

RWR 4013

Digital Twins for Smart Cities

Dr. Ahmad Mohammadi

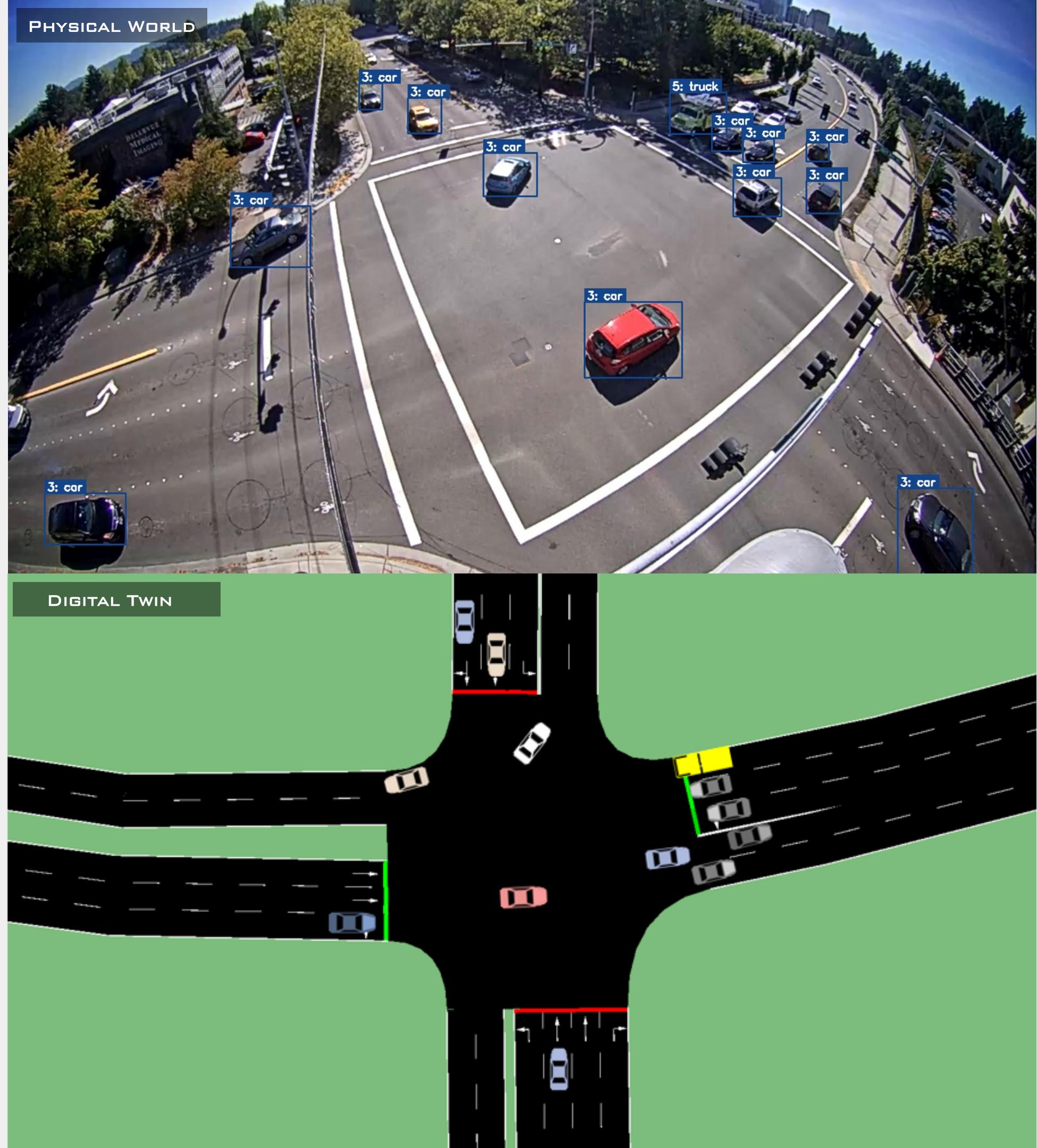
Week 6 | Session 1:
Road Network Development

Fall 2026

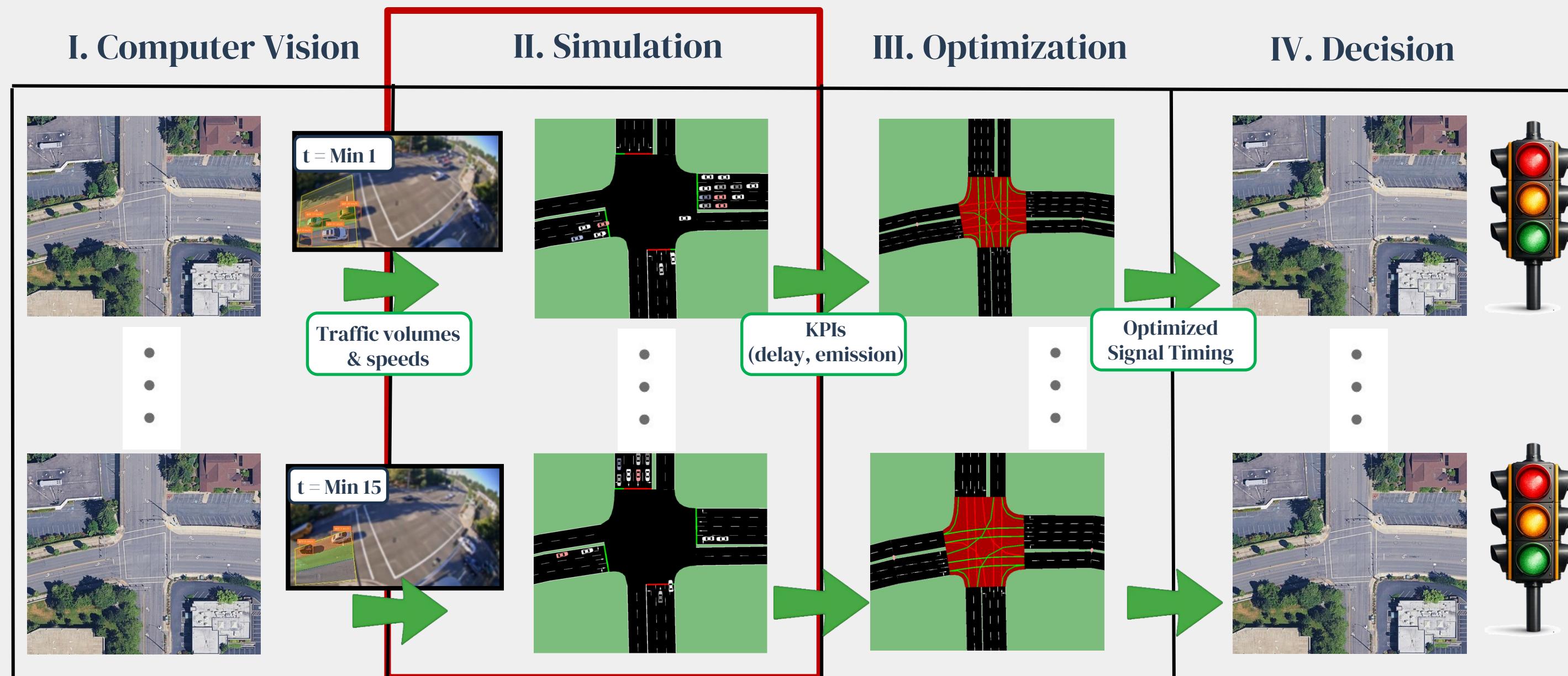
RoadwayVR



roadwayvr.github.io/DigitalTwinsforSmartCities

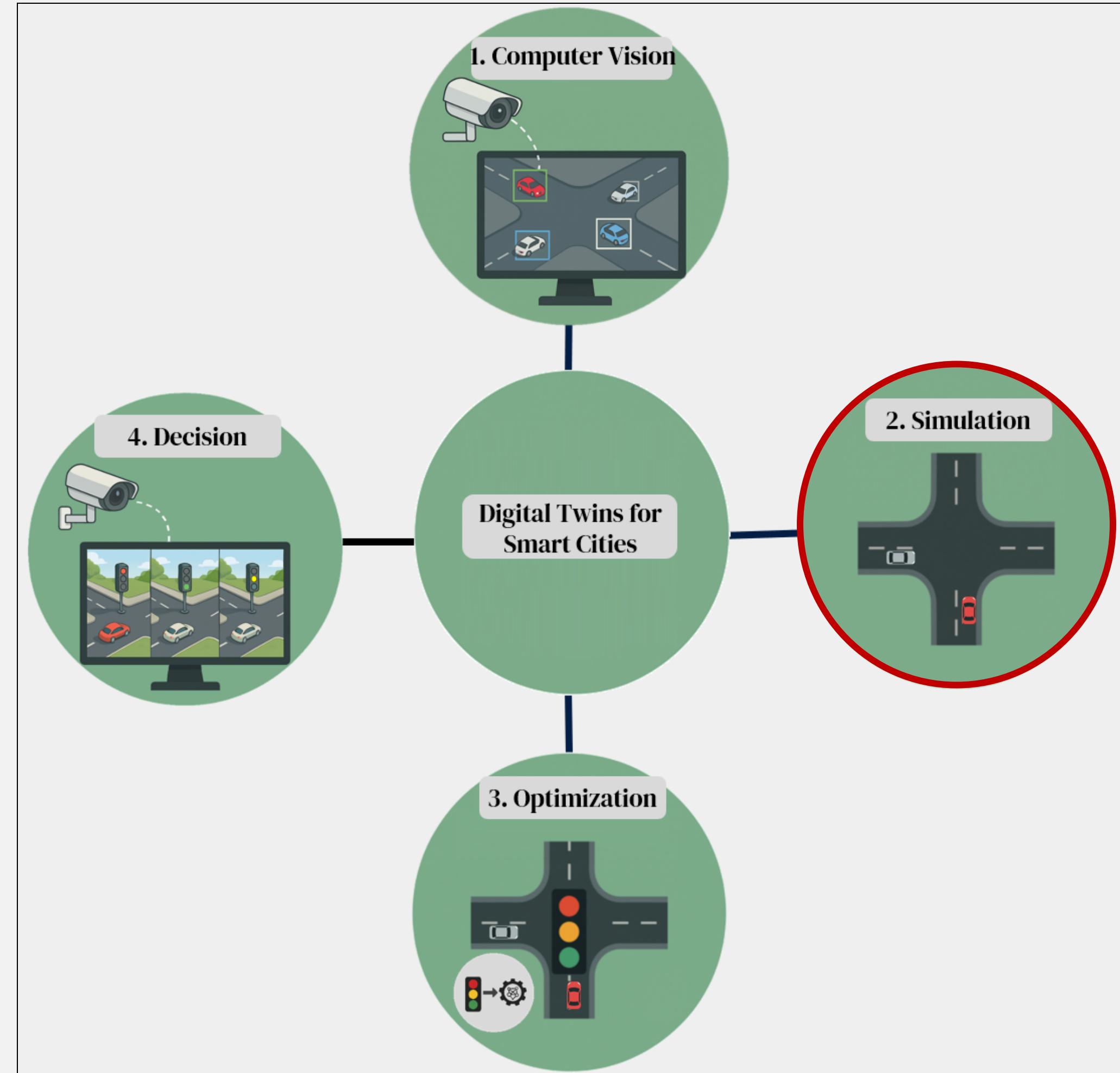


Overview of Course Syllabus in One Shot

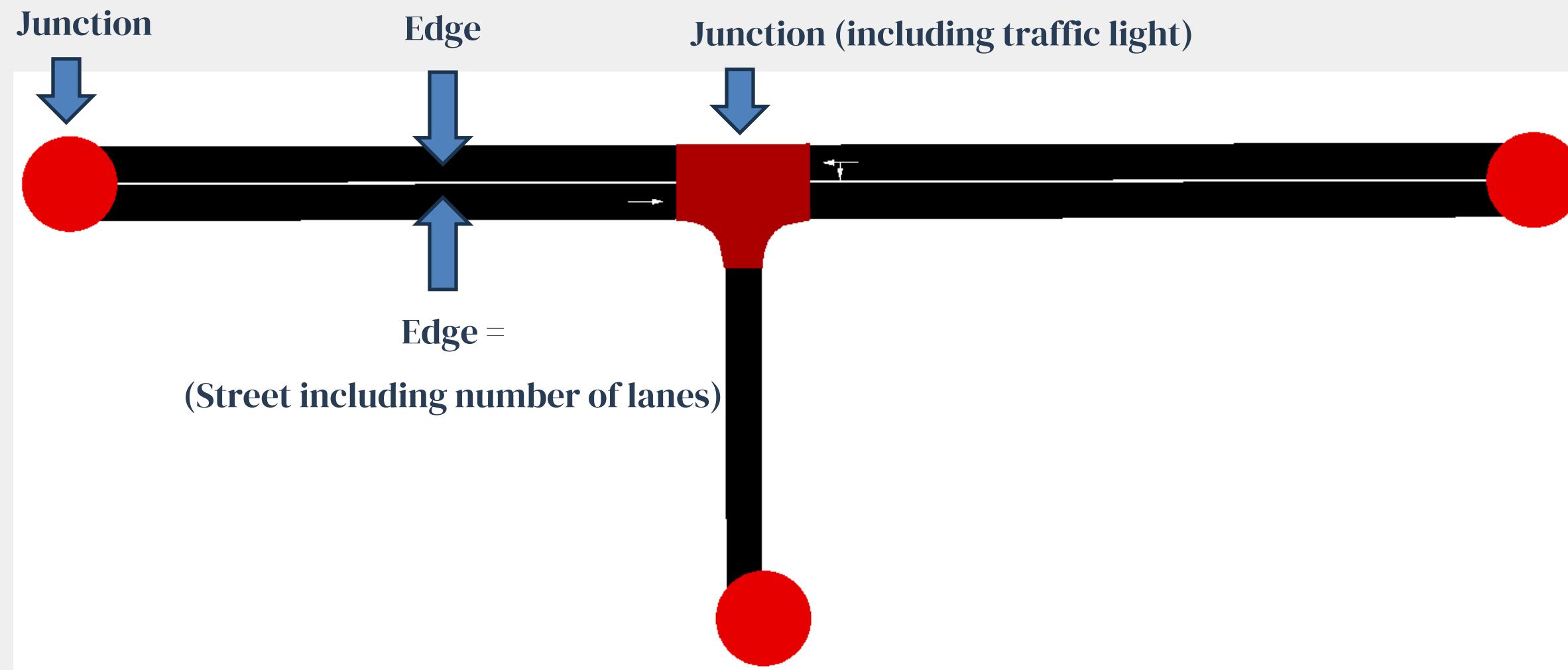


Agenda

1. Edge vs Junction
2. Junction Types
3. Download Materials and Import GIS Map
into Simulation (NetEdit)
4. Create a Road Network on Top of a GIS Map



