# Mapping Urban Cycle Efficiency

## From Stops to Flow: Breaking the Cycle of Delays

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**In cities worldwide, urban cycling has become a preferred mode of transportation due to its health benefits, environmental sustainability, and convenience [1]. This project evaluates how traffic lights in Munich contribute to cycling delays and creates a visual representation of the existing cycling landscape. This tool can be instrumental when advocating for cyclist-centred urban planning, ensuring that infrastructure designs accounts not only for cycle path quantity and quality, but also for flow and uninterrupted travel.**

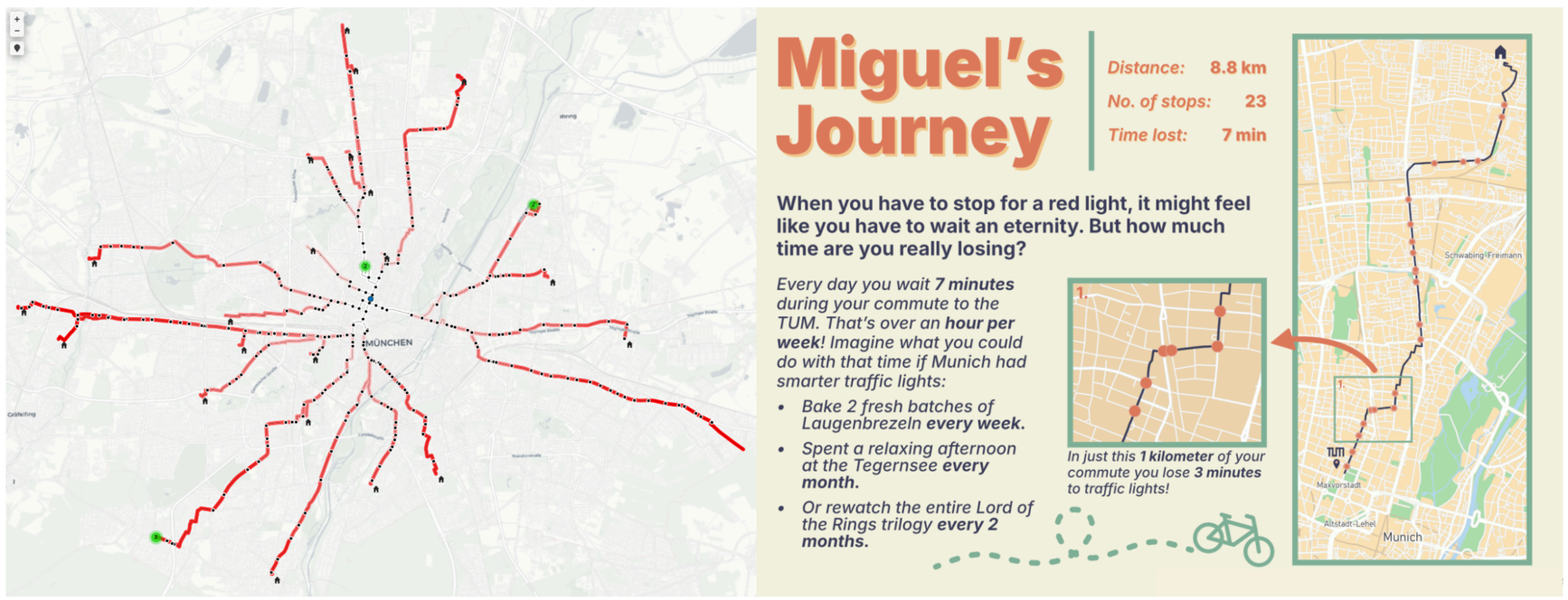


*Fig 1: Interactive web-map (left) with routes from the TUM to residences. Personal flyer (right) with a route, created to raise awareness about the delay experienced when cycling in Munich.*

## PROBLEM & GOAL

To show the impact of unoptimised traffic lights, the aim of this project was to visualise the delay that students of this Master's program experience when commuting to the TUM by bicycle. When turning left at an intersection, cyclists often have to wait twice—once to cross, and once to turn left—while motorists have a separate light to turn. Every stop at a traffic light introduces delay, and without separate lights for bicycles, delays stack up quicker compared to travelling by car.

The goal is to raise awareness of the challenges facing Munich's cycling infrastructure and highlight that simply adding more bike lanes isn't enough to make the city truly bicycle-friendly.

## METHOD

The aim was to develop a concept for a transferable and scalable model that can be used anywhere. To facilitate this, exclusively OpenStreetMap data was used.

Using the OSM2GMNS library for Python [2], a cycling network of Munich was created from OSM data. Using this network, the shortest routes from the TUM to the students' houses were calculated, and individual routes and the traffic lights encountered were exported. A custom function was created to classify the direction of every turn in the route, using the bearing of the line segments before and after an intersection. Combining this with the average timing of traffic lights in Munich measured at different intersections, the accumulative delay along the cycling routes was calculated.

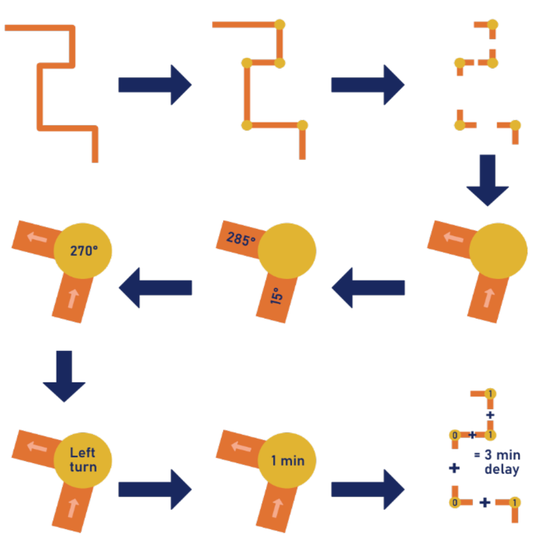


*Fig 2: Visualisation of the data processing, from routes and traffic lights to total delay.*

Based on this research, a delay of 28 seconds was added when going straight at an intersection and 56 seconds when turning left. No delay was added when turning right—as cyclists can often make the turn without stopping.

## RESULT

The output consists of three key products: First, a structured methodology that can replicate these results for any location, demonstrating the robustness of this work. Second, an interactive web map showcasing the results for Munich, providing a quick overview of the local situation. Finally, personalised flyers were designed. The flyers detail participants' cycling journey and connect their daily delay to tangible effects. The goal of the flyers is to appeal to participants on an emotional level and to raise awareness about how cycling infrastructure can have a direct effect not only on paper but also in real life.

## CONCLUSION

Munich already has an extensive cycling network, but due to the large number of inefficient intersections in the city, delays can quickly add up. By mapping the cycling experiences of the 14th intake of the Cartography MSc, this project highlights the need for efficient cycling infrastructure. With improvements to intersection design aimed at optimizing cycle flow, Munich has the potential to position itself as a truly bicycle-friendly city.

## IMPRINT

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## Keywords

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## LINK

## References

[1] United Nations Environment Programme (n.d.). *Cycling, the better mode of transport.* UNEP. https://www.unep.org/news-and-stories/story/cycling-better-mode-transport

[2] osm2gmns. *osm2gmns – osm2gmns 0.7.6 documentation.* (n.d.) https://www. osm2gmns.readthedocs.io

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