

Safety effects of traffic calming on roads through villages: proactive evaluation using GPS data



Jiří Ambros, Jan Kubeček, Jan Elgner
CDV – Transport Research Centre



Mariusz Kieć, Radosław Bąk
Cracow University of Technology



Contents

Introduction

- Characteristic of roads through villages
- Safety problems

The study

- GPS data collection
- Speed variations (surrogate safety measures)

Results

- Speed profiles
- Surrogate safety measure based on GPS data

Conclusions

Background

- Two-lane road sections through small towns or villages
- Variation of speed in built-up area
- High share of heavy vehicles
- Various land use in the road surrounding
- No access control in built-up areas
- Mixed local and through traffic
- Various physical speed management devices

Traffic disruptions and speed changes may be caused by: intersections, accesses, bus stops, pedestrian crossings...



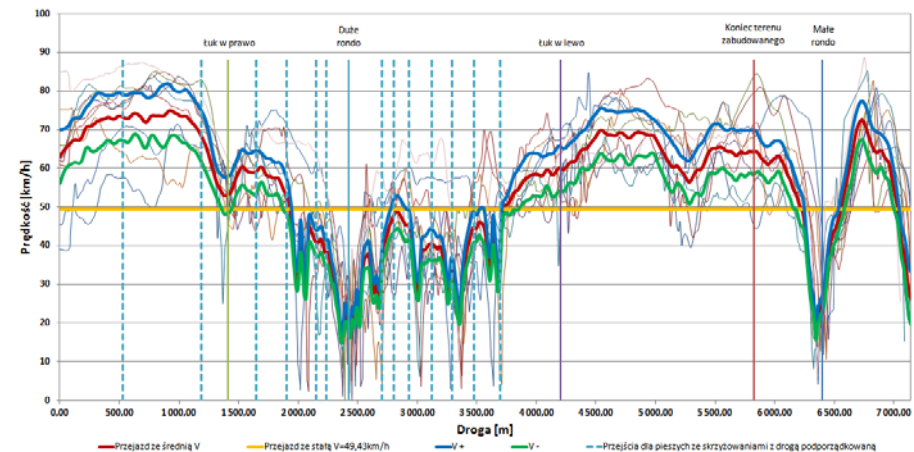
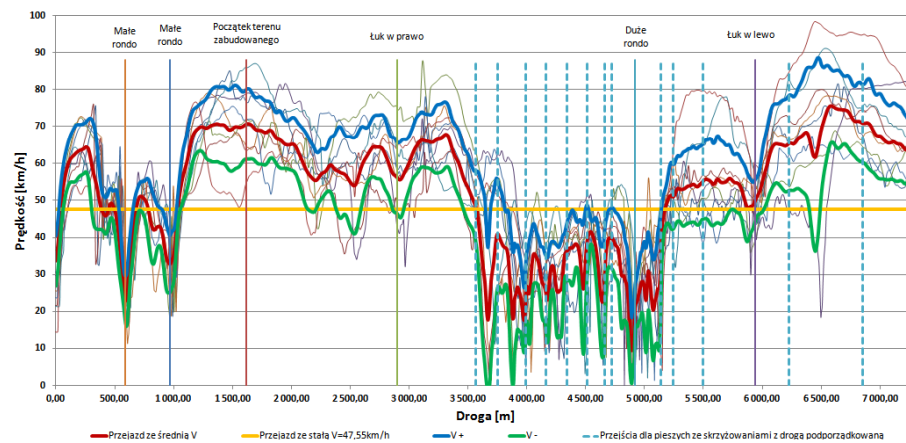
Safety problems

- Speeding problem
- The safety effects for villages are not always known and may be highly variable, given the differences in design, configuration, or surroundings conditions
- Overlapping of through traffic with local traffic leading to interruptions, in result changes in speed variations and road safety levels
- More collision points, and the need for speed reduction, stopping, accelerating, the frequency of the disruptions depends on the land use character

Many variables have impact on road safety

Aim of study

- To test a proactive safety evaluation approach, speed data from vehicles on selected roads through a sample of small towns or villages in the Czech Republic and Poland were collected
- The effects include impacts on speed and standard deviation of speeds as well as safety



