PHOEBE Project

Athens use case simulations

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This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101076963

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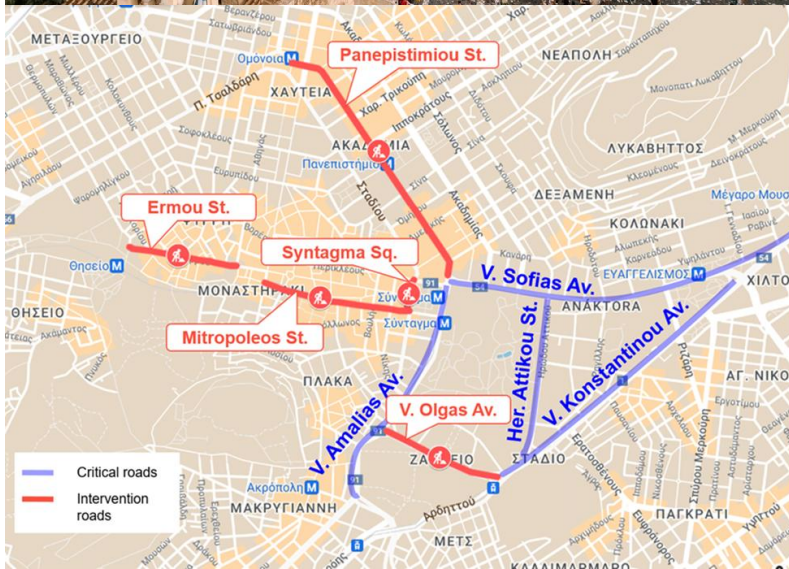
Athens Use Case

Athens implemented **a series of mobility interventions** in the city center to promote sustainable transport, improve pedestrian safety, and reorganize traffic.

Key Locations:

- Panepistimiou St.: Fewer lanes, wider sidewalks and a new dedicated bus lane
- Syntagma Sq.: Wider sidewalks, reorganized bus/taxi space
- Vasilissis Olgas Ave.: Closed to cars (pedestrians & cyclists only)
- Ermou St.: Motorcycle parking management



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Simulation Scope & Scenarios

The Athens use case simulation explored **the impacts of urban interventions** on traffic conditions, safety and mobility behaviour, focusing on three distinct scenarios:

- **Scenario 0 (baseline)**: Conditions before any intervention implementation
- **Scenario 1**: Conditions after interventions implementation
- **Scenario 2**: After interventions with a 30 km/h speed limit

For each scenario, **10 different replications** with random seeds were simulated.

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Simulation Model Description

- A traffic simulation model was developed in Aimsun Next, focusing on central Athens and **key intervention corridors**.
- The simulation model covered an area of approximately **3 km²** with a total road length of 47 km.
- The model included **five types of users**: private cars, trucks, buses, taxis and pedestrians.
- The simulation was conducted during the **morning peak hour** (08:00-09:00 a.m.).

