

# Motor Vehicles Overtaking Cyclists on Two-lane Rural Roads: Analysis on Speed and Lateral Clearance

**Carlos Llorca**

**Antonio Angel-Domenech**

**Fernando Agustin-Gomez**

**Vicente Ferrer**

**Alfredo Garcia**

# Introduction



- **Vulnerable Road Users:**
  - Pedestrians, cyclists, motorbikers, etc.
- **Cycling on two-lane rural roads:**
  - Sport and leisure activities
  - 26% of accidents involving cyclists
  - 65% of deaths (45 of 69)
  - Overtaking manoeuvres





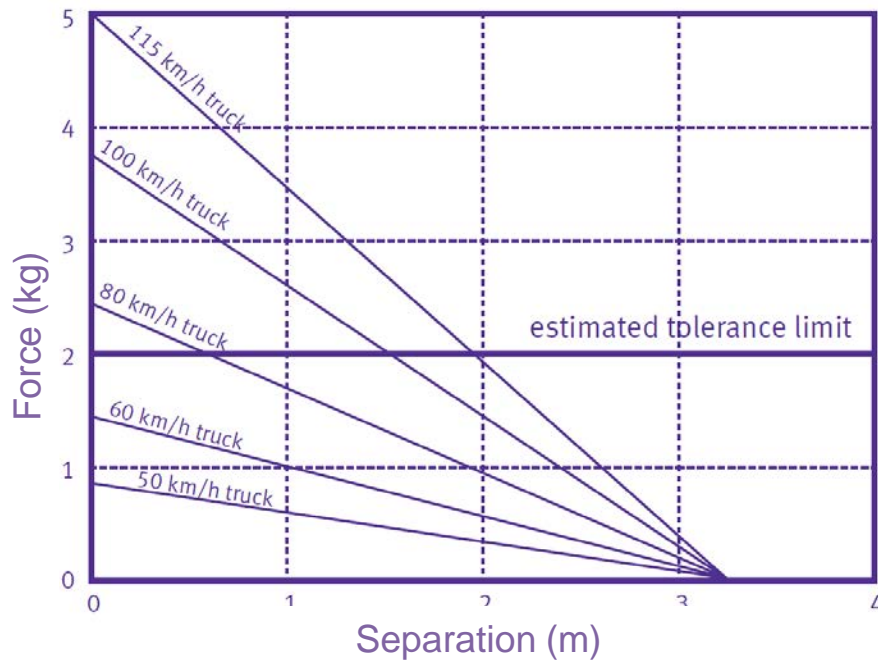
# Introduction

- Overtaking manoeuvre

Common space  
occupancy



Aerodynamic  
forces



$$F_y = \frac{1}{2} \rho S V^2 C_y$$

- V: motor vehicle speed
- S: front surface
- C<sub>y</sub>: separation, etc.

# Objectives



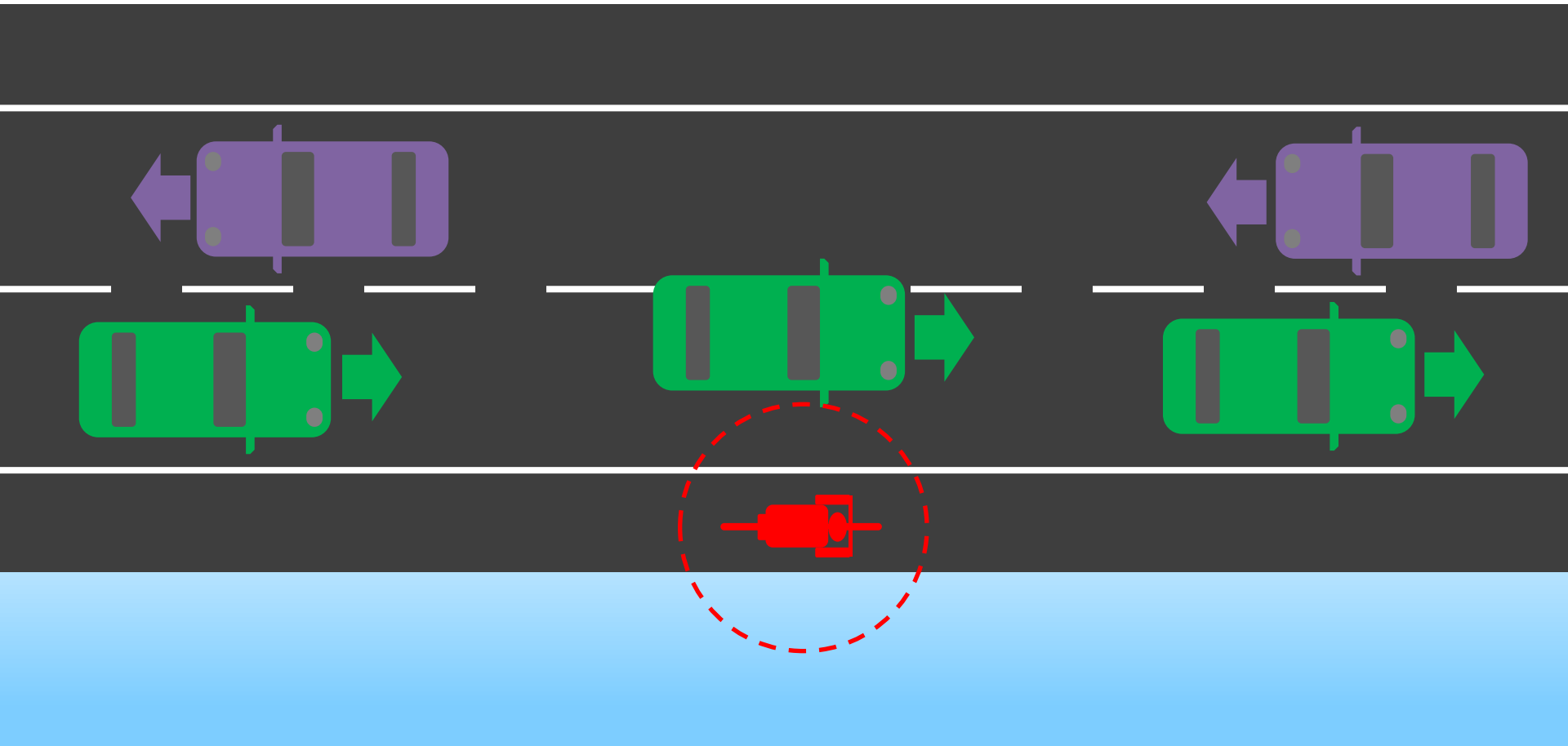
- **Observation of motor vehicles overtaking bicycles:**
  - Lateral distance
  - Speed
- **Comparison of objective and subjective overtaking risk**



