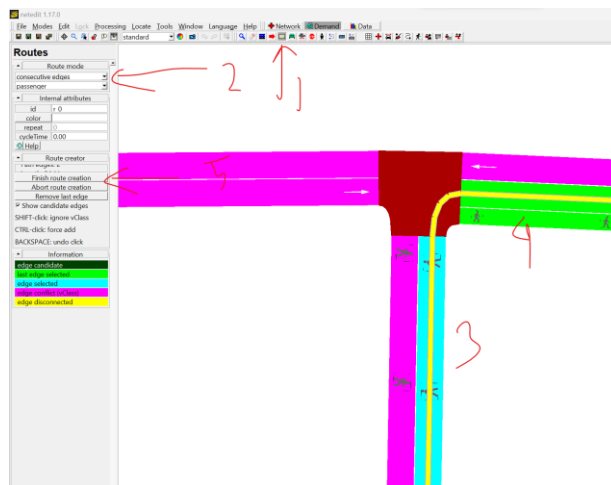
v: class selection dialog:

- Selection options:**
 - ☒ Allow all vehicles
 - ☒ Allow only road vehicles
 - ☐ Allow only rail vehicles
 - ☐ Disallow all vehicles
- Select vClasses:**
 - ☒ passenger: Default vehicle class. A passenger car assigned for private use.
 - ☒ car: Vehicle for hire with a driver.
 - ☒ truck: Overland transport.
 - ☒ delivery: Vehicles specialized to deliver goods.
 - ☒ rail truck: Vehicle designed to transport cargo.
 - ☒ trailer: Truck with trailer.
 - ☒ emergency: Vehicle designated to respond to an emergency.
 - ☒ motorcycle: Two- or three-wheeled motor vehicle.
 - ☒ motor: Motorcycle not allowed in motorways.
 - ☒ bicycle: Human-powered, pedal-driven vehicle.
 - ☒ pedestrian: Person travelling on foot.
 - ☒ train: Rail vehicle which runs on tracks.
 - ☒ rail electric: Rail electric vehicle.
 - ☒ high speed rail vehicle: High speed rail vehicle.
 - ☒ rail urban: Heavier than train.
 - ☒ rail: Heavy rail vehicle.
 - ☒ electric: Future electric mobility vehicles.
 - ☒ army: Vehicle designed for military forces.
 - ☒ ship: Basic class for navigating waterway.
 - ☒ authority: Vehicle of a governmental security agency.
 - ☒ security: A civilian security armored car used by VIPs.
 - ☒ tow: High-Occupancy Vehicle (two or more passengers).
 - ☒ custom1: Reserved for user-defined semantics.
 - ☒ custom2: Reserved for user-defined semantics.
- Buttons:** accept, cancel, reset

3. Make a Connection



4. Create Pedestrian Route



*Create the vehicle route like pedestrian

5. Creating Pedestrian and Taxi/Bus Demand

I got an error but I do not know how to solve it

Shortcut:

e= creating edge

i= inspection mode

m=move edge

4. Route and Vehicle type distributions:

https://sumo.dlr.de/docs/Definition_of_Vehicles%2C_Vehicle_Types%2C_and_Routes.html#:~:text=first%20route%20file-,Route%20and%20vehicle%20type%20distributions,-%23

5. Stops and waypoints:

https://sumo.dlr.de/docs/Definition_of_Vehicles%2C_Vehicle_Types%2C_and_Routes.html#:~:text=files%20with%20sumo-,Stops%20and%20waypoints,-%23

Lesson 5: Micro mobility: cycle, motorcycle | pedestrian

C. Pedestrian Lane and crossing: sumo 2022

https://www.youtube.com/watch?v=3J5KqOPT2qI&list=PLy7t4z5SYNaQVVuKmGVz8ET_oOTXLk6J-

D. Micro-Mobility: Cycle, Motorcycle, etc.

https://www.youtube.com/watch?v=3J5KqOPT2qI&list=PLy7t4z5SYNaQVVuKmGVz8ET_oOTXLk6J-

Lesson 6: Traffic Sign, Street light, furniture

E. Street light: sumo 2021

F. Street Furniture: Tree, Bench

Lesson 7: Building Highway and Expressway/Freeway

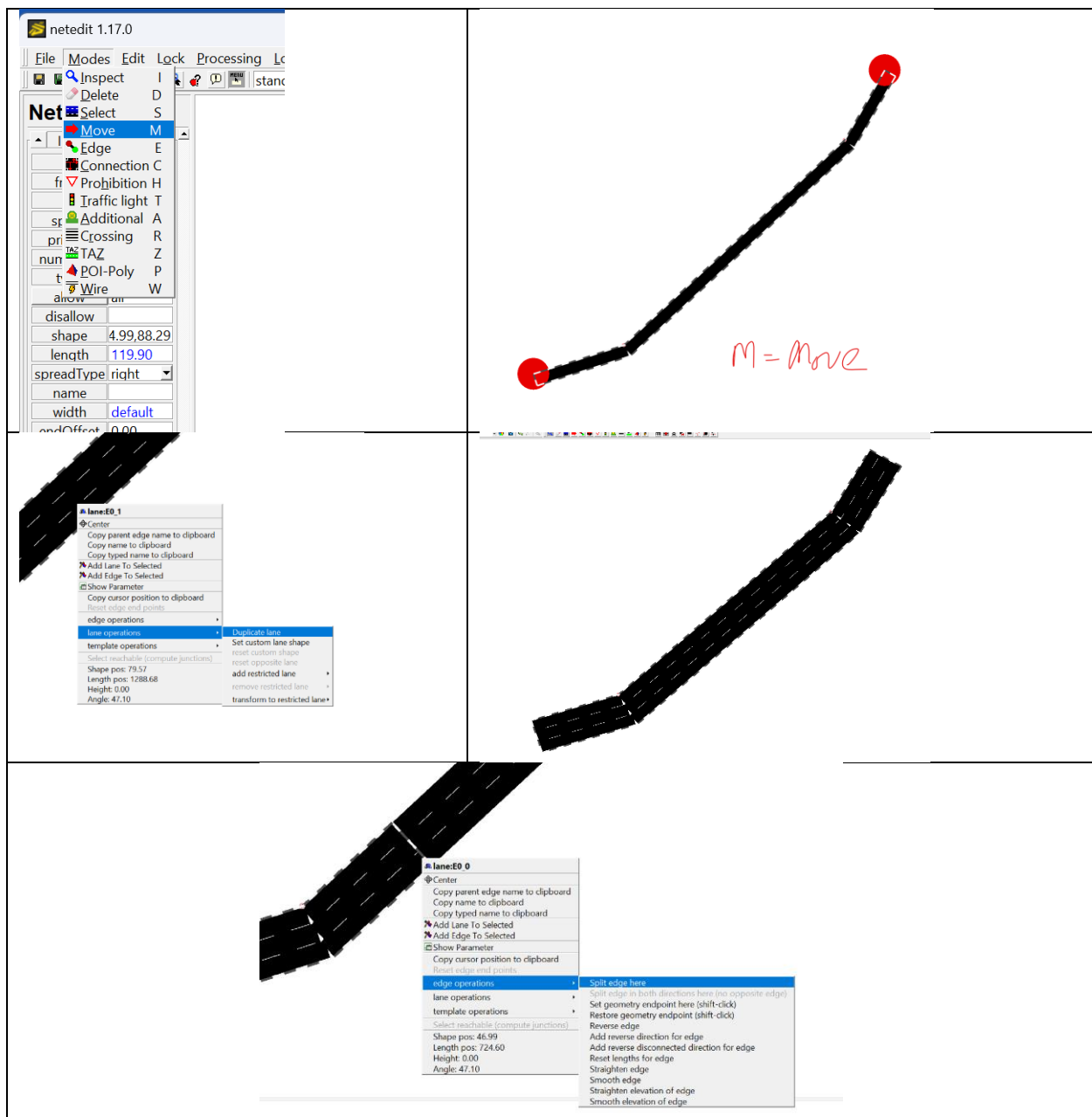
1. Highway/Expressway:

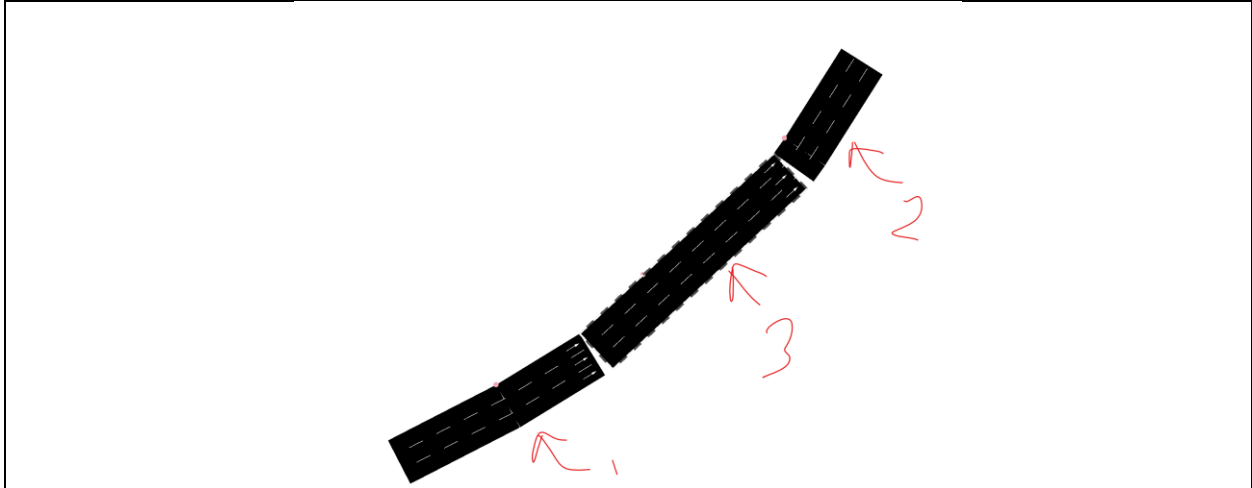
1. Network Creation

Lane Speed: 36.11m/s ~ 130km/h

1/2: Entry/Exit: 100 m

3. Long Edge: 2000 m





2. Traffic Demand

Vehicle type: heterogeneous

- many normal passenger cars
- some trucks
- a few coaches
- a few sporty passenger cars (higher desired travelling speed, less dawdling)

Speed Distribution/Car-Following/Lane-Changing Models:

https://sumo.dlr.de/docs/Definition_of_Vehicles%2C_Vehicle_Types%2C_and_Routes.html#speed_distributions

Actual Speed = max Speed * speed Factor

Max speed: maximum speed of a vehicle

Speed factor: how fast a vehicle can travel compare with the maximum speed. The value greater than 1 will make the vehicle faster than their specified max speed and the value lower than 1 means the vehicle is traveling less than the max speed.

Speed Dev: standard deviation for the vehicle speed adding some randomness to the vehicle speed

Sigma: the roughness of driving, the value can be between 0 to 1. 1 means the higher skilled driver and 0 means the driver is new.

Code:

Rou.xml (autobahn.rou.xml)
<pre> <routes> <vType id="normal_car" vClass="passenger" maxSpeed="40" speedFactor="0.9" speedDev="0.2" sigma="0.5" /> <vType id="sporty_car" vClass="passenger" maxSpeed="60" speedFactor="1.3" speedDev="0.1" sigma="0.1" /> <vType id="trailer" vClass="trailer" maxSpeed="30" speedFactor="1" speedDev="0.05" /> </pre>


```

    <vType id="coach" vClass="coach" maxSpeed="30" speedFactor="1" speedDev="0.05" />
    <flow id="normal" type="normal_car" begin="0" end="5000" number="5000" from="entry" to="
exit" departSpeed="avg" departLane="best" />
    <flow id="sporty" type="sporty_car" begin="0" end="5000" number="300" from="entry" to="e
xit" departSpeed="avg" departLane="best" />
    <flow id="coach" type="coach" begin="0" end="5000" number="300" from="entry" to="exit" d
epartSpeed="avg" departLane="best" />
    <flow id="trailer" type="trailer" begin="0" end="5000" number="700" from="entry" to="exi
t" departSpeed="avg" departLane="best" />
</routes>