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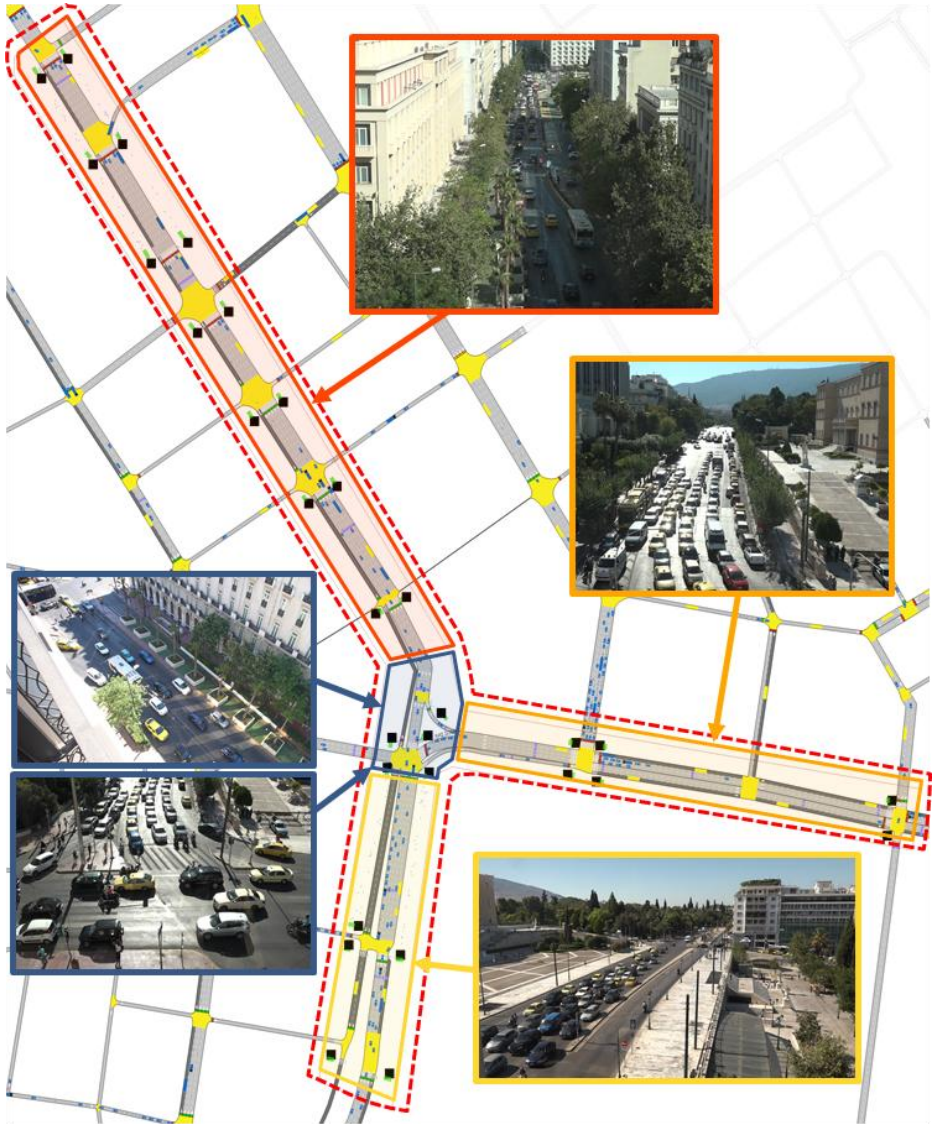
Pedestrian Integration

- Pedestrian measurements were conducted manually by analyzing **videos from cameras**.
- A total of **6,912 pedestrians** were counted during the simulated period.
- Entrances and exits for pedestrians were established on each side of the crossings, and a corresponding **OD matrix** was developed.



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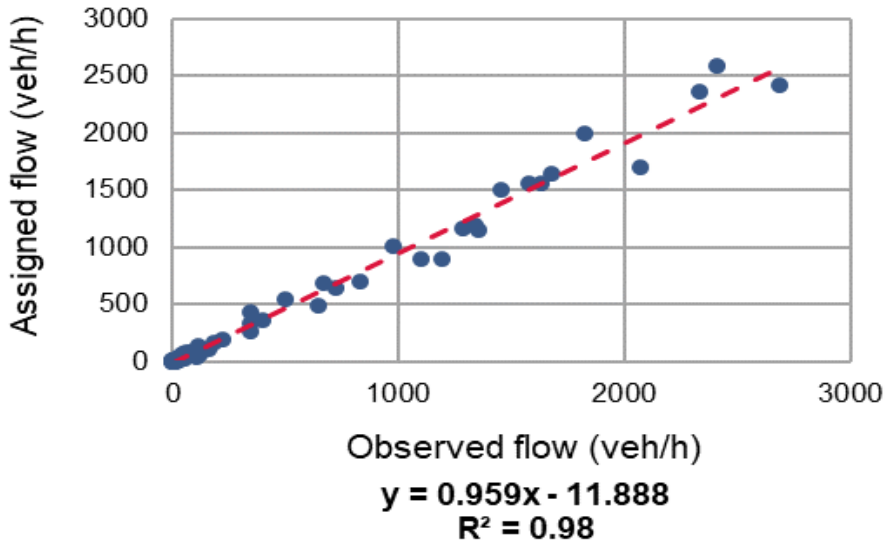
Motorized Vehicles Integration

Before interventions integration

- **Traffic data** were collected from the Athens Traffic Management Centre (ATMC) using 19 detectors (traffic cameras).
- Additional **field measurements** were used to account for fleet composition.
- The model was successfully calibrated using the **GEH index** (85.2% of cases had GEH values below 5, and 100% were below 10).
- The model achieved an **R^2 value of 0.98**, indicating an excellent fit.



