

RWR 4015

Traffic Simulation for Planning Applications

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Week 5 | Hands-on:
Demand Modelling and
Route Assignment

Fall 2026

RoadwayVR



Agenda

□ Demand Modelling and Route Assignment

1. Road Network Development

2. Traffic Signal Timing

Provided

3. Traffic Movement

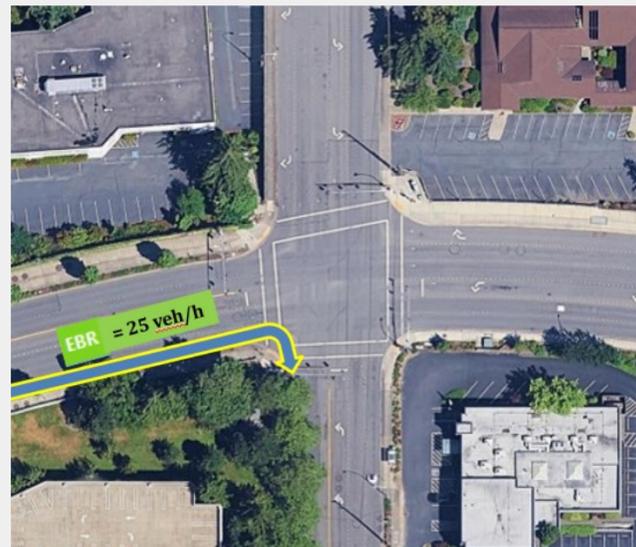
4. Traffic Volume

5. Traffic Speed

This Session

Traffic Movement & Volume Calibration

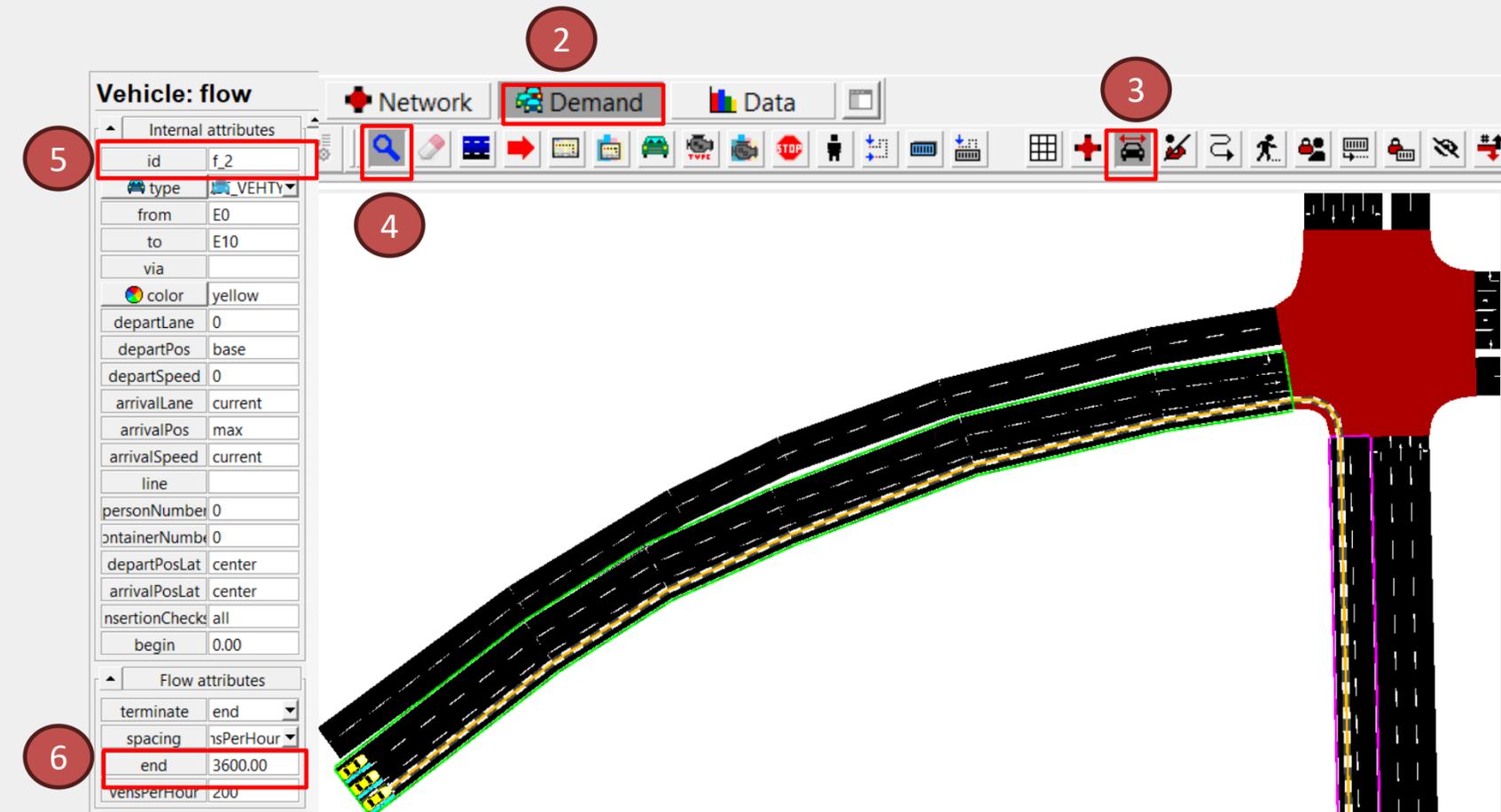
□ Download Exercise 1 Response



Traffic Movement & Volume Calibration

Task: We need to assign each observed traffic movement and volume to Simulation

1. Open SUMODT.netecfg
2. On top bar → Select Demand,
