+ 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**.
rescuePY
Simulation-based Emergency Service Impact Assessment

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

Datum: 15.05.2024
Where can mobility innovations potentially influence rescue services?

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

Questions:
- Positioning
- Stationing of rescue equipment
- Impact of traffic light controls
- Analysis of structural changes
- 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

**Operative planning**
- Interaction Simulation
  - Average Traveltimes

**Evacuation planning**
- Microscopic, multi-modal evacuation simulation
  - Evacuation Times

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**Methodology**

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

Does the system meet the requirements to a sufficient degree?

Rescue stations

Equipment

Transport infrastructure

\[ \Delta v_{\text{Exceeding}} = 1.28 \]

\[ \Delta t_{\text{LOSS}} = 4s \] [16]
Architecture of the Strategic Planning

**Input**
- Rescue Station
- Rescue Equipment
- Alarm Data
- Traffic Networks
- Zone Definitions
- Travel Times

**rescuePY**

**Strategic Planning**
- SUMO

**Result:**
- Station Order Calculation
- Duplicity Analysis

**rescuePY**
- Operative Planning
Strategic Planning - Implementation

Station Order Calculation

Alarm Order = {Station 2, Station 1}

TraCi Simulation Logic

Mesoscopic SUMO Simulation

Recieving a Call

Dispatch vehicle and insert emergency vehicle into simulation with stop at site.

Insert truck vehicle into simulation with route to station.
The alarms & dispatched vehicles are synthetic!
Results of the Strategic Planning

The model provides useful results for off-peak times.

Integration of traffic and further constraints is necessary!
Operative Planning in a Nutshell

Demand can be derived using the hybridPY approach!
Extending the Microscopic Model
Plausibility Check of the Model

- State of the art
- Changes of rescue lane formation
- Evading at traffic lights
- Evading with reaction time 5s
- Evading with reaction time 1s

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Activity-based Modeling of Urban, Time-critical Evacuations

Evacuation order at 12.00 o'clock
ctivity-based Modeling of Urban, Time-critical Evacuations

Input

Strategic planning
- Population & Activities
- Facilities & Traffic Network

Operative planning

Evacuation planning
- Evacuation Zones

Output

rescuePY

Evacuation Planning

SUMO

Result:
- Evacuation Times
Summary

Where can the mobility transition potentially influence rescue services?

Results of the strategic planning

Plausibilisierung des Modells

rescuePY: Simulation-based Emergency Service Impact Assessment

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Discussion and Outlook

**Strategic planning**
- Integration of further EMS Services
- Parameterization with real world data

**Operative planning**
- Survey-based parameterization for future scenarios
- Validation with real world data of munich

**Evacuation planning**
- Implementation of real-world scenario

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