+ 1 minute 31 seconds

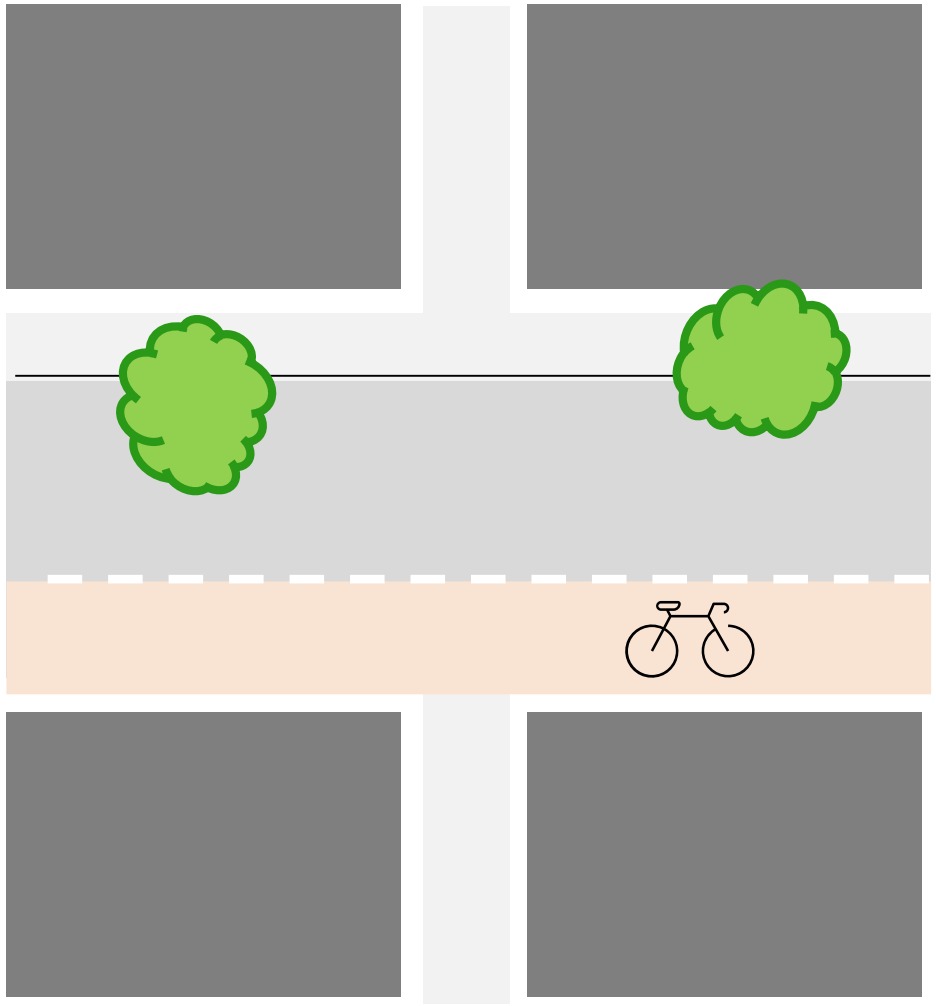
Increase in travel time on average across Bavaria within the last 10 years.

[36]

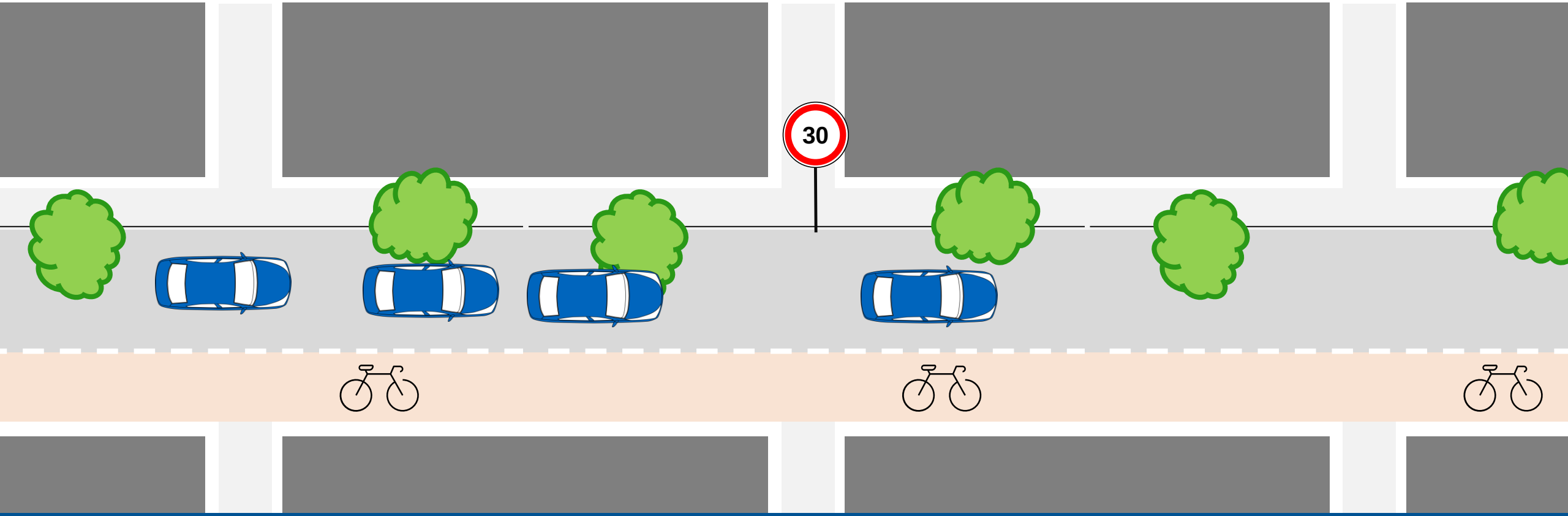
.

Picture: https://www.mdr.de/nachrichten/deutschland/politik/notfallversorgung-reform-lauterbach-rettungsdienst-leipzig-notruf-100.html

Reduction of the speed



Changing the street space



Currently, it is only possible to analyze **what-if considerations in a limited way**. Nevertheless, due to the increasingly rapid changes in mobility, a comprehensive and interlinked **analysis will be necessary**

Lehrstuhl für Fahrzeugtechnik
TUM School of Engineering and Design
Technische Universität München