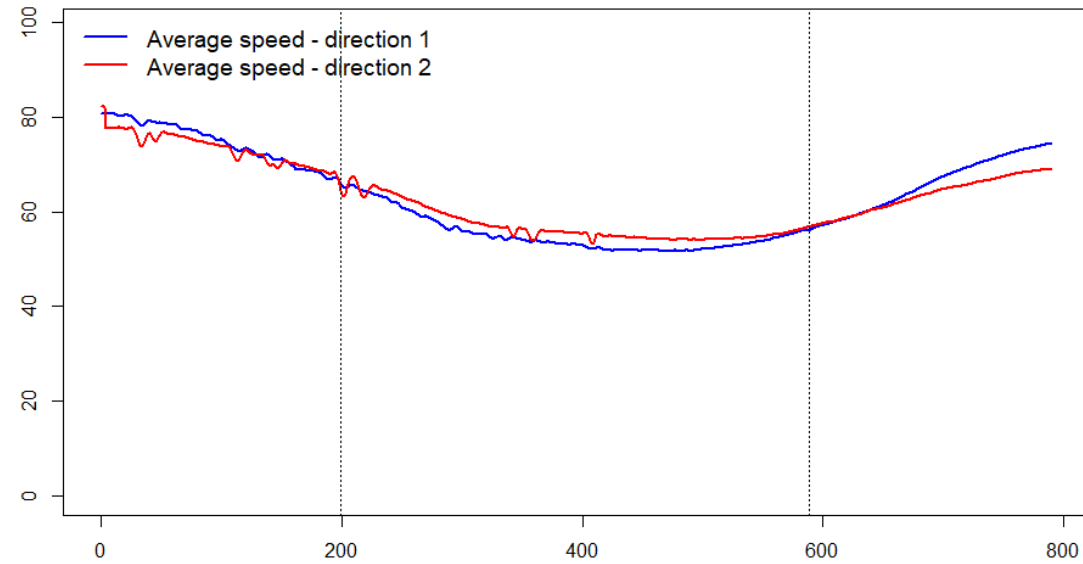
Method

- Data collection technique:
 - Test vehicle technique (10 Hz GPS) and video recording - PL
 - Floating Car Data - CZ
- Drives through the villages in both driving directions of each section were conducted and analyzed, in order to collect data on drivers' behaviour
- The collected GPS data was used to obtain representative speed profiles
- Estimation of speed changes, induced by variables, related to cross-section, road surroundings, access, etc.