3. Select “Vehicles Spread ..”
4. Select Magnifier
5. Start from Eastbound → Select The right most lane Car
6. In the left side, read flow id and volume per hour



Quiz

Q: *What is the traffic flow for f_2 , if it is defined as **200 (veh/h)**? Select the most proper response.*

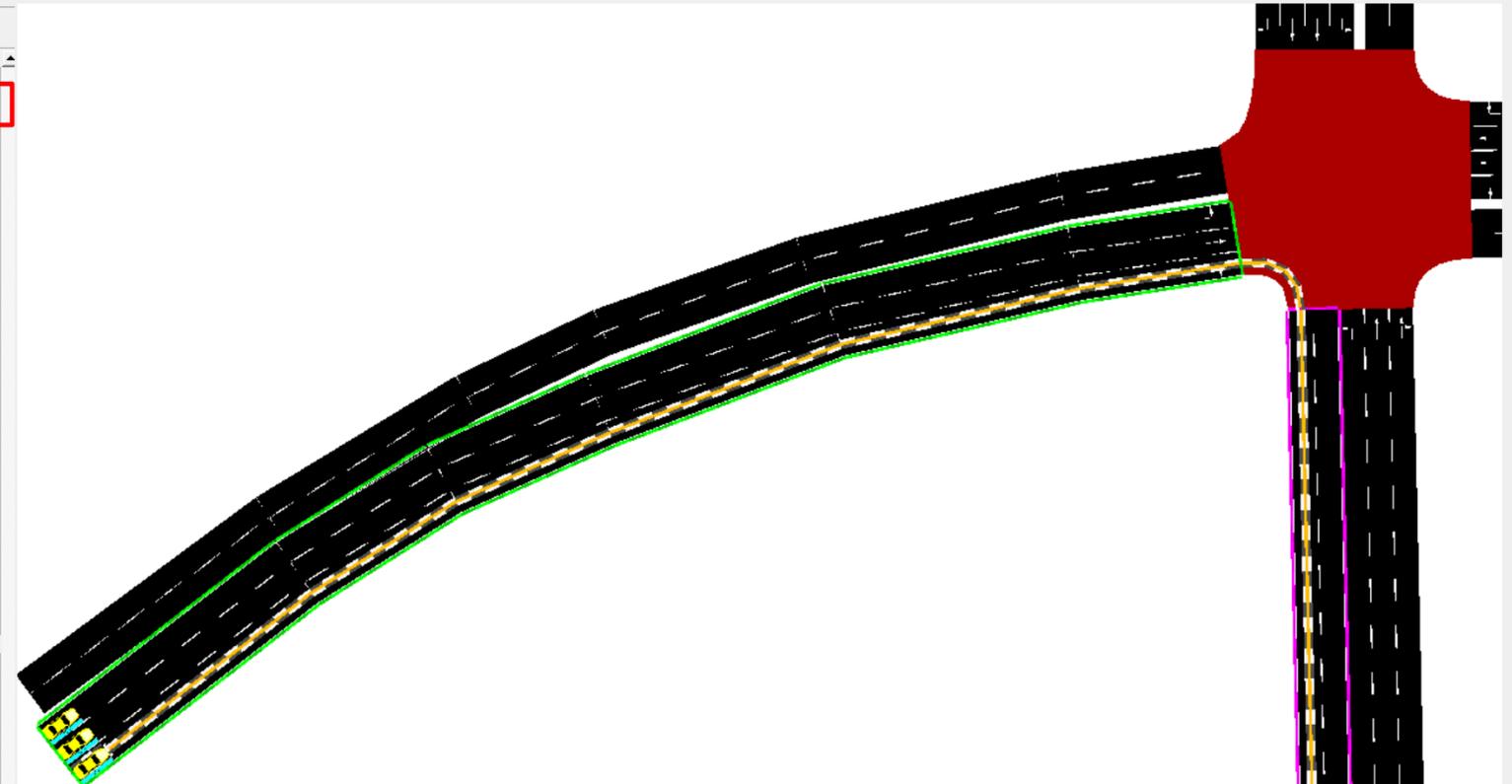
- A) It generates **exactly 200 vehicles every hour**, no more no less.
- B) It generates **200 vehicles randomly in each hour**, meaning the model tries to average 200 but the exact count can vary.
- C) It generates **200 vehicles each minute** (so 12,000 vehicles per hour).
- D) It generates **200 vehicles total for the whole simulation**, regardless of simulation duration.