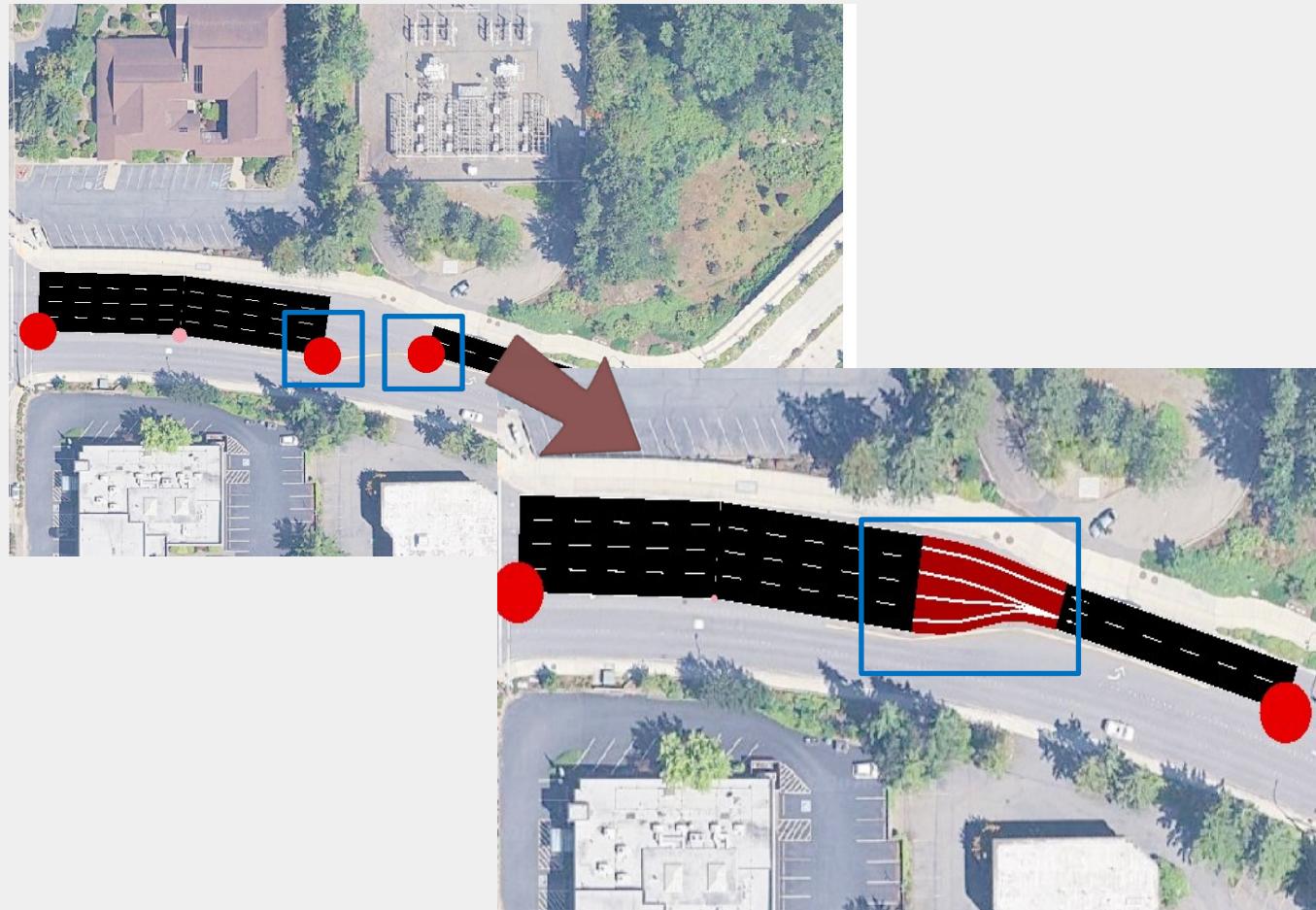
Edge vs Junction



Junction Types

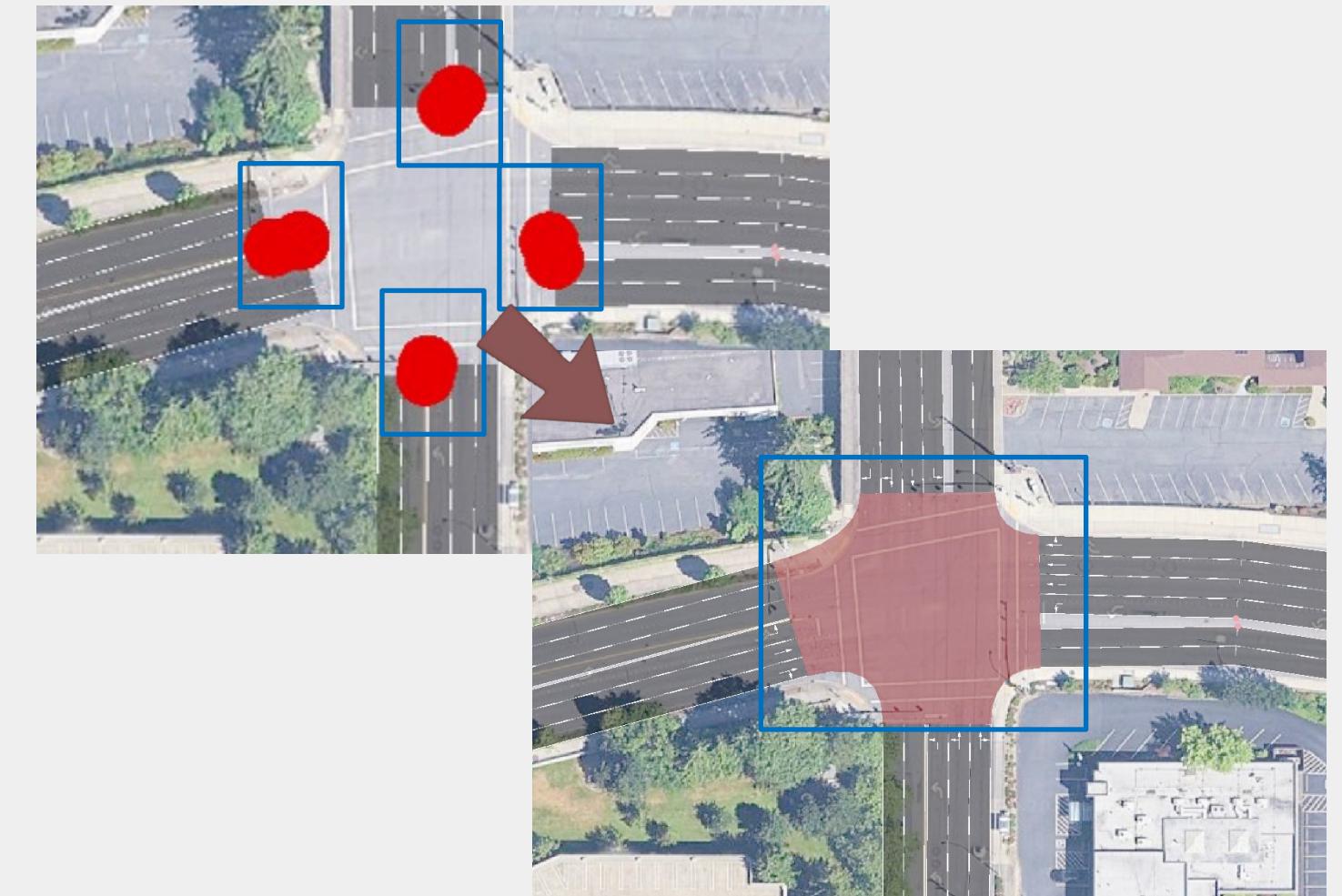
1. Lane Transition Junctions

- ❑ Where the number of lanes changes on the same road
- ❑ Lane merging (2 lanes → 1 lane) or lane addition (1 lane → 2 lanes)
- ❑ Typically, no crossing conflicts, mainly merging/diverging movements



2. Intersection Junctions

- ❑ Where two or more roads cross or meet
- ❑ Involve crossing movements and turning movements
- ❑ Require traffic control (signals, stop signs, yield signs)

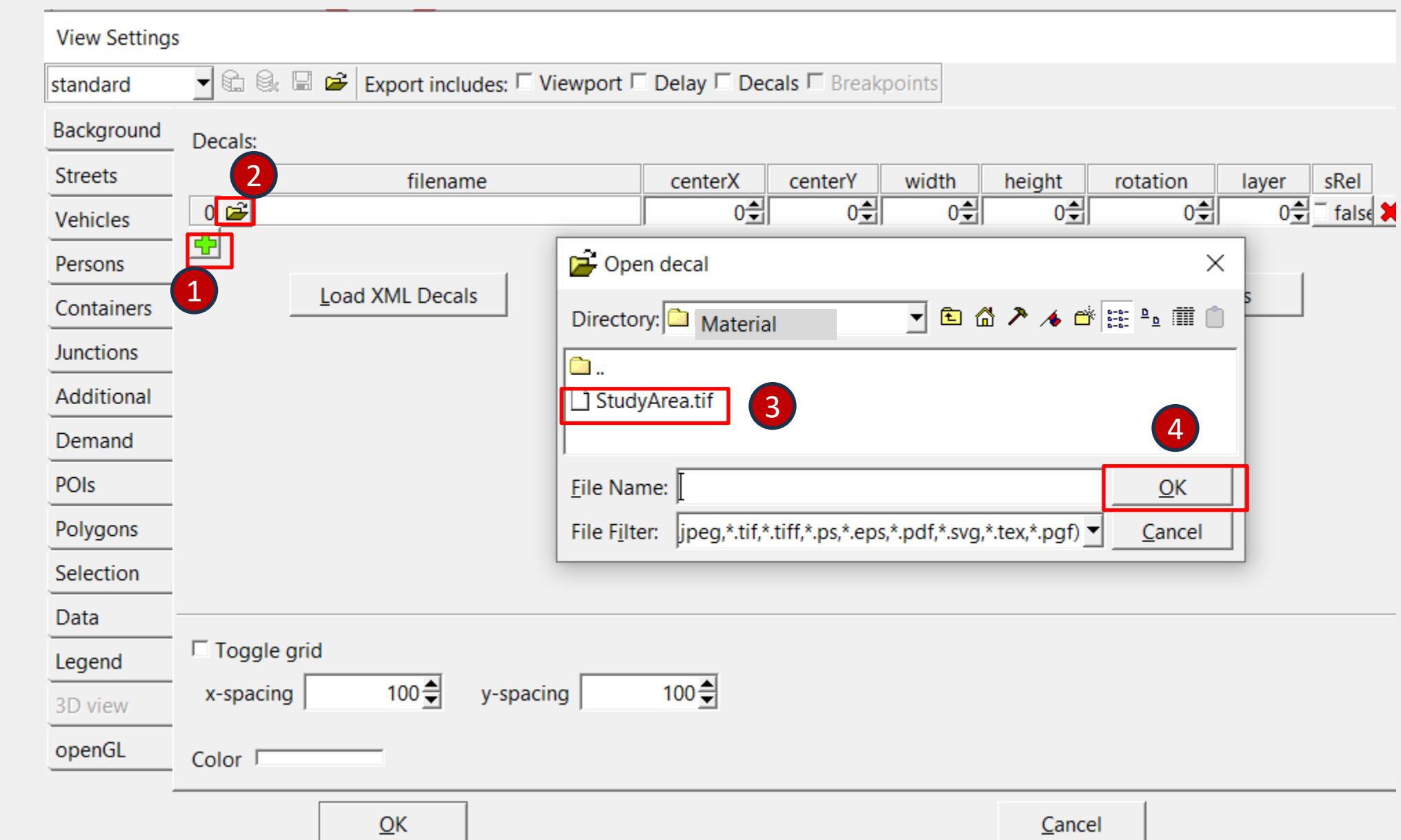


Download Materials and Import GIS Map into Simulation (NetEdit)

- 1. Download Week6a.Material.zip and extract it**
- 2. Open Exercise2.netecfg**
- 3. Zoom out**
- 4. Assign the Background Map**

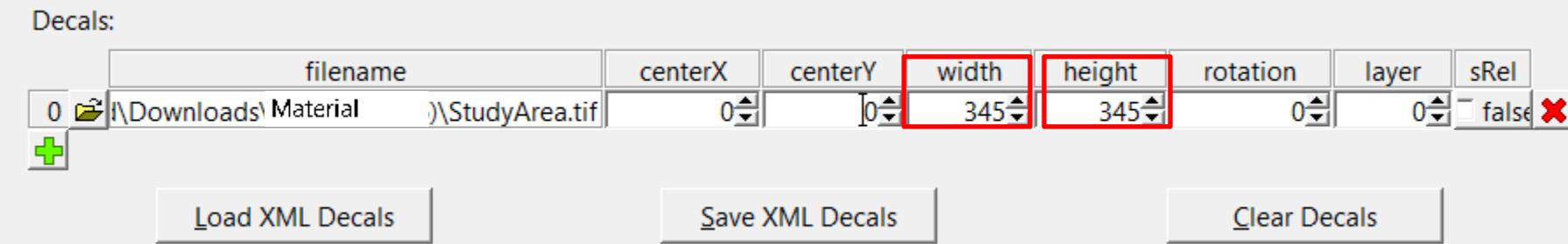
Download Materials and Import GIS Map into Simulation (NetEdit)

5. MainMenu → Edit → Edit Visualization → Select “plus” button → Select “Folder”
→ Select the StudyArea.tif → Select “Ok”



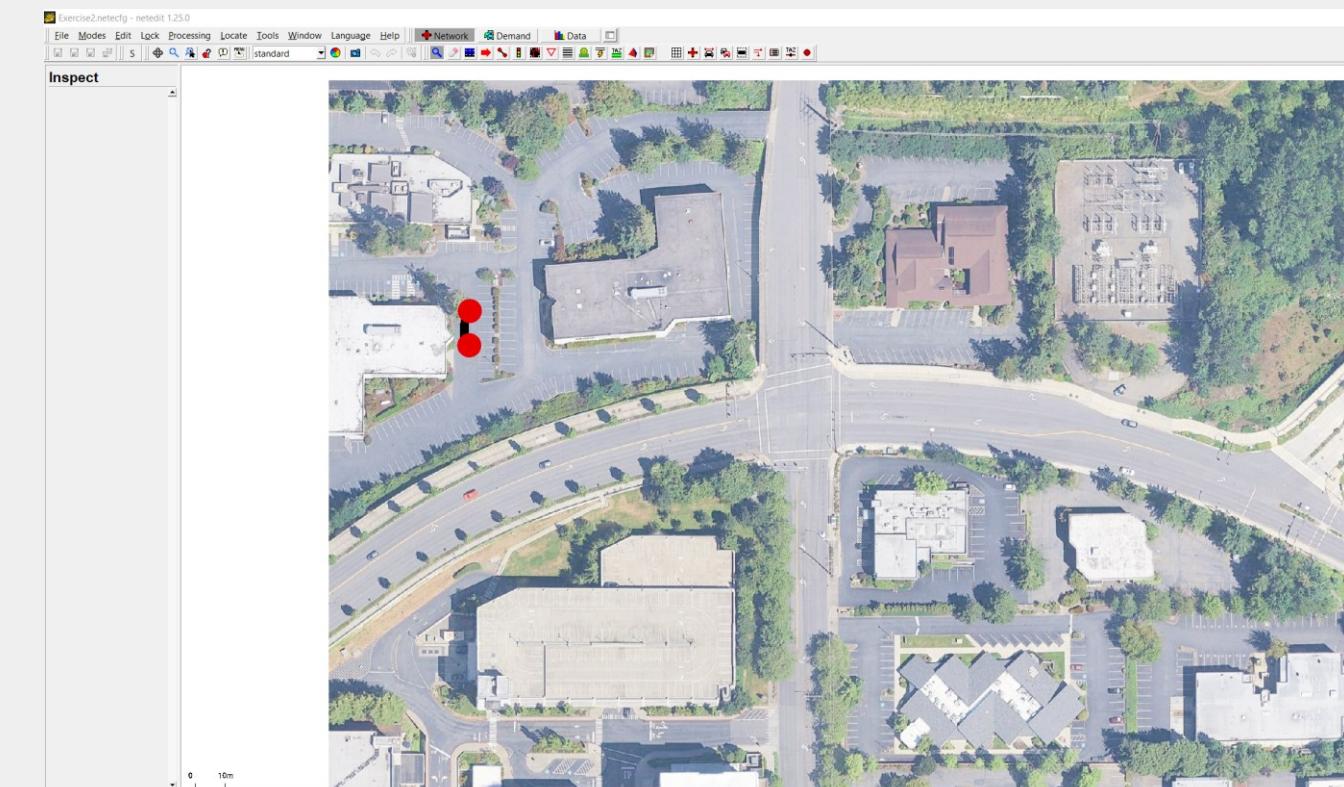
Download Materials and Import GIS Map into Simulation (NetEdit)

6. Enter the values of Width and Height recorded in QGIS (in the previous tutorial)



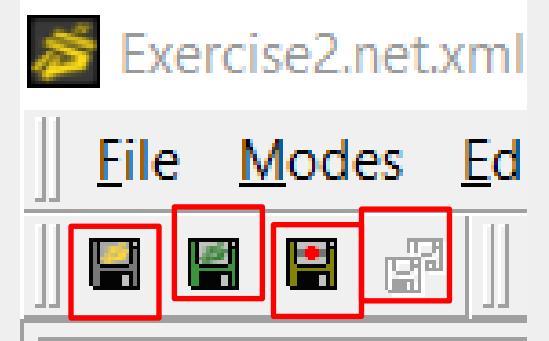
7. We have the GIS map in SUMO

SUMO



Download Materials and Import GIS Map into Simulation (NetEdit)

- Always save the network files using these buttons.