# Method



- Data collection





# Method

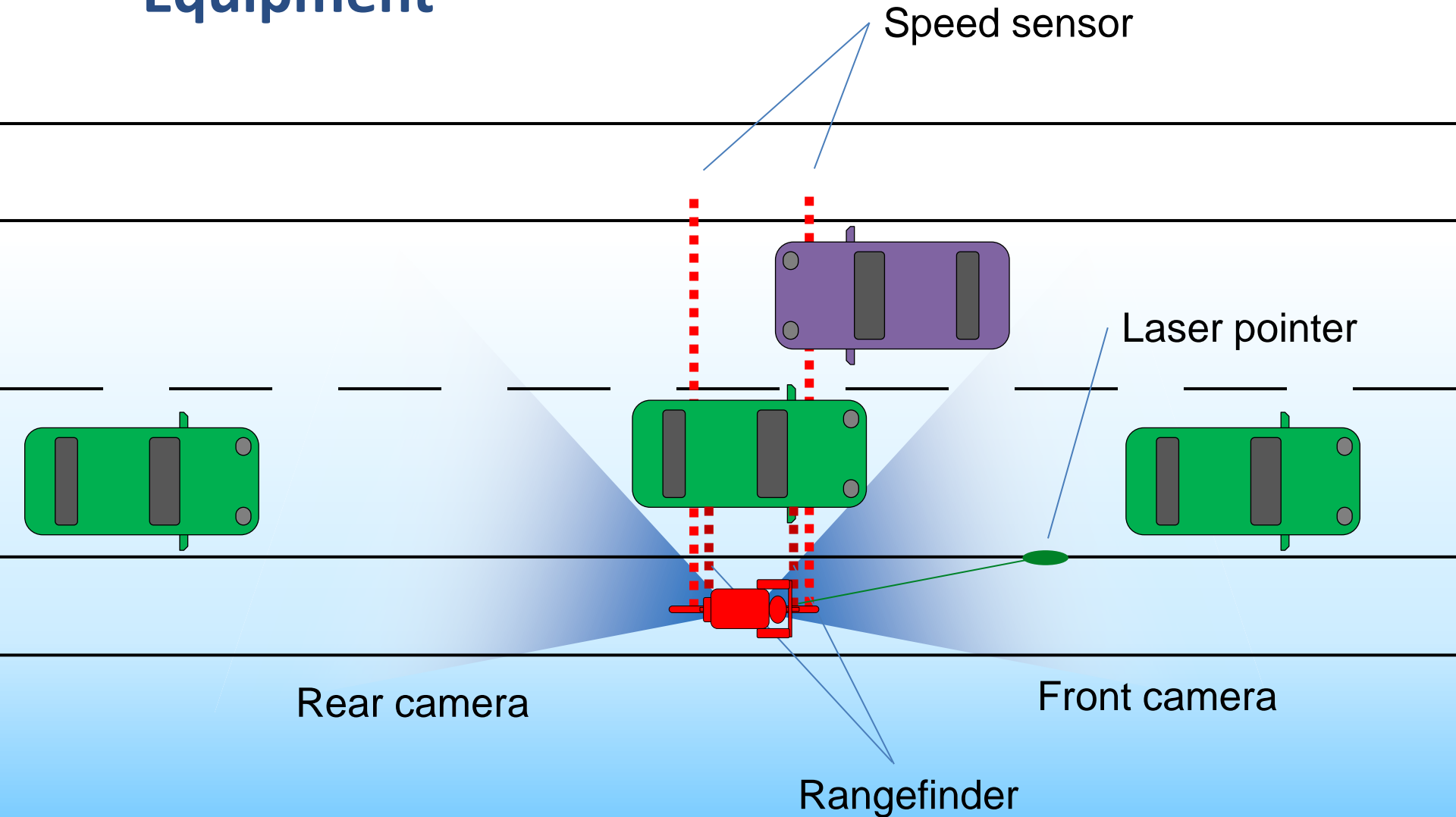
- Instrumented bicycle



# Method



- **Equipment**





