The use of surrogate measures of safety in site-based observations of road traffic: a scoping review

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Introduction

- **Surrogate measures of safety:**
  - Investigate road safety without relying on accident data
  - Alternative or complement to analyses of accident records
Introduction

- Great improvements in sensor technologies
  - New opportunities for SSM, but also new challenges
- Literature in the domain is vast and diverse
  - Researchers risk to lose track of critical points of attention
  - „Reinventing the wheel“, double work, errors from the past repeated,...
Objectives

- Provide descriptive insight into the available literature
- Identify critical challenges and opportunities that should be central in future research
- Emphasis on Vulnerable Road Users (VRU)
Methodology

- **Scoping review**
  - Systematic protocol to identify relevant literature
  - Focus limited to studies that measure the severity of events from real traffic using static on-site cameras, sensors or observers
  - Information of each publication stored in predefined codebook
Overview of the literature

The diagram illustrates the number of publications included and not located across different years from 1968 to 2014. The years are not evenly distributed, with a notable increase in the number of publications after 2010.
Focus of the studies

![Bar chart showing the focus of studies]
Overview of indicator use

![Bar chart showing the number of publications for different indicator types between 2005 and 2015. The categories are TTC, PET, Deceleration, and Other. The data indicates a significant increase in publications related to TTC over the years.]
TTC family

- Time-to-Collision (TTC) was originally defined as “time until a collision between two road users would occur if they continued on their present course at their present rates”
  - Not measured directly ➔ calculated based on future motion prediction
  - Can be calculated as long as road users are on collision course
    - This concept is vital, but also subject to a lot of debate
  - Continuous indicator
- Most commonly used value: minimum TTC-value during an interaction ($TTC_{\text{min}}$)
- Other distinct value: Time-to-Accident: TTC at start of evasive action
  - Part of STCT
- And others: e.g. T2, TET, TIT, TTL
TTC family

- Analysis of applied threshold values for \( \text{TTC}_{\min} \) (\( N=55 \))
PET family

- **PET** = time between the moment that the first road user leaves the path of the second and the moment that the second reaches the path of the first
- Argumentation: useful supplement to TTC because also non-collision course events can be risky
- Some related indicators include: Gap Time, Time Headway, TAdv,...

\[ PET = t_2 - t_1 \]
PET family

- Analysis of applied threshold values for PET (N=28)
Integration of indicators to a single index

- Integrate different indicators describing a traffic event into a single value that describes “severity” of the event
  - Single indicators are usually not sufficiently universal to be applied to any situation at any time
  - Possibly they all represent partial images of the “true” severity of a traffic event
- Many TCT’s can also be considered part of this category
Traffic Conflict Techniques

- DOCTOR: Before 2005 = 0, 2005 - 2015 = 5
- Canadian: Before 2005 = 0, 2005 - 2015 = 5
- Other: Before 2005 = 0, 2005 - 2015 = 5
Study design

- Number of observation sites
Study design

- Average duration of observations per site

![Bar chart showing average observation duration (hours) with categories for different duration ranges and data for 'Before 2005' and '2005 - 2015'.]
Study design

- Types of road users that are observed

![Bar chart showing the number of publications for different road users: motor vehicles, pedestrians, bicyclists, and mopeds. The chart compares the number of publications before 2005 and from 2005 to 2015.](attachment:chart.jpg)
Study design

- Data collection method
Discussion and conclusions

- Applied TCTs and indicators show an overwhelming variety and creativity
- Relation with accidents needs to be explored further
- Validation studies are mostly based on human observations
  - Transferability to automated techniques uncertain
- Many indicators are hardly validated
  - Additional research around validity of surrogates is highly needed
- “Outcome severity” should be better reflected in applied surrogate measures of safety
Thank you very much for your attention!

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- Full report: InDev Deliverable 2.1, Appendix 6
- Key publications: ICTCT library: www.ictct.org/ictct-library/tct-library

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