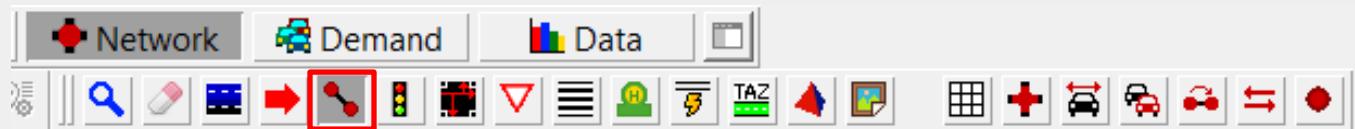
4. Create a Road Network on Top of a GIS Map

Create a Road Network on Top of a GIS Map

1. Main Menu → Select Network → Select Magnifier → Move The View Horizontally by Holding Left Click and Move Mouse (Alternatively, Hold Ctrl and Move Mouse)



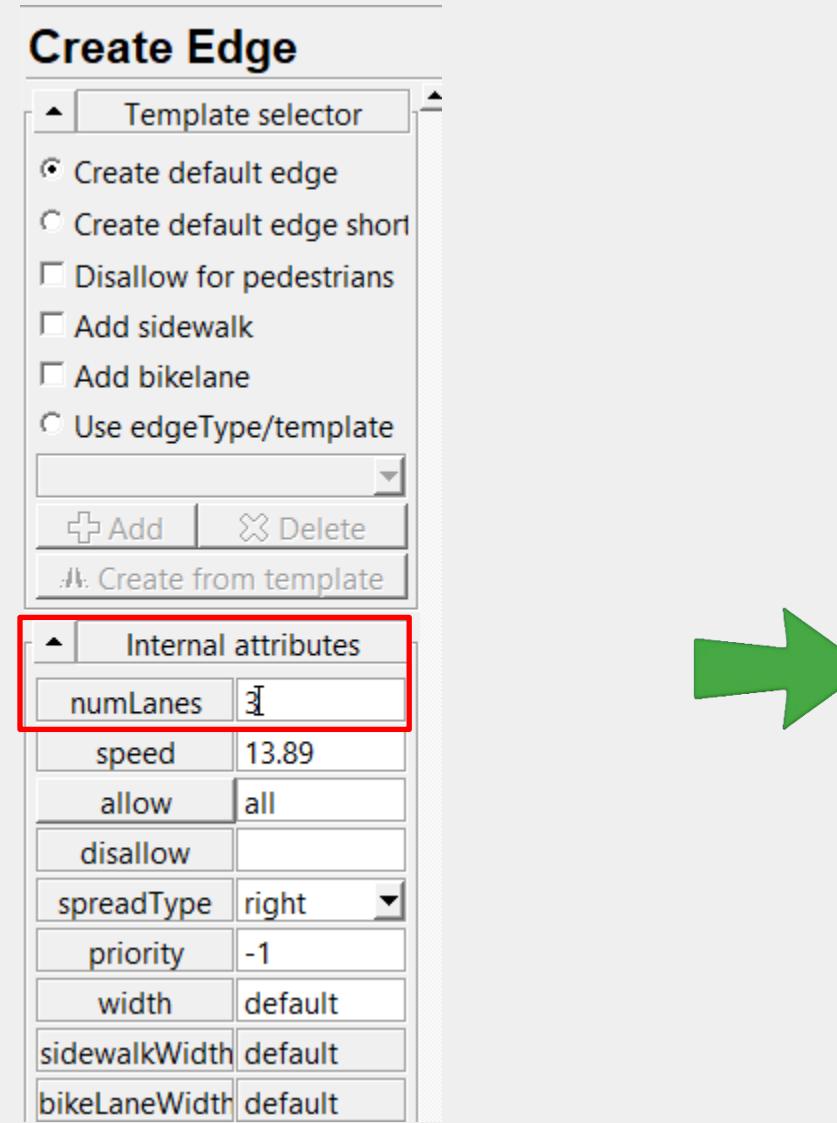
2. Select Network → Select “Create Junctions and Edges”



Create a Road Network on Top of a GIS Map

3. Left panel → Create Edge → Set the number of lanes to “3”.

4. Start creating the road network from the eastbound approach of the intersection.

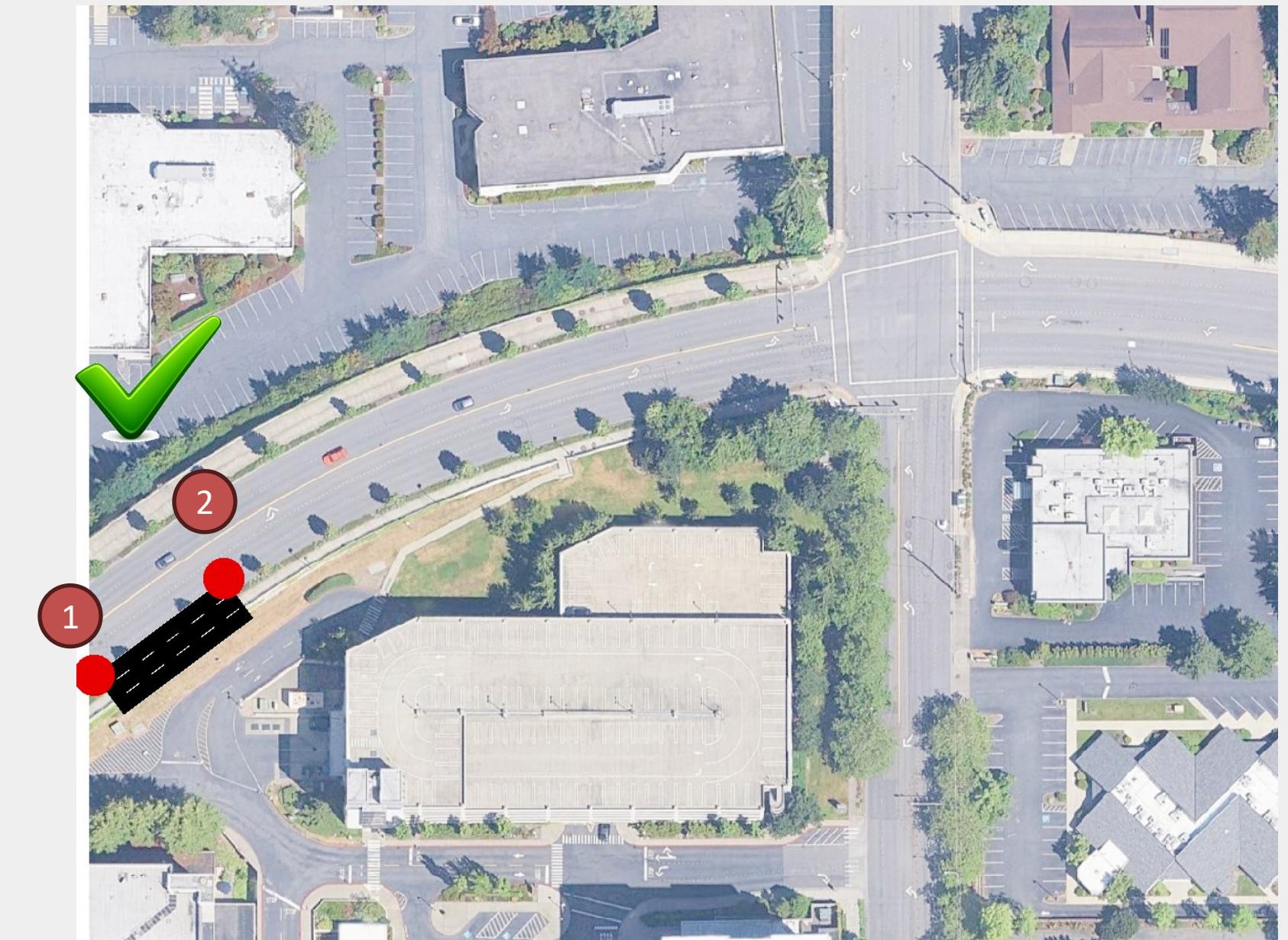
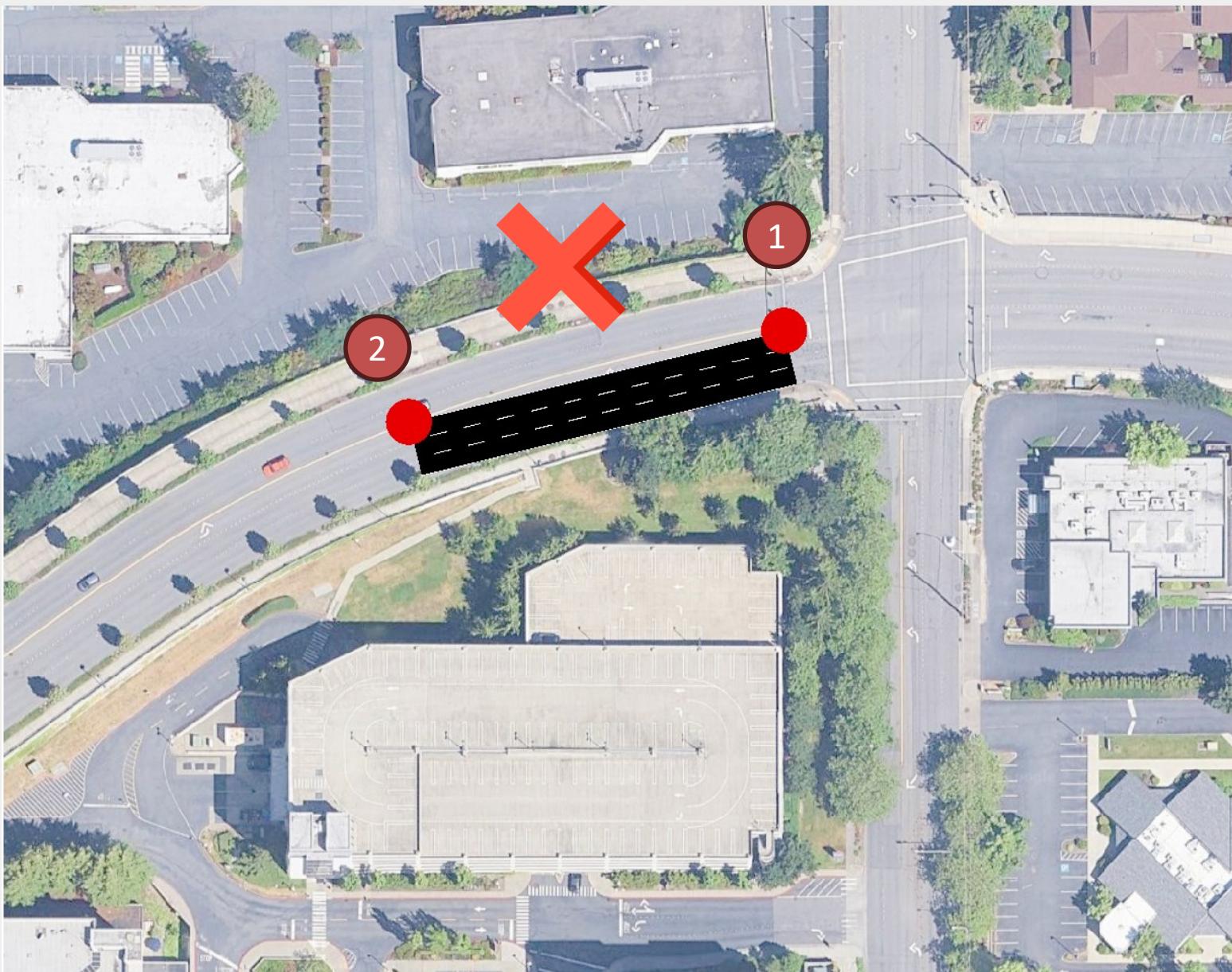


Mistake

✗ The road was drawn reversed compared to the actual road direction.

✓ Draw the road in the direction of traffic flow (left to right in this example).

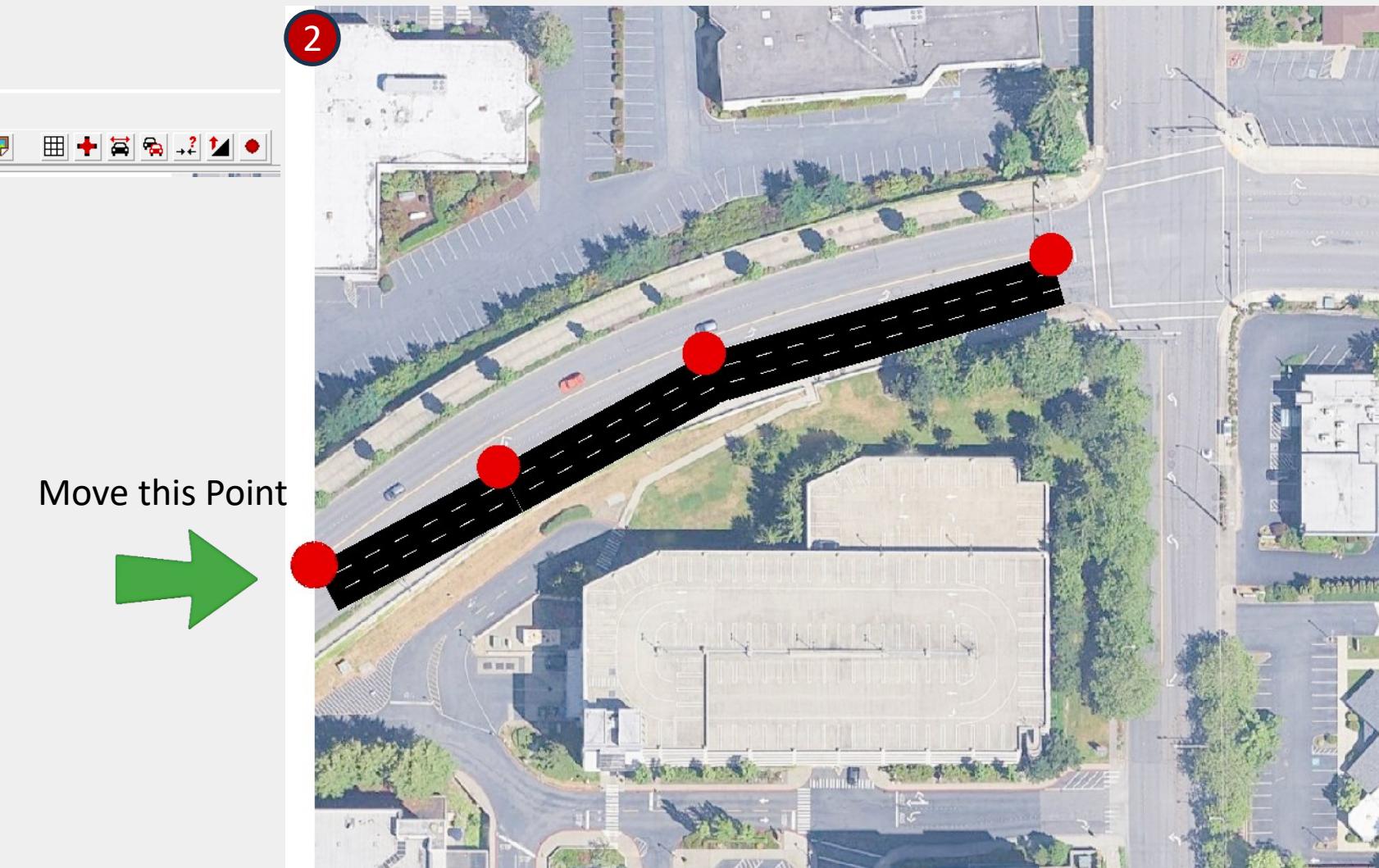
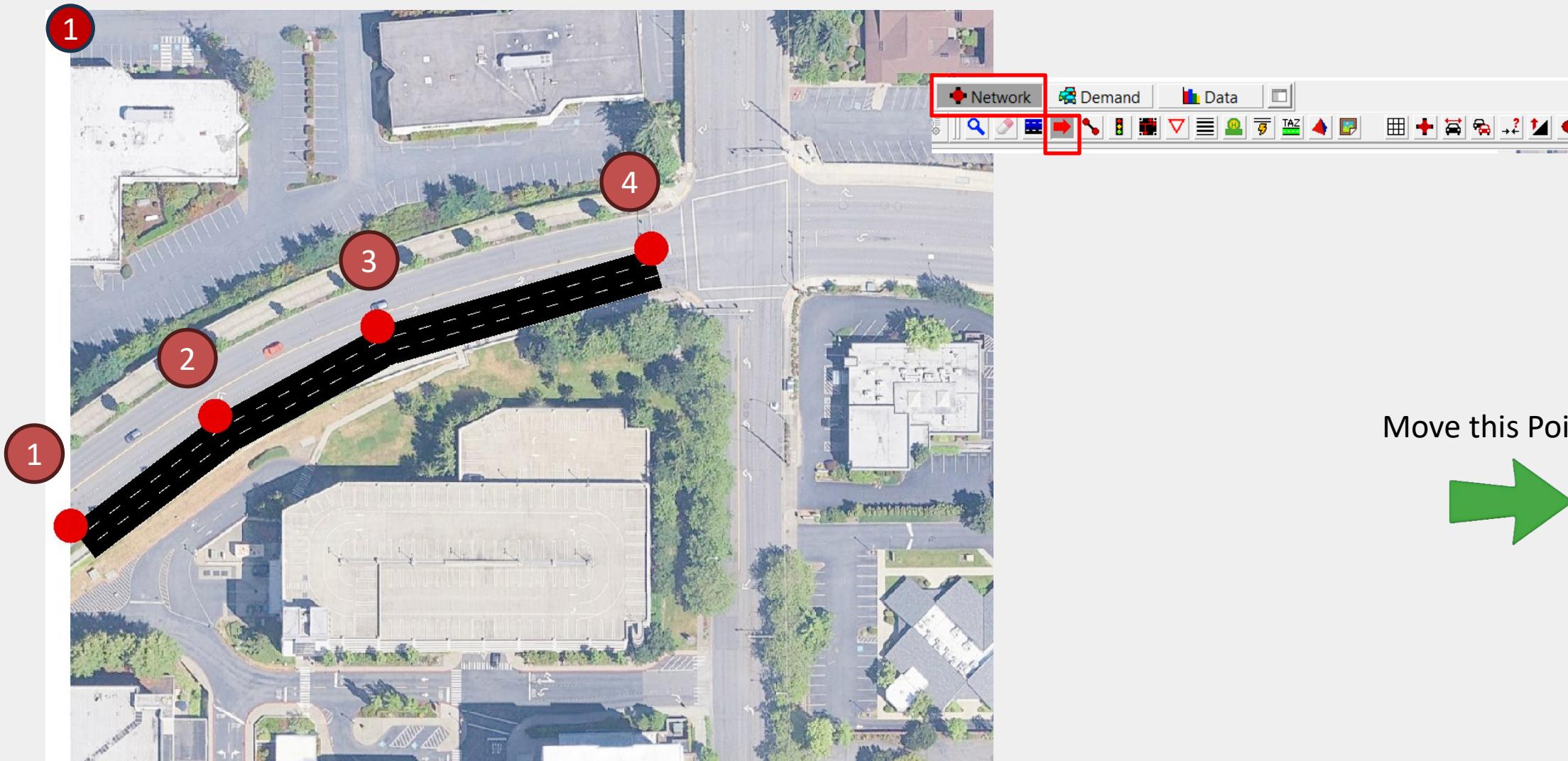
✓ Remove the road using “Eraser” tool  and redraw it correctly