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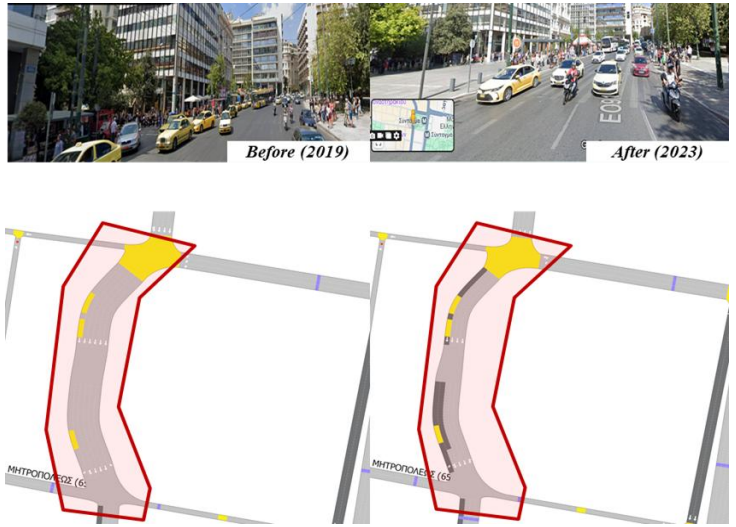
Interventions Integration

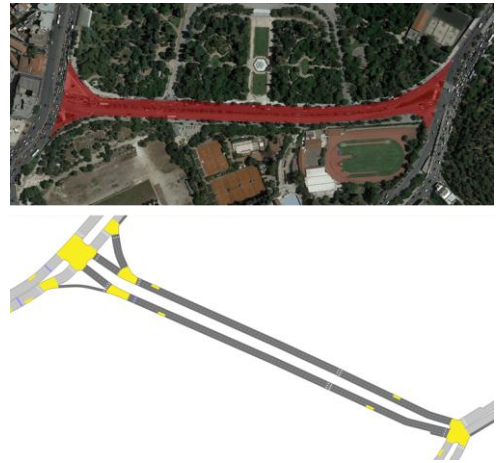
- The implemented interventions were incorporated into the simulation network by modifying **road geometry, lane allocation and traffic regulations**.

Panepistimiou Street

Syntagma Square



Vasilissis Olgas Avenue



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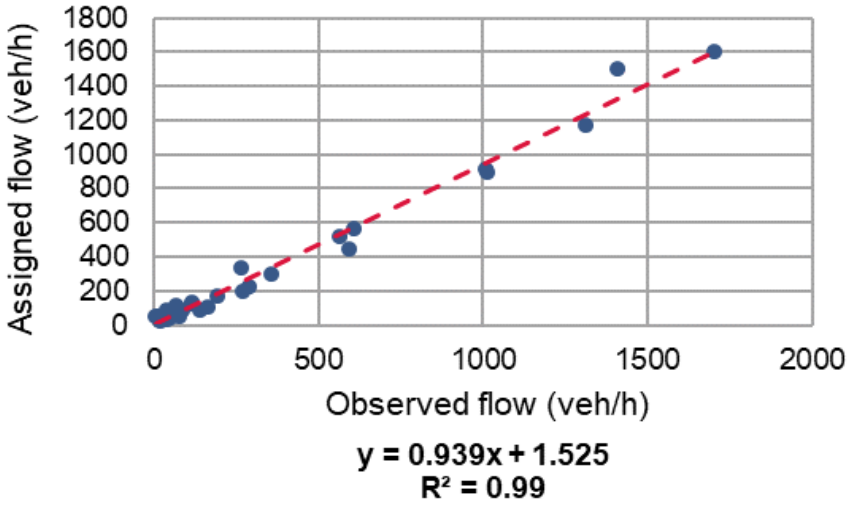
Motorized Vehicles Integration

After interventions integration

- **Traffic data were** collected from the ATMC using 6 detectors (traffic cameras).
- Additional **field measurements** were used to account for fleet composition.
- The model was successfully calibrated using the **GEH index** (85% of cases had GEH values below 5, and 100% were below 10).
- The model achieved an **R^2 value of 0.99**, indicating an excellent fit.



