Building a planning tool for the E-Bike City

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1 Introduction

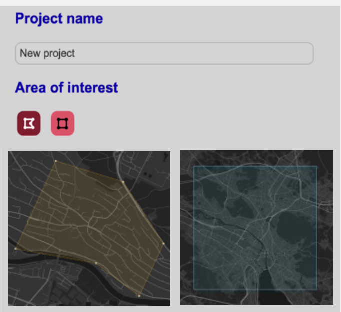
The E-Bike City project envisions a radical re-distribution of the available street space to prioritize cycling. To design the street network, we introduced a new mathematical approach that optimizes the trade-off between car and bike travel times through Pareto optimality [1].

However, accessible tools are needed to help planners use and evaluate optimization strategies for planning bike networks. We developed a user-friendly **web application** that enables planners to reallocate road space comparing multiple optimization strategies and bike and car network efficiency.

2 Web-app design

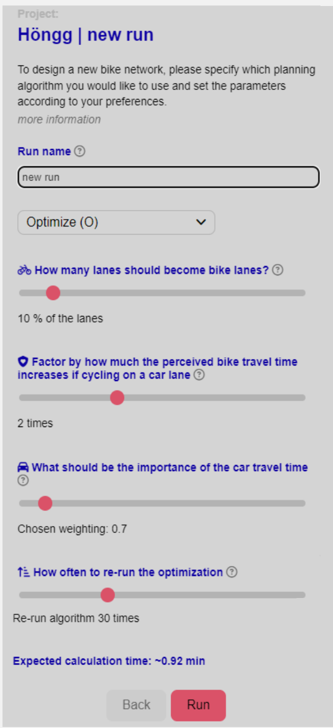
User input

Flexibly optimize neighbourhoods, districts or entire city networks. ▼

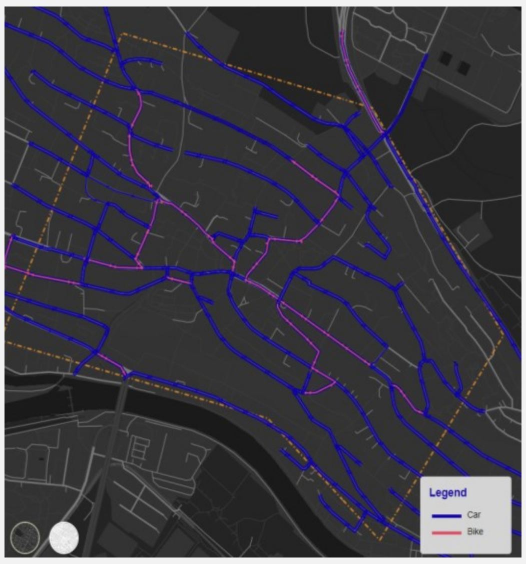


OpenStreetMap networks are used as an initial network input.

Other necessary inputs for the optimization strategies. The list can be further extended to account for additional criteria. ▶

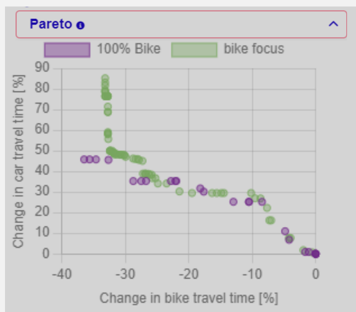


Optimized Bike and Car Network Visualization



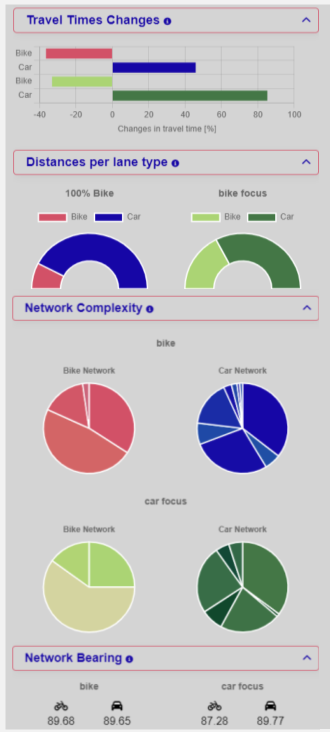
Dashboard

Pareto frontier compares trade-offs between car and bike travel times. ▼



Evaluate networks across different optimization scenarios.

The web tool compares bike and car travel times, bike and car lane lengths, intersection degrees for route complexity, and network angularity relevant for comfort. ▶



3 Methods

Web application: the application architecture is built on a Vue.js, a Python Flask backend providing RESTful APIs and a PostgreSQL database for data storage. A GeoServer handles geospatial data services (WMS/WFS). The entire system is hosted on an Apache HTTP Linux Server of ETH.

Network design setting: The street infrastructure is assumed to be fixed, but lane widths and directions can be changed.

Available network optimization strategies:
- *Optimization approach*: a linear programming formulation minimizes a weighted sum of car and bike travel times.
- *Betweenness Biketime:* allocates bike lanes iteratively, starting with car lanes with high betweenness centrality.
- *Betweenness Cartime:* allocates bike lanes iteratively, starting with car lanes with low betweenness centrality.

4 Discussion

- The web application allows for running a bike network optimization algorithms, dynamically visualizing and evaluating the resulting networks.
- The tool utilizes OpenStreetMap (OSM) data, making it adaptable to various locations.
- The dashboard allows to easily compare networks based on various criteria but should be expanded with more diverse set of metrics [2].
- Usability studies are needed to assess the user-friendliness of the developed web application.

5 Conclusion

The web-based tool simplifies interaction with mathematical models for bike network optimization, improving anticipation of road space allocation impacts on other transportation modes.

The web interface also aids urban planning by visualizing various scenarios, fostering collaboration, and enhancing communication among stakeholders.

References

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