Traffic Movement and Volume Calibration

7. Read from real-world image in slide and modify the traffic volume in NetEdit



Vehicle: flow	
Internal attributes	
id	f_2
type	VEHTY
from	E0
to	E10
via	
color	yellow
departLane	0
departPos	base
departSpeed	0
arrivalLane	current
arrivalPos	max
arrivalSpeed	current
line	
personNumber	0
containerNumber	0
departPosLat	center
arrivalPosLat	center
insertionCheck	all
begin	0.00
Flow attributes	
terminate	end
spacing	vehPerHour
end	3600.00
vehsPerHour	???



Traffic Movement and Volume Calibration

8. Make Sure you → Select Demand, → Select “Vehicles Spread ..” → Select Magnifier

The image shows a workflow for assigning traffic volume in a simulation. It starts with an aerial photograph of a road intersection. A yellow arrow points to a specific lane, with a green box containing the text "WBR = 25 vehicles per 15Min". A blue arrow points from this box to a software interface. The software interface has a top toolbar with tabs for "Network", "Demand", and "Data". The "Demand" tab is selected and highlighted with a red box. Below the toolbar is a road network diagram with a red highlighted area. To the left of the diagram is a "Vehicle: flow" panel with a table of attributes. The "id" attribute is highlighted with a red box and contains the value "f_11". Below the "Flow attributes" section, the "vehPerHour" field has a red question mark next to it. A blue arrow points from the question mark to three question marks "???" below it.

Internal attributes	
id	f_11
type	VEHTY
from	E1
to	E9
via	
color	yellow
departLane	first
departPos	base
departSpeed	0
arrivalLane	current
arrivalPos	max
arrivalSpeed	current
line	
personNumber	0
containerNumber	0
departPosLat	center
arrivalPosLat	center
insertionCheck	all
begin	0.00

Flow attributes	
terminate	end
spacing	vsPerHour
end	3600.00
vehPerHour	???

9. Follow the same process for assigning real-world traffic volume to other simulated traffic volume

Deliverables

- Follow the same process for assigning real-world traffic volume to other simulated traffic volume
- Submit the file

Traffic Volume Calibration using GEH

Download Exercise 3 Response

Download Required Materials

Traffic Volume Calibration using GEH

Question: Can we calculate GEH using traffic volume and movement in real-world images and simulation in previous slides?

GEH Formula:
$$GEH = \sqrt{\frac{2(M - C)}{M + C}}$$

$M = \text{Simulated Traffic Volume (veh/h)}$

$C = \text{Observed Traffic Volume (veh/h)}$

Interpretation:

$GEH < 5$ *Good match*

$5 \leq GEH < 10$ *Needs investigation*

$10 \leq GEH$ *Likely mismatch (check data, mapping, or model settings)*

Compute GEH for each traffic movement separately.

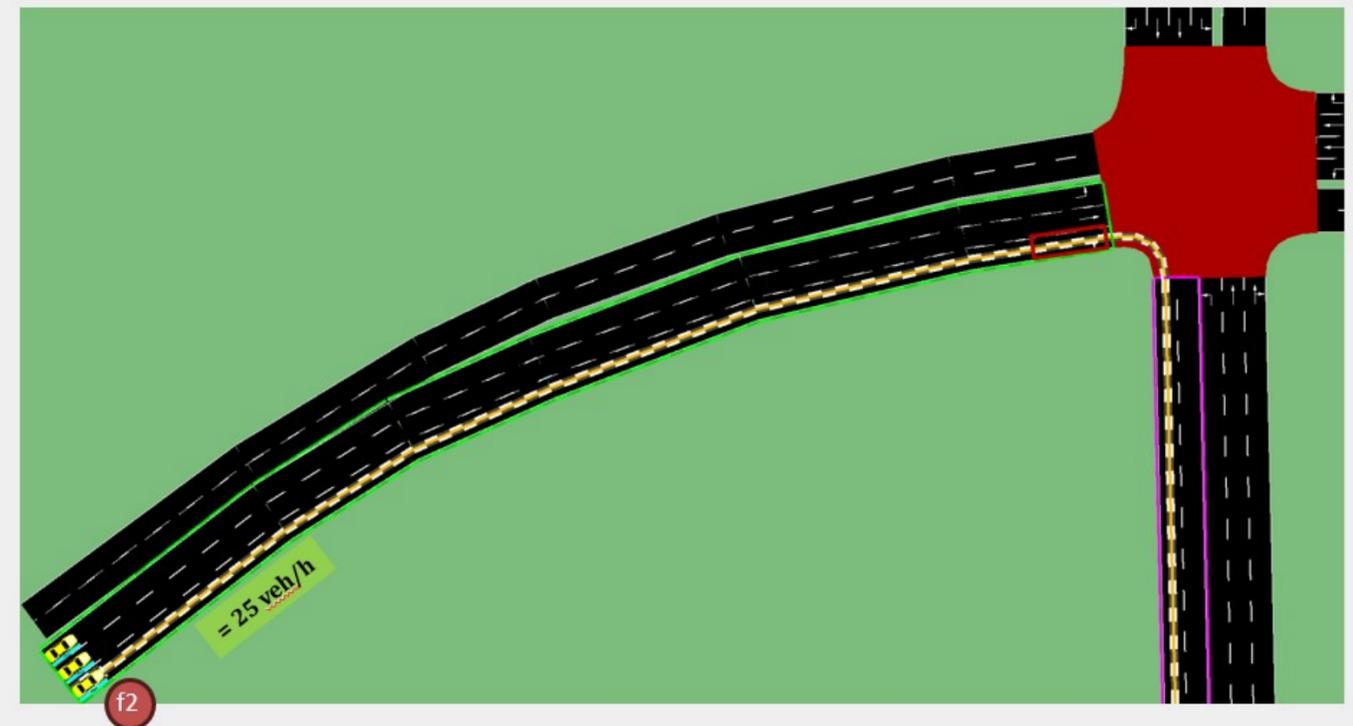
Aim for $GEH < 5$ for at least $\sim 85\%$ of traffic movements