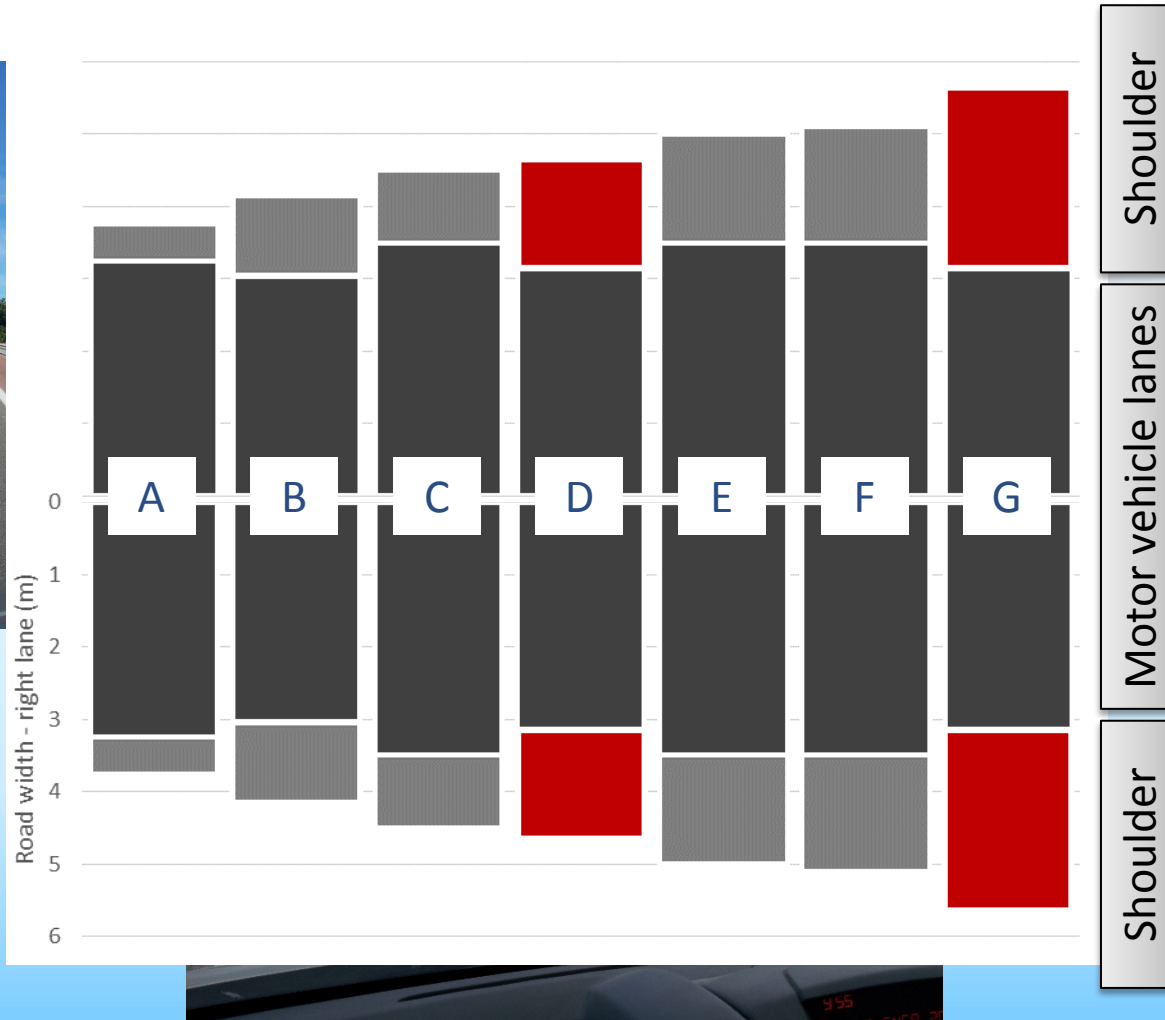






# Method

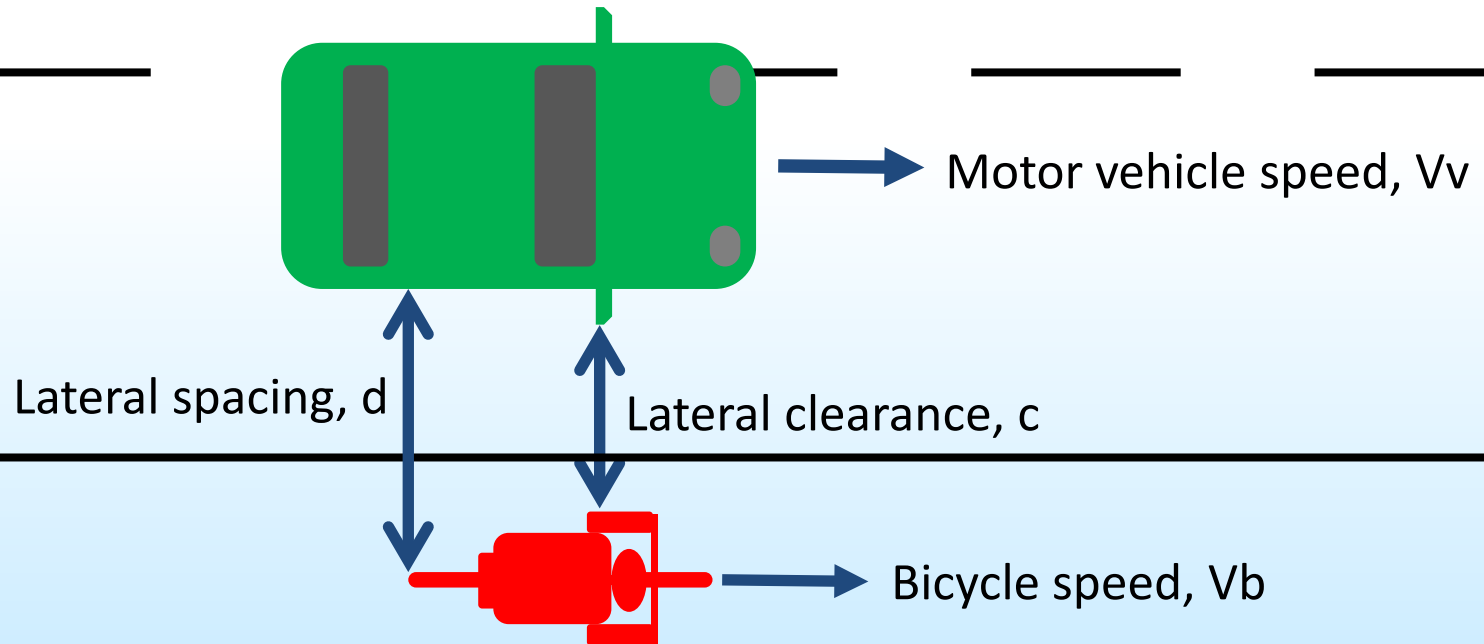
- Roads



# Method



- Variables