```

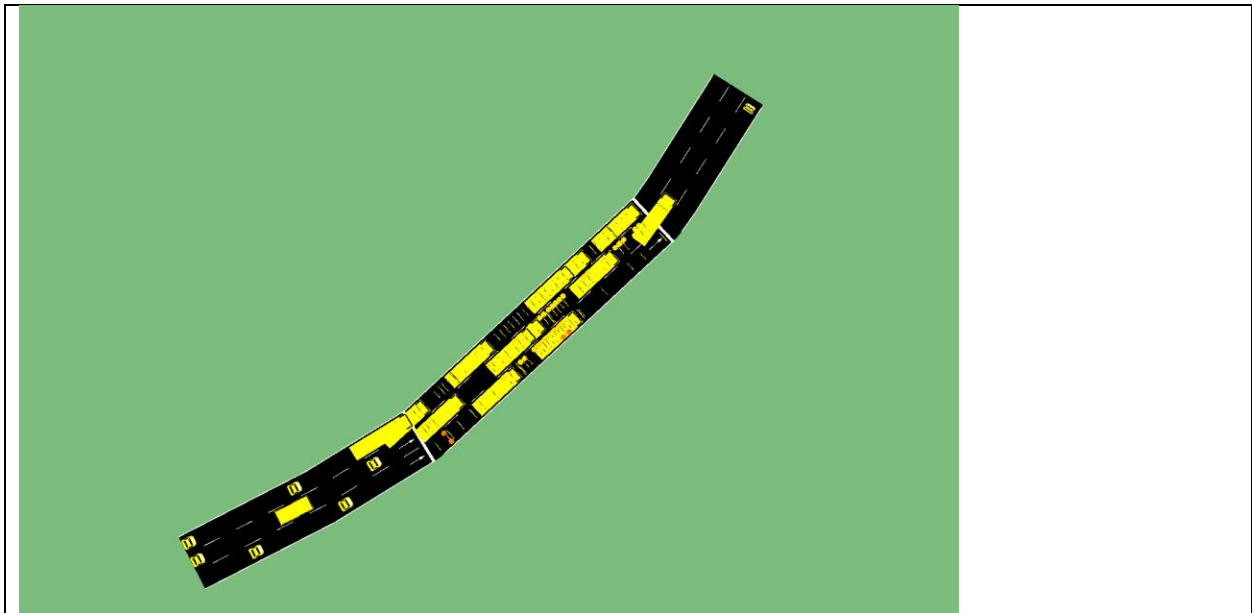
Sumocfg (autobahn.sumocfg)

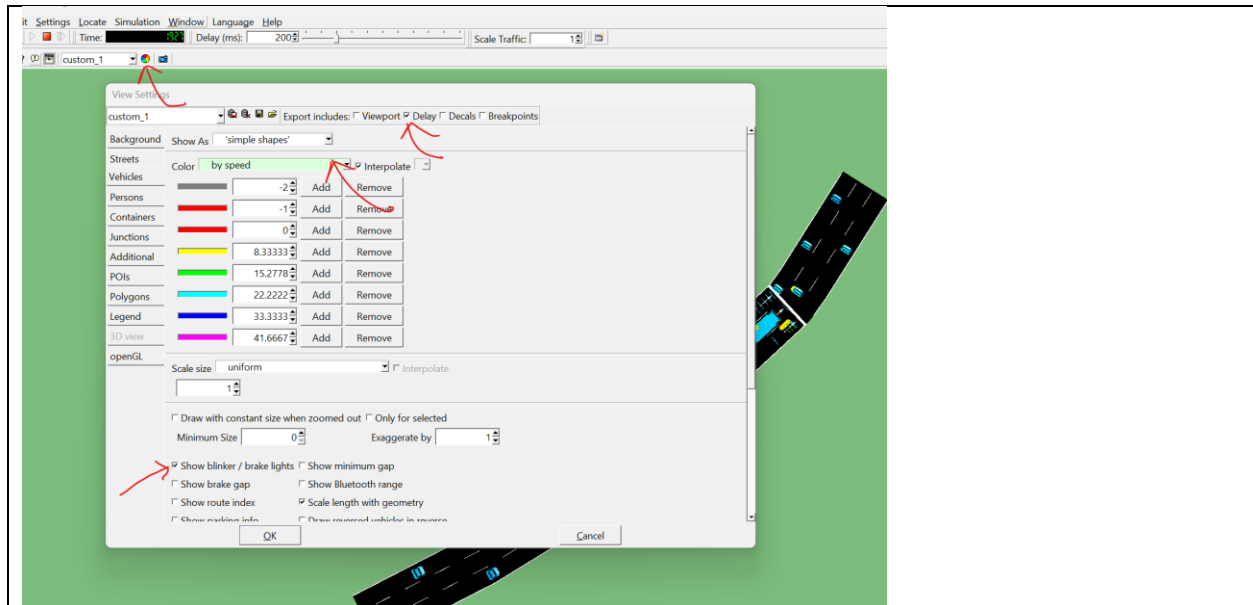
```

<configuration>
  <input>
    <net-file value="autobahn.net.xml"/>
    <route-files value="autobahn.rou.xml"/>
  </input>
</configuration>

