

Multi-Modal Traffic Stress Analysis of Road Network Quality: A Comparative Study of Athens and Munich

Master’s Thesis of Hasan Can Buldu

Mentoring:

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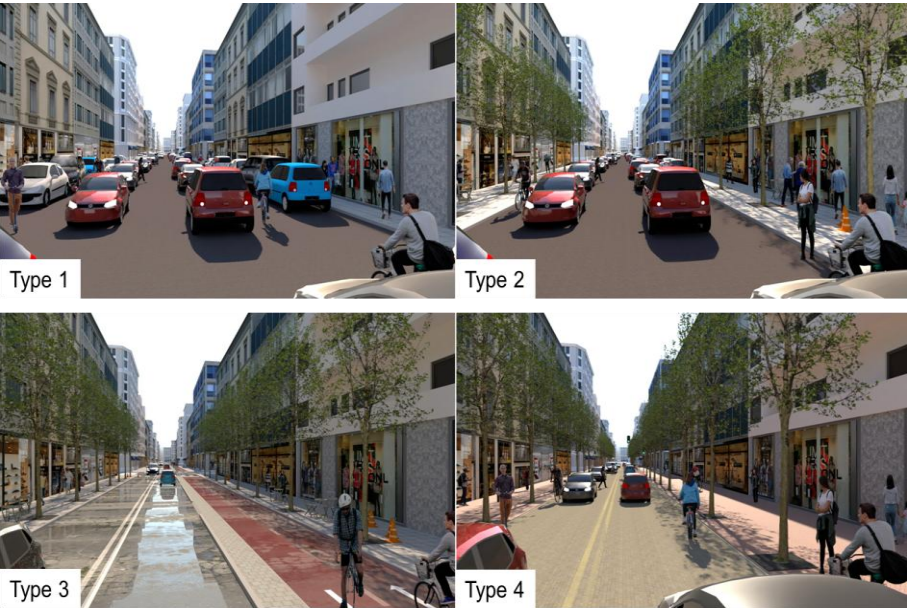


Figure 1: Infrastructure Types (Other elements differ per scenario)
(Retrieved from Tzouras et al., 2024)

A stated preference survey is conducted in Munich with 36 scenarios, each with different road environment characteristics. Respondents rated the perceived safety and mode choice for all of the scenarios, as well as the stress levels and the reasons for their stress for four different modes: car, e-bike, e-scooter and walking. The perceived safety is analyzed using ordered logit models, and for the mode choice, binary and mixed logit models are preferred. The results showed that walking is rated as the safest mode, followed by car, e-bike and e-scooter. The main findings show that infrastructure type, pavement quality and crossings affect perceived safety the most. A new methodology is developed for the analysis of perceived stress: a conditional weighted average based on mode experiences. The absence of bike lanes affected the perceived stress levels the most for bike users and e-scooter riders. For cars, the most reported stressor was the traffic load. Last but not least, the lack of safe crossings affected the stress levels of pedestrians the most.

The main objective of this study is to investigate the reasons for perceived stress among road users. Furthermore, it examines how perceived stress differs among different road users. While past studies focused on directly measuring the stress and objectively classifying the stress levels for road segments, this study sheds light on the subjective stress levels of the users. To investigate this subject, a stated choice questionnaire was conducted in Munich with the help of the survey that was conducted in Athens by Tzouras et al. (2024) with fictitious scenarios. The Athens survey mainly investigated the perceived safety and mode choice of road users by developing a universal methodology, and by keeping the perceived safety questions, the differences in perceived safety among users in Athens and Munich were investigated. Furthermore, by adding stress-related questions, the stress levels and reasons are analyzed. This structure made it possible to examine the effects of road environment on perceived safety, perceived stress and mode choice.

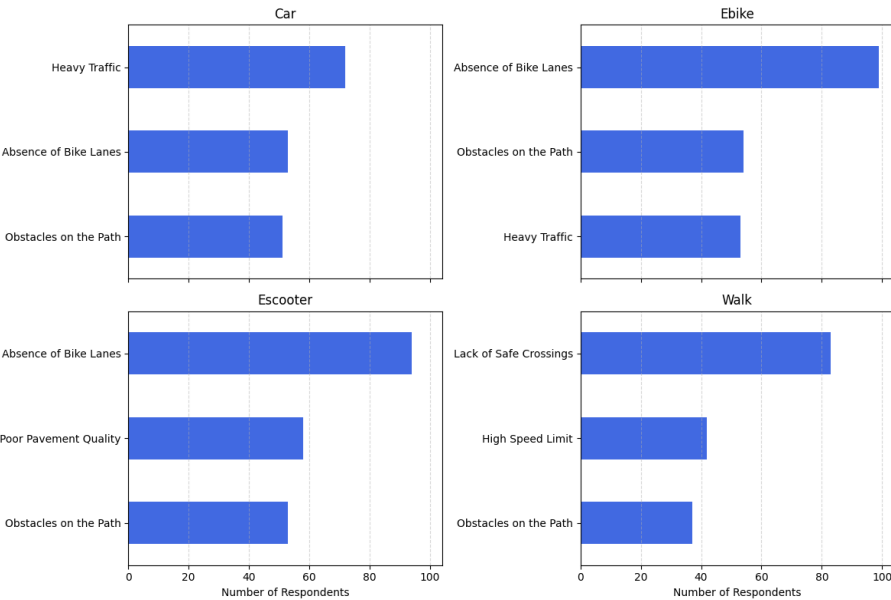


Figure 2: Top Three Reported Stressors per Mode

Weighted Average Stress Score	Subjective Classification	LTS Equivalent
1.0–2.2	Very Low Stress	LTS 1
2.3–3.4	Low Stress	LTS 2
3.5–4.6	Moderate Stress	LTS 3
4.7–5.8	High Stress	LTS 4
5.9–7.0	Very High Stress	LTS 5

Table 1: Level of Traffic Stress (LTS) Classification Scale

Conducting a survey which solely includes perceived stress questions can help understand which infrastructural aspects affect stress better for both Munich and Athens. This type of survey would allow better models to be created for perceived stress, and since the scenarios are designed around the parameters, choosing particular scenarios leads to an issue of not capturing every aspect of the scenarios. To sum up, respondents mainly prefer a structurally separated environment with safe crossings, with good pavement quality and less congested roads. Therefore, to design safe and stress-free environments, the decision makers should consider designs with a separate micro-mobility lane and controlled crossings, and periodical maintenance of the pavements should be done to achieve good-quality pavements.

References

Tzouras, P. G., Pastia, V., Kaparias, I., & Kepaptsoglou, K. (2024). Exploring the effect of perceived safety in first/last mile mode choices. *Transportation*. <https://doi.org/10.1007/s11116-024-10487-4>