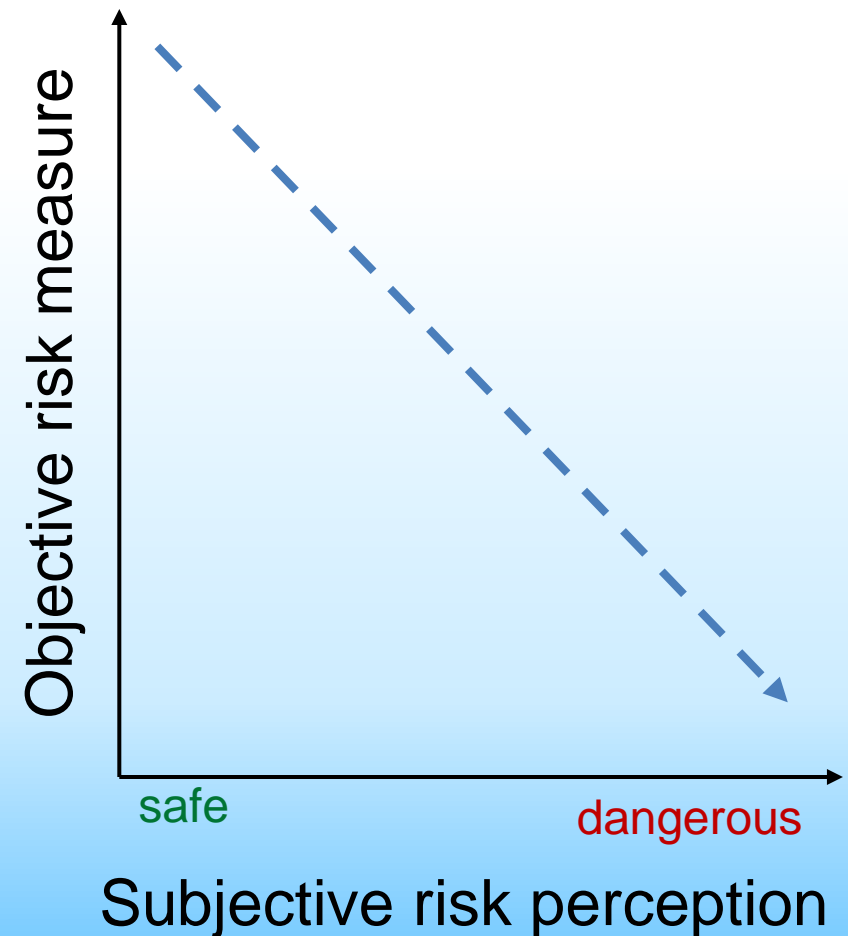
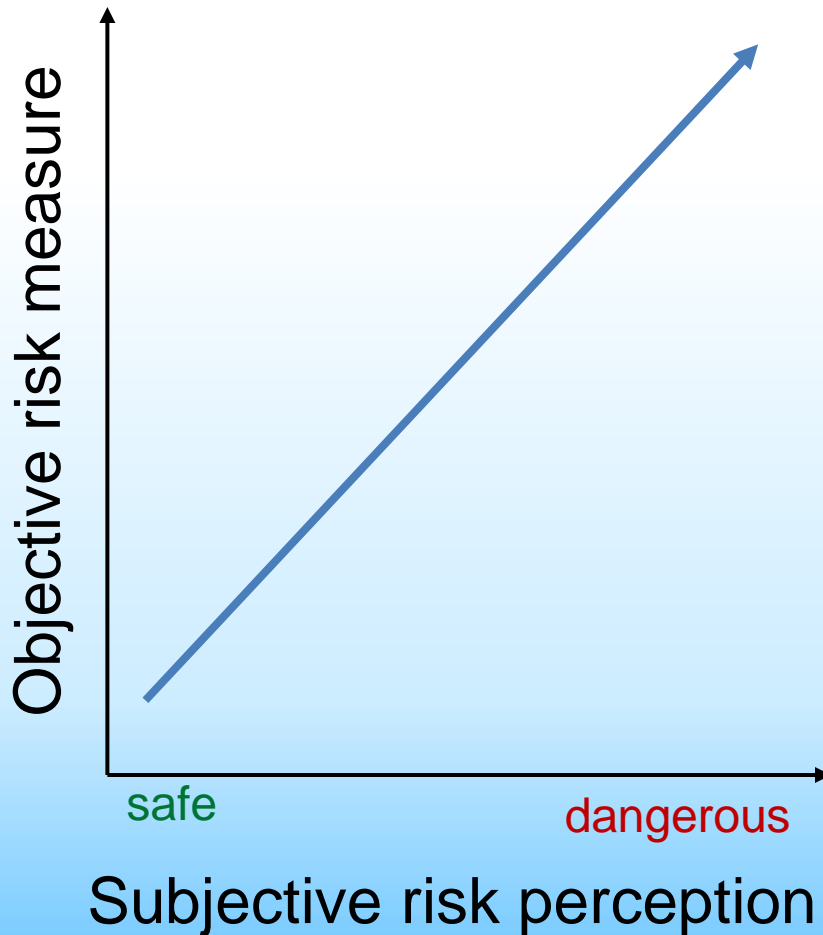


- Risk perception ranking of locations: 1 (the safest) to 5 (the most dangerous)