```

3. Output: 200 sec



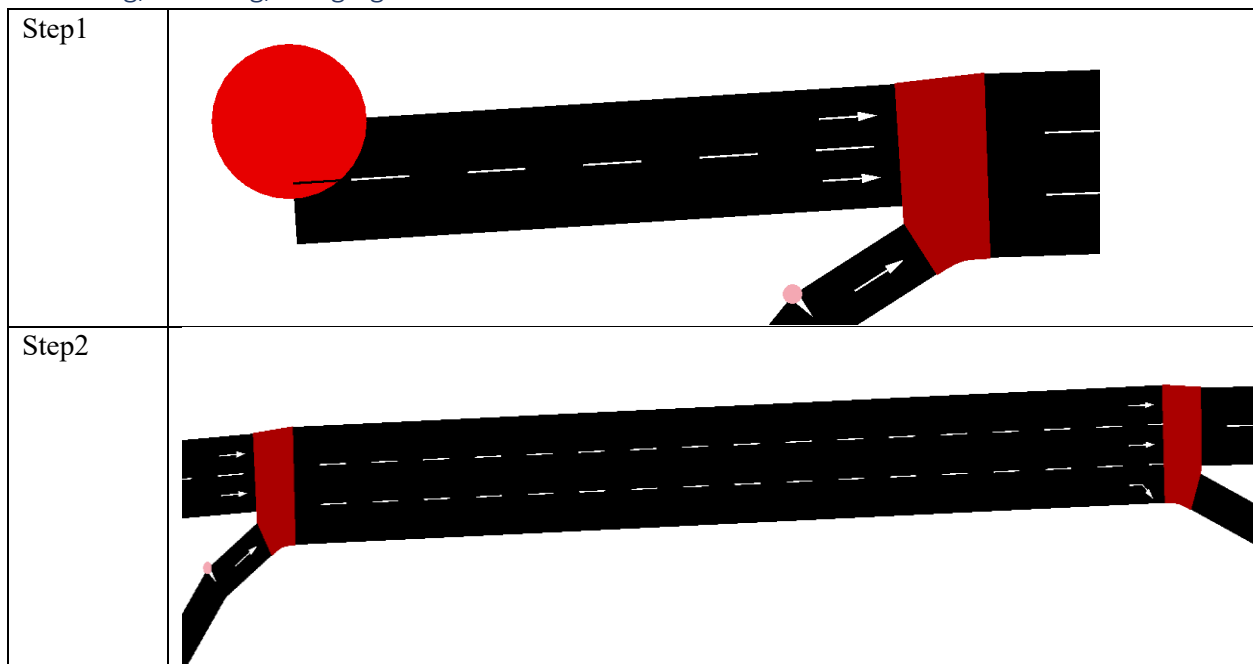


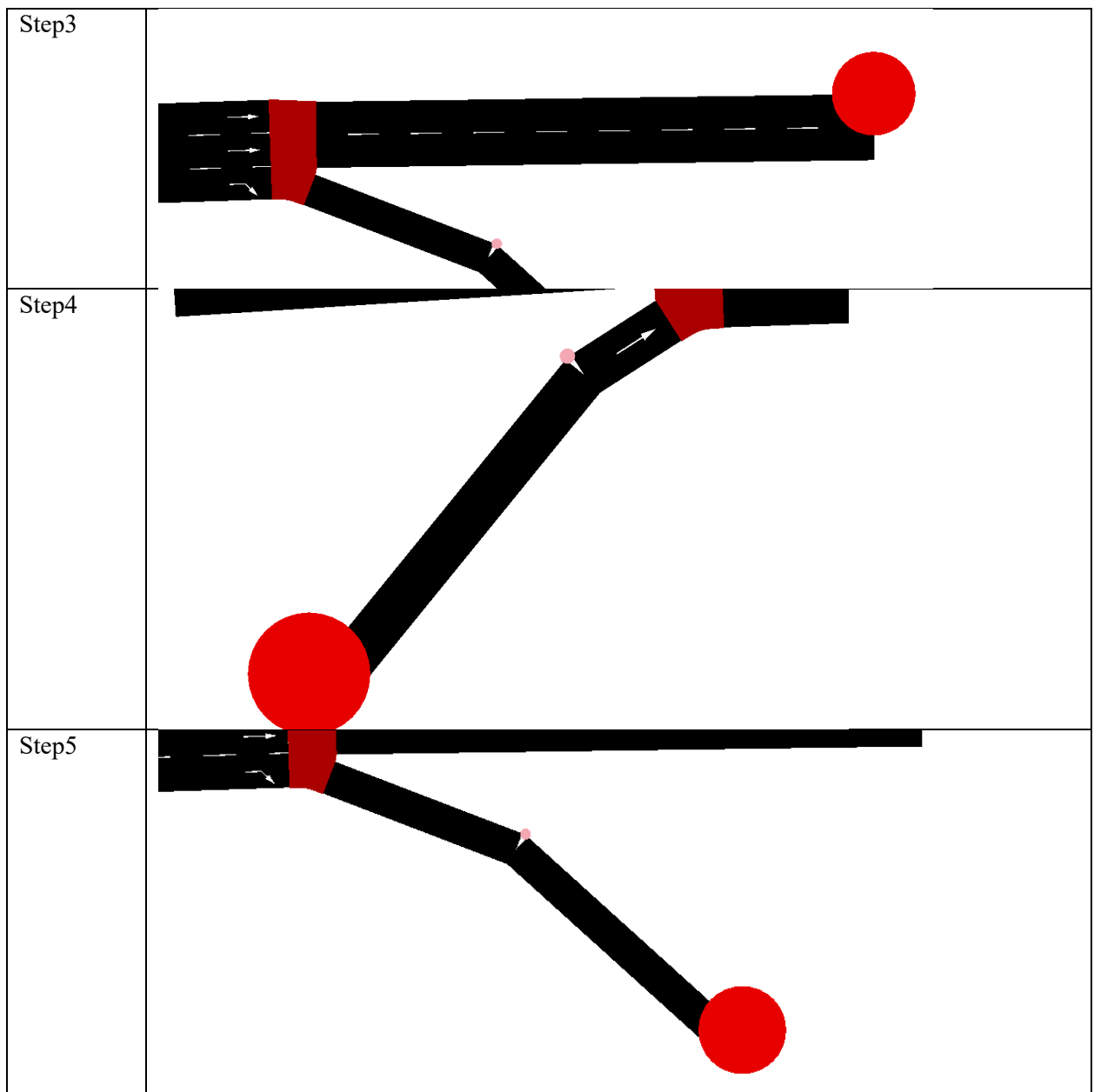
2. Ramp:

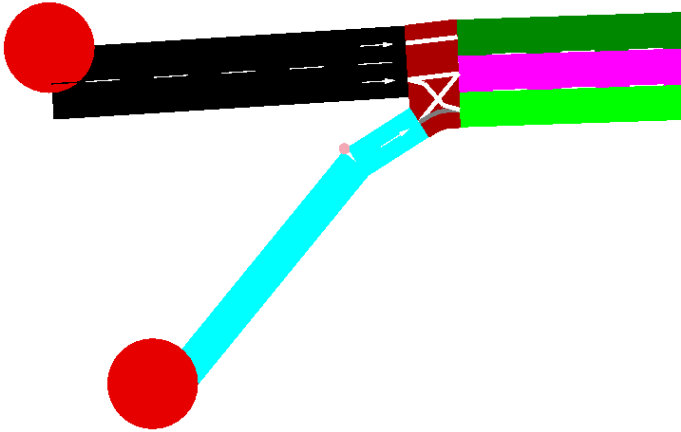
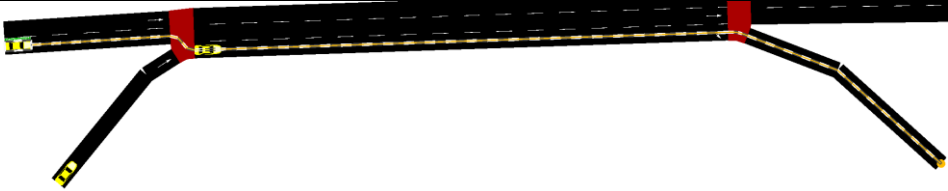

create ramp, > <https://sumo.dlr.de/docs/Simulation/Motorways.html>

Definition: Ramps usually merge into the main road via an acceleration lane. This acceleration lane opens up where the ramp enters the motorway and is modelled as a dead-end lane (no outgoing connection). This forces on-ramp vehicles to change lanes in order to continue their route.