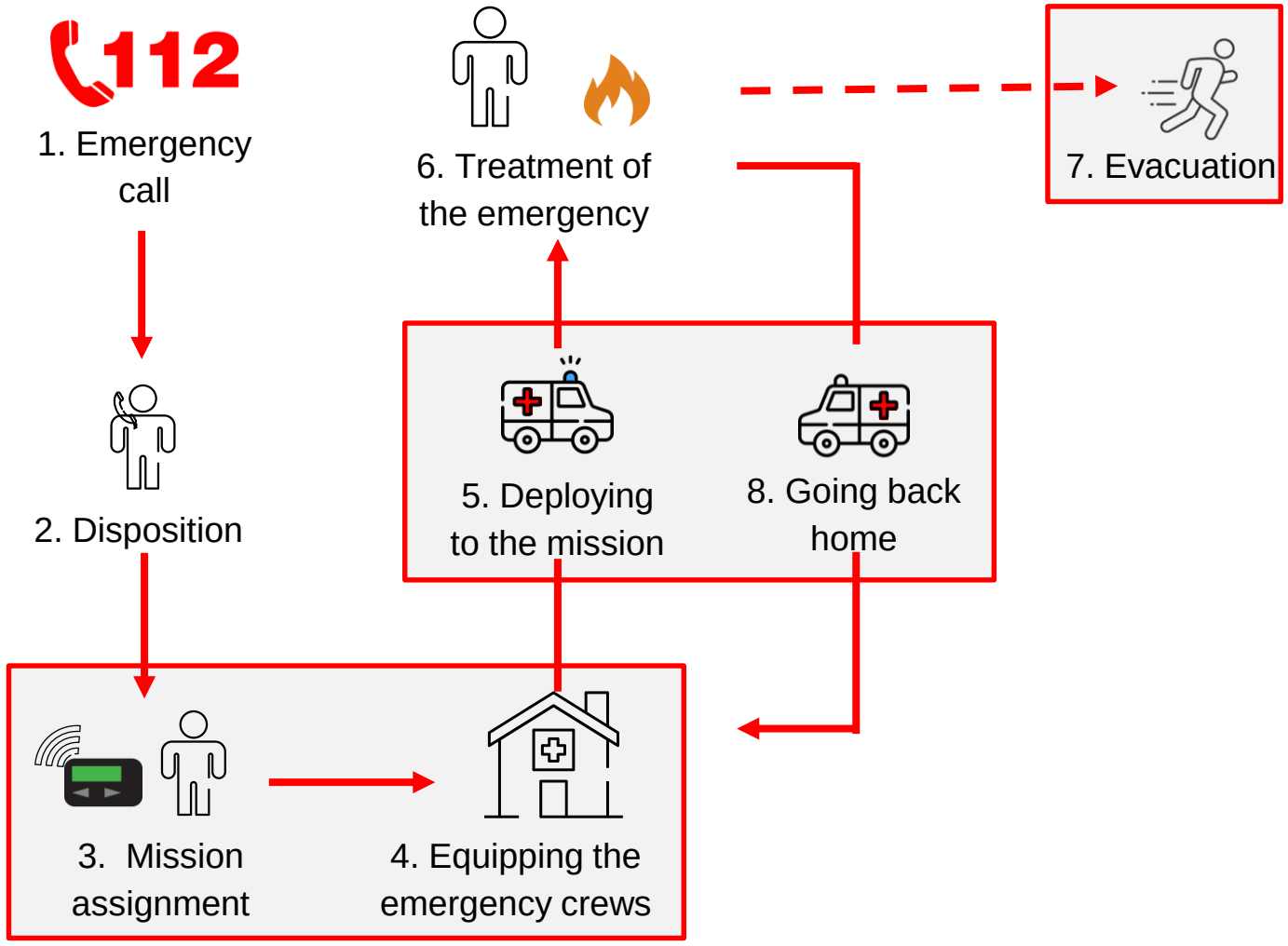
rescuePY
Simulation-based Emergency Service Impact Assessment

Fabian Schuhmann, Maximilian Sievers, Stefan Schrott, Ivan Kapovich, Lijie Feng, and Markus Lienkamp

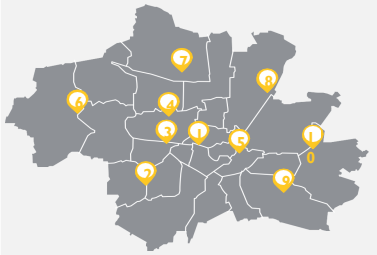
Datum: 15.05.2024

Picture: https://www.stuttgarter-nachrichten.de/inhalt.verkehrssuender-in-stuttgart-keine-rettungsgasse-117-fahrverbote-als-strafe.112b3762-247f-4422-9bb2-b692fabfeb42.html

Where can mobility innovations potentially influence rescue services?

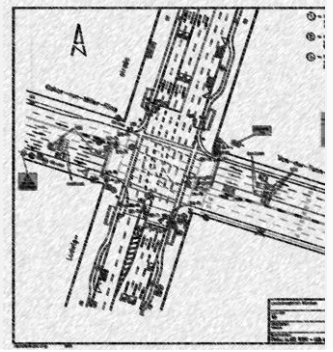


Strategic planning



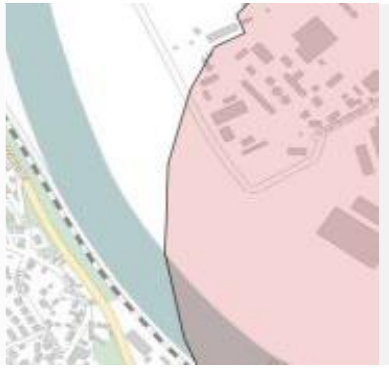
Questions:
- Positioning
- Stationing of rescue equipment

Operative planning



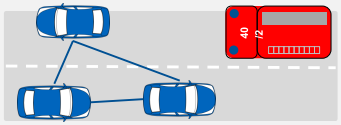
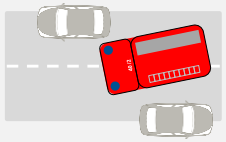
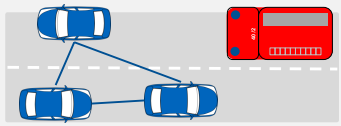
Questions:
- Impact of traffic light controls
- Analysis of structural changes

Evacuation planning



Questions:
- Evacuation time
- Rate of evacuation

How can the impact on the rescue system be modeled?

Strategic planning	System analyses in the event of a disaster [7,8,11]	CIS-KOSMAS [12]	 V2X - Communication [9], [10]
Operative planning	 Behavior modeling [16], [19]	 Traffic lights [15], [8]	 AV & V2X - Communication [13], [14], [18], [20]
Evacuation planning	Activity-based models [30, 32,33, 36, 34, 35]		Trip-based models [28, 29]

Regulations

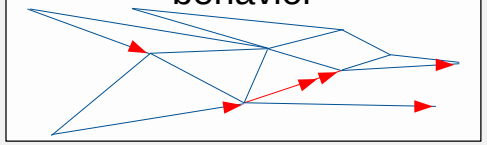
§

Lack of tool-based, holistic consideration of changes in mobility (infrastructure and demand) and their impact on the rescue services

rescuePY: Simulation-based Emergency Service Impact Assessment

Strategic planning

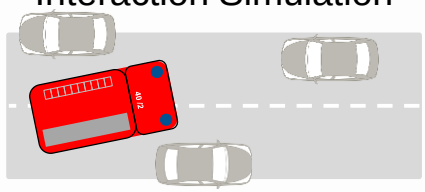
Calculation of the system behavior



→ Duplicity

Operative planning

Interaction Simulation



→ Average Traveltimes

Evacuation planning

Microscopic, multi-modal evacuation simulation

→ Evacuation Times

rescuePY

- PlugIn for SUMOPy / hybridPy
- Uses mesoscopic & microscopic SUMO
- Available in Python 3
- Customizable Datainput