# Results



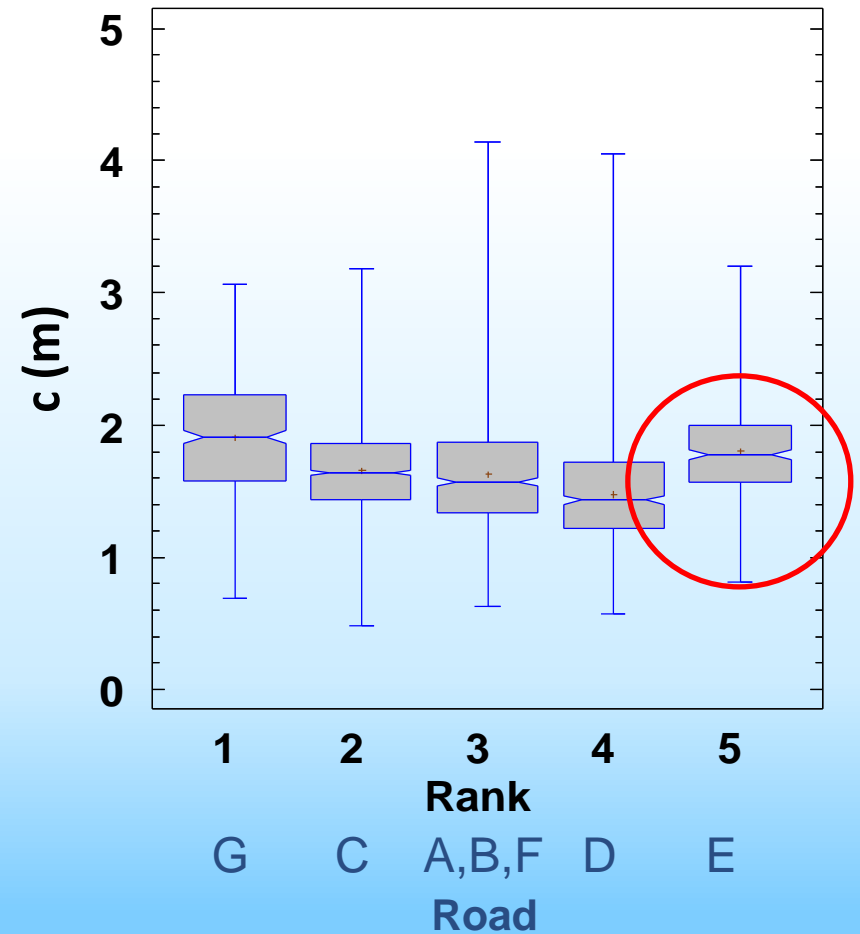
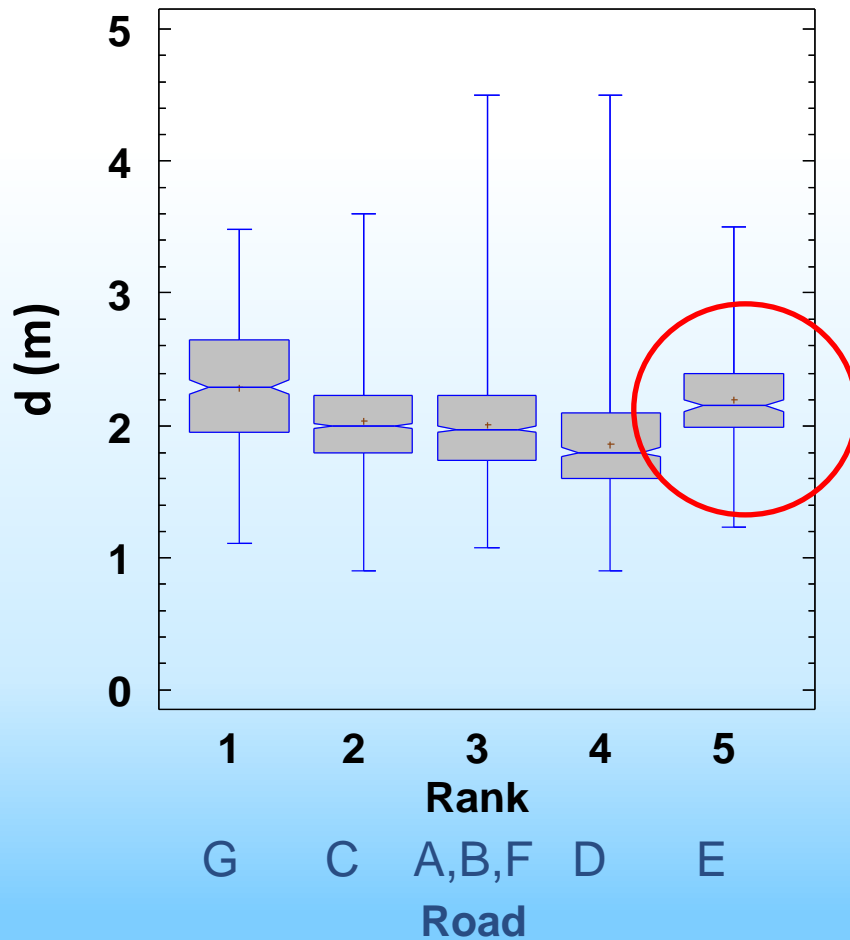
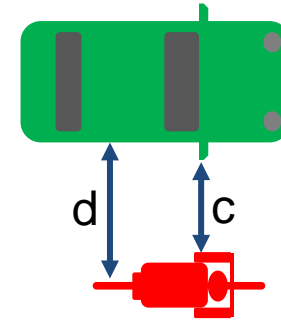
- Hypothesis