1.Weaving/diverting/Merging area





Step6: Create Connectio n and Route	
Step7: Input demand in different route	
Step8: run simulation	
Output	

Lesson 8: Traffic Light/Signal Controlling

A. Traffic Light:*****

https://sumo.dlr.de/docs/Simulation/Traffic_Lights.html

Traffic_light: https://sumo.dlr.de/docs/Tutorials/TraCI4Traffic_Lights.html

Ped_Crossing: <https://sumo.dlr.de/docs/Tutorials/TraCIPedCrossing.html>

<https://mathpretty.com/14088.html>

<https://salonirk11.medium.com/the-sumo-traffic-d9cc11bf817d#:~:text=A%20traffic%20signal%20in%20our%20simulated%20environment%20Cars,if%20it%20is%20grey%20the%20signal%20is%20green.>









Conference: 2019; vehicle trajectory

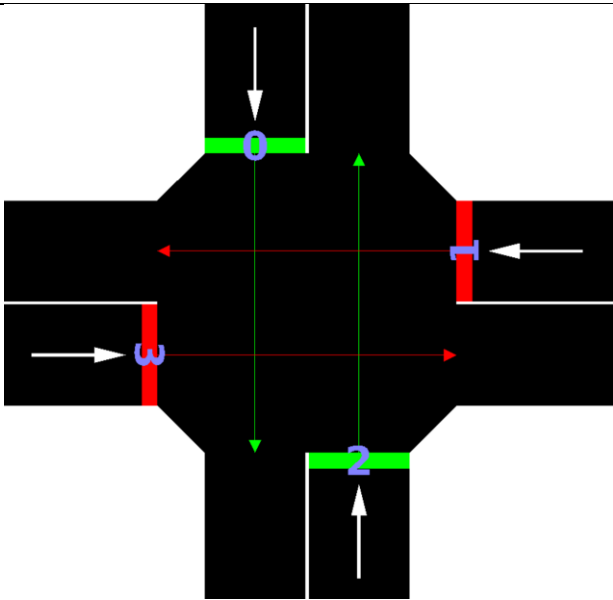
Traffic light: green, red, yellow

By default, all traffic lights are generated with a fixed cycle and a cycle time of 90s.

the green phases usually have a duration of 31s.

Code	Notion	Meaning
<pre><additional> <tlLogic id="0" programID="my_program" offset="0" type="static"> <phase duration="31" state="GGgrrrrrGGgrrrrr"/> <phase duration="5" state="yygrrrrryygrrrrr"/> <phase duration="6" state="rrGGrrrrrrGGrrrrr"/> <phase duration="5" state="rryyrrrrrryyrrrrr"/> <phase duration="31" state="rrrrGGgrrrrrGGgg"/> <phase duration="5" state="rrrryygrrrrryyg"/> <phase duration="6" state="rrrrrrGGrrrrrrGG"/> <phase duration="5" state="rrrrrryyrrrrrryy"/> </tlLogic> </additional></pre>	GGgg	

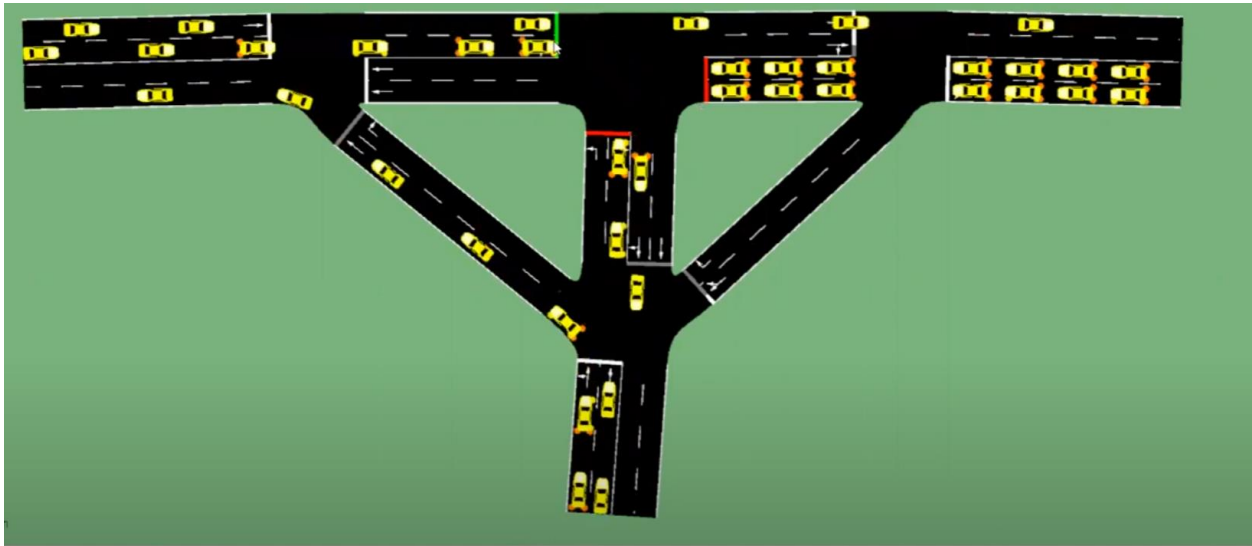
GUI		Description
Character	Color	
r		'red light' for a signal - vehicles must stop
y		'amber (yellow) light' for a signal - vehicles will start to decelerate if far away from the junction, otherwise they pass
g		'green light' for a signal, no priority - vehicles may pass the junction if no vehicle uses a higher prioritised foe stream, otherwise they decelerate for letting it pass. They always decelerate on approach until they are within the configured visibility distance
G		'green light' for a signal, priority - vehicles may pass the junction
s		'green right-turn arrow' requires stopping - vehicles may pass the junction if no vehicle uses a higher prioritised foe stream. They always stop before passing. This is only generated for junction type <i>traffic_light_right_on_red</i> .
u		'red+yellow light' for a signal, may be used to indicate upcoming green phase but vehicles may not drive yet (shown as orange in the gui)
o		'off - blinking' signal is switched off, blinking light indicates vehicles have to yield
O		'off - no signal' signal is switched off, vehicles have the right of way



Example: traffic light with the current state "GrGr". The leftmost letter "G" encodes the green light for link 0, followed by red for link 1, green for link 2 and red for link 3. The link numbers are enabled via

Traffic Light and Left Hand Rule:

https://www.youtube.com/watch?v=37J27c9_rIo&list=PLgIPH6KYX7xDPmxkvuZ4XtnAXEX4eTRIE&index=5



B. Traffic Sign***

Lesson 10: Traffic Models

Sumo 2019 – conf.