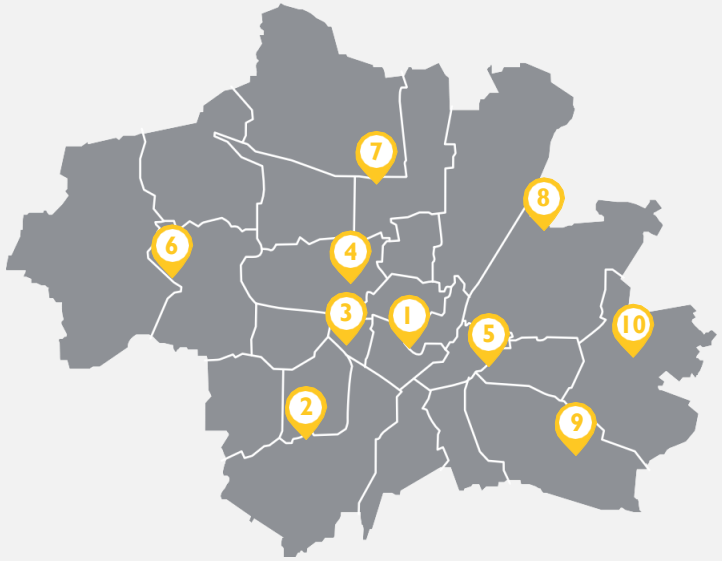
Strategic Planning in a Nutshell

Strategic planning

Operative planning

Evacuation planning

Does the system meet the requirements to a sufficient degree?



Rescue stations

Equipment

Transport infrastructure

$$\Delta v_{Exceeding} = 1{,}28$$

$$\Delta t_{Loss} = 4s \quad [16]$$

Alarm data

Architecture of the Strategic Planning

Strategic planning

Operative planning

Evacuation planning

Input

Rescue Station

Rescue Equipment

Alarm Data

Traffic Networks

Zone Definitions

Travel Times

rescuePY

Operative Planning

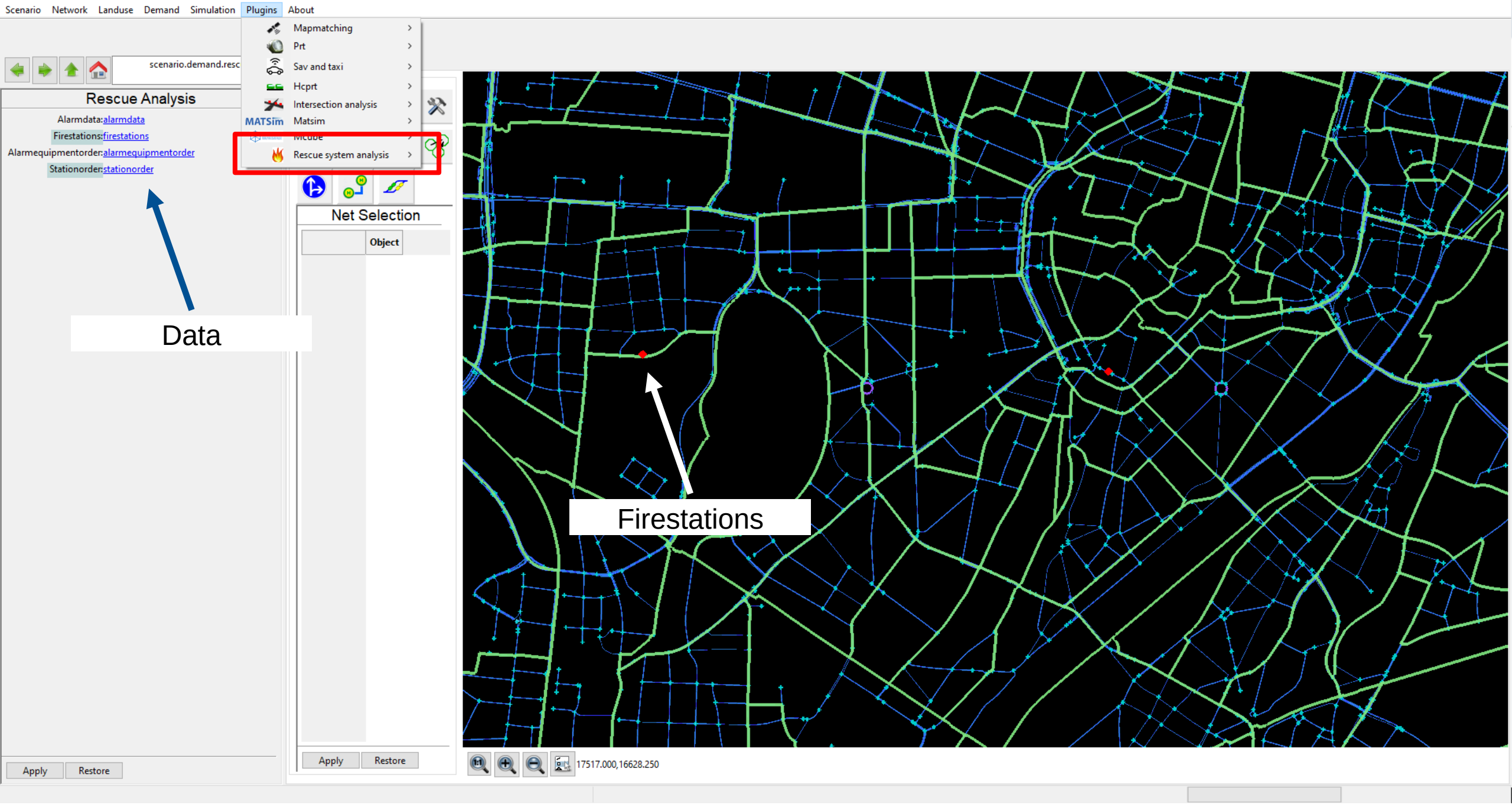
rescuePY

Station Order Calculation

SUMO

Result:

Duplicity Analysis

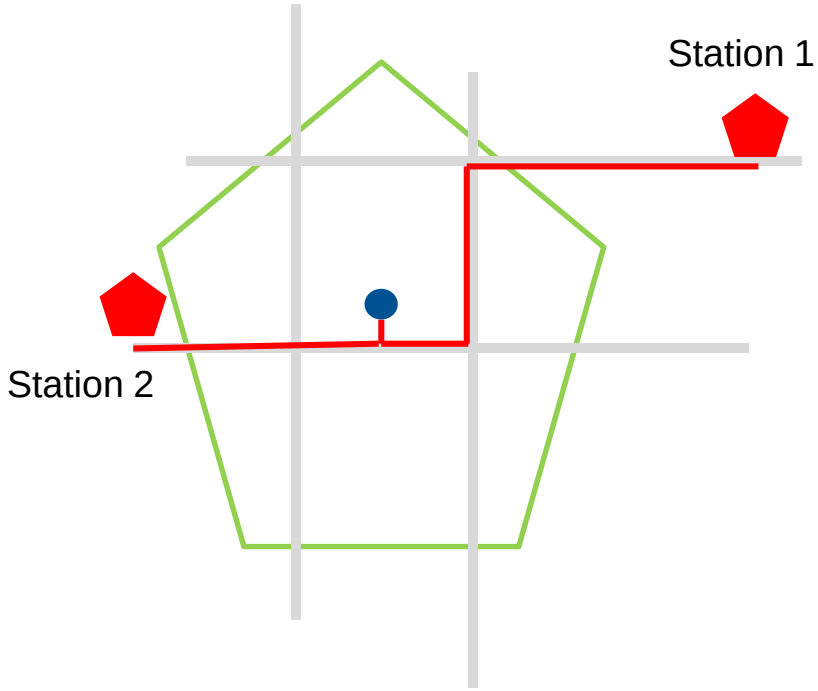

Scenario
Network
Landuse
Demand
Simulation
Plugins
About
Mapmatching
Prt
Sav and taxi
Hcprt
Intersection analysis
Matsim
Rescue system analysis
scenario.demand.resc
Rescue Analysis
Alarmdata:alarmdata
Firestations:firestations
Alarmequipmentorder:alarmequipmentorder
Stationorder:stationorder
Data
Net Selection
Object
Apply
Restore
Apply
Restore
Firestations
17517.000,16628.250