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Non-Compliant Behaviour Modelling

- To enable realistic safety critical interactions, some **non-compliant behaviours** have been added to the traffic simulation software:
  - **Speeding**
  - **Pedestrian red light violation**
- Behaviours are triggered dynamically **via an API** using observed data inputs.
- Behaviour is activated at each **simulation time step**.

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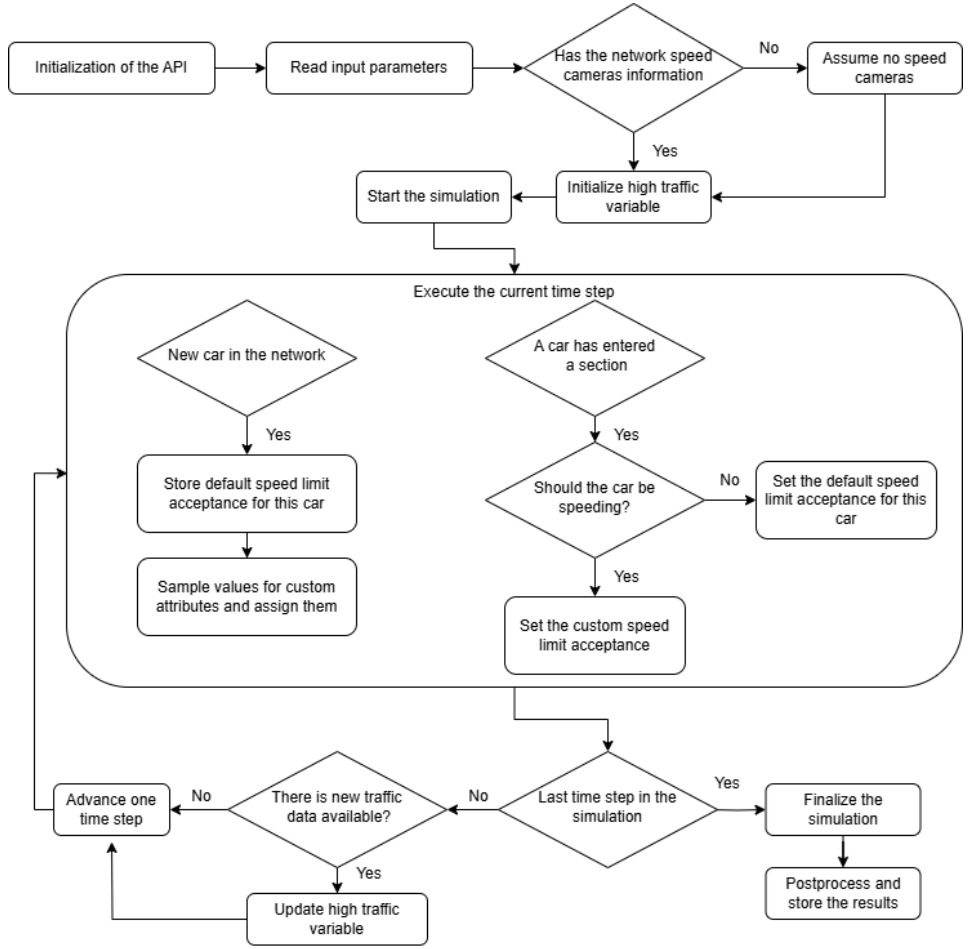
Speeding

- Speeding is implemented through the **speed limit acceptance parameter** in Aimsun.
- The probability of speeding depends on **traffic and human-related factors**.
- Traffic-related variables are derived from the **simulation**.
- Human-related variables (e.g., behaviour, demographics) are **externally provided**.