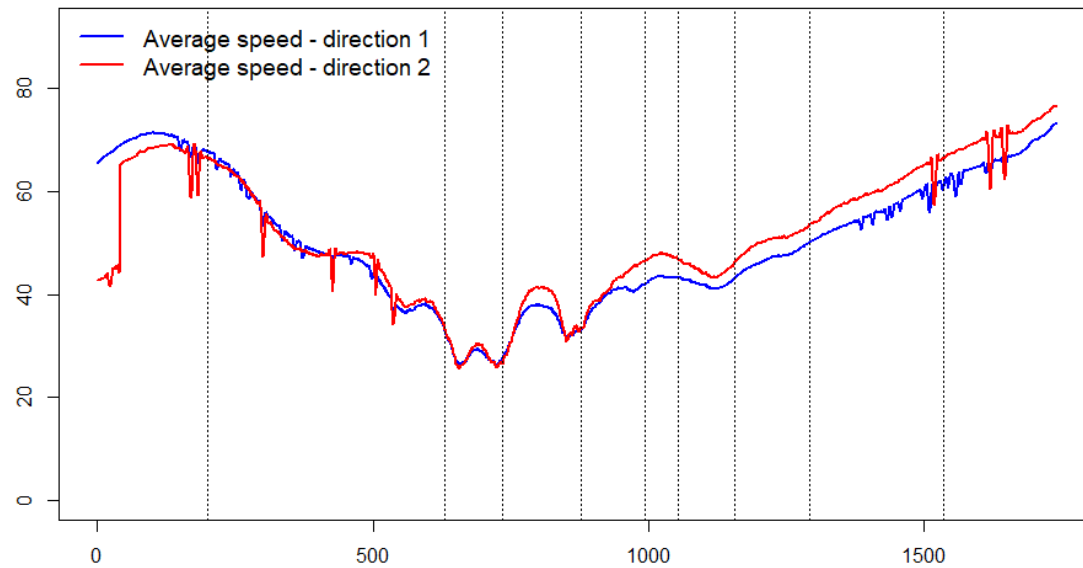


Results – Czech examples

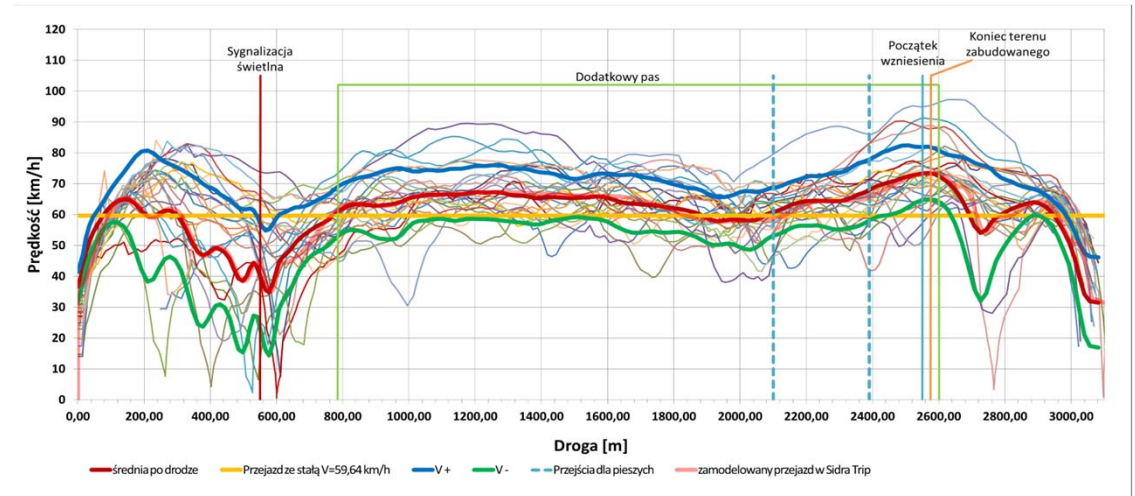
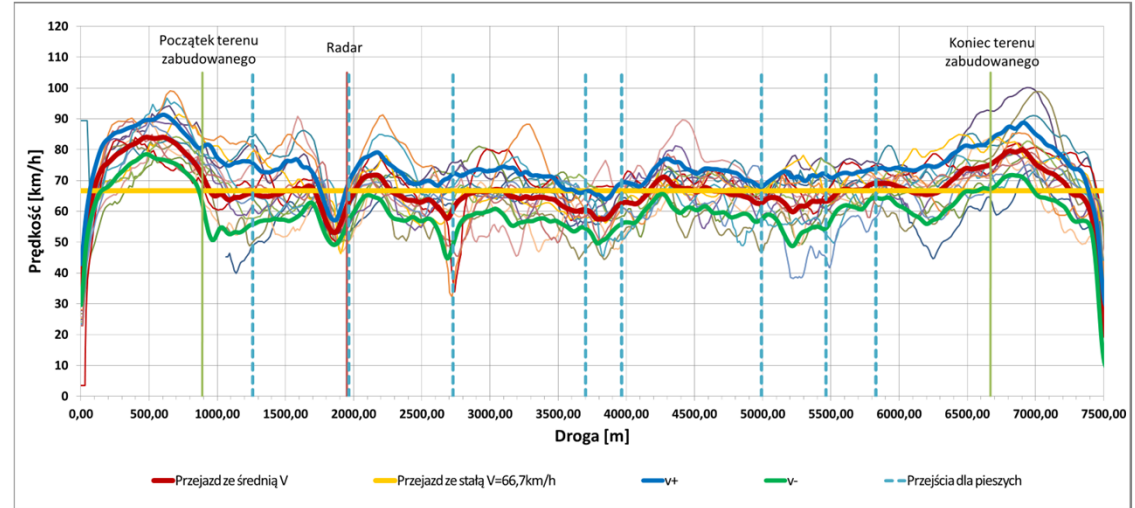
- without calming