Create a Road Network on Top of a GIS Map

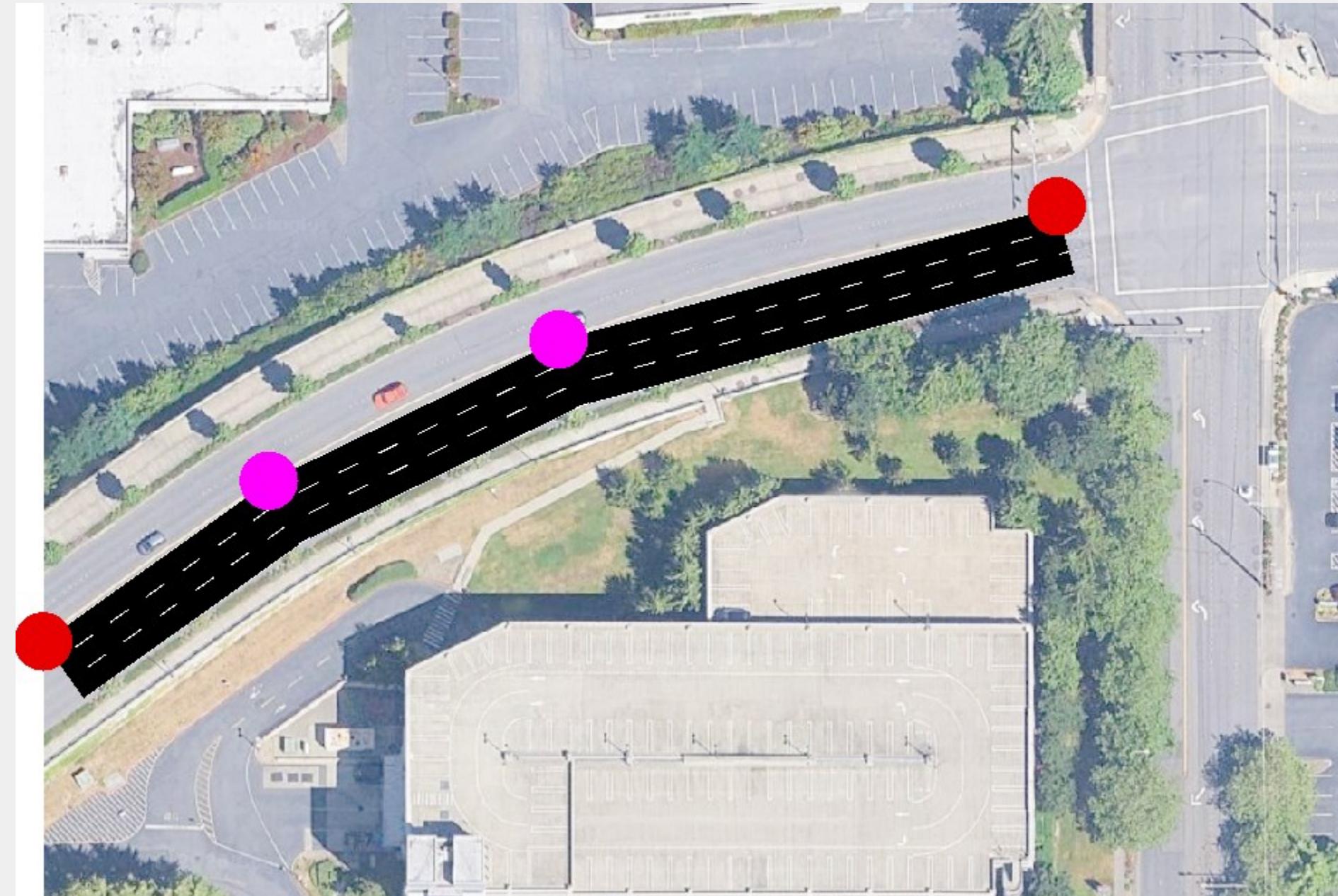
5. Using four large red points (junctions), we created the road, but it is not aligned with the real-world image.

6. Move the first point to align with the GIS basemap



Create a Road Network on Top of a GIS Map

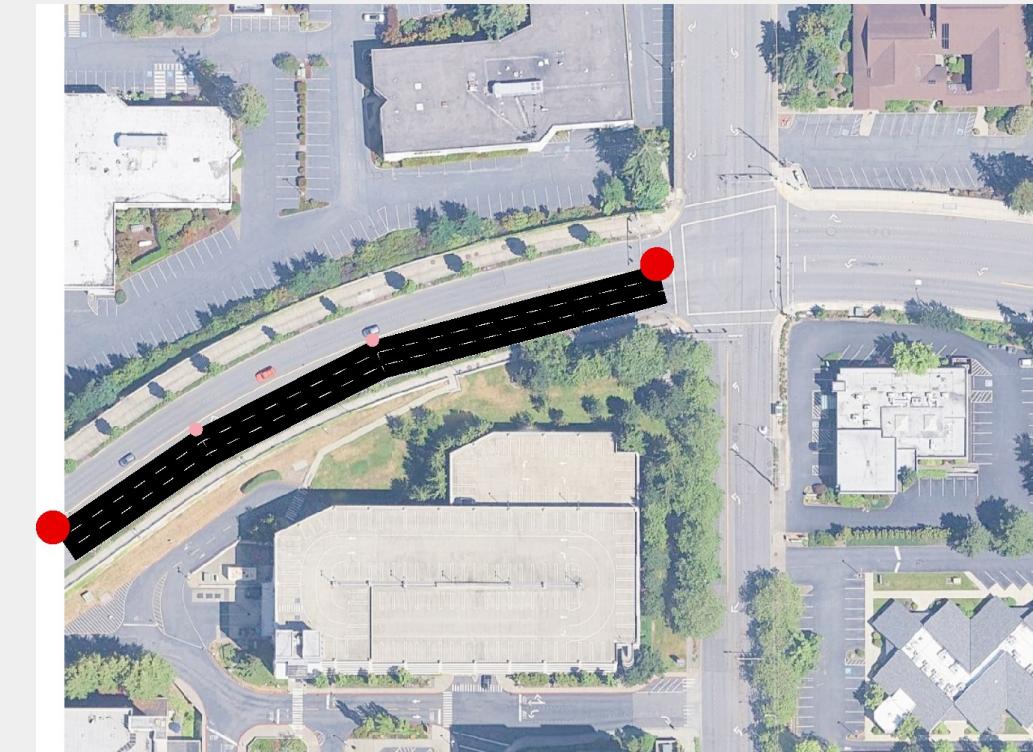
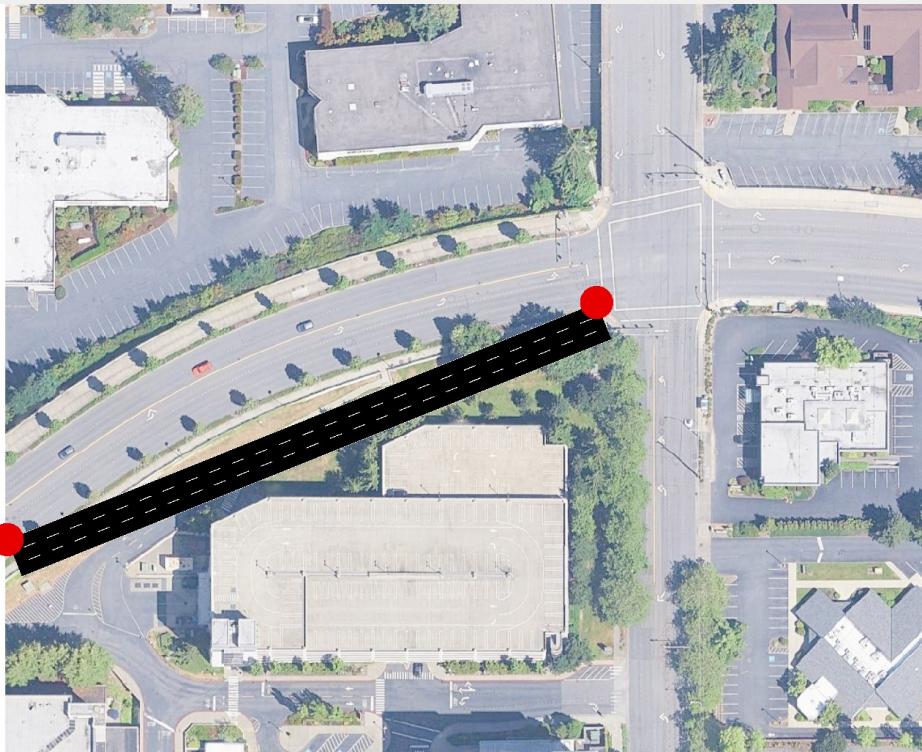
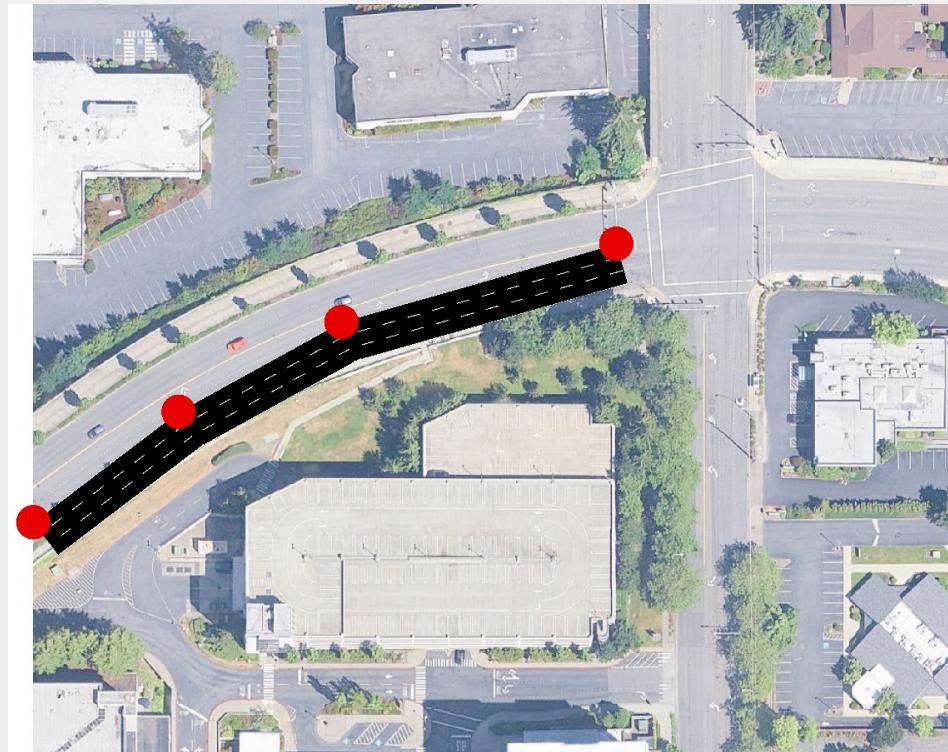
7. After moving all the points, the road is now aligned with the real-world image



Mistake

✗ We used four redundant junctions (large red points) to create the road curve.

✓ 8. Do not create redundant junctions (large red points). Instead, create a straight road, then use the Move tool and add small red points to curve the road.

