



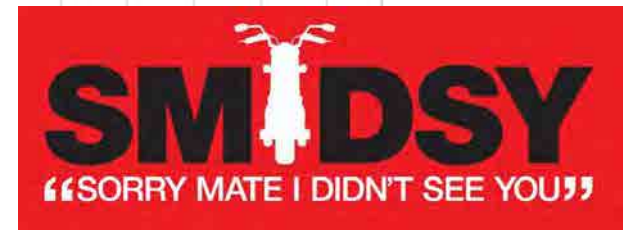