Strategic Planning - Implementation

Strategic planning

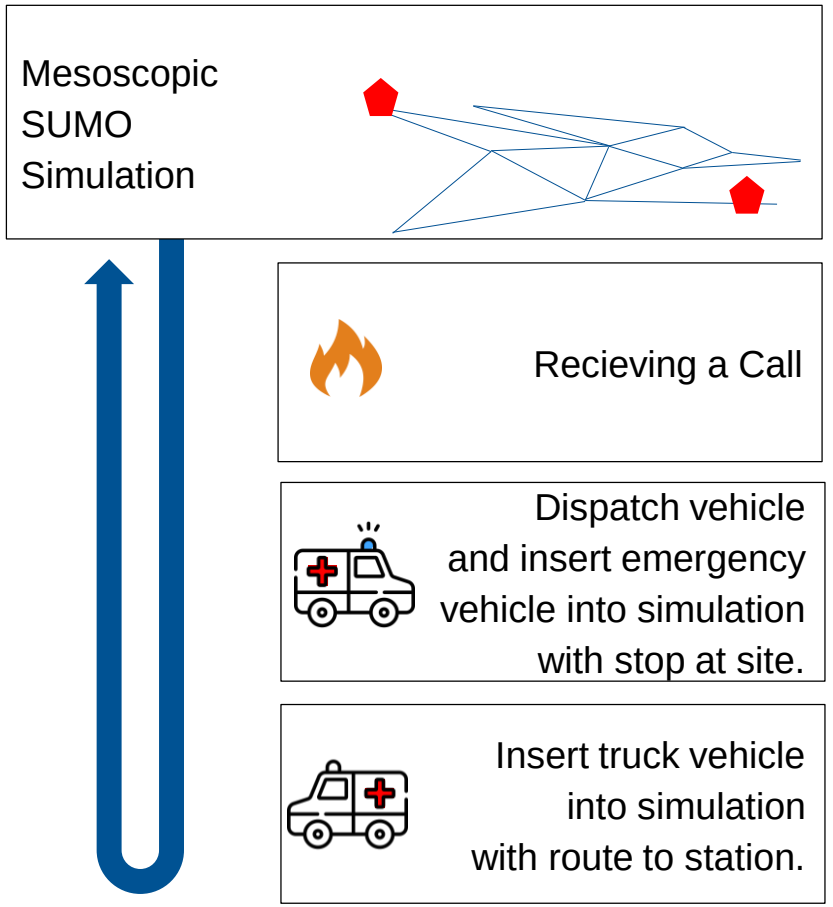
Operative planning

Evacuation planning

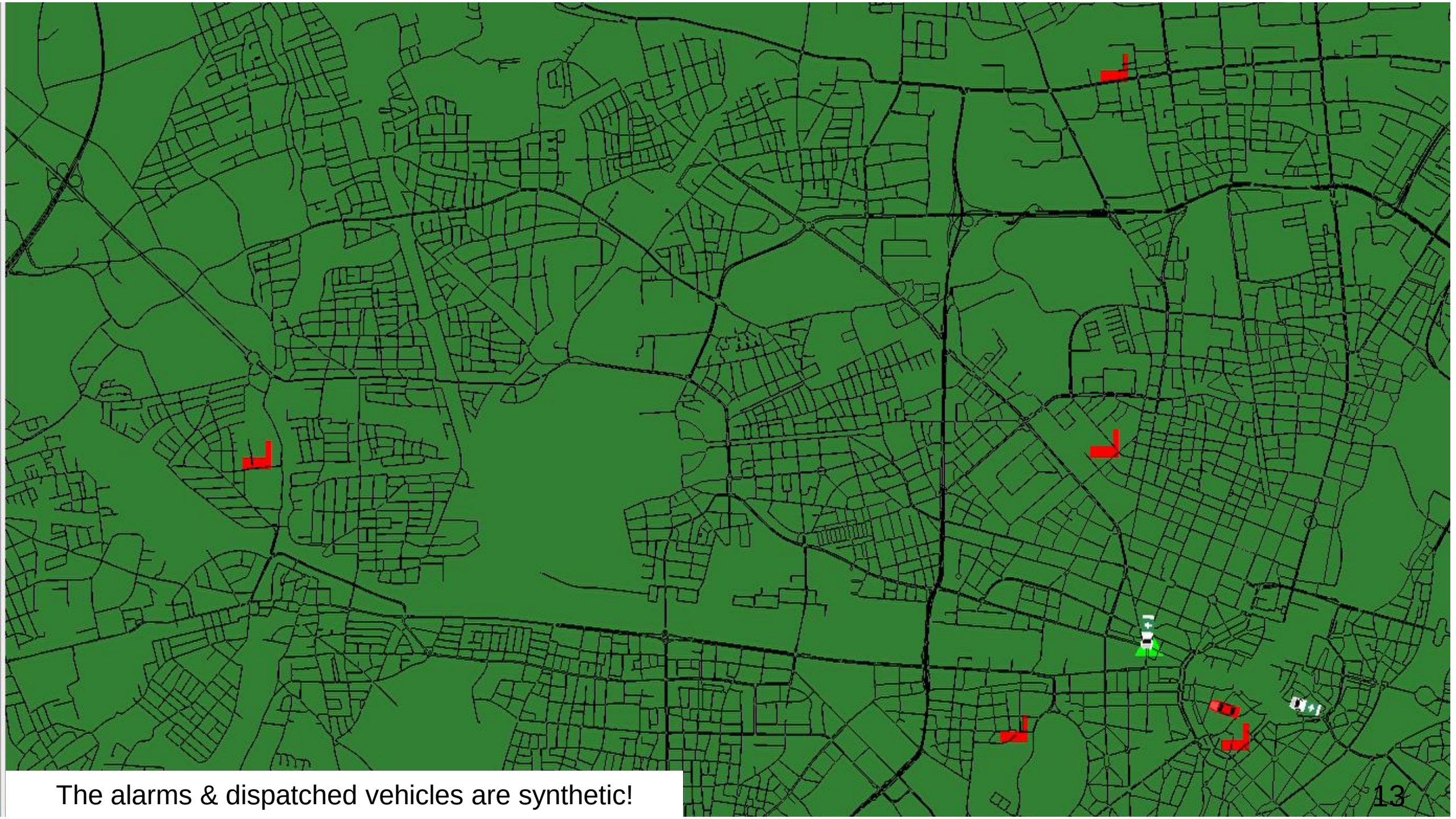


Alarm Order = {Station 2, Station 1}

Station Order Calculation



TraCi Simulation Logic



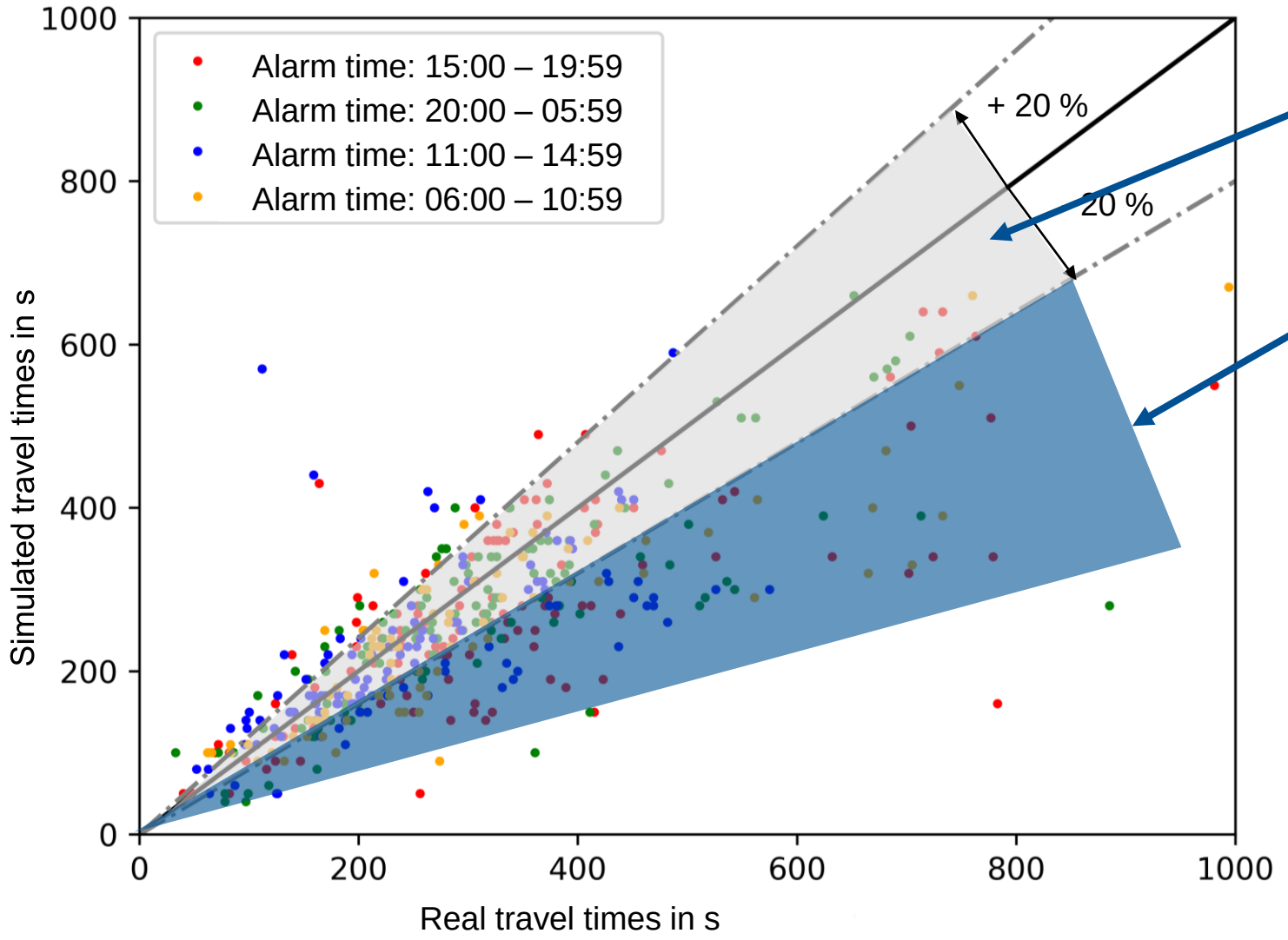
The alarms & dispatched vehicles are synthetic!

Results of the Strategic Planning

Strategic planning

Operative planning

Evacuation planning



The model provides useful results for off-peak times.