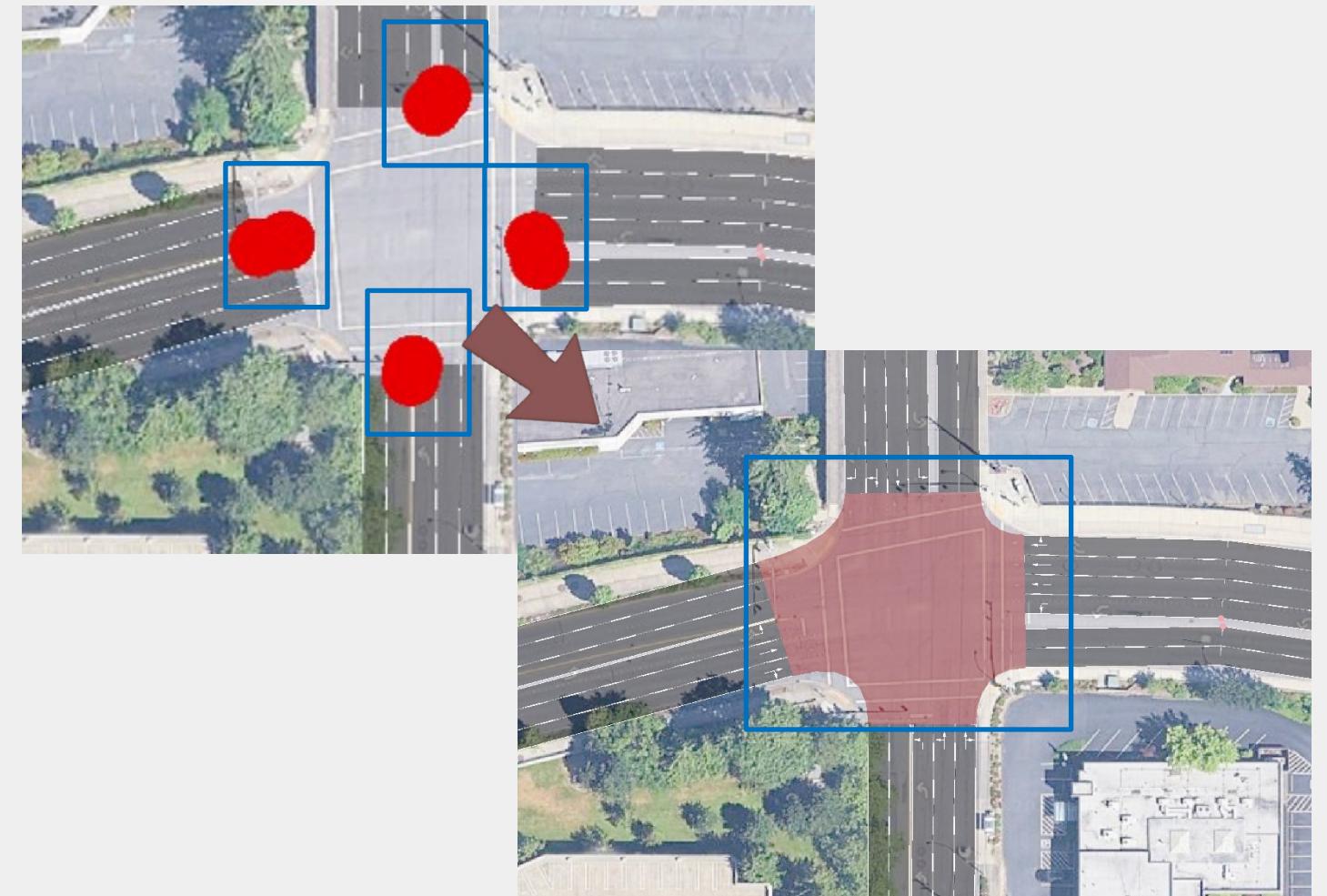
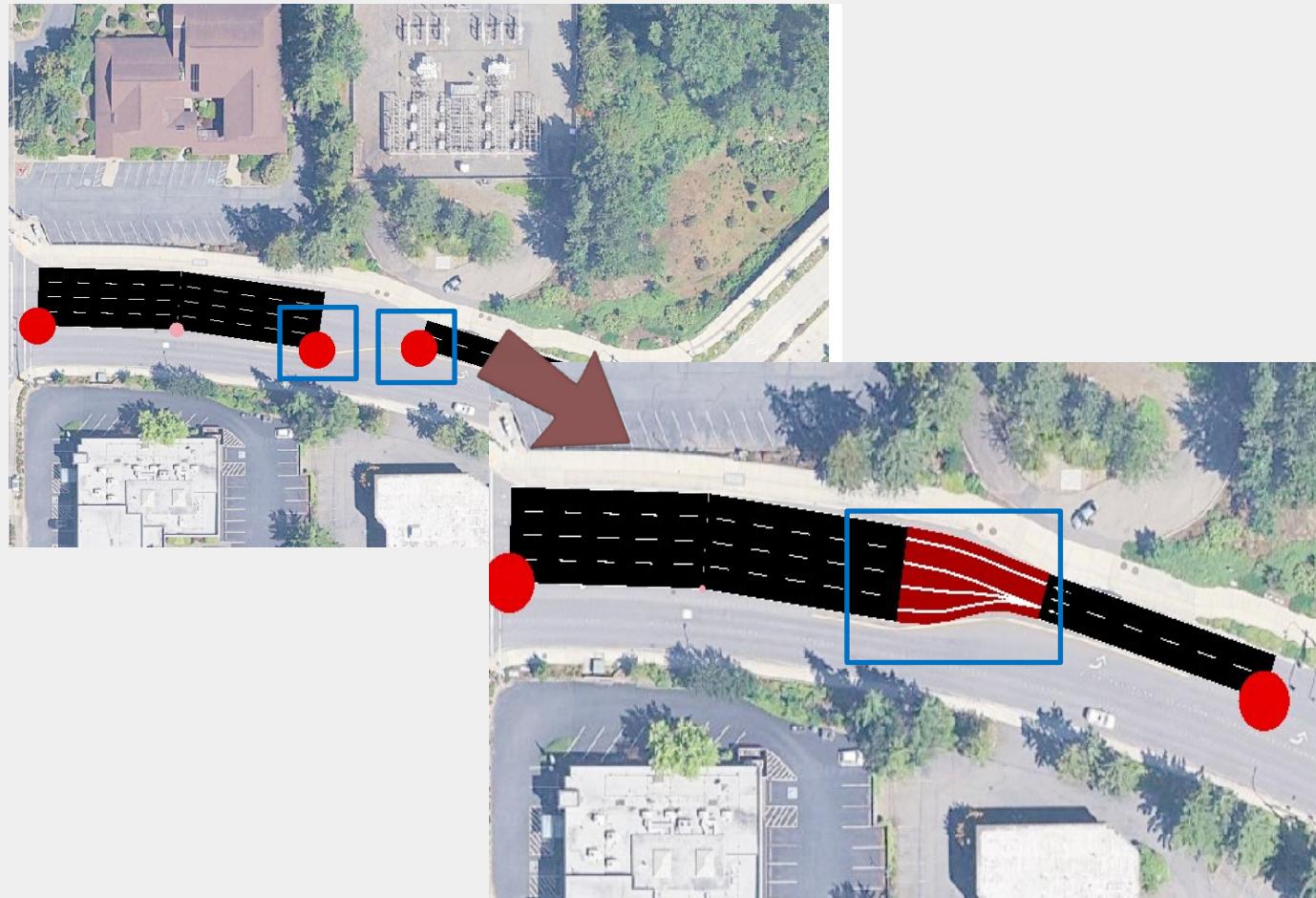


Large Red Points (Junction points)

9. Junction points (large red points) are used for:

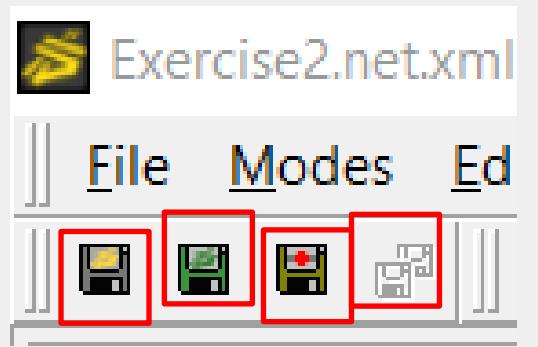
- Lane Transition Junctions
- Intersection Junctions

10. We will cover these two examples in the following slides.

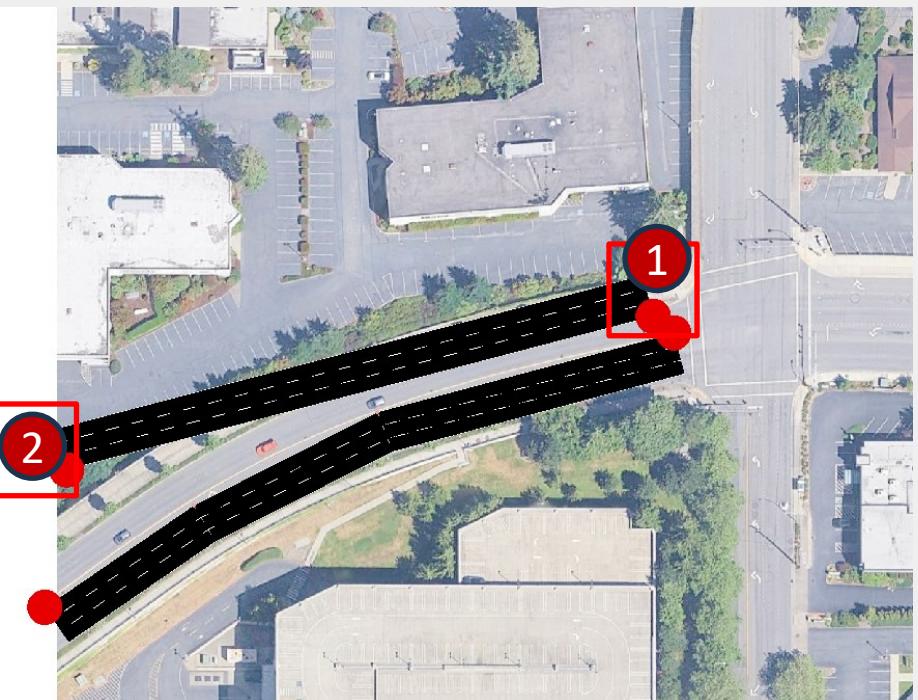


Create a Road Network on Top of a GIS Map

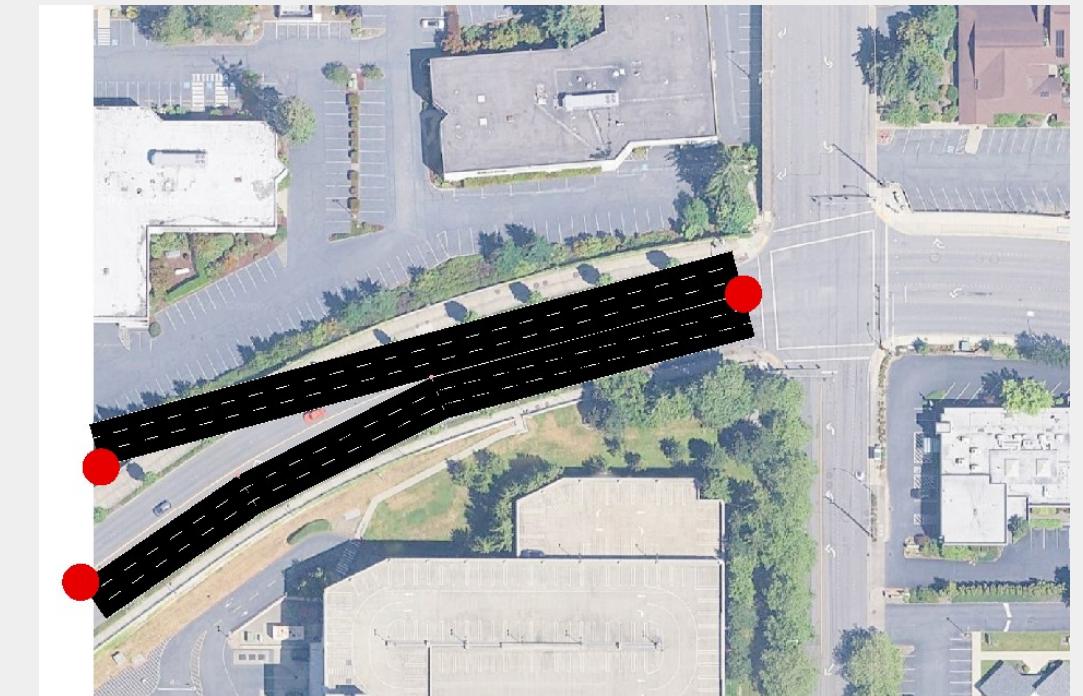
11. Remember to save your network files using these buttons.



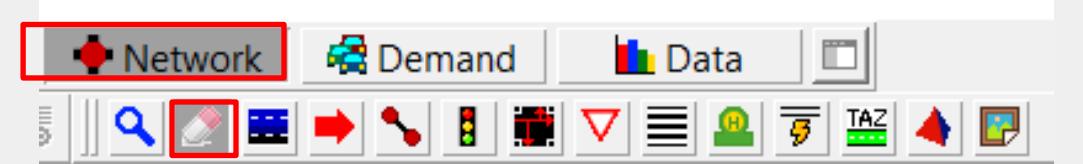
12. Create the other side of the road by clicking points 1 and 2 in the direction of traffic.



