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POSTER SESSION

# Establishing the relationship between crashes and unsafe driver behaviors in motorway segments

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## INTRODUCTION

- Crash-based safety analysis suffers from several limitations (e.g., unreliable crash data)
- Surrogate safety analysis stands as an alternative approach.
- It remains unclear how various metrics that describe unsafe driving relate to crash occurrence.

## OBJECTIVES

This work aims to address existing research gaps by investigating the relationship between crashes and three unsafe driver behaviors: 1. speeding, 2. harsh braking and 3. harsh acceleration. The outcome of this work will be a step towards the establishment of proactive safety assessment methods.

## DATA

The analysis was conducted for Olympia Odos motorway, (~200km) for which relevant data were available.

- **Road data**: horizontal curve radius, inside and outside shoulder widths, outside clearance, lane width, median width, barrier type, and interchange design characteristics
- **Crash data** (2017-2020)
- **AADT data** (2017-2020)
- **Driver telematics data**: 2019 and 2020 trip data with a total of ~1.3 million trips

**Figure 1:** Crash frequency per year

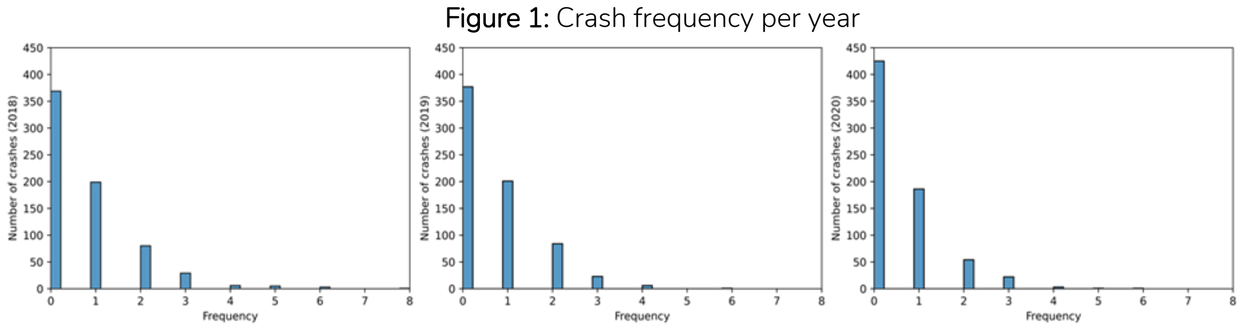


**Table 1:** Summary statistics for the representative dataset provided by OSeven.

| | 2019 (6 months) | | | 2020 (12 months) | | |
|---|---|---|---|---|---|---|
| | Harsh acceleration events | Harsh braking events | Speeding events | Harsh acceleration events | Harsh braking events | Speeding events |
| Mean | 1.42 | 1.56 | 1.26 | 1.53 | 1.69 | 1.27 |
| St. deviation | 13.63 | 11.89 | 9.15 | 11.67 | 10.85 | 10.11 |
| Variance | 185.83 | 141.28 | 83.72 | 136.23 | 117.69 | 102.21 |

## METHODOLOGY

Crash prediction models were developed to model the relationship between crashes and unsafe driver events.
It is assumed that the number of crashes per motorway segment follows the Poisson distribution.

## RESULTS

**Table 2:** Crash prediction model with harsh acceleration events

| Variable | Coefficient | St. Error | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | -7.0100 | 1.337 | -5.245 | 0.000 | -9.630 | -4.390 |
| ln(AADT) | 0.7740 | 0.143 | 5.415 | 0.000 | 0.494 | 1.054 |
| ln(length) | 0.9291 | 0.273 | 3.402 | 0.001 | 0.394 | 1.464 |
| Average HA | 20.1427 | 8.826 | 2.257 | 0.023 | 2.647 | 37.638 |

**Table 3:** Crash prediction model with harsh braking events

| Variable | Coefficient | St. Error | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | -7.4137 | 1.335 | -5.552 | 0.000 | -10.031 | -4.796 |
| ln(AADT) | 0.8134 | 0.143 | 5.690 | 0.000 | 0.533 | 1.094 |
| ln(length) | 0.8598 | 0.266 | 3.234 | 0.001 | 0.339 | 1.381 |
| Average HB | 18.4454 | 12.930 | 1.426 | 0.154 | -6.899 | 43.788 |

**Table 4:** Crash prediction model with harsh speeding events

| Variable | Coefficient | St. Error | z | P>\|z\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| Intercept | -7.2976 | 1.999 | -3.651 | 0.000 | -11.215 | -3.380 |
| ln(AADT) | 0.8014 | 0.204 | 3.933 | 0.000 | 0.402 | 1.201 |
| ln(length) | 0.8085 | 0.262 | 3.082 | 0.002 | 0.294 | 1.323 |
| Average Speeding | 0.0289 | 0.646 | 0.045 | 0.964 | -1.237 | 1.295 |

## CONCLUSIONS

The conclusions drawn from the current research can serve as the base for developing similar models to further explore the relationship between unsafe driver events and crash occurrence. Future research should explore how disaggregate driver telematics data can be used instead of aggregated one.

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