- with calming



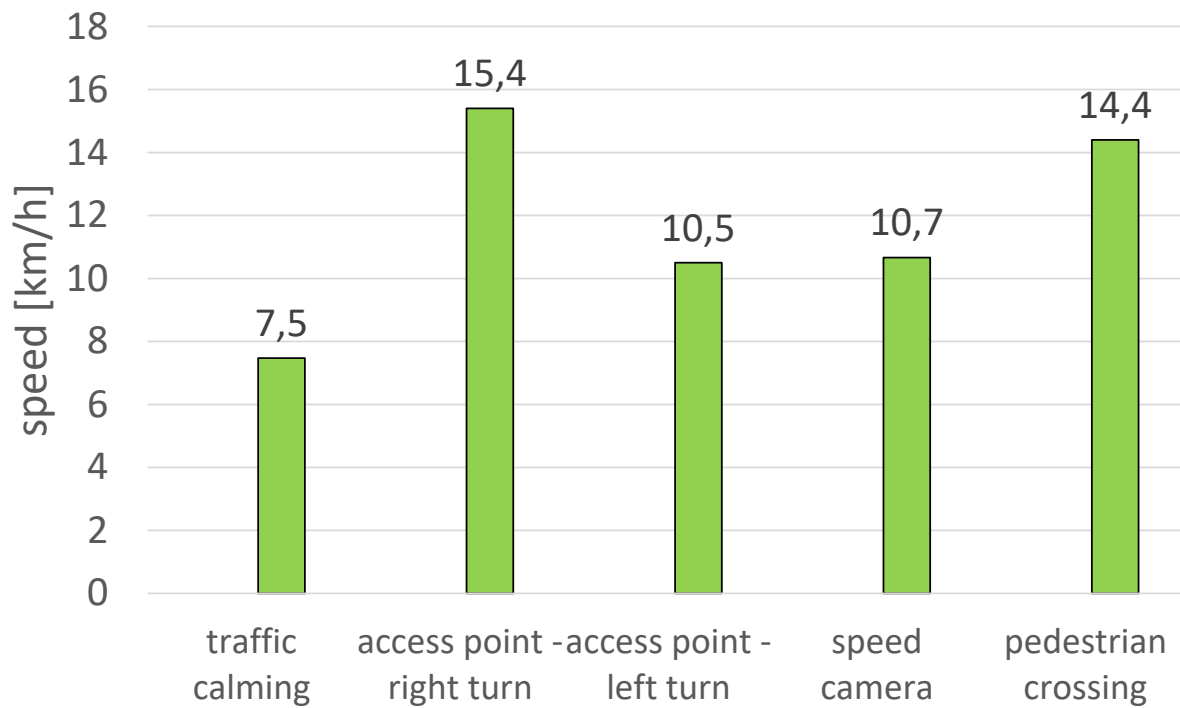
Results – Polish examples



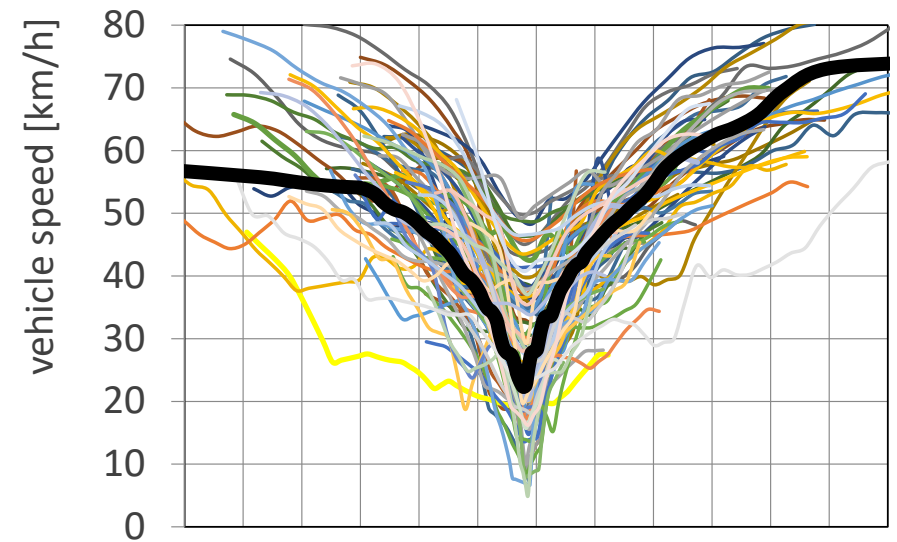
Results

Variability of speed across roads through a small towns or villages

speed reduction