# Results

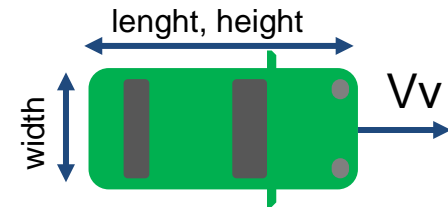


- Risk vs. Lateral distance

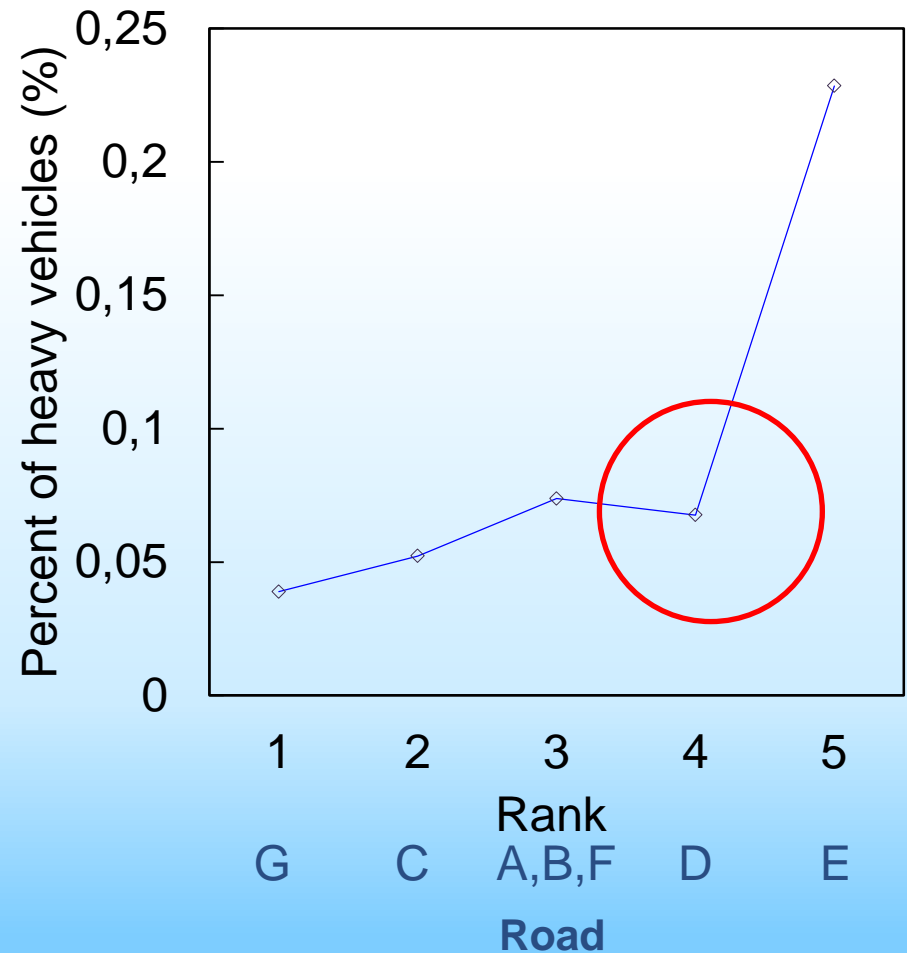
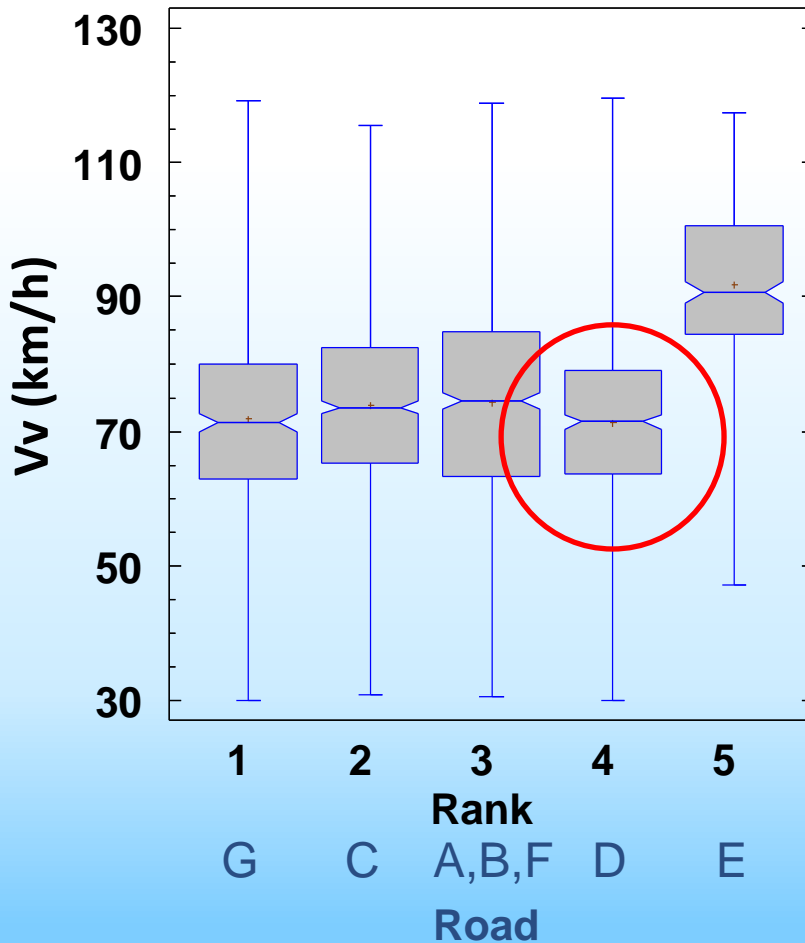