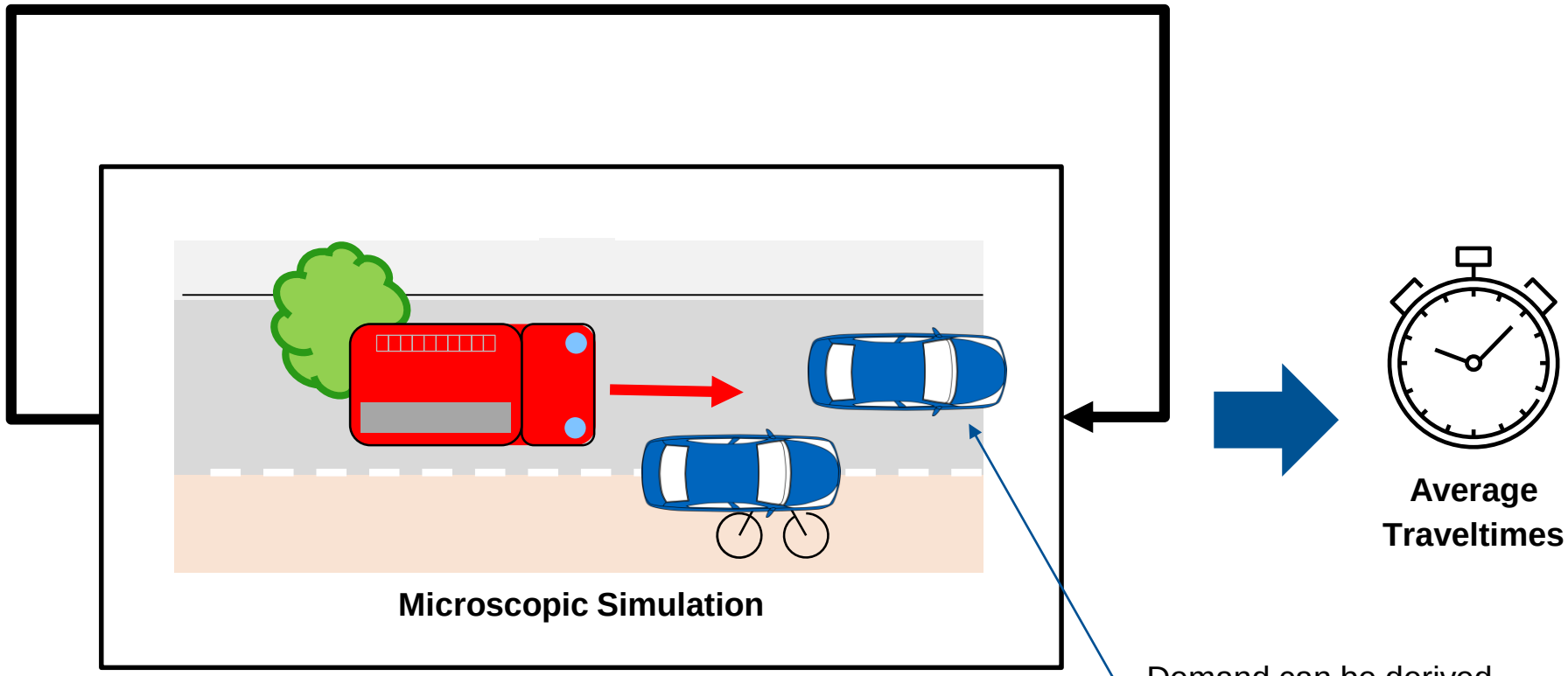
Integration of traffic and further constraints is necessary!

Operative Planning in a Nutshell

Strategic planning

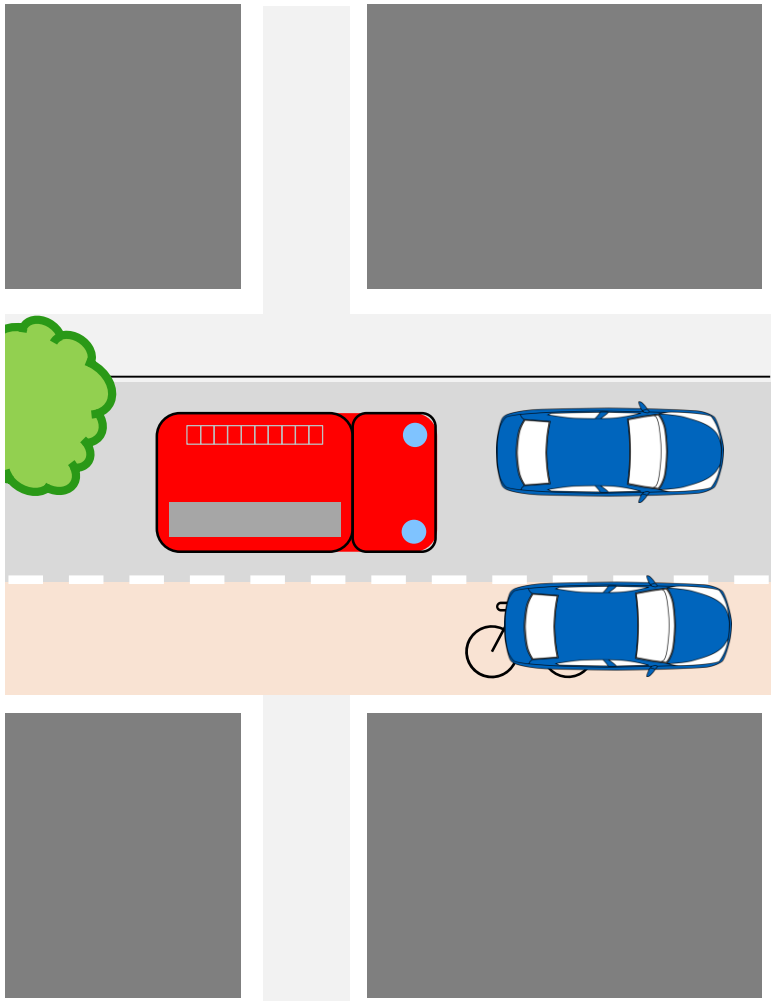
Operative planning

Evacuation planning



Extending the Microscopic Model

Strategic planning



Operative planning

Evacuation planning

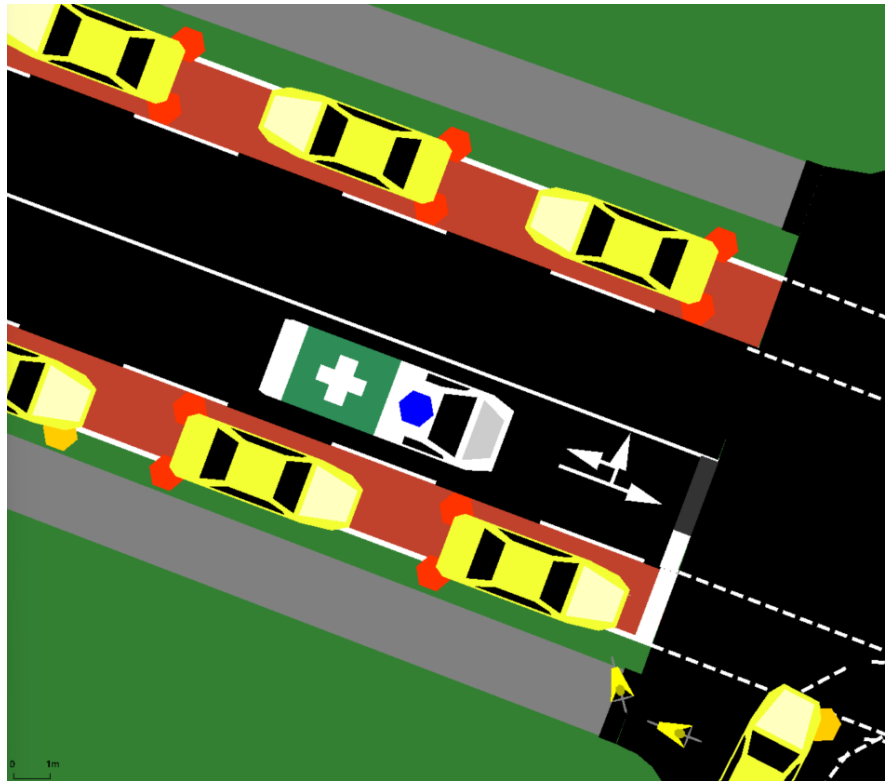

o_Schellingstraße_Bikelanes_HalvedTraffic.sumocfg - SUMO 42950284703
Edit Settings Locate Simulation Window Language Help
Time:
Delay (ms): 300
Scale Traffic: 1
custom_1