Sumo 2023 – plotting tools

Car Following models:

Car-Following Models section:

https://sumo.dlr.de/docs/Definition_of_Vehicles%2C_Vehicle_Types%2C_and_Routes.html

Lane-Changing Models:

Lane-Changing Models:

https://sumo.dlr.de/docs/Definition_of_Vehicles%2C_Vehicle_Types%2C_and_Routes.html

Lesson 11: Traffic Safety Study: Collision

<https://sumo.dlr.de/docs/Simulation/Safety.html>

Collision parameters in Caar Following models:

Read: Car-Following Model Parameters

https://sumo.dlr.de/docs/Definition_of_Vehicles%2C_Vehicle_Types%2C_and_Routes.html

Lesson 12: CAV Simulation: Omnet

CAV

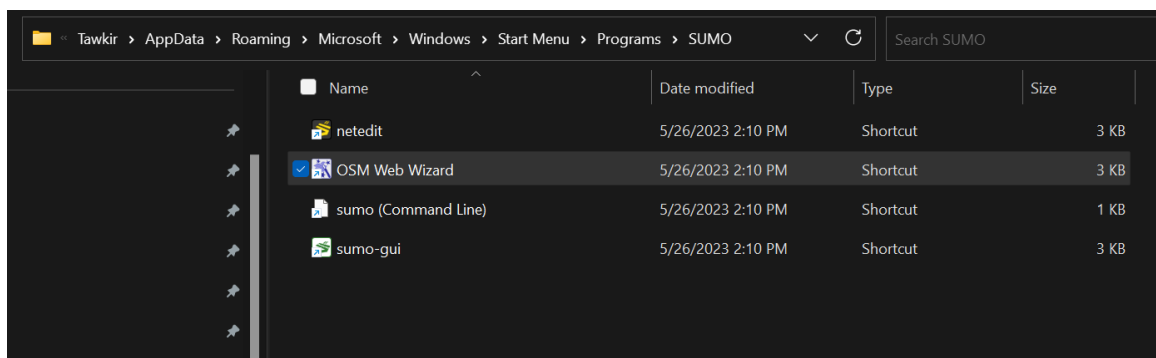
```
<vehicle id="ego" depart="0" route="r0">
  <param key="carFollowModel.ignoreIDs" value="foe1 foe2"/>
  <param key="carFollowModel.ignoreTypes" value="bikeType"/>
</vehicle>
```

*see Transient carFollowModel Parameters

Lesson 13: Work with open street map

1. Download

Requirement: SUMO, Python



OSM Web Wizard is essentially a collection of python script located: All Programs -> SUMO -> OSM Web Wizard

1. Open Anaconda Prompt (Anaconda3/r-minicon)

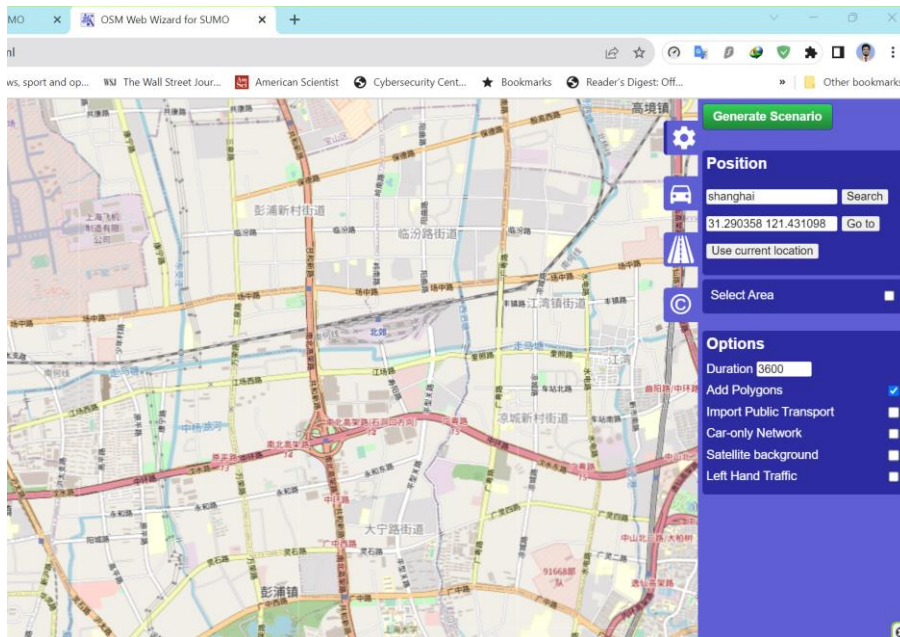
```
Anaconda Prompt (r-minicon) x + v

(base) C:\Users\Tawkir>cd C:\Program Files (x86)\Eclipse\Sumo\tools

(base) C:\Program Files (x86)\Eclipse\Sumo\tools> python osmWebWizard.py
python: can't open file 'C:\Program Files (x86)\Eclipse\Sumo\tools\osmWebWizard.py': [Errno 2] No such file or directory

(base) C:\Program Files (x86)\Eclipse\Sumo\tools> py osmWebWizard.py
```

2. It will open a map in a browser



**taking large network need large time for simulation. Hence choose small network

3. Demand Generation

The screenshot shows a software interface for demand generation. On the left is a map of a city street intersection. Overlaid on the map is a settings panel with a green 'Generate Scenario' button at the top. Below the button is a gear icon. The panel lists vehicle types with checkboxes: 'Cars' (checked), 'Trucks' (unchecked), 'Bus' (unchecked), 'Motorcycles' (unchecked), 'Bicycles' (unchecked), and 'Pedestrians' (unchecked). Under the 'Cars' section, there are two input fields: 'Through Traffic Factor' with the value '5' and 'Count' with the value '12'.