# Results



- Risk vs. Speed/ Risk vs. %HV

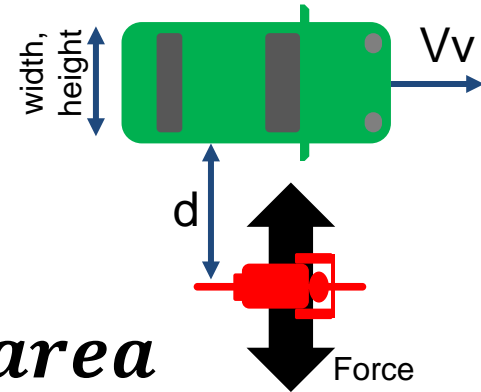


# Results

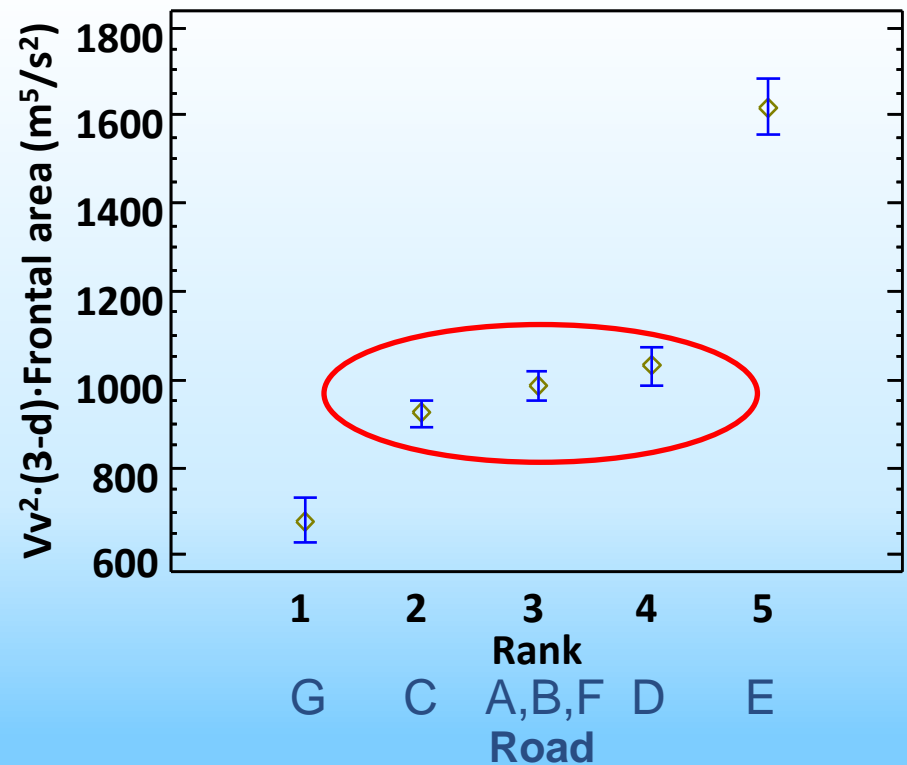
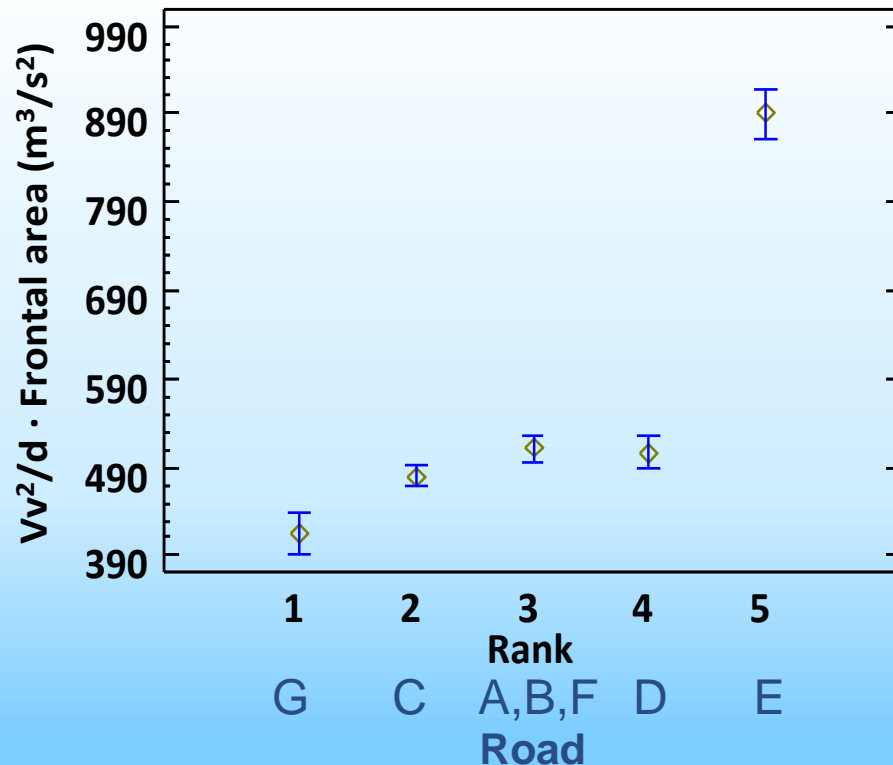


- Aerodynamic forces:

- Proportional to  $\frac{V_v^2}{d} \cdot \text{Frontal area}$



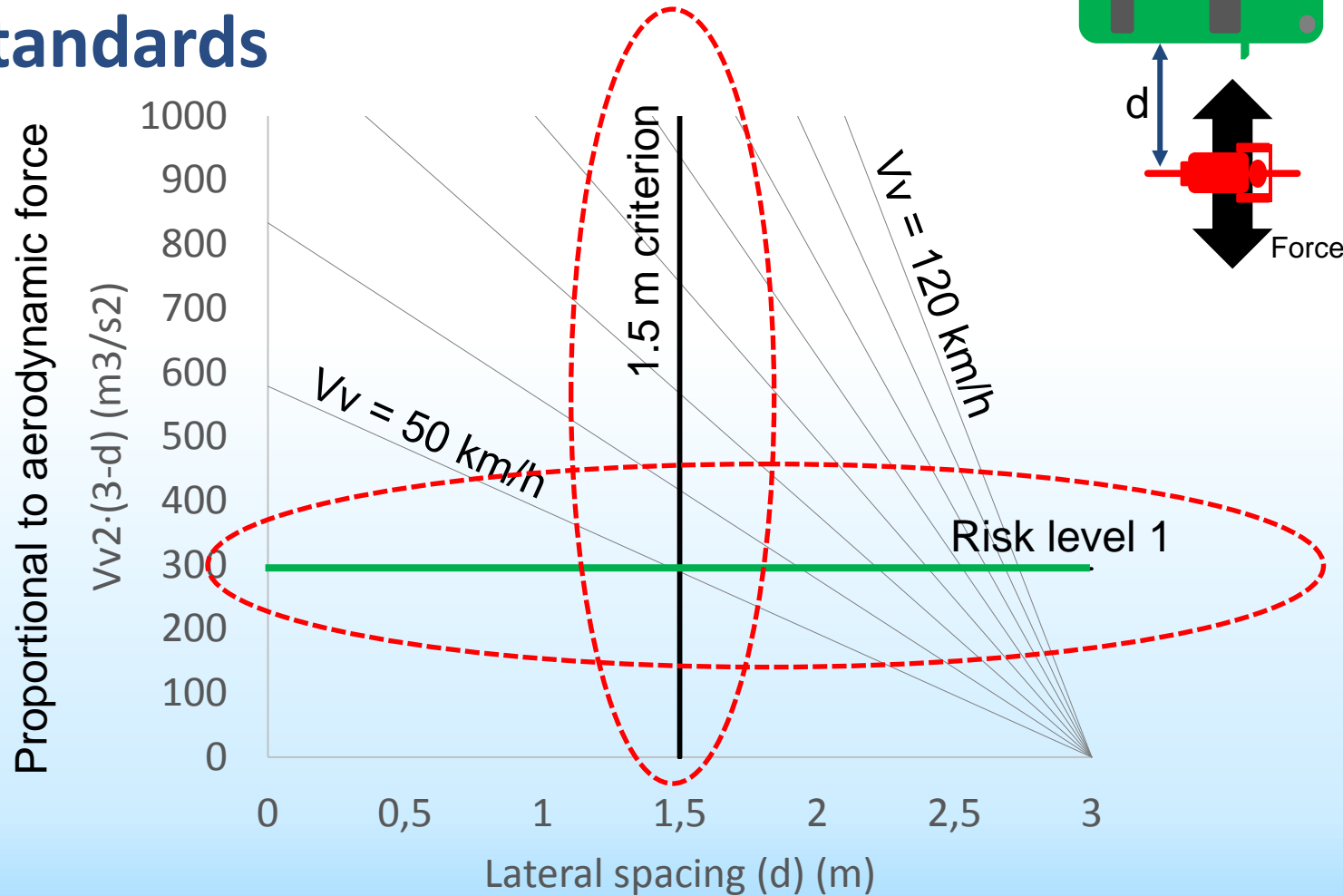
➔ Proportional to  $V_v^2 \cdot (3 - d) \cdot \text{Frontal area}$