Traffic Volume Calibration using GEH

1. We cannot calculate GEH using information in previous Slides.
2. Read Slide 9 again
3. We need to run simulation and then collect traffic volume in red box from SUMO
4. Then, calculate GEH



$$\text{EBR (25 veh/h)} = f2 \text{ (25 veh/h)}$$



Traffic Volume Calibration using GEH

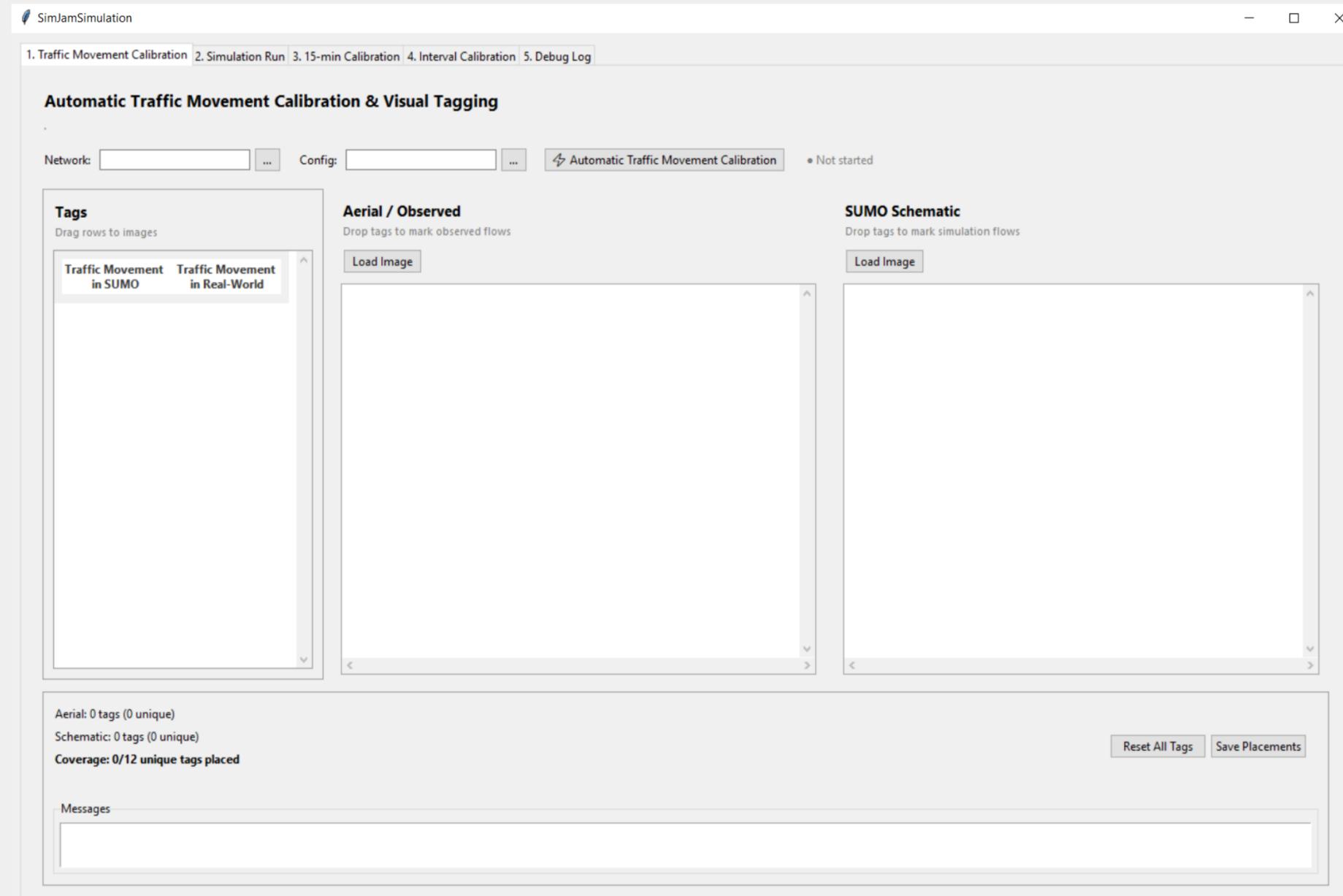
5. For this course, we created an application so it can automatically collect traffic volume from red boxes from

