

# Stress and Situational Awareness among Bus Drivers

Extended Abstract

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## Introduction

Taking a bus every day as a customer it is difficult to imagine that driving a bus is considered as one of the very stressful jobs. Most of the time a bus driver has to do plenty of tasks simultaneously, moreover timetable compliance together with increasing road congestion contribute to strain, pressure and workloads of bus drivers, which leads to health and mental problems. The aim of this study is to analyze stress level and situational awareness of bus drivers during changing working conditions. Recently, studies have shown that buses, which operate under headway-based holding strategy provide better on-time service performance than buses, which operate under schedule-based holding strategy, the new system was under trial in Stockholm; it required some operational differences during driving than the common schedule-based system and according to bus drivers caused additional stress. The idea of the study appeared due to the mentioned above reasons. Therefore, the study aims to evaluate level of stress with heart rate as a main indicator among drivers before driving, during driving, and right after driving. Changing working situations include: switch from headway-based to scheduled based holding strategy and extreme weather conditions, these two occurrences took place during four days two weeks before Christmas.

## Experimental Methods

The experimental methods used for this study combine subjective and objective data collection. Subjective data collection was made via surveys, which the drivers filled in before and after driving the route. The questions were related to personal perception of stress, time pressure, driving patterns, emotions before and after driving and personal opinions on the main stress on the route. Objective data collection was made via collecting the heart rate, speed and position (GPS data) on the route. The objective data collection was successful due to the high participation of bus drivers during data collection days and reliable, non-obtrusive equipment Garmin Edge 800, which was developed for cyclists.

### Experimental design

Experimental Group	Control Group
Switch from even-based holding strategy to schedule-based holding strategy	Schedule-based holding strategy
Extreme weather conditions, snow storm	Normal weather conditions, sunny days
measurements during peak-hour	measurements during peak-hour
measurements during off peak-hour	measurements during off peak-hour

1. Route: bus trunk-line 3. Only drivers, who operate on line 3 were tested.
2. Sample size: experimental group – 22 drivers, control group – 13 drivers

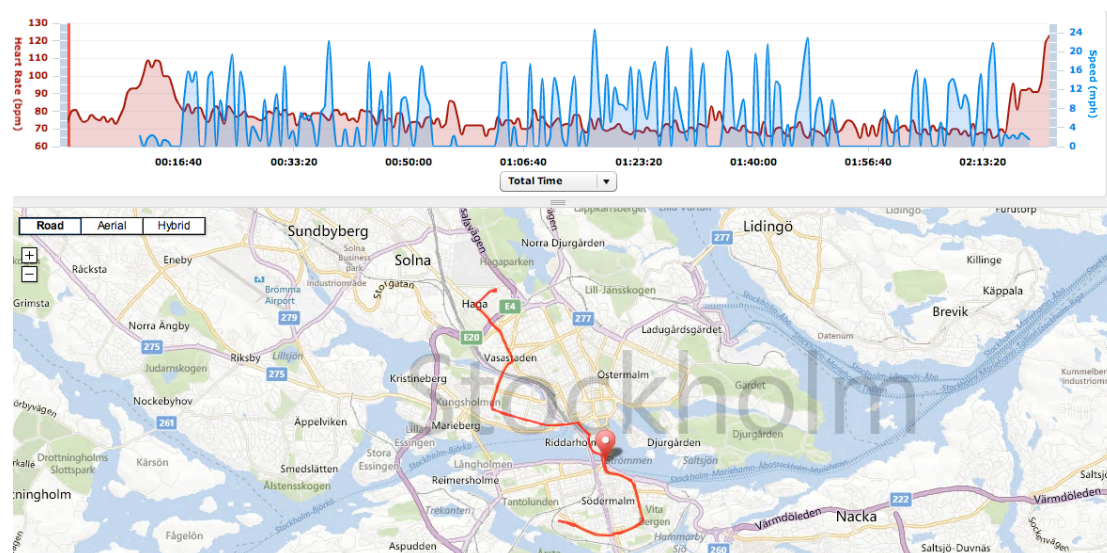
## Analyses

The data collection has just been finished. Further analyses will be conducted via comparison of data sets: one with changing working conditions and snow storm and the other one with regular working conditions, sunny weather and schedule-based holding strategy. Regression models will be used for analyses in order to find the relationship between the heart rate and explanatory variables. Explanatory variables, are determined as following: time variable – period of the day (peak-hour & off peak hour, Friday & Sunday, etc.), spatial variable – section of the road; individual variable – age, gender, personal feelings and emotions.

Preliminary results have shown that the heart rate is on peak just before driving, approximately 5 minutes before. This is the time, when a driver is getting ready on route, going to a stop, replaces and does some other required actions. Drivers confirmed, that the most difficult time during the day is every time before the ride rather than during driving. Heart rate on route was relatively normal with some distinguishable sudden peaks. The study aims to find out if the peaks happened due to unpredictable situations on route or if they have any pattern and come from any similar origin.

Heart rate during the snow storm event was rather discernible with extremely high sudden and repetitive peaks, which draw a pattern for an average heart rate thought the day to be ten points higher than in other days.

Picture 1. Heart rate and speed on the route



## Conclusions

Final results will show if there is a relationship and what kind of relationship exists between heart rate and part of the day, section of the road and individual characteristics. The study will help to understand if there is any pattern of sudden increase of heart rate on the route or if it is of any unexpected situation on the road. It will also be valuable, because the study will enlighten any possible improvements or suggestion for bus operations and personal behavior for bus drivers in order to cope and decrease stress during and before the driving and improve working conditions.

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