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HUPMOBILE

Using Multi-Actor Simulation Modeling For Sustainable Production Logistics

Case: City of Turku

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Production logistics and urban logistics

Goal

Improving production and urban logistics

Objectives

- Propose a **planning approach** and **tools** focussing on the flow of goods
- Analysing how **inbound and outbound traffic from ports** impact transport flows and their interaction

Output

- **Simulation-based multilevel optimisation model** that allows stakeholders to model their own flows

Applications

- Optimizing flows for multi stakeholder views
- Active participation is necessary for all stakeholders
- Identifying relevant variables for optimisation and simulation

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SUMO – Simulation of Urban Mobility

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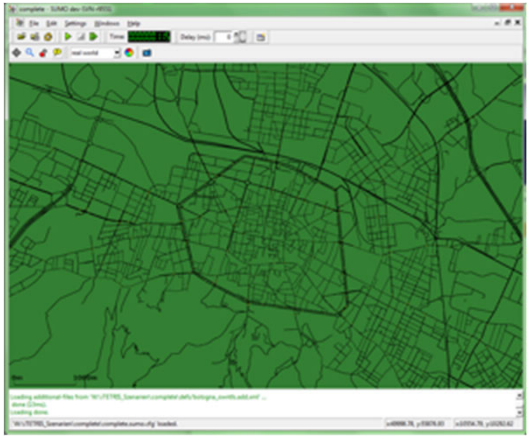
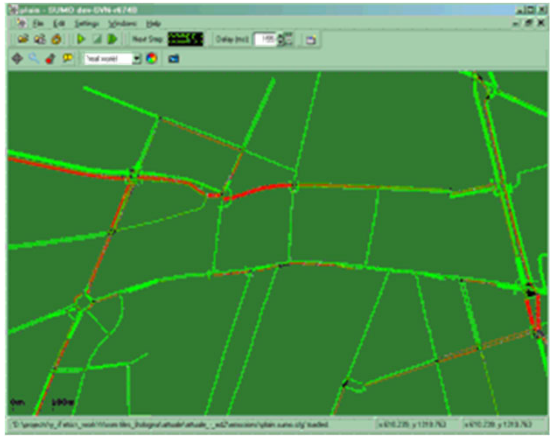
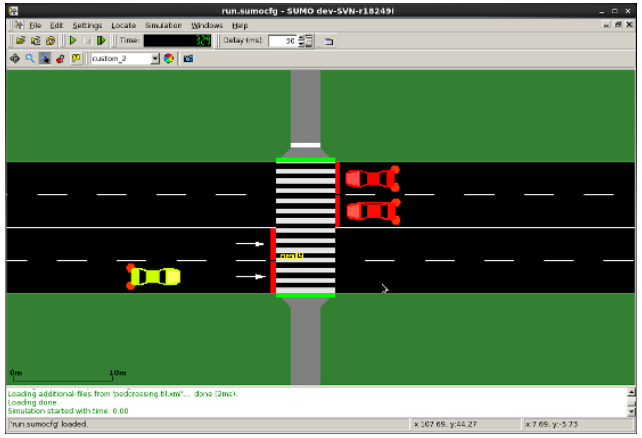
SUMO - https://sumo.dlr.de/docs/index.html







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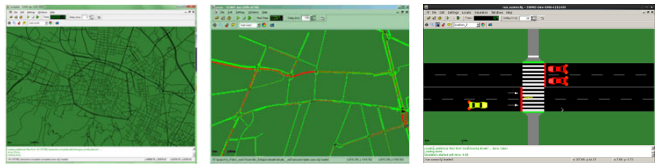


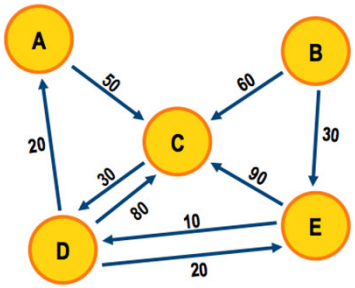
SUMO simulation model

Road network (map)

Traffic demand

- Basic vehicle information
- Origin/destination matrix

Spatial Interactions



Traffic Matrix

	A	B	C	D	E	Ti
A	0	0	50	0	0	50
B	0	0	60	0	30	90
C	0	0	0	30	0	30
D	20	0	80	0	20	120
E	0	0	90	10	0	100
Tj	20	0	280	40	50	**390**