13. The drawing below is wrong.



14. You can remove elements using the “Eraser” tool.

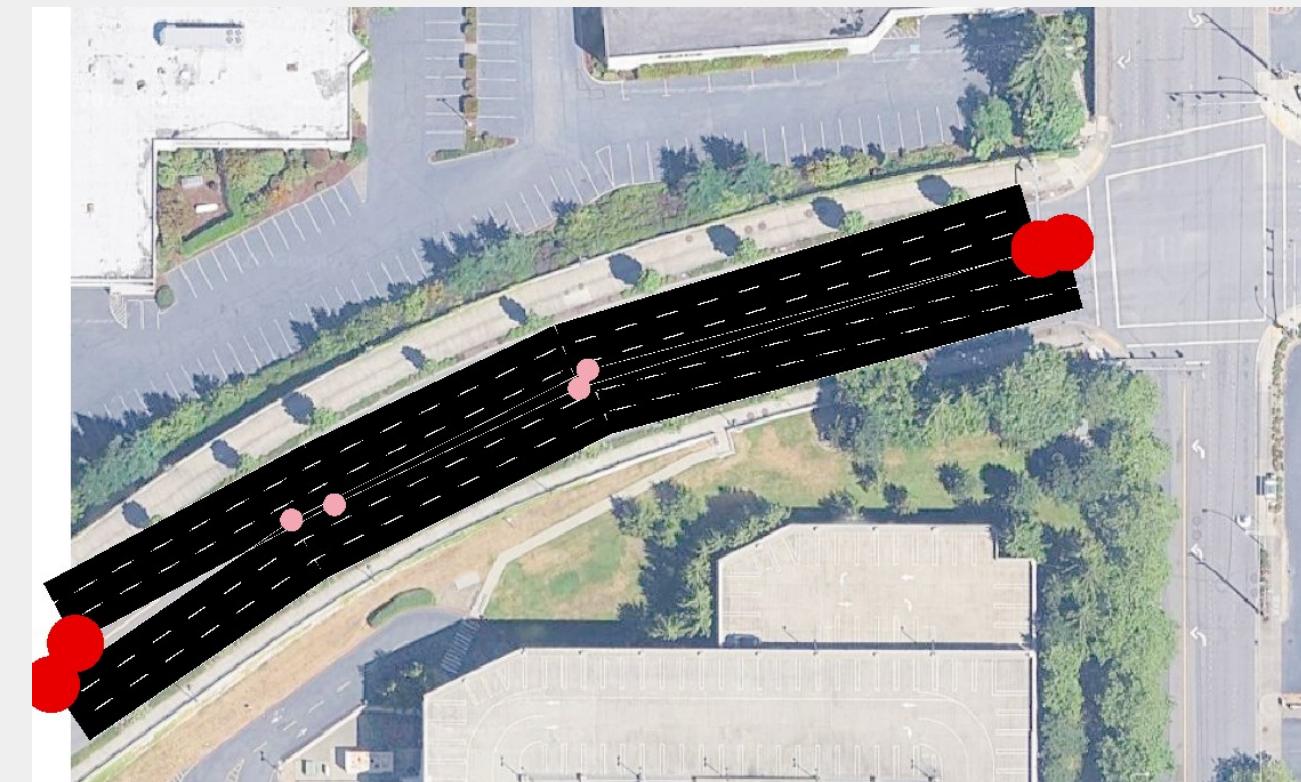


Create a Road Network on Top of a GIS Map

15. Use the Move tool to align the road with the GIS map.

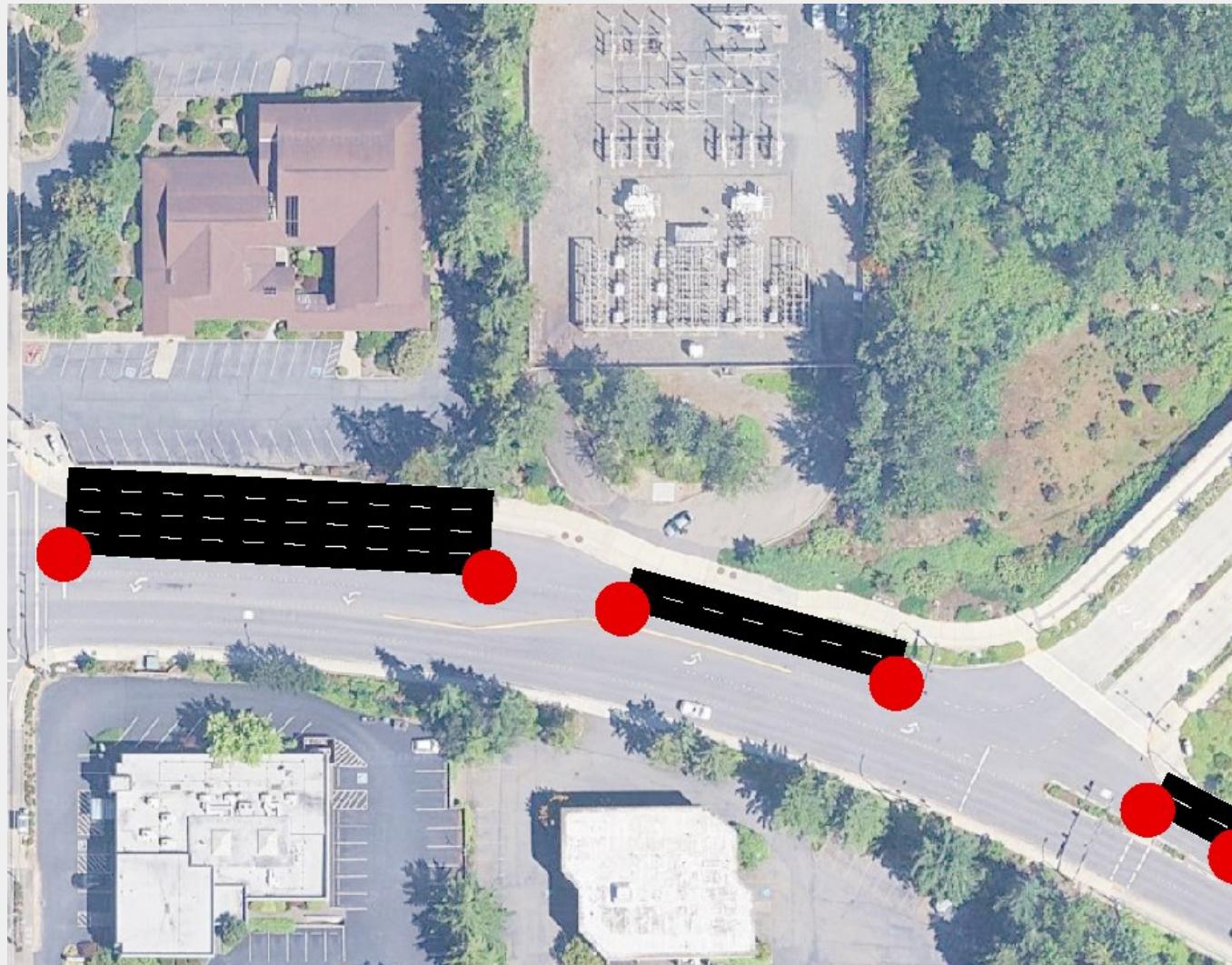


16. Avoid overlapping road segments. (Wrong example)

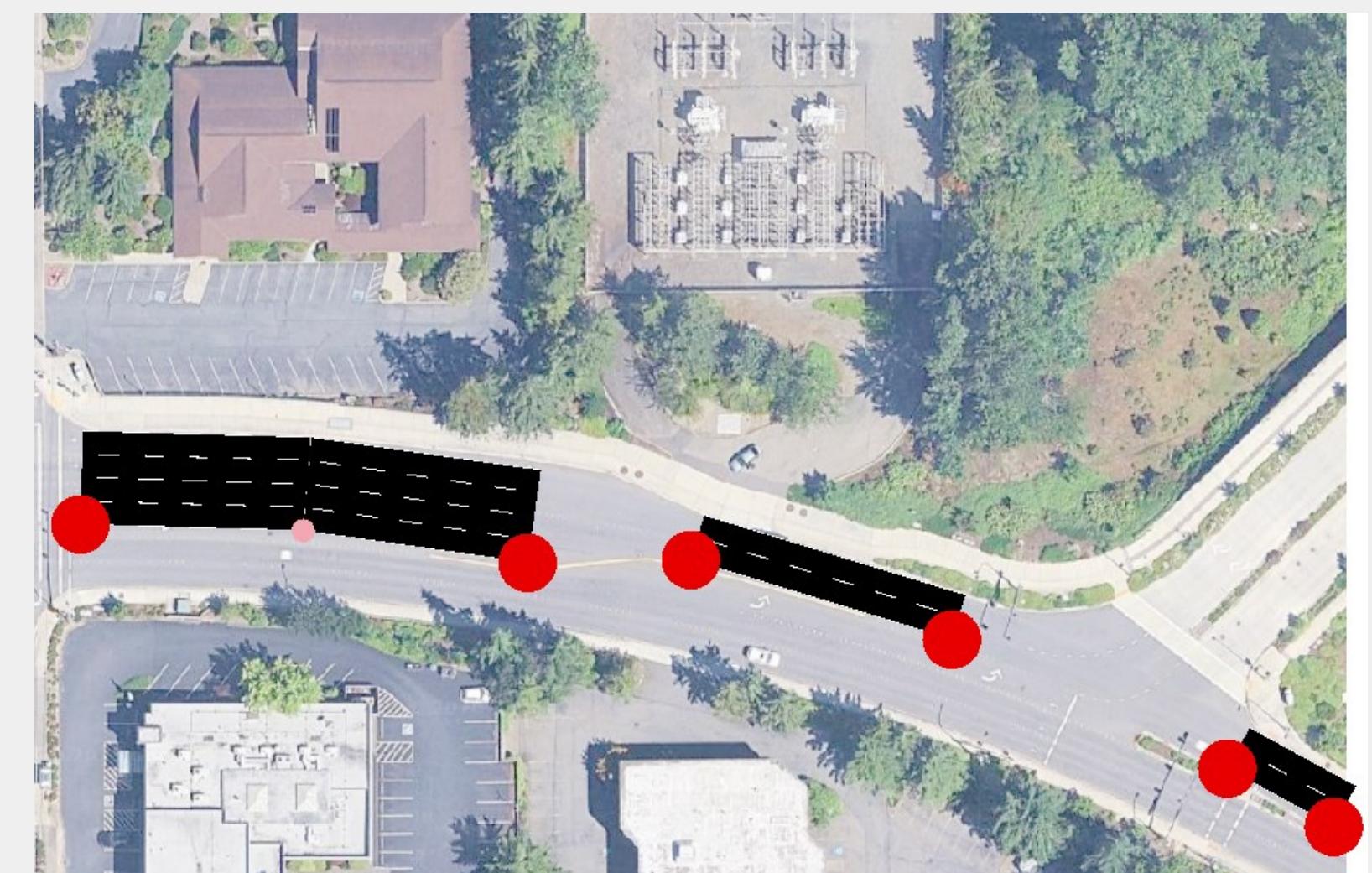


Create a Road Network on Top of a GIS Map

17. Draw the road network for the westbound approach.

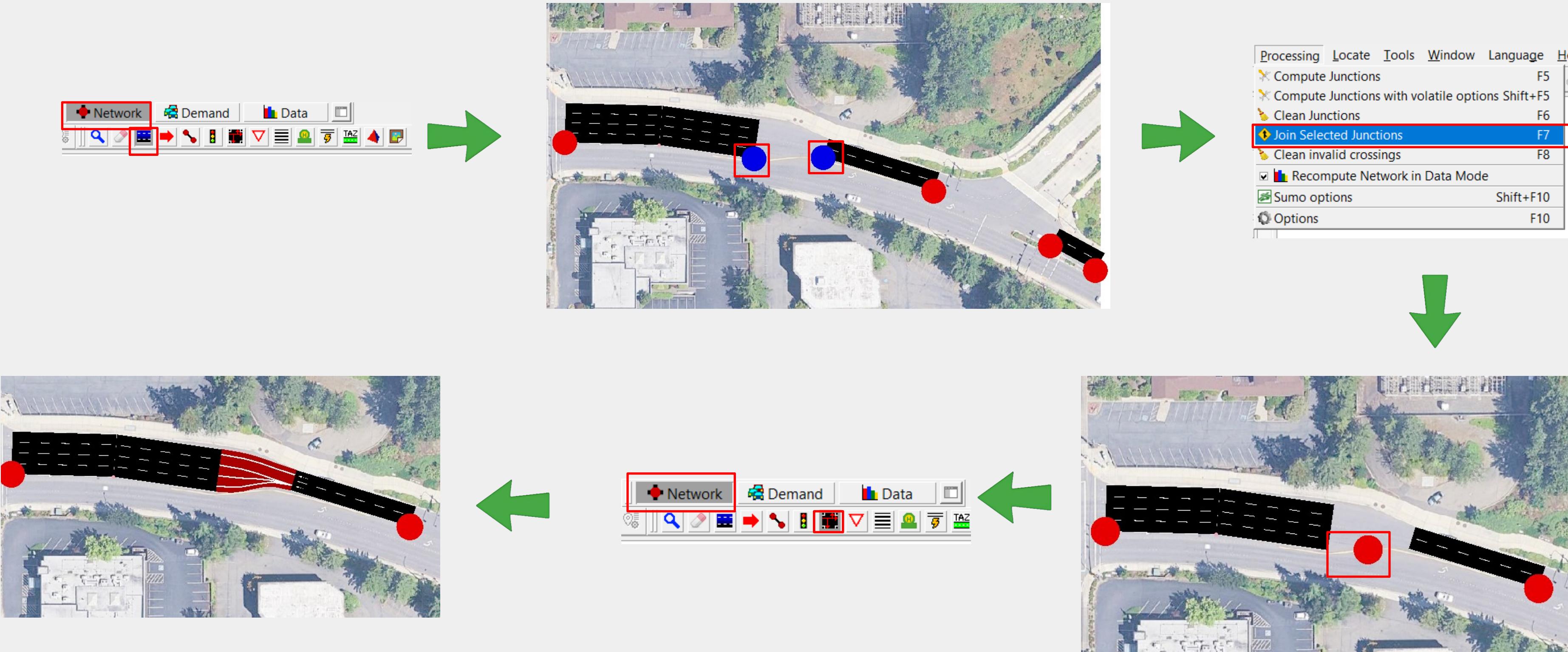


18. Adjust the road to match the GIS map.



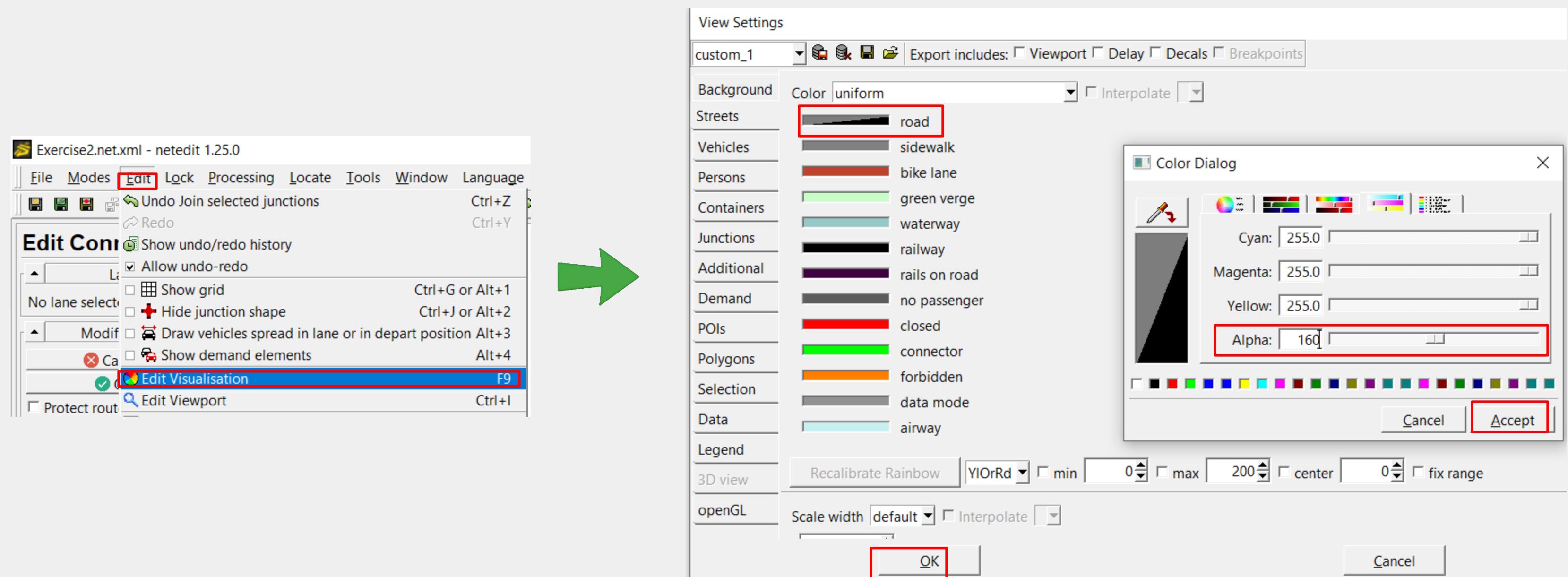
Create a Road Network on Top of a GIS Map

19. Join two junctions to transition from 2 lanes to 3 lanes.



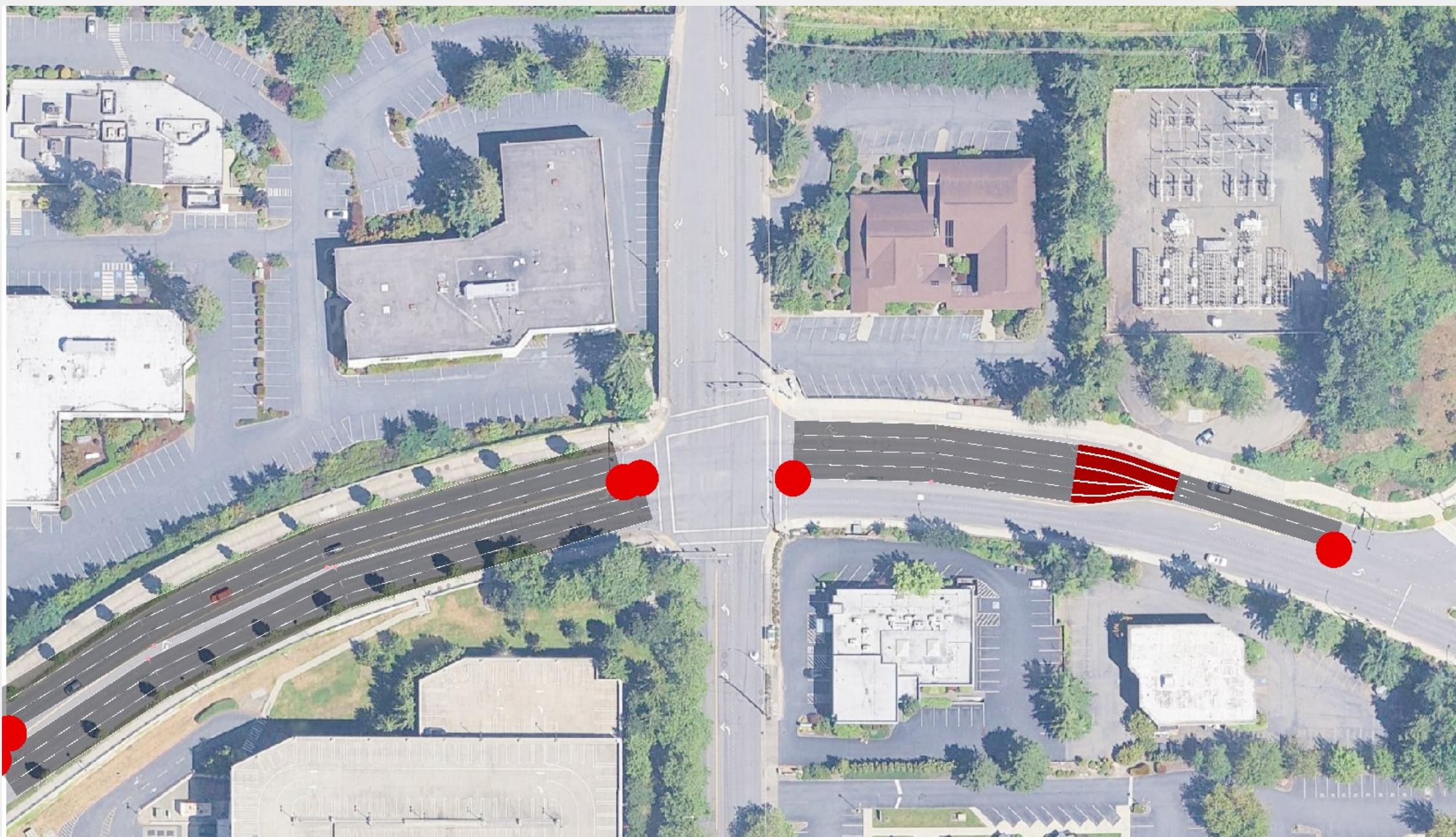
Create a Road Network on Top of a GIS Map

20. Adjust the road transparency so the GIS map remains visible.



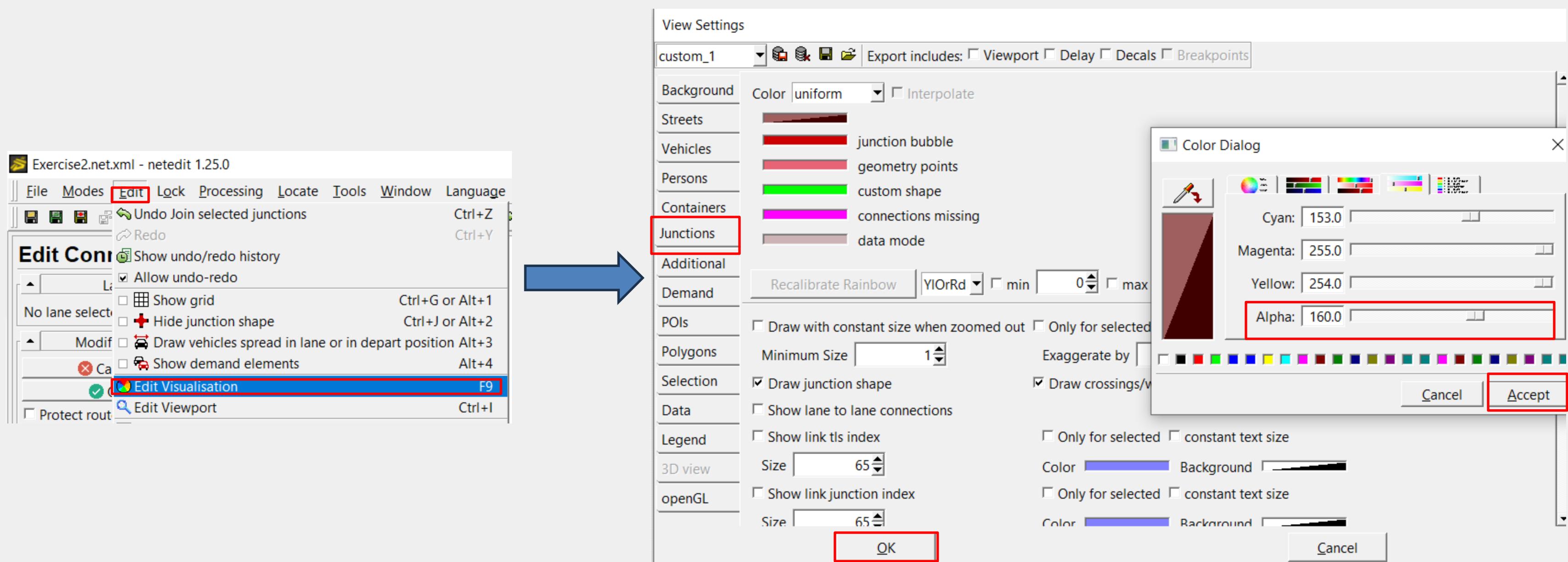
Create a Road Network on Top of a GIS Map