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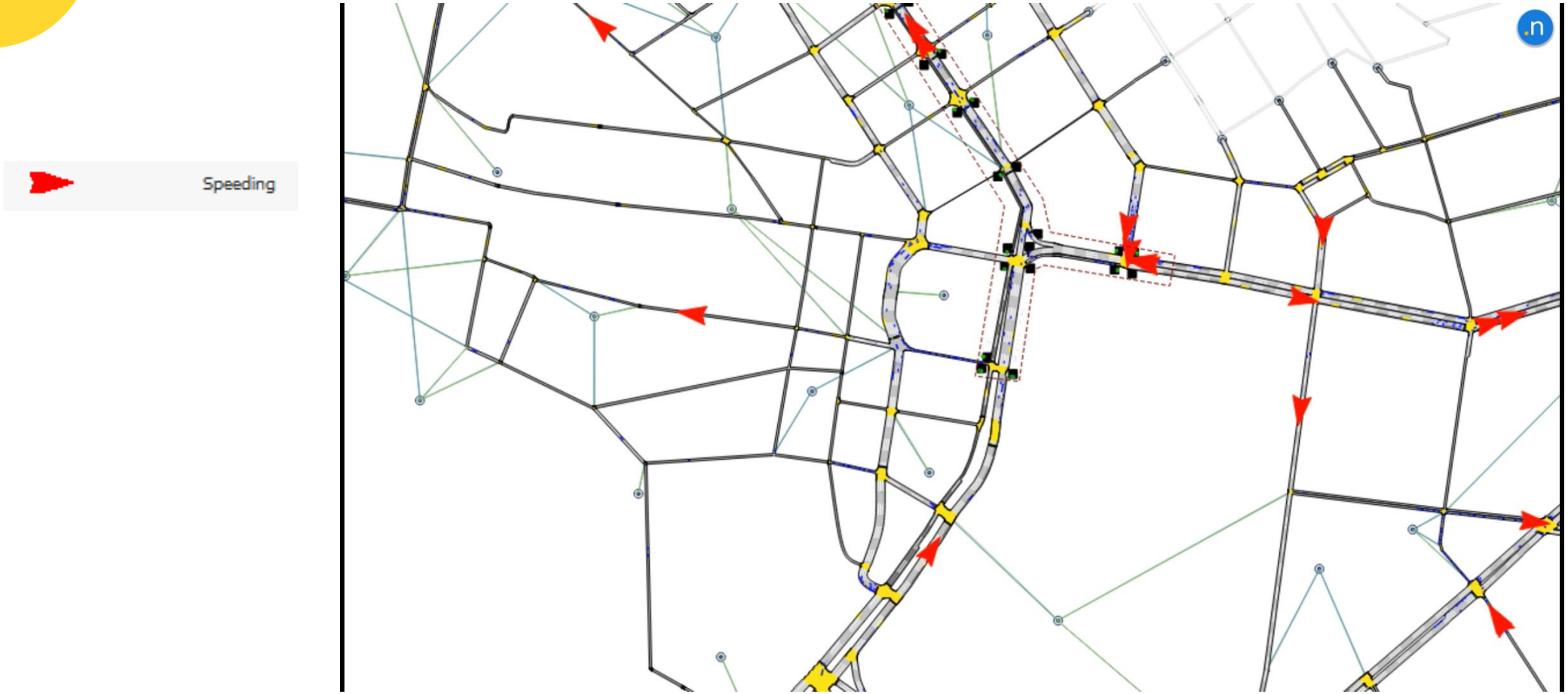
Example of Speeding API