# Discussion

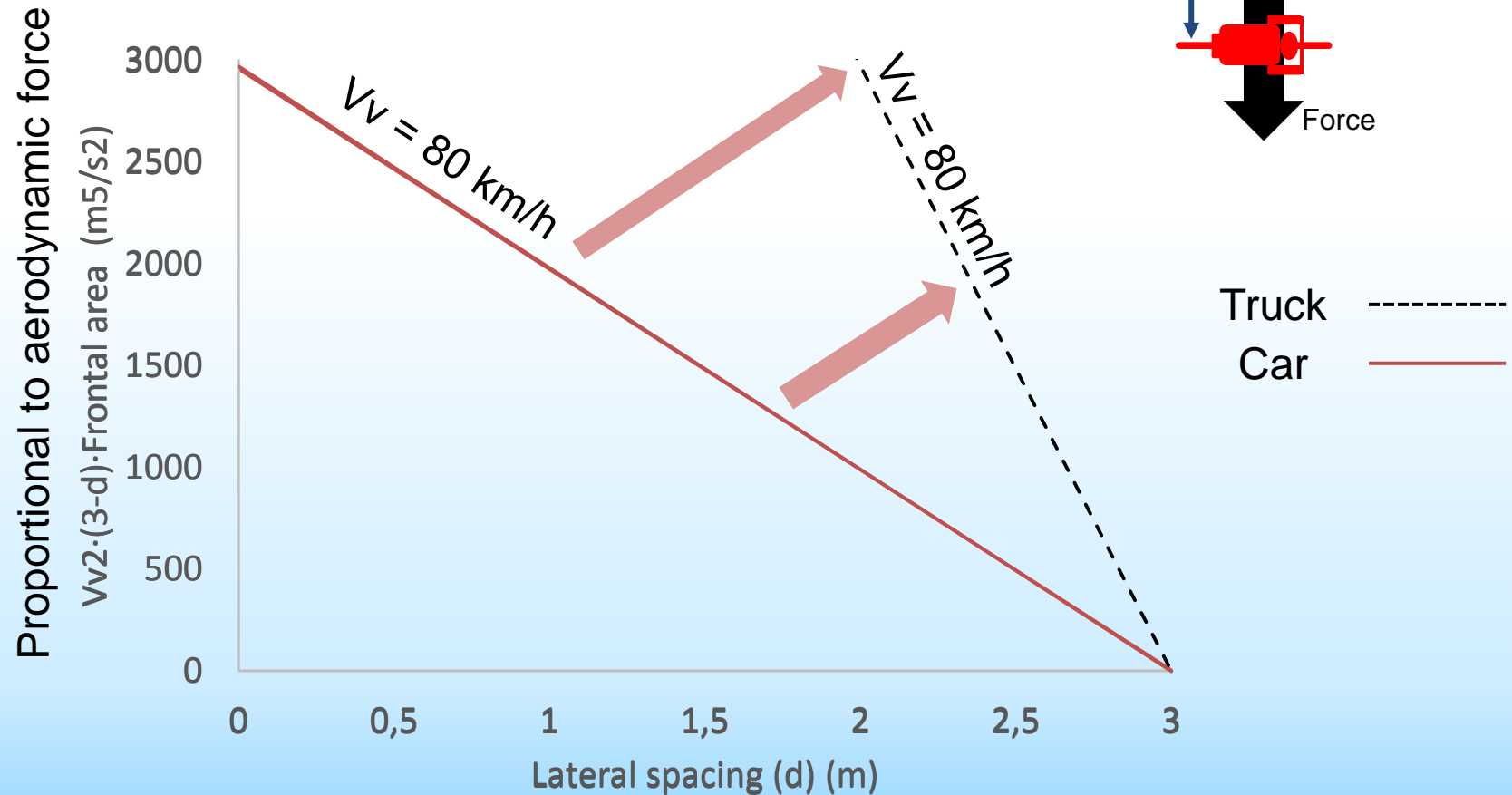
- Standards





# Discussion

- Standards





# Conclusions and recommendations



- **Relationship between perceived risk and aerodynamic forces:**
  - $V_v^2 \cdot (3 - d) \cdot \textit{Frontal area}$
- **Recommendations:**
  - Increase lateral separation with speed and %HV
  - Shoulder width = f(speed, %HV)

# Thanks for your attention