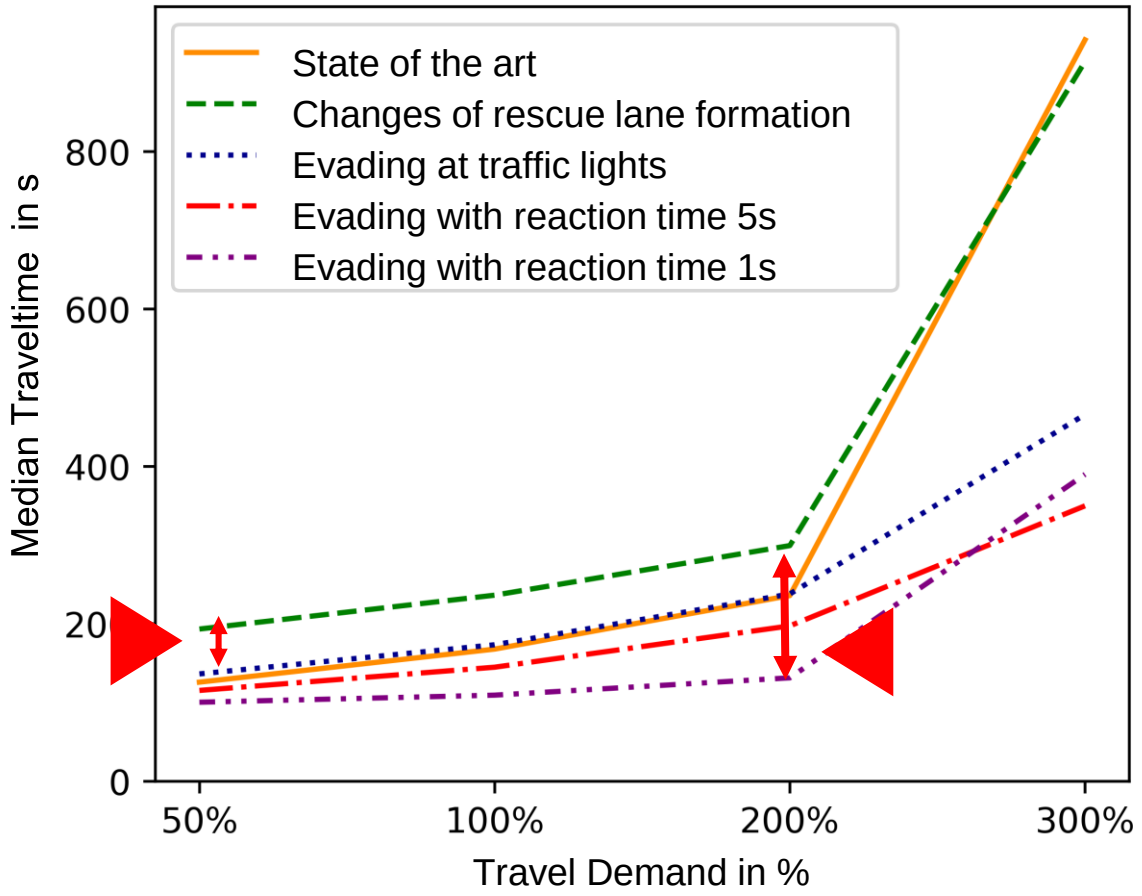
Plausibility Check of the Model

Strategic planning

Operative planning

Evacuation planning



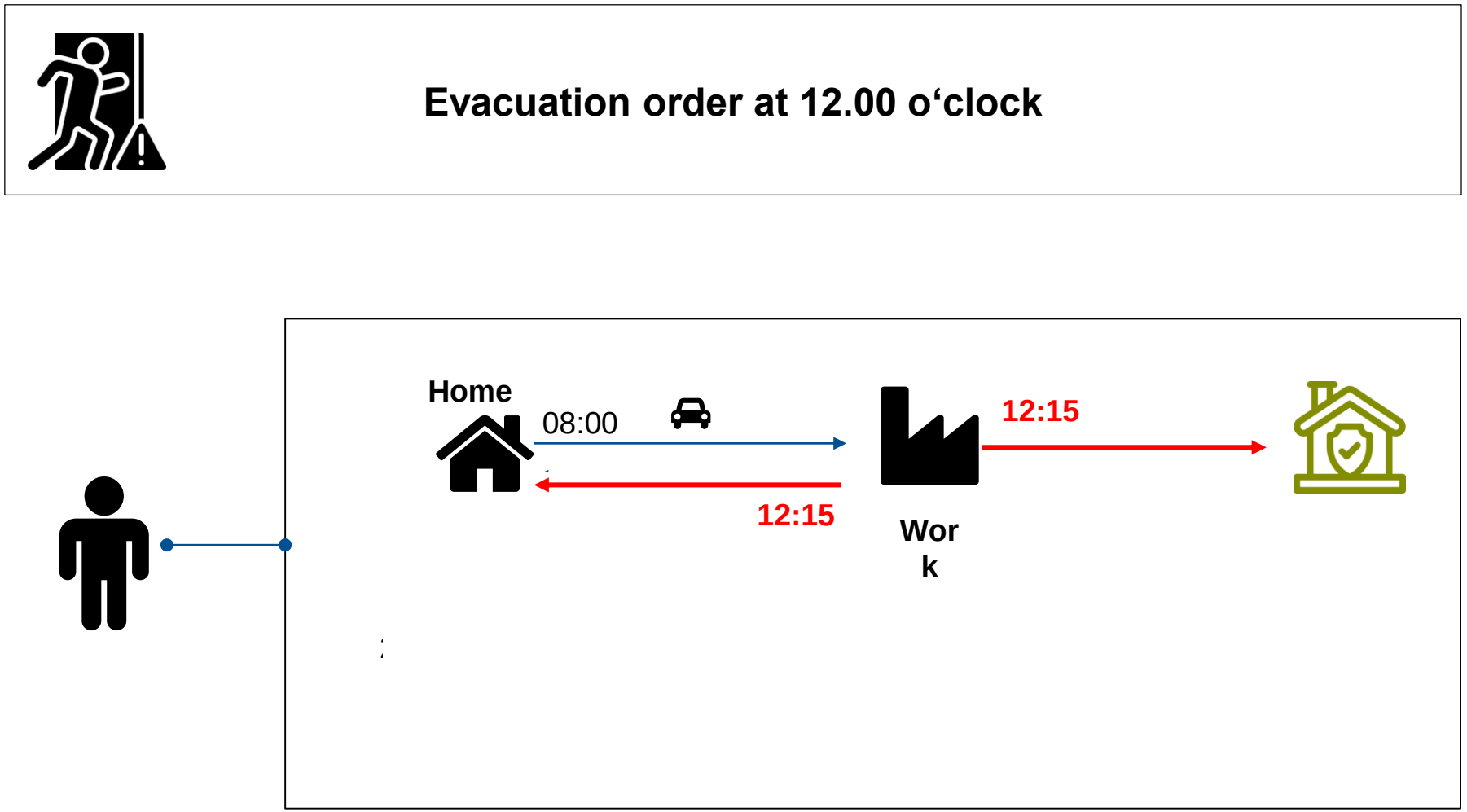


Activity-based Modeling of Urban, Time-critical Evacuations

Strategic planning

Operative planning

Evacuation planning



ctivity-based Modeling of Urban, Time-critical Evacuations

Strategic planning

Operative planning

Evacuation planning

Input

Population & Activities

Facilities & Traffic Network

Evacuation Zones

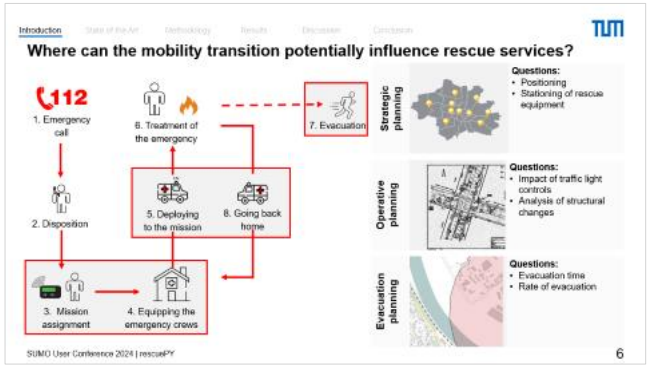
rescuePY

SUMO

Result:

Evacuation Times

Summary


Where can the mobility transition potentially influence rescue services?
112
1. Emergency call
2. Disposition
3. Mission assignment
4. Equipping the emergency crews
5. Deploying to the mission
6. Treatment of the emergency
7. Evacuation
8. Going back home
Strategic planning
Questions:
• Positioning
• Stationing of rescue equipment
Operative planning
Questions:
• Impact of traffic light controls
• Analysis of structural changes
Evacuation planning
Questions:
• Evacuation time
• Rate of evacuation
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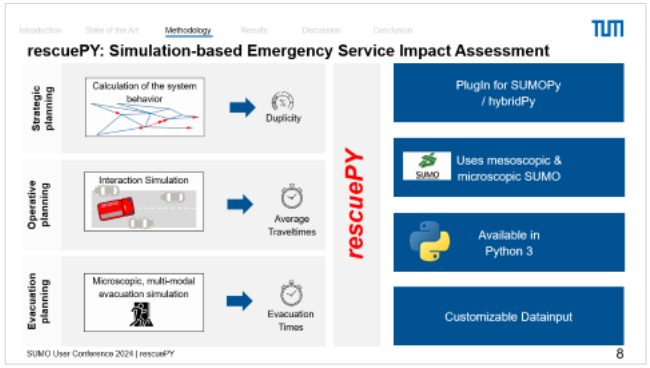
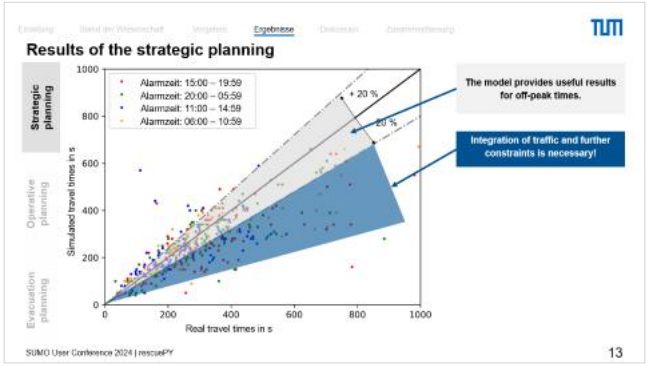
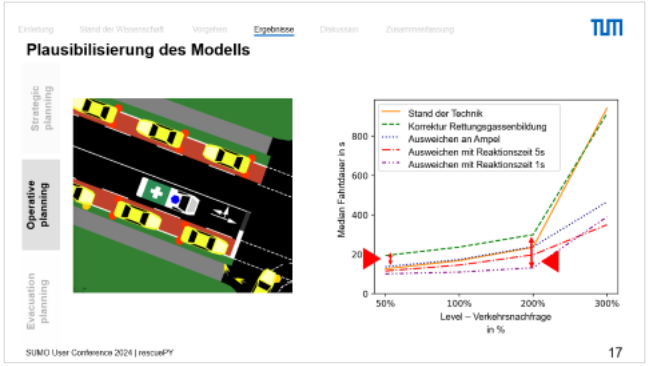
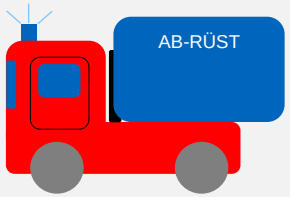
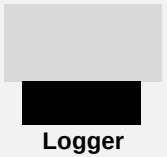
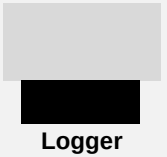
6