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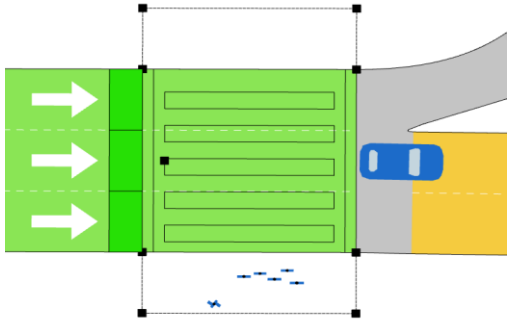
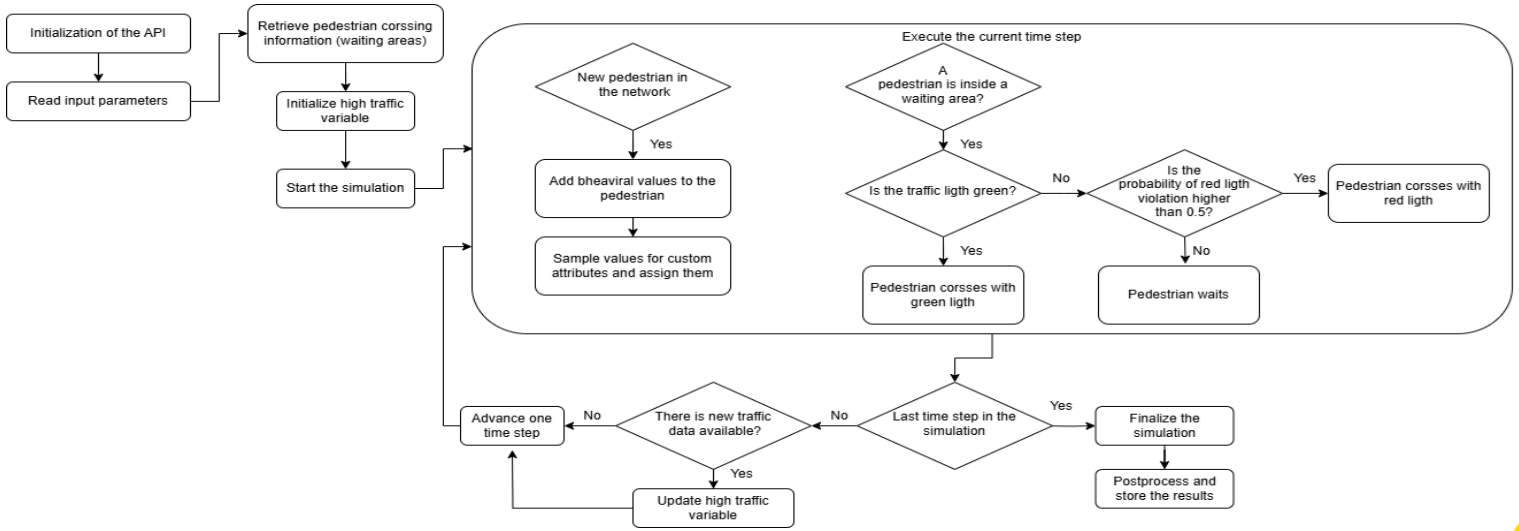
Pedestrian Red-light Violation

- Pedestrians are evaluated when they are in crossing **waiting areas**.
- If the signal is not green, a **probability of violation** is calculated.
- If the probability exceeds a **threshold**, the pedestrian crosses against the red light.
- **Social attributes** (e.g., age, urgency) are assigned to pedestrians.

Detail of a pedestrian crossing with the waiting areas in the simulation





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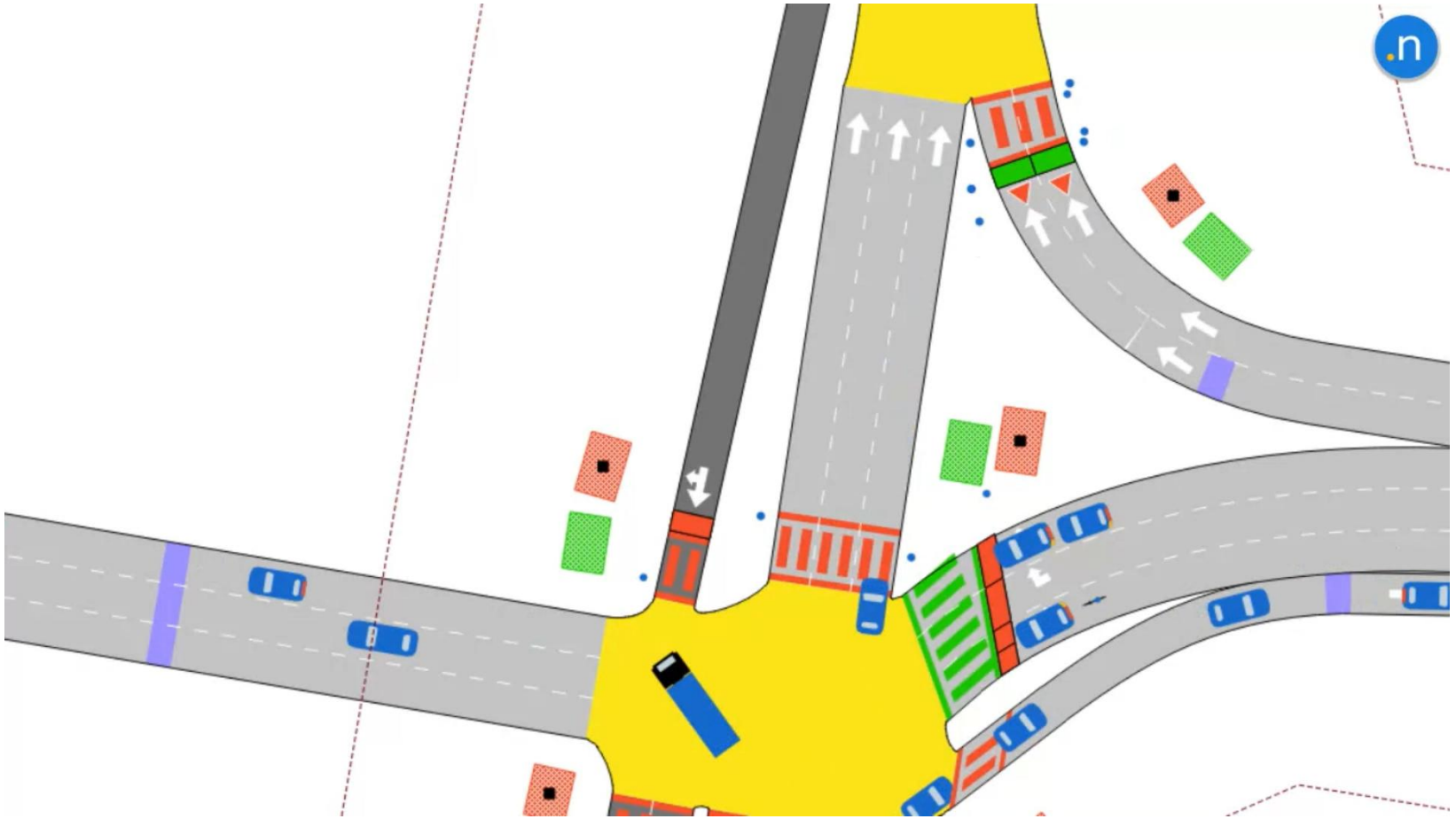
Example of Red-Light Violation API