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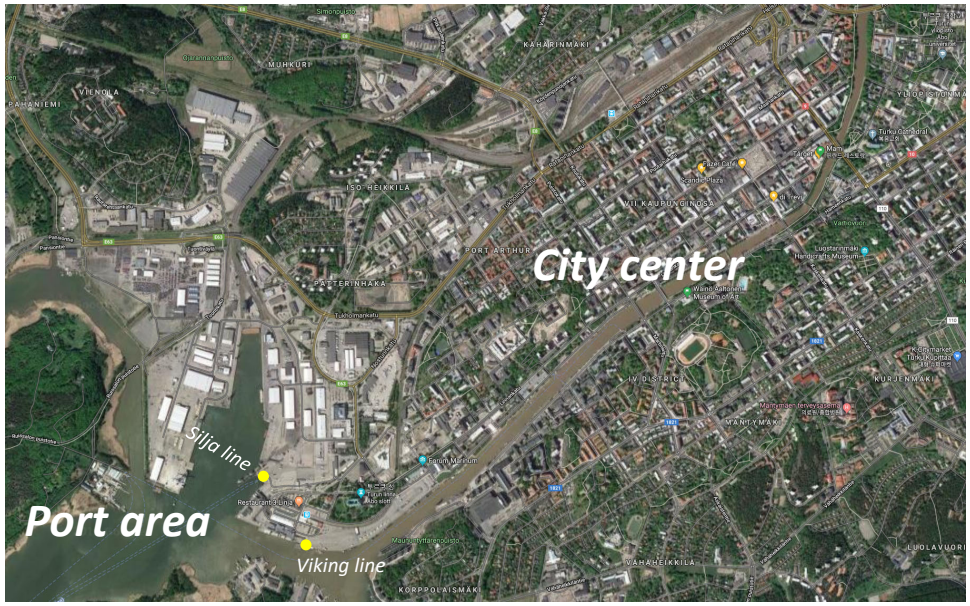
Turku city case



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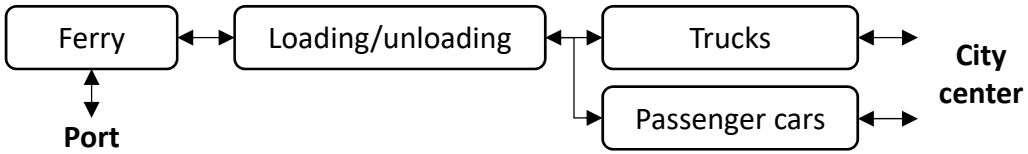
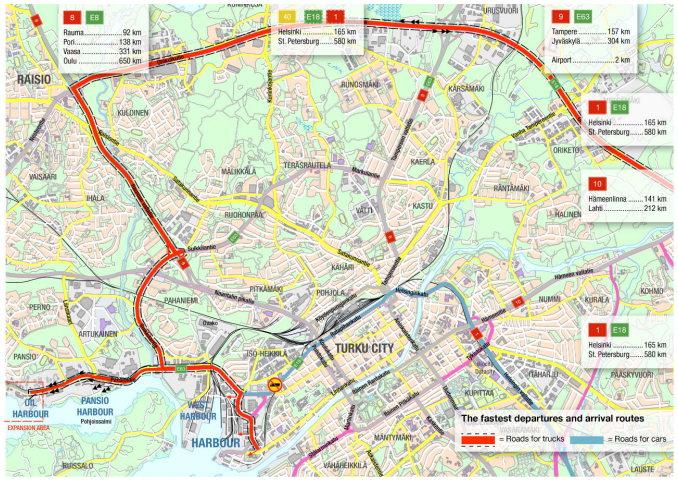


- **Turku city map** imported from OpenStreetMap
- **Truck and passenger car traffic** (from the ferry)
  - # of trucks cargo traffic (import/export) (from Port of Turku cargo statistics)
  - Remaining ferry capacity is assumed to be filled with passenger cars
- **Routes for truck and passenger car**



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Assumptions

- Trucks start to line up 4 hours before boarding for paperwork and clearance
- Passenger cars start to line up approximately 1 hour before the ferry arrives
- Loading and unloading takes 20 minutes each
- Loading and unloading times are divided equally for each vehicle

Simulation cases

Variables	Case 1	Case 2
Incoming # of trucks	74	
Outgoing # of trucks	84	
Incoming # of passenger cars	346	
Outgoing # of passenger cars	356	
Engine type for all vehicles	diesel driven heavy duty vehicle Euro norm 5	diesel driven heavy duty vehicle Euro norm 6