rescuePY: Simulation-based Emergency Service Impact Assessment
Strategic planning
Calculation of the system behavior
Duplicity
Operative planning
Interaction Simulation
Avarage Traveltimes
Evacuation planning
Microscopic, multi-modal evacuation simulation
Evacuation Times
rescuePY
PlugIn for SUMOPy / hybridPy
Uses mesoscopic & microscopic SUMO
Available in Python 3
Customizable Datainput
SUMO User Conference 2024 | rescuePY
8


Results of the strategic planning
Strategic planning
Operative planning
Evacuation planning
Alarmzeit: 15:00 – 19:59
Alarmzeit: 20:00 – 05:59
Alarmzeit: 11:00 – 14:59
Alarmzeit: 06:00 – 10:59
+ 20 %
- 20 %
Simulated travel times in s
Real travel times in s
The model provides useful results for off-peak times.
Integration of traffic and further constraints is necessary!
SUMO User Conference 2024 | rescuePY
13


Plausibilisierung des Modells
Strategic planning
Operative planning
Evacuation planning
Stand der Technik
Korrektur Rettungsgassenbildung
Ausweichen an Ampel
Ausweichen mit Reaktionszeit 5s
Ausweichen mit Reaktionszeit 1s
Median Fahrtdauer in s
Level – Verkehrsnachfrage in %
SUMO User Conference 2024 | rescuePY
17

Discussion and Outlook

Strategic planning	 Integration of further EMS Services	 Parameterization with real world data
Operative planning	Survey-based parameterization for future szenarios	 Validation with real world data of munich
Evacuation planning	Implementation of real-world scenario	