SUMO and calculate GEH

6. Download Required Materials

7. Open Folder "SUMODT"

8. Run SimJamSimulation application

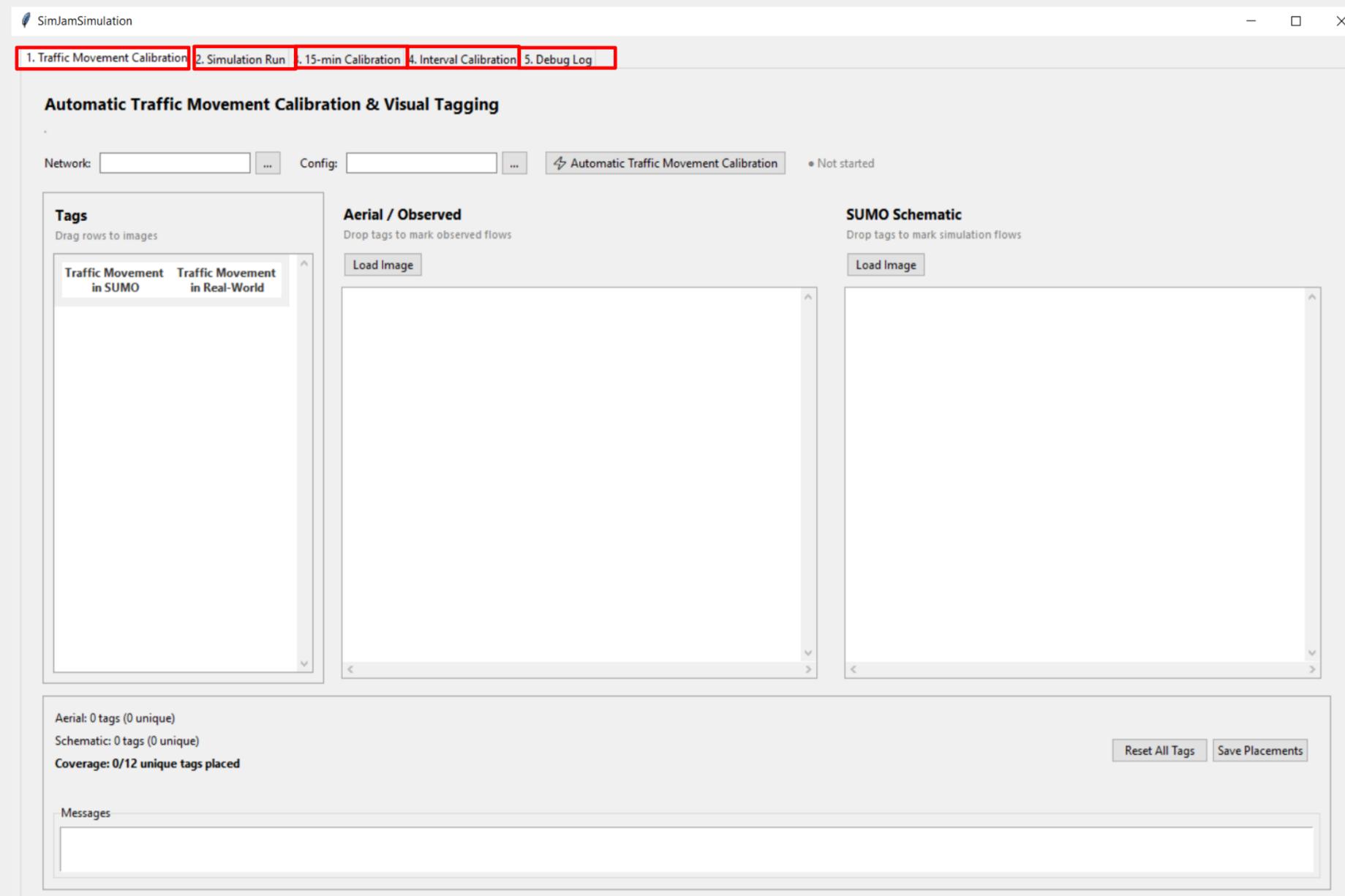


SimJamSimulation App

SimJamSimulation App

1. The SimJamSimulation app automatically perform

Traffic Movement & Volume Calibration using GEH



Traffic Movement Calibration

2. In Traffic Movement Calibration Tab → Select Sumo Network → Select Sumo Visualization Interface (.sumocfg)

→ Click Automatic “Traffic Movement Calibration”

SimJamSimulation

1. Traffic Movement Calibration 2. Simulation Run 3. 15-min Calibration 4. Interval Calibration 5. Debug Log

Automatic Traffic Movement Calibration & Visual Tagging

Network(.net.xml): ... Config (.sumocfg): ... • Not started

Tags
Drag rows to images

Traffic Movement in SUMO	Traffic Movement in Real-World
--------------------------	--------------------------------

Aerial / Observed
Drop tags to mark observed flows

SUMO Schematic
Drop tags to mark simulation flows

Aerial: 0 tags (0 unique)
Schematic: 0 tags (0 unique)
Coverage: 0/12 unique tags placed

Traffic Movement Calibration

3. Traffic Movement Calibration is automatically done

See the information in Red box.