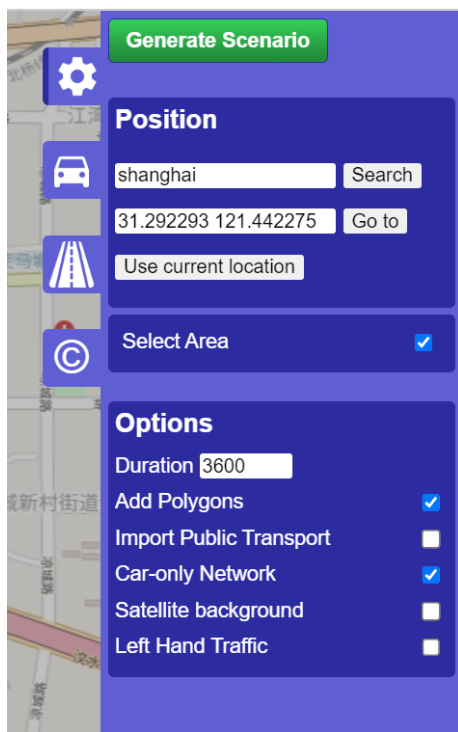
Vehicle Type	Through Traffic Factor	Count	Selected
Cars	5	12	<input checked="" type="checkbox"/>
Trucks			<input type="checkbox"/>
Bus			<input type="checkbox"/>
Motorcycles			<input type="checkbox"/>
Bicycles			<input type="checkbox"/>
Pedestrians			<input type="checkbox"/>

4. Road-Type Selection

The screenshot shows a software interface for road-type selection. On the left is a map of a city street intersection. Overlaid on the map is a settings panel with a green 'Generate Scenario' button at the top. Below the button is a gear icon. The panel lists road types with checkboxes: 'Highway' (checked), 'motorway' (checked), 'trunk' (checked), 'primary' (checked), 'secondary' (checked), 'tertiary' (checked), 'unclassified' (checked), 'residential' (checked), 'living_street' (checked), 'unsurfaced' (checked), 'service' (checked), 'raceway' (checked), 'bus_guideway' (checked), 'Pedestrians' (unchecked), 'track' (unchecked), 'footway' (unchecked), 'pedestrian' (unchecked), 'path' (unchecked), 'bridleway' (unchecked), 'cycleway' (unchecked), 'step' (unchecked), 'steps' (unchecked), and 'stairs' (unchecked).

Road Type	Selected
Highway	<input checked="" type="checkbox"/>
motorway	<input checked="" type="checkbox"/>
trunk	<input checked="" type="checkbox"/>
primary	<input checked="" type="checkbox"/>
secondary	<input checked="" type="checkbox"/>
tertiary	<input checked="" type="checkbox"/>
unclassified	<input checked="" type="checkbox"/>
residential	<input checked="" type="checkbox"/>
living_street	<input checked="" type="checkbox"/>
unsurfaced	<input checked="" type="checkbox"/>
service	<input checked="" type="checkbox"/>
raceway	<input checked="" type="checkbox"/>
bus_guideway	<input checked="" type="checkbox"/>
Pedestrians	<input type="checkbox"/>
track	<input type="checkbox"/>
footway	<input type="checkbox"/>
pedestrian	<input type="checkbox"/>
path	<input type="checkbox"/>
bridleway	<input type="checkbox"/>
cycleway	<input type="checkbox"/>
step	<input type="checkbox"/>
steps	<input type="checkbox"/>
stairs	<input type="checkbox"/>

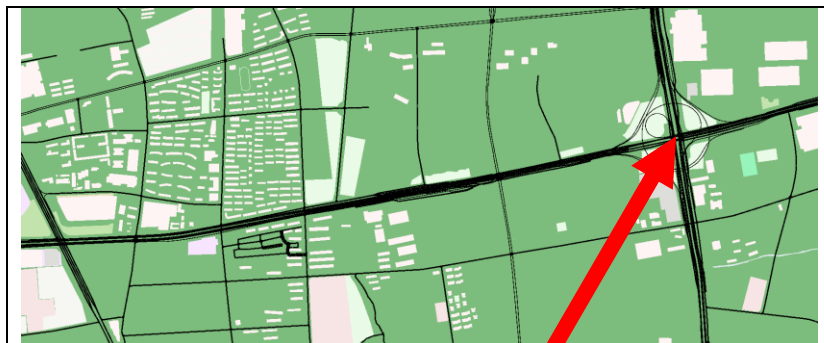
5. Generate Scenario:

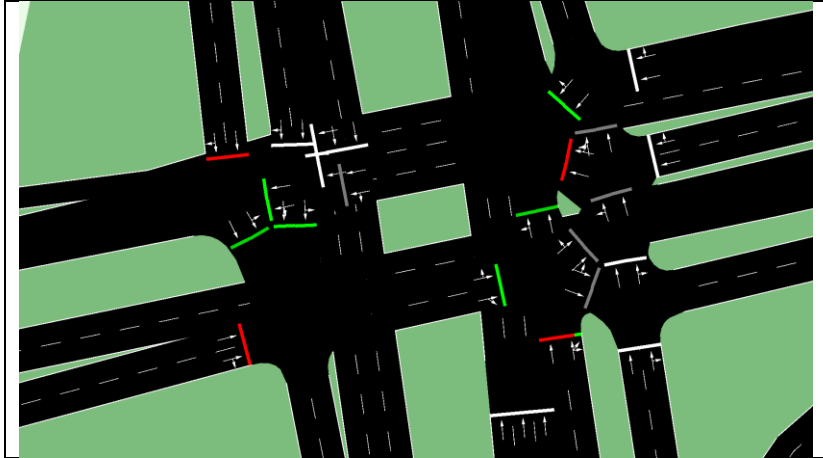


6. View Map in SUMO

Click Generate Scenario > then you get the new map

**make sure the anaconda prompt open and active/connected





7. File source:

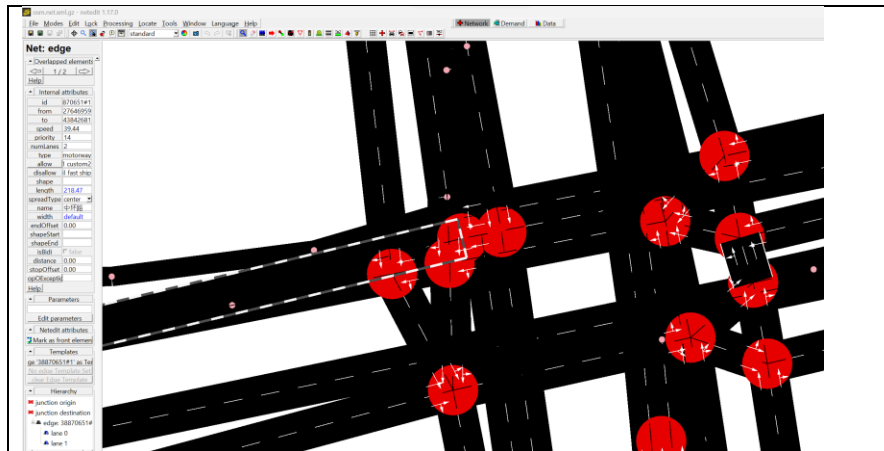
This PC > Local Disk (C:) > Users > Tawkir > Sumo > 2023-08-01-18-41-11