21. Step 20: Output



Create a Road Network on Top of a GIS Map

22. Adjust the junction transparency so the GIS map remains visible.



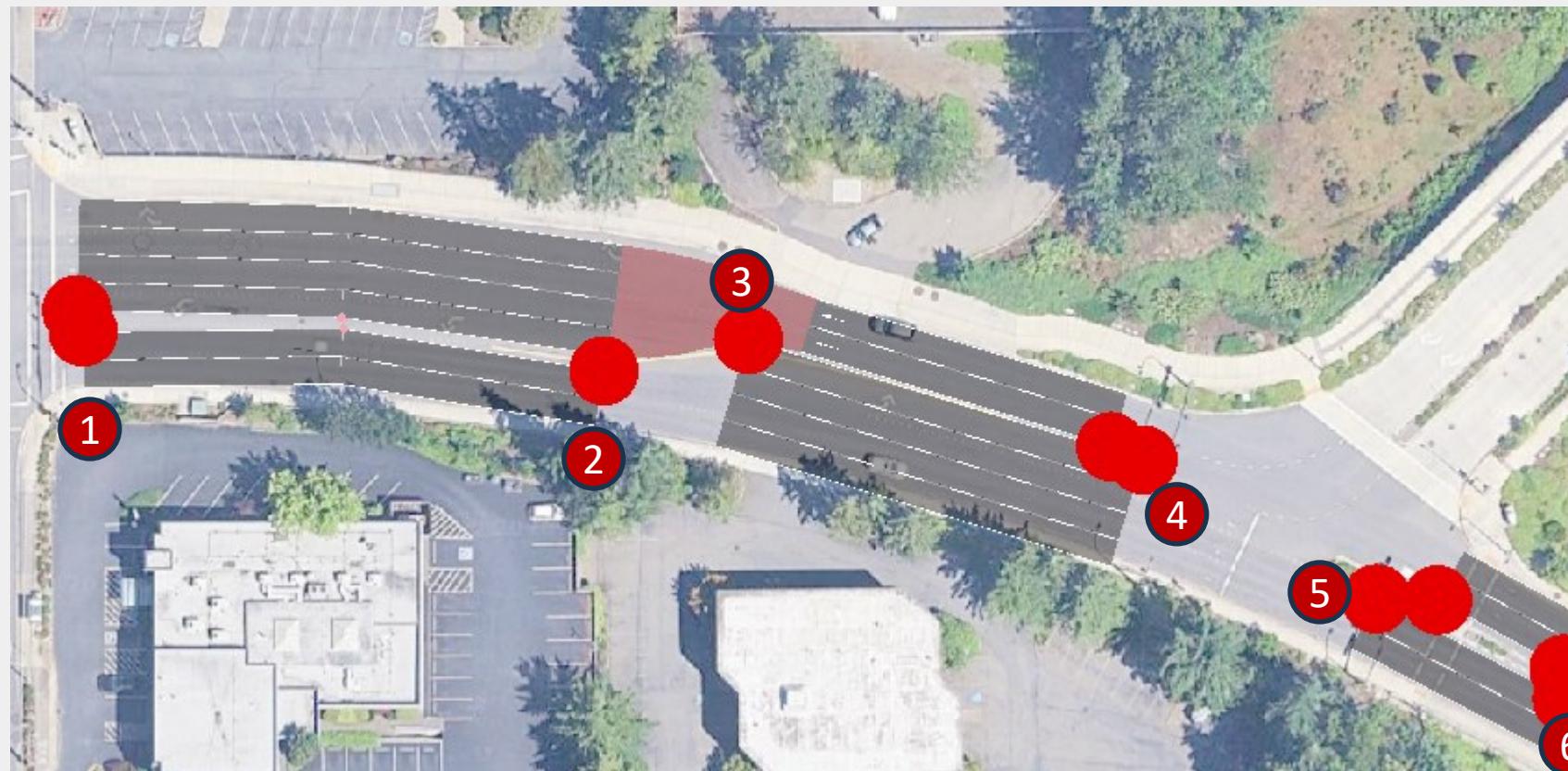
Create a Road Network on Top of a GIS Map

23. Step 22: Output



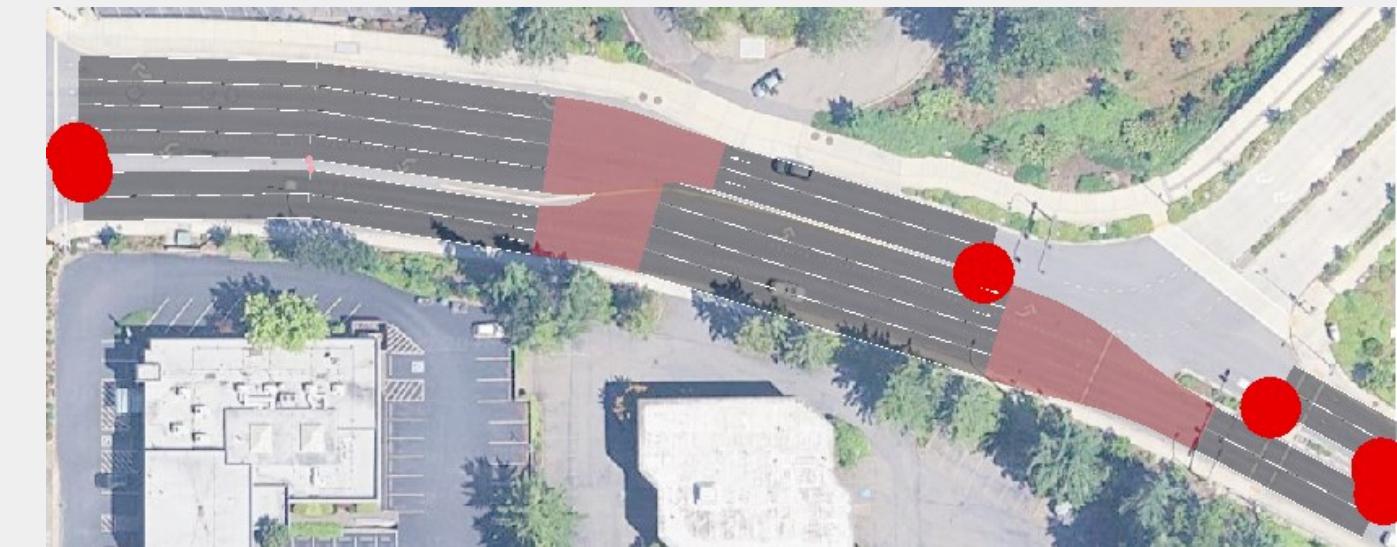
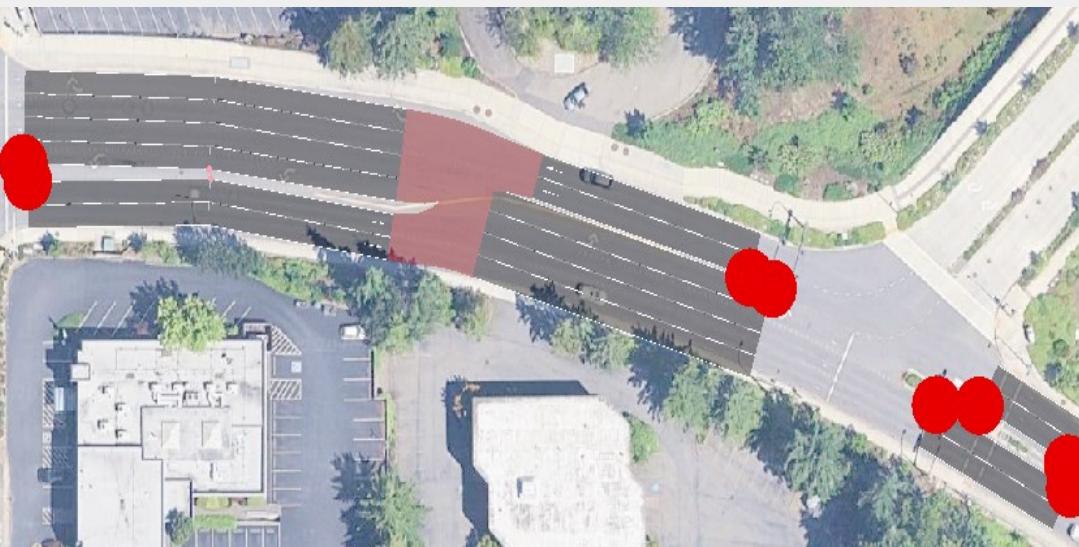
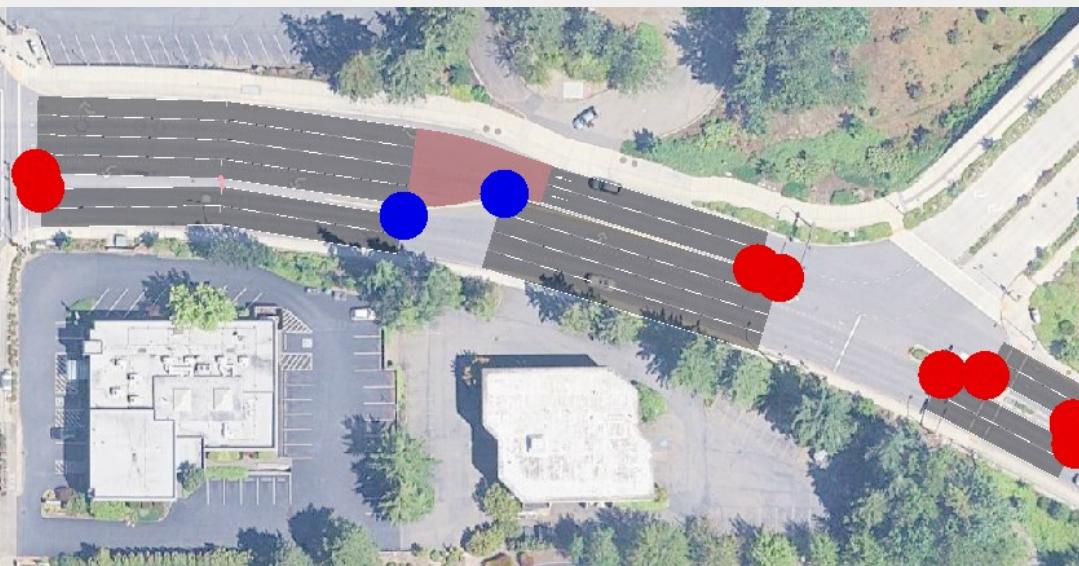
Create a Road Network on Top of a GIS Map

24. Start creating the other side of the road by clicking points 1–6 in the direction of traffic.



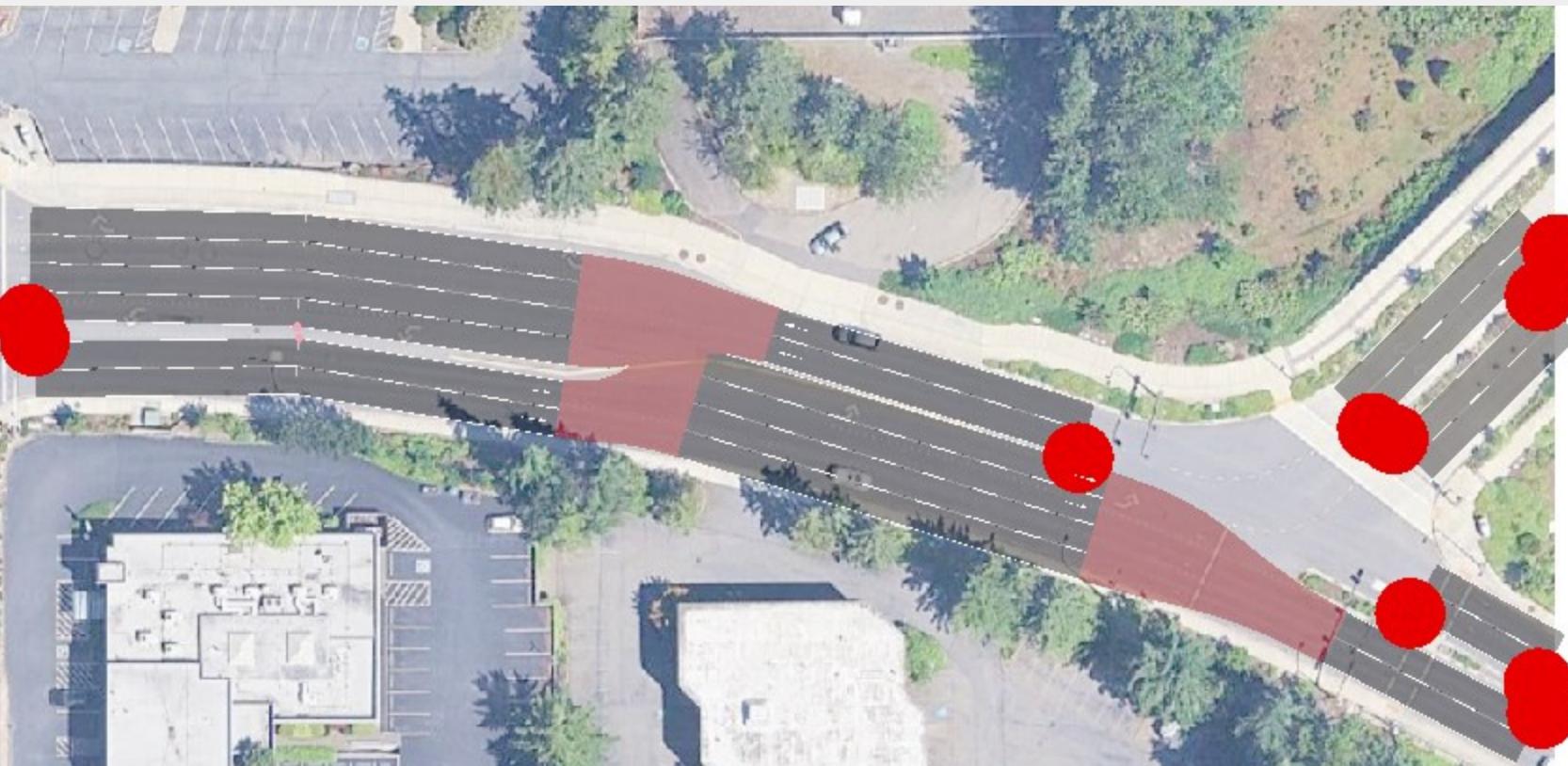
Create a Road Network on Top of a GIS Map

- Create “Lane Transition Junctions”



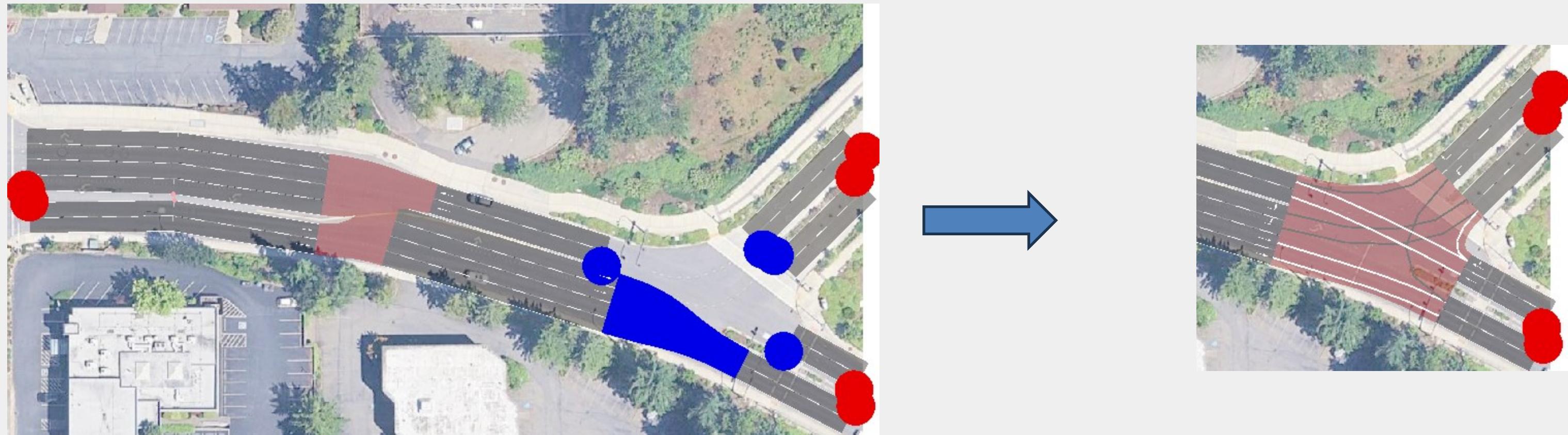
Create a Road Network on Top of a GIS Map