The screenshot shows the SimJamSimulation software interface. At the top, there are navigation tabs: 1. Traffic Movement Calibration (selected), 2. Simulation Run, 3. 15-min Calibration, 4. Interval Calibration, and 5. Debug Log. Below the tabs is the main title "Automatic Traffic Movement Calibration & Visual Tagging".

Under the title, there are two input fields for file paths: "Network(.net.xml): D:/OneDrive - York Universit ..." and "Config (.sumocfg) D:/OneDrive - York Universit ...". To the right of these fields is a button labeled "Automatic Traffic Movement Calibration" with a lightning bolt icon, and a green checkmark followed by the word "Complete".

The interface is divided into three main sections:

- Tags:** A section with the instruction "Drag rows to images". It contains a table with two columns: "Traffic Movement in SUMO" and "Traffic Movement in Real-World". The table is organized into three sections: "North Bound", "South Bound", and "East Bound". A red box highlights this entire section.
- Aerial / Observed:** A section with the instruction "Drop tags to mark observed flows". It has a "Load Image" button and a large empty rectangular area for image placement.
- SUMO Schematic:** A section with the instruction "Drop tags to mark simulation flows". It has a "Load Image" button and a large empty rectangular area for image placement.

At the bottom of the interface, there is a status bar with the following text: "Aerial: 0 tags (0 unique)", "Schematic: 0 tags (0 unique)", and "Coverage: 0/12 unique tags placed". On the far right, there are two buttons: "Reset All Tags" and "Save Placements".

Traffic Movement Calibration

4. Open SUMODT.cfg and zoom in → Change to real-world → take Screenshot → Save

5. Open QGISToSUMO.tif → Zoom in and take Screenshot → Save

6. Load Images of SUMO and Real-world in the App

The screenshot shows the SimJamSimulation application window. At the top, there are tabs for '1. Traffic Movement Calibration', '2. Simulation Run', '3. 15-min Calibration', '4. Interval Calibration', and '5. Debug Log'. The main title is 'Automatic Traffic Movement Calibration & Visual Tagging'. Below this, there are input fields for 'Network(.net.xml): D:/OneDrive - York Universit...' and 'Config (.sumocfg) D:/OneDrive - York Universit...', followed by a button 'Automatic Traffic Movement Calibration' with a green checkmark and the word 'Complete'.

The interface is divided into three main sections:

- Tags:** A list of tags for traffic movement in SUMO and Real-World. It is organized by direction: North Bound (f_4 NBL, f_3 NBT, f_5 NBR), South Bound (f_6 SBL, f_7 SBT, f_8 SBR), and East Bound (f_0 EBL, f_1 EBT). A 'Load Image' button is highlighted with a red box.
- Aerial / Observed:** A satellite image of a road intersection. A 'Load Image' button is highlighted with a red box.
- SUMO Schematic:** A schematic diagram of the road intersection. A 'Load Image' button is highlighted with a red box.

At the bottom, there is a status bar showing 'Aerial: 0 tags (0 unique)', 'Schematic: 0 tags (0 unique)', and 'Coverage: 0/12 unique tags placed'. There are also buttons for 'Reset All Tags' and 'Save Placements'.

Deliverables

7. Drag and Drop tags to each image

8. Assigning all the directions

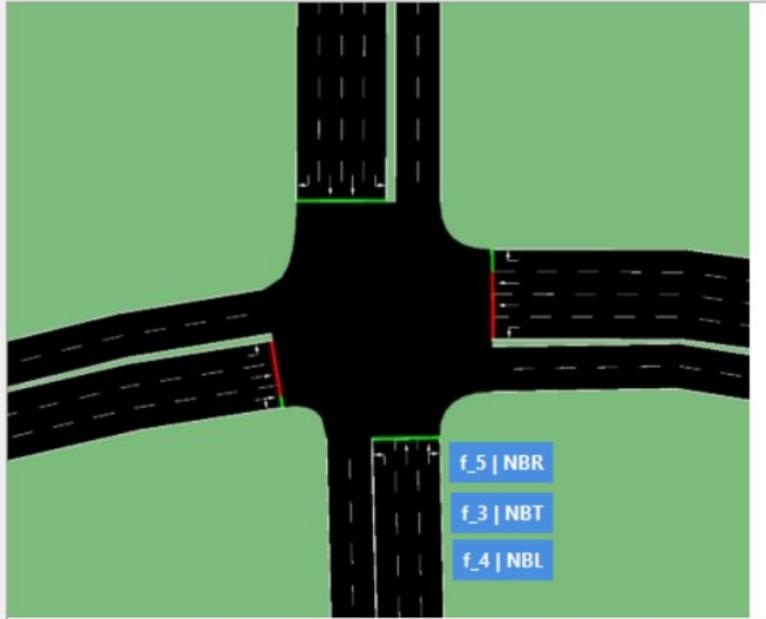
9. After completing it, take a screenshot similar to below and submit (make sure you assigned all the tags)