access point



How to assess road safety?

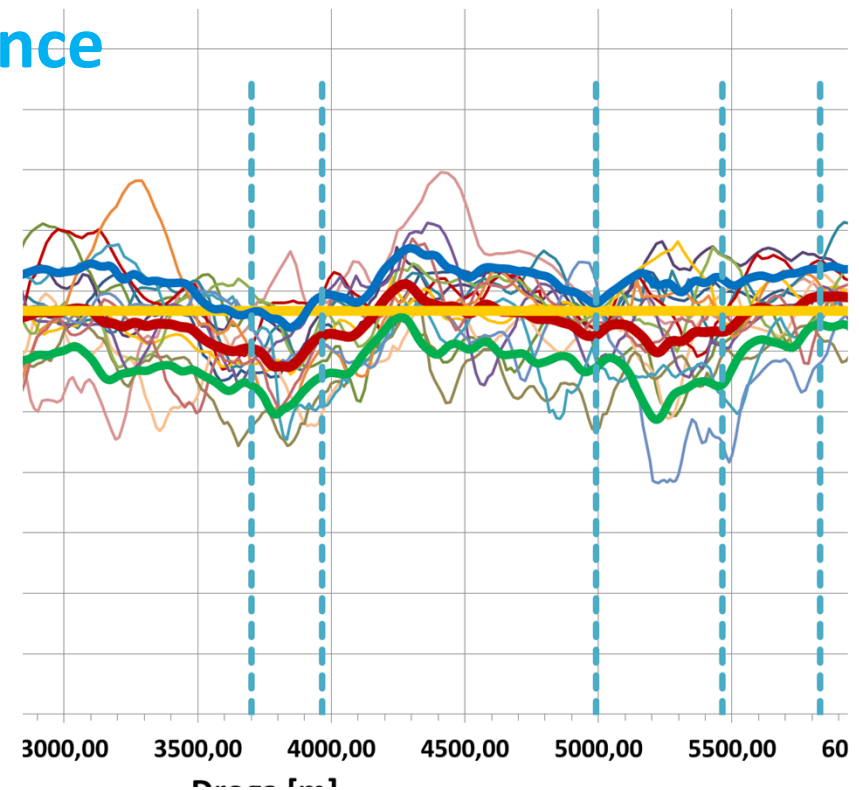
- Low occurrence of accidents
- Many variables: traffic exposure (local and through), variables reflecting geometric features, land use, access