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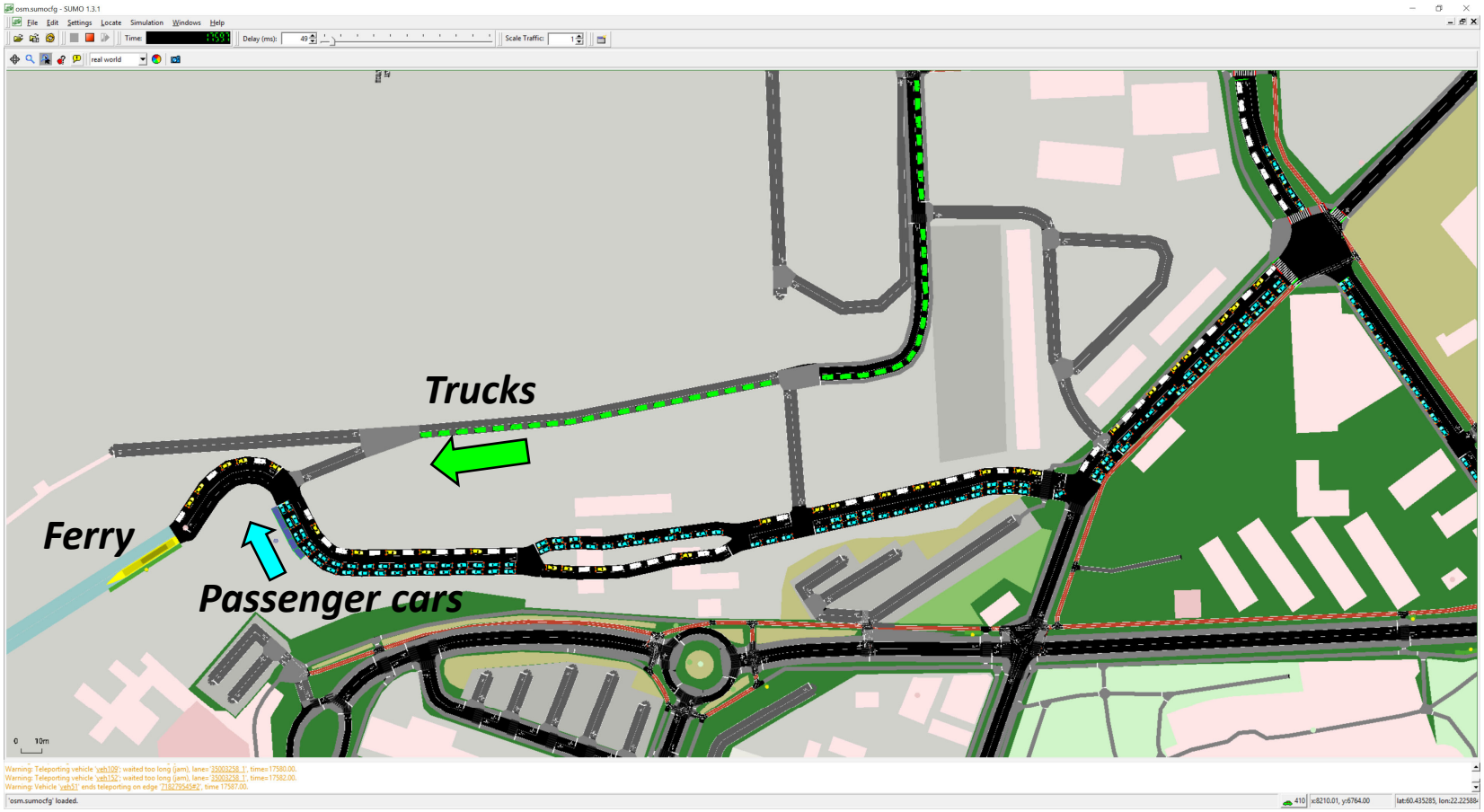

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Turku city case

Results
(per vehicle)

- Current waiting time [s]
- Total accumulated waiting time [s]
- Emissions (CO2, CO, HC, NOx, PMx) [mg/s]
- Fuel consumption [ml/s]
- Power consumption (electricity) [Wh/s]
- Noise levels (Harmonoise)[dB]

Required input for future

- New map of the planned area (for road network)
- Vehicle traffic forecasts
- Vehicle distribution (inter arrival time)
- Cargo distribution (periodical demand changes)

vehicle:1630 Parameter

Name	Value	Dynamic
lane [id]	216251668#2_1	✓
position [m]	233.29	✓
lateral offset [m]	0.00	✓
speed [m/s]	0.00	✓
lateral speed [m/s]	0.00	✓
acceleration [m/s^2]	0.00	✓
angle [degree]	115.88	✓
slope [degree]	0.00	✓
speed factor	1.25	✗
time gap on lane [s]	-1.00	✓
waiting time [s]	50.00	✓
waiting time (accumulated, 100.00s) [s]	83.00	✓
time loss [s]	437.84	✓
noise (Harmonoise) [dB]	55.94	✓
devices		✗
persons	0	✓
containers	0	✓
lcState right	c|overlapping|blocked	✓
lcState left	unknown	✓

Contact

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