Tags
Drag rows to images

Flow	Movement
North Bound	
f_4	NBL
f_3	NBT
f_5	NBR
South Bound	
f_6	SBL
f_7	SBT
f_8	SBR
East Bound	
f_0	EBL
f_1	EBT
f_2	EBR

SUMO Schematic
Drop tags to mark simulation flows

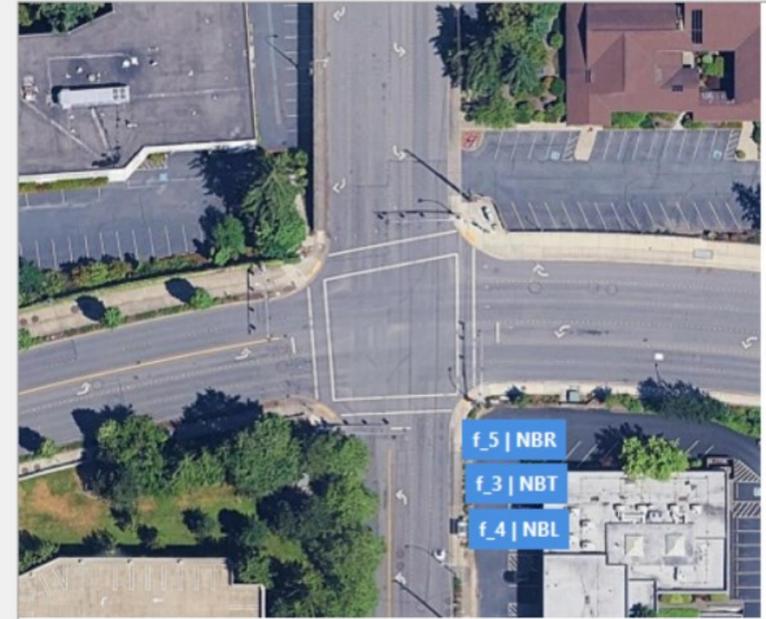
Load Image



The SUMO Schematic shows a top-down view of a road intersection. The road is black with white dashed lines. The surrounding area is green. Three blue tags are placed on the schematic: 'f_5 | NBR' on the top-right lane, 'f_3 | NBT' on the top-left lane, and 'f_4 | NBL' on the bottom-left lane.

Aerial / Observed
Drop tags to mark observed flows

Load Image



The Aerial / Observed view shows a top-down aerial photograph of the same road intersection. Three blue tags are placed on the aerial view: 'f_5 | NBR' on the top-right lane, 'f_3 | NBT' on the top-left lane, and 'f_4 | NBL' on the bottom-left lane.

Traffic Volume Calibration using GEH

1. Click browse and Assign 15-Min Observed Data (The format is csv, download the data in material)
2. Click browse and Assign SUMO Network (.net.xml)
3. Click browse and Assign SUMO Config (.sumocfg)
4. Click browse and Assign Route File (.rou.xml)
5. Click browse and Assign Output Directory (Create an output folder first)
6. Traffic Light ID : J1
7. Run Calibration → you should see “Calibration complete”

Traffic Digital Twin Synchronization

1. Flow Mapping 2. Baseline Run 3. 15-min Calibration 4. Interval Calibration 5. Debug Log

Input Files

15-Min Observed Data: D:/OneDrive - York University/Bussiness2/CodingPractical/Tutorials/

SUMO Network: D:/OneDrive - York University/Bussiness2/CodingPractical/Tutorials/

SUMO Config: D:/OneDrive - York University/Bussiness2/CodingPractical/Tutorials/

Existing Route File: D:/OneDrive - York University/Bussiness2/CodingPractical/Tutorials/

Output Directory: D:/OneDrive - York University/Bussiness2/CodingPractical/Tutorials/

Traffic Light ID:

Generate output files (calibrated_routes_final.rou.xml, calibration_summary.csv, etc.)

Calibration complete

Traffic Volume Calibration using GEH

1. Open the “15-Min Calibration” tab.
2. The app automatically copies the observed 15-minute volumes into the simulation inputs for each movement.
3. The first two columns list the traffic movements (e.g., NBL, EBT).
4. The third column shows the observed 15-minute volume (collected from video).
5. The fourth column shows the simulated 15-minute volume for each movement.
6. The next column shows the hourly volumes (Observed and Simulated), converted from the 15-minute values.
7. The final column shows the GEH for each movement.

Traffic Digital Twin Synchronization

1. Flow Mapping 2. Baseline Run 3. 15-min Calibration 4. Interval Calibration 5. Debug Log

Adjust scale factors (0-50) and click Recalibrate to improve GEH

GEH Quality Assessment

Total movements (non-N/A): 12

GEH < 5: 12/12 (100.0%) | Target: ≥85% Status: ✓ EXCELLENT

GEH < 10: 12/12 (100.0%) | Target: 100%

Direction	Movement	15-Min Obs	15-Min Sim	Hourly Obs	Hourly Sim	GEH	Status	Scale Factor
North								
	LEFT	30	28	120	112	0.74	GOOD	1.0
	THROUGH	143	129	572	516	2.40	GOOD	1.0
	RIGHT	19	18	76	72	0.46	GOOD	1.0
South								
	LEFT	22	21	88	84	0.43	GOOD	1.0
	THROUGH	154	140	616	560	2.31	GOOD	1.0
	RIGHT	24	24	96	96	0.00	GOOD	1.0
East								
	LEFT	20	20	80	80	0.00	GOOD	1.0
	THROUGH	100	98	400	392	0.40	GOOD	1.0
	RIGHT	21	21	84	84	0.00	GOOD	1.0
West								
	LEFT	24	24	96	96	0.00	GOOD	1.0
	THROUGH	129	127	516	508	0.35	GOOD	1.0
	RIGHT	25	25	100	100	0.00	GOOD	1.0

Recalibrate Export 15-Min Calibrated Observed Data

Traffic Volume Calibration using GEH

8. Status column: shows the GEH result for each movement. A

movement is Good when $GEH < 5$.

9. GEH Quality Assessment: summarizes overall calibration quality. The target is at least 85% of movements with $GEH < 5$.

10. If any movement has $GEH \geq 5$, do this:

I. Compare Hourly Observed vs Hourly Simulated volume for that movement.

II. If Simulated $>$ Observed, reduce the Scale Factor (set < 1) and click Recalibrate.

III. If Simulated $<$ Observed, increase the Scale Factor (set > 1) and click Recalibrate.

IV. Repeat steps I–III until the movement reaches Acceptable or Excellent GEH.

Traffic Digital Twin Synchronization

1. Flow Mapping 2. Baseline Run 3. 15-min Calibration 4. Interval Calibration 5. Debug Log

Adjust scale factors (0-50) and click Recalibrate to improve GEH

GEH Quality Assessment

Total movements (non-N/A): 12

GEH < 5: 12/12 (100.0%) | Target: $\geq 85\%$ Status: ✓ EXCELLENT

GEH < 10: 12/12 (100.0%) | Target: 100%

Direction	Movement	15-Min Obs	15-Min Sim	Hourly Obs	Hourly Sim	GEH	Status	Scale Factor
North								
	LEFT	30	28	120	112	0.74	GOOD	1.0
	THROUGH	143	129	572	516	2.40	GOOD	1.0
	RIGHT	19	18	76	72	0.46	GOOD	1.0
South								
	LEFT	22	21	88	84	0.43	GOOD	1.0
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East								
	LEFT	20	20	80	80	0.00	GOOD	1.0
	THROUGH	100	98	400	392	0.40	GOOD	1.0
	RIGHT	21	21	84	84	0.00	GOOD	1.0
West								
	LEFT	24	24	96	96	0.00	GOOD	1.0
	THROUGH	129	127	516	508	0.35	GOOD	1.0
	RIGHT	25	25	100	100	0.00	GOOD	1.0

Recalibrate Export 15-Min Calibrated Observed Data

Traffic Volume Calibration using GEH

11. Once you are satisfied with the results, click “Export 15-

Min Calibrated Observed Data.”

12. This creates a CSV file containing the calibrated 15-

minute traffic volumes (by movement) for use in the

simulation.

13. See the next slide for how to use/import the exported file

The screenshot shows the 'Traffic Digital Twin Synchronization' interface. At the top, there are five tabs: '1. Flow Mapping', '2. Baseline Run', '3. 15-min Calibration' (highlighted with a red box), '4. Interval Calibration', and '5. Debug Log'. Below the tabs, there is a sub-header 'Adjust scale factors (0-50) and click Recalibrate to improve GEH'. The main content area is titled 'GEH Quality Assessment' and displays the following information:

- Total movements (non-N/A): 12
- GEH < 5: 12/12 (100.0%) | Target: ≥85% Status: ✓ EXCELLENT
- GEH < 10: 12/12 (100.0%) | Target: 100%

Below the assessment, there is a table with columns: Direction, Movement, 15-Min Obs, 15-Min Sim, Hourly Obs, Hourly Sim, GEH, Status, and Scale Factor. The table is grouped by direction: North, South, East, and West. Each row shows the observed and simulated traffic volumes for a specific movement, along with the GEH value and status. A 'Recalibrate' button and an 'Export 15-Min Calibrated Observed Data' button (highlighted with a red box) are located to the right of the table.

Direction	Movement	15-Min Obs	15-Min Sim	Hourly Obs	Hourly Sim	GEH	Status	Scale Factor
North								
	LEFT	30	28	120	112	0.74	GOOD	1.0
	THROUGH	143	129	572	516	2.40	GOOD	1.0
	RIGHT	19	18	76	72	0.46	GOOD	1.0
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	RIGHT	24	24	96	96	0.00	GOOD	1.0
East								
	LEFT	20	20	80	80	0.00	GOOD	1.0
	THROUGH	100	98	400	392	0.40	GOOD	1.0
	RIGHT	21	21	84	84	0.00	GOOD	1.0
West								
	LEFT	24	24	96	96	0.00	GOOD	1.0
	THROUGH	129	127	516	508	0.35	GOOD	1.0
	RIGHT	25	25	100	100	0.00	GOOD	1.0