The Traffic Safety Problem = **exposure** x **risk** x **consequence**

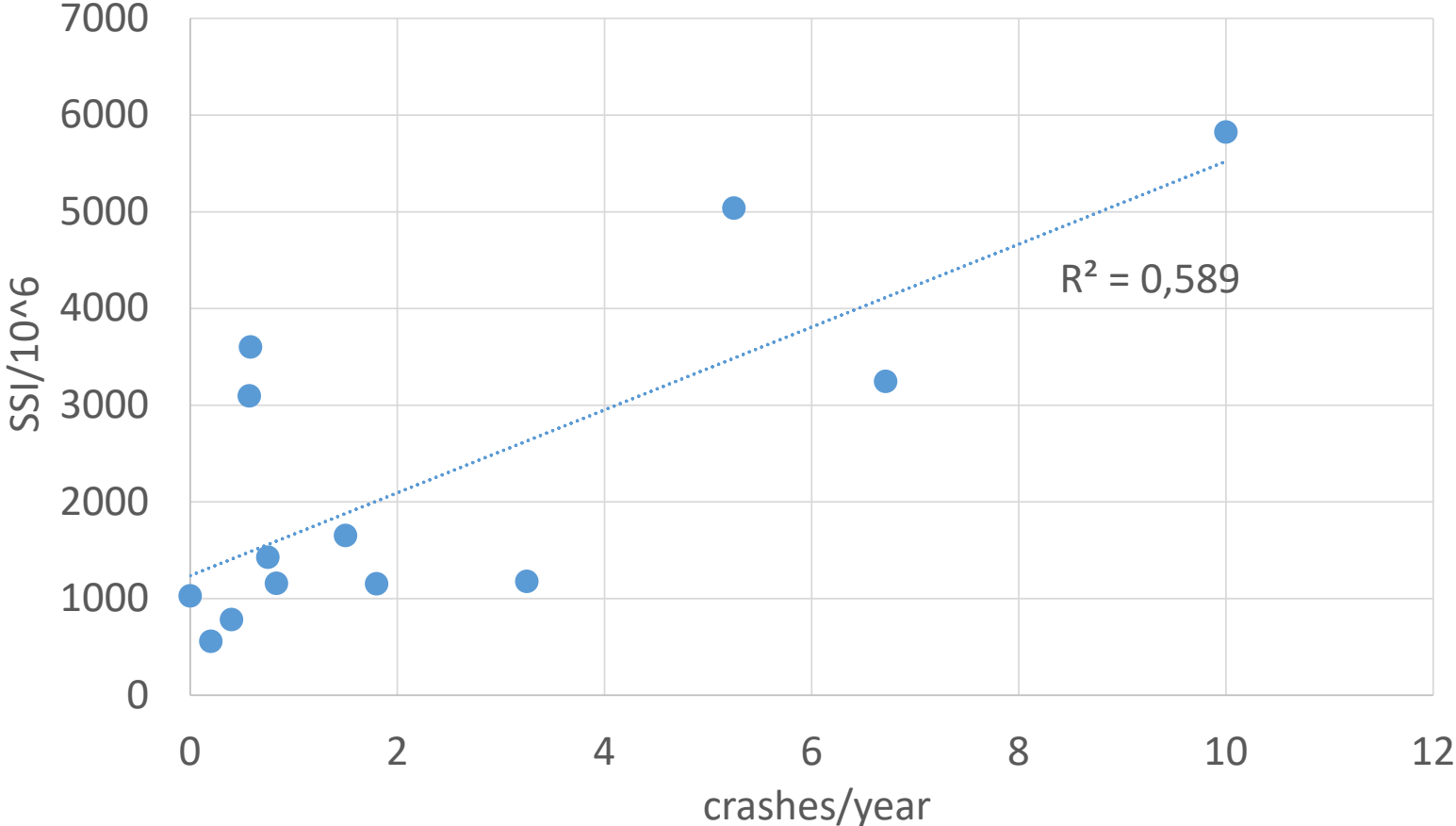
How to assess road safety?

- Safety through villages = f (speed, changes in speed, AADT)
 - σ_i – standard deviation of speed at i -th section - **risk**
 - V_i – speed at i -th section - **consequence**
 - $AADT$ – traffic volume - **exposure**
 - SSI – speed safety index

$$\left(\sum_{i=1}^n \sigma_i \cdot V_i \right) \cdot AADT = SSI$$



Speed safety index vs. number of crashes



Conclusions

- The developed method enables using GPS data to obtain speed-based metrics. Speed Safety Index is a promising surrogate safety measure, applicable for proactive safety evaluations.
- Segmentation has to be analyzed because of impact on Speed Safety Index value
- GPS data present a valuable emerging big data source, but they have also limitations, e.g. sampling rate, uncertain estimation of free-flow speed, or generalizability to driving population
- Research needs to find a compatibility between test vehicle technique and Floating Car Data results

Thank you for your attention



Jiří Ambros, Jan Kubeček, Jan Elgner
CDV – Transport Research Centre



Mariusz Kieć, Radosław Bąk
Cracow University of Technology

