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## MASTER'S THESIS

# Analysis of Factors Leading to Rule Breaking Behavior of Bicyclists at Urban Intersections

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## **Abstract**

As the number of cyclists in urban settings continues to increase, it becomes necessary to better understand cyclists' behavior and needs. There are numerous existing studies focusing on factors influencing why people bike, why they choose a certain route or what infrastructure they require. However there is limited research on the subject of why cyclists engage in unexpected or rule breaking behavior at urban intersections

### **Scope:**

The scope of this thesis includes:

- a thorough review of previous research concerning bicycle transportation in terms of rule breaking behavior
- the development of a stated choice experiment using hypothetical scenarios
- creation, development, and distribution of an online survey (i.e. personal questionnaire and stated choice experiment)
- evaluation of the results including primary and secondary relationships of the survey data
- observations and recommendations for future graphic-dependent, transportation-behavior-measuring survey design

### **Objective:**

The goal of this thesis is to evaluate certain factors that influence cyclists' unexpected behavior at urban intersections in a red light scenario. This is to be accomplished through the creation, development, and distribution of a stated choice online survey and the analysis of the results.

### **Approach:**

A set of potential determinants of unexpected, or risky, behavior at urban intersections were determined based on the review of earlier studies, reports, intuitive judgment, and input from the thesis supervisors at the Technische Universität München (TUM). There are few studies that adequately identify these factors and quantify their impact at red light crossings.

Although this research project potentially encompasses multiple areas of rule breaking behavior, particular emphasis was placed on red light situations since risky behaviors at

urban intersections tend to have the highest impact on safety for cyclists and other road users. Final attributes chosen for examination were:

1. Urban Intersection Red Light Scenario Characteristics (red light duration, Level-of-Service of cross traffic, trip purpose, presence of other cyclists upon arrival and while waiting)
2. Demographics (age, gender, education, monthly income, marital status, geographic location of residence)
3. Bicycle and Driving Characteristics (experience level, cyclists self image, frequency of red light crossing as a cyclist, possession of driver's license)
4. Behavioral Characteristics (self reported level of awareness, likelihood of engaging in risky behaviors)
5. Safety in Numbers (belief in concept of safety in numbers, actual number of cyclists respondents would feel safe crossing with)

The above mentioned attributes were compiled through fractional factorial/orthogonal experimental design into 2 blocks of 9 choice sets consisting of 2 scenarios each. A total of 36 scenarios were tested. Each scenario was accompanied by 5 computer rendered images to aid respondents with scenario visualization. A total of 180 individual images were created. The scenarios were incorporated into an online survey. Respondents were asked to select from each choice set the scenario in which they were most likely to cross during the red light. The selected scenarios as well as the respondents' answers to a variety of additional questions (ranging from basic demographics to behavioral characteristics and cyclist-themed beliefs) were then summarized and analyzed through IBM SPSS Statistics 21. Observations and recommendations based on the survey results as well as the experience gained through the creation, distribution, and administration of this stated choice survey were included to assist with future graphic-dependent, cyclist-behavior-related survey design.