Name	Date modified	Type	Size
build	8/1/2023 6:41 PM	Windows Batch File	1 KB
osm.net.xml	8/1/2023 6:41 PM	WinRAR archive	307 KB
osm.netcfg	8/1/2023 6:41 PM	NETCFG File	2 KB
osm.passenger.trips.xml	8/1/2023 6:41 PM	xmlfile	436 KB
osm.poly.xml	8/1/2023 6:41 PM	WinRAR archive	60 KB
osm.polycfg	8/1/2023 6:41 PM	POLYCFG File	1 KB
osm	8/1/2023 6:41 PM	SUMO Configuration...	1 KB
osm.view.xml	8/1/2023 6:41 PM	xmlfile	1 KB
osm_bbox.osm.xml	8/1/2023 6:41 PM	WinRAR archive	140 KB
run	8/1/2023 6:41 PM	Windows Batch File	1 KB

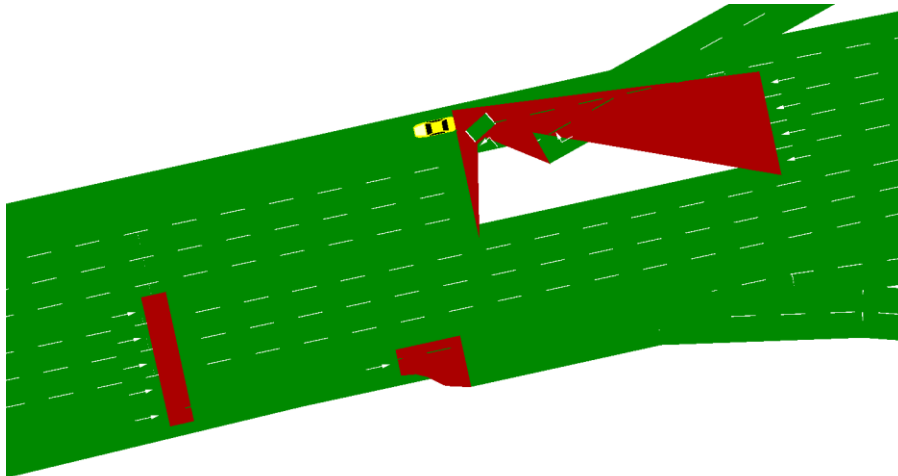
Copy

.netccfg > network file, osm> sumo file





8. Add route and vehicle following previous lesson and run it for 120 second



2. Network Editing

See sumo conference 2020

A. Delete the unnecessary network by selecting and deleting

B. Change the lane number in intersection

C. Change the geometry: move the object

D. Edit Crossing: delete or install
Conference 2022

3. Edit Traffic Light

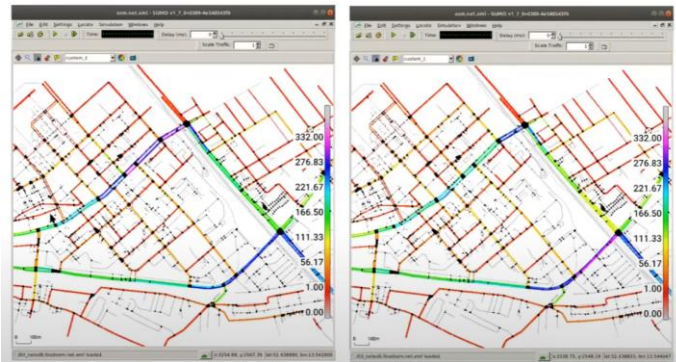
Static traffic light and dynamic traffic light** all road is not actuated so see and change

A. Change the status of traffic light: static vs dynamic

B. Edit the traffic cycle/ Change color of the particular signal
Conf 2022

4. Traffic

Fastest routes w/o traffic



A. Edge Count: Traffic Flow create from real-world counting data

Step 1: define edges

Step 2: Create traffic count

Step 3: apply the count by clicking in street map network

Step 4: run simulation

B. Turning Count: to create traffic data

C. Select Traffic Analysis Zone (TAZ)

Conference 2021: time 29

5. Pedestrian Crossing

A. Create Pedestrian Crossing

Conf 22, time 40

B. Create Pedestrian Traffic

Conf 22, time 48

*match the network with the real world and open street map can be different

Edit and join junction: 2022 conference

C. Bicycle Traffic

Conf 23, time 22

6. Mode Sharing: Taxi Fleet (stop in any site using TraCI/Netedit)

*stop and go: make flow disruption

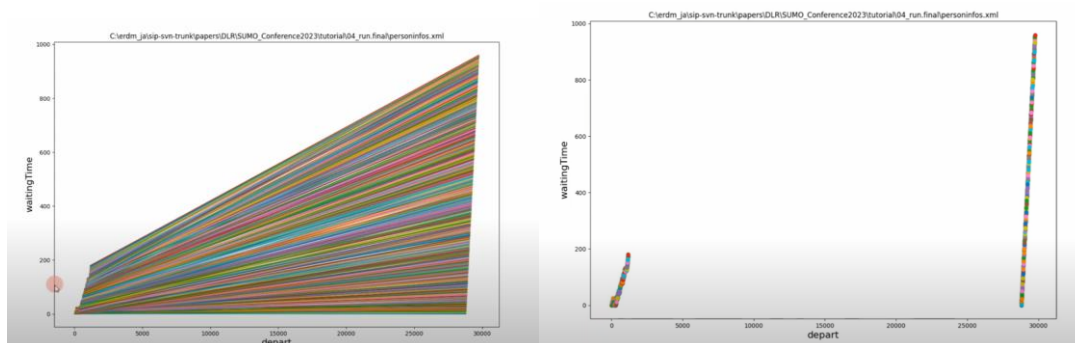
7. Traffic Parking

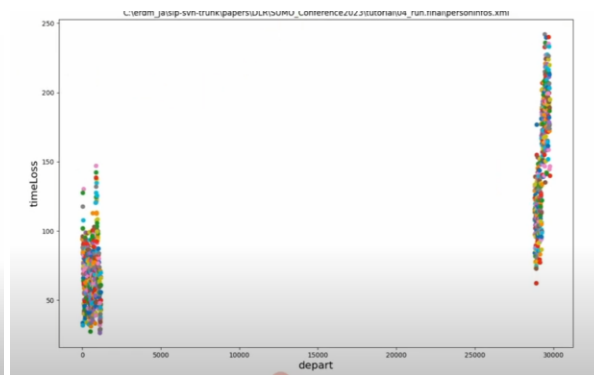
Conf 22, time 50

Lesson 9: Visualize simulation results

Sumo Conf 2023, time 44

A. Summary Statistics





Conf 23, time 50

Lesson 14: Work with python: TraCI package