25. Create the other roads as shown below.



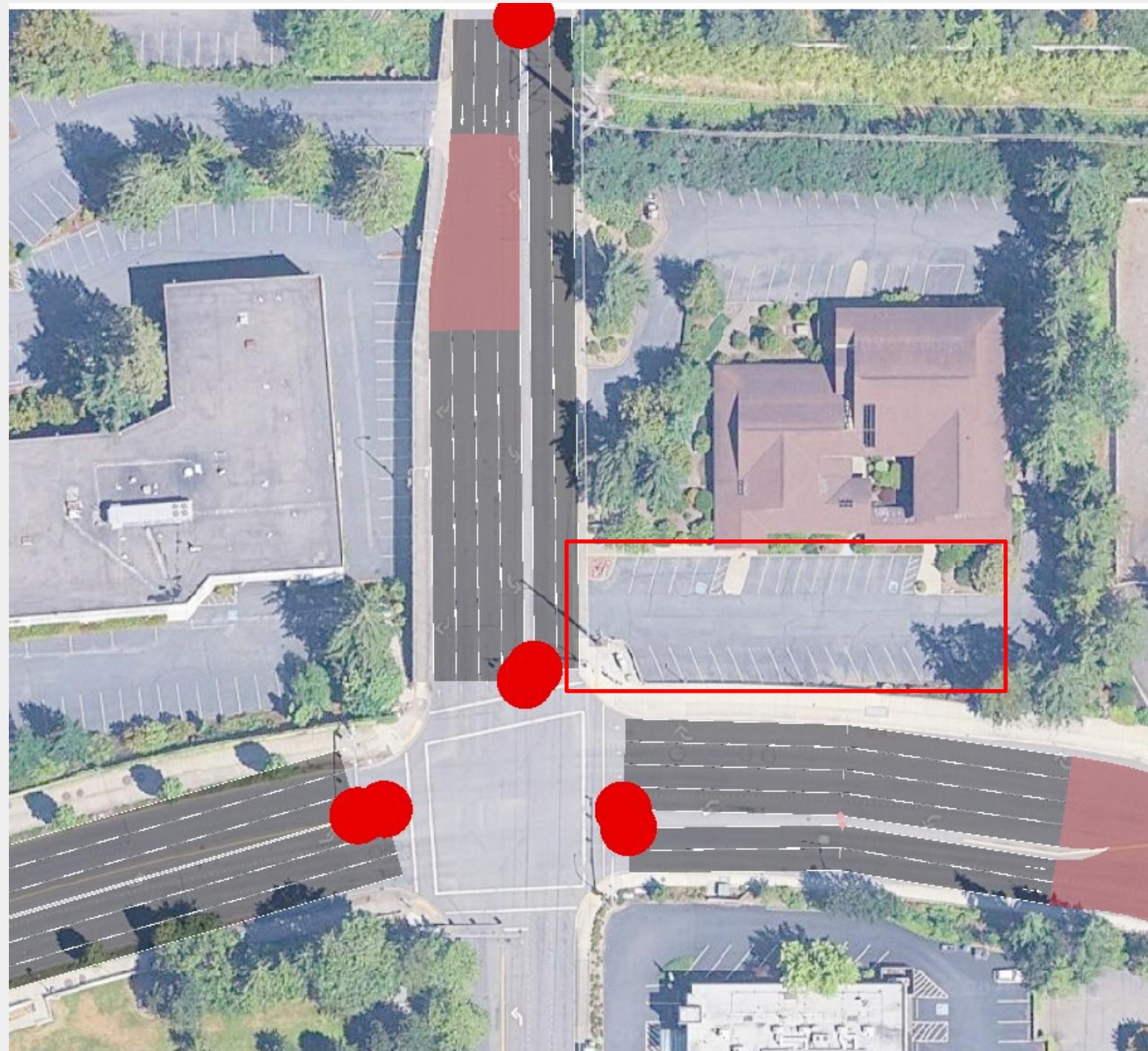
Create a Road Network on Top of a GIS Map

- Create an “Intersection Junction”



Create a Road Network on Top of a GIS Map

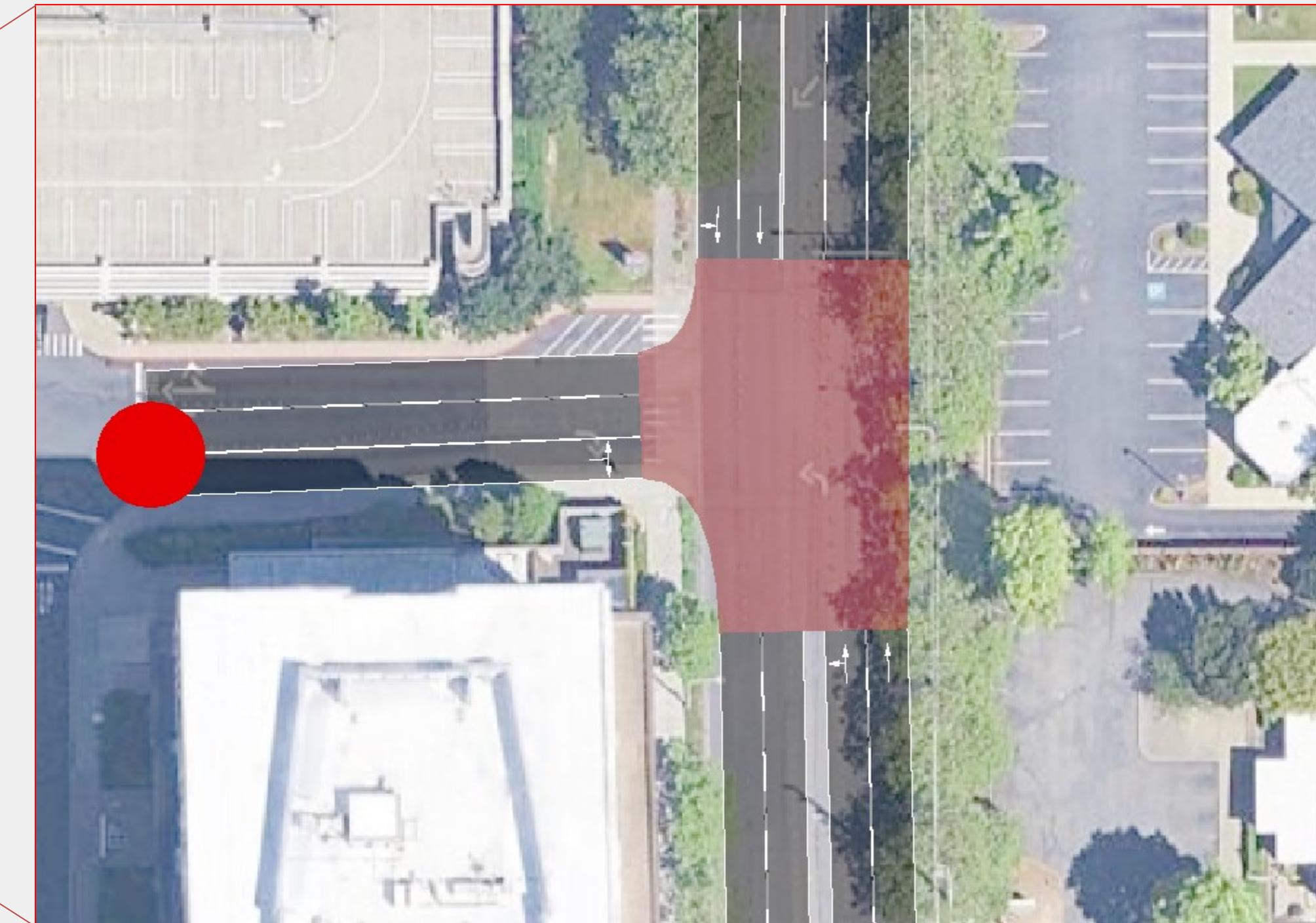
26. Create the road network in the Southbound direction



Parking lot/driveway can be omitted due to low access volumes.
Include them for a parking study.

Create a Road Network on Top of a GIS Map

- Create an “Intersection Junction”



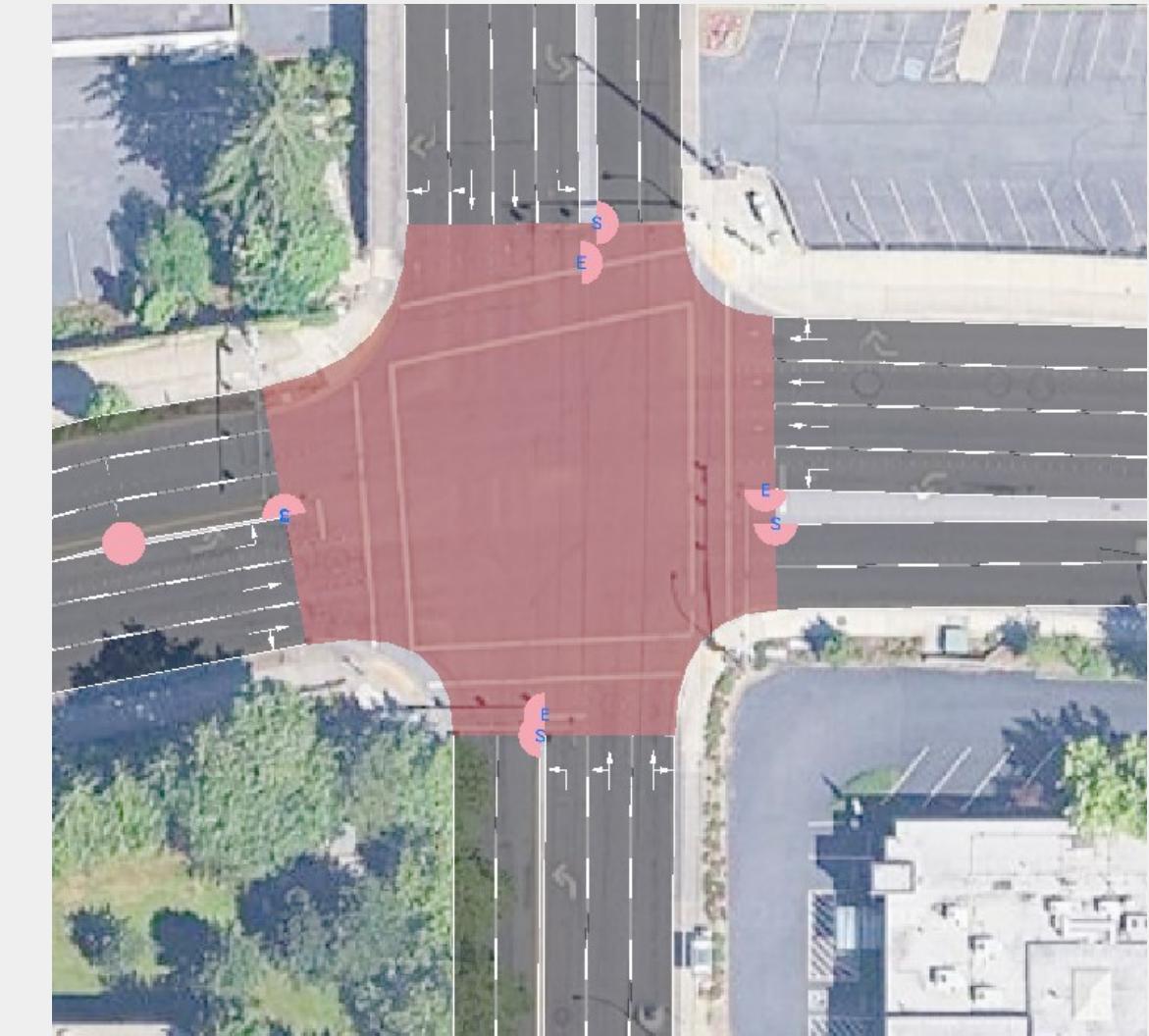
Create a Road Network on Top of a GIS Map

- Create an “Intersection Junction”



Create a Road Network on Top of a GIS Map

- Use the Move Tool to adjust the small points near the intersection.



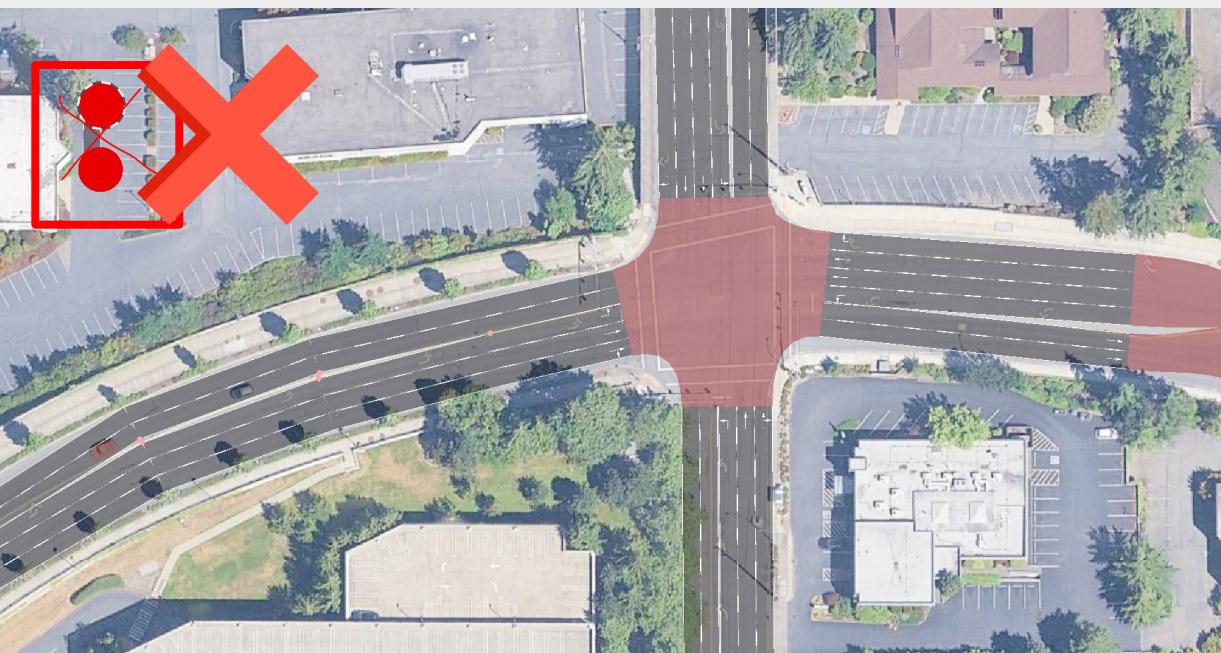
Traffic Signal

- Select Junction
- Change the ID to “J1”



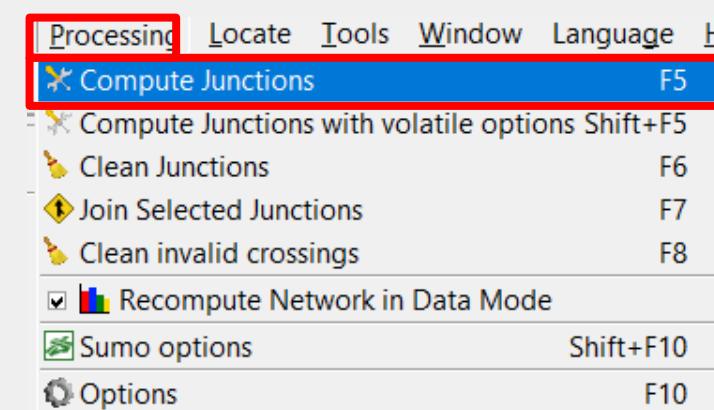
Net: junction	
Internal attributes	
id	J1
pos	-16.02,60.58
type	affic_light
shape	4 -1.38,73.63
radius	default
keepClear	<input checked="" type="checkbox"/> true
rightOfWay	default
fringe	default
name	
tlType	static
tlLayout	default
tl	J33_#4more
isRoundabout	<input type="checkbox"/> false
Parameters	

- If you get an error because J1 already exists, remove the dummy junctions/roads using the Eraser tool.



Create a Road Network on Top of a GIS Map

- The westbound road after the intersection has two lanes, not three.



Create a Road Network on Top of a GIS Map

- Always save the network files using these buttons.