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Key Results & Conclusion

Road Safety

- High traffic volumes and infrastructure design **reduced speeding behaviour**.
- Pedestrian violations were more likely under **low traffic** and time pressure conditions.

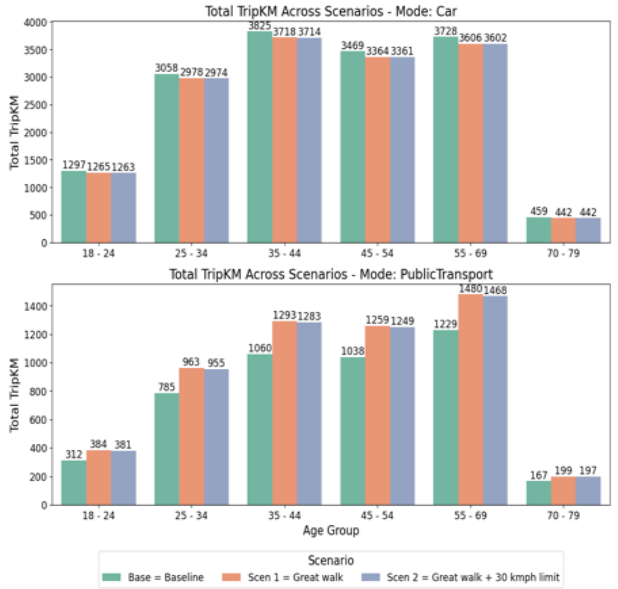
Mode Shift

- Use of private cars and motorcycles **decreased**.
- Public transport usage, walking and micromobility **increased**.

➢ Overall, the interventions **improved safety and shifted mobility** towards more sustainable and people-oriented transport.

Pedestrians Red Light Running Behaviour

Variables		Estimates	z value	Pr(>|z|)	95% CI	
					L	U
Intercept		2.833	5.914	0.000	1.894	3.772
High traffic		-1.098	-22.642	0.000	-1.193	-1.003
Wide crossing width		-0.682	-14.383	0.000	-0.774	-0.589
Being in a rush		0.497	10.534	0.000	0.404	0.589
Age		-0.024	-2.950	0.003	-0.040	-0.008
Past behaviour	Red light violation	0.777	6.378	0.000	0.538	1.015
	Not looking when in hurry	0.483	2.923	0.003	0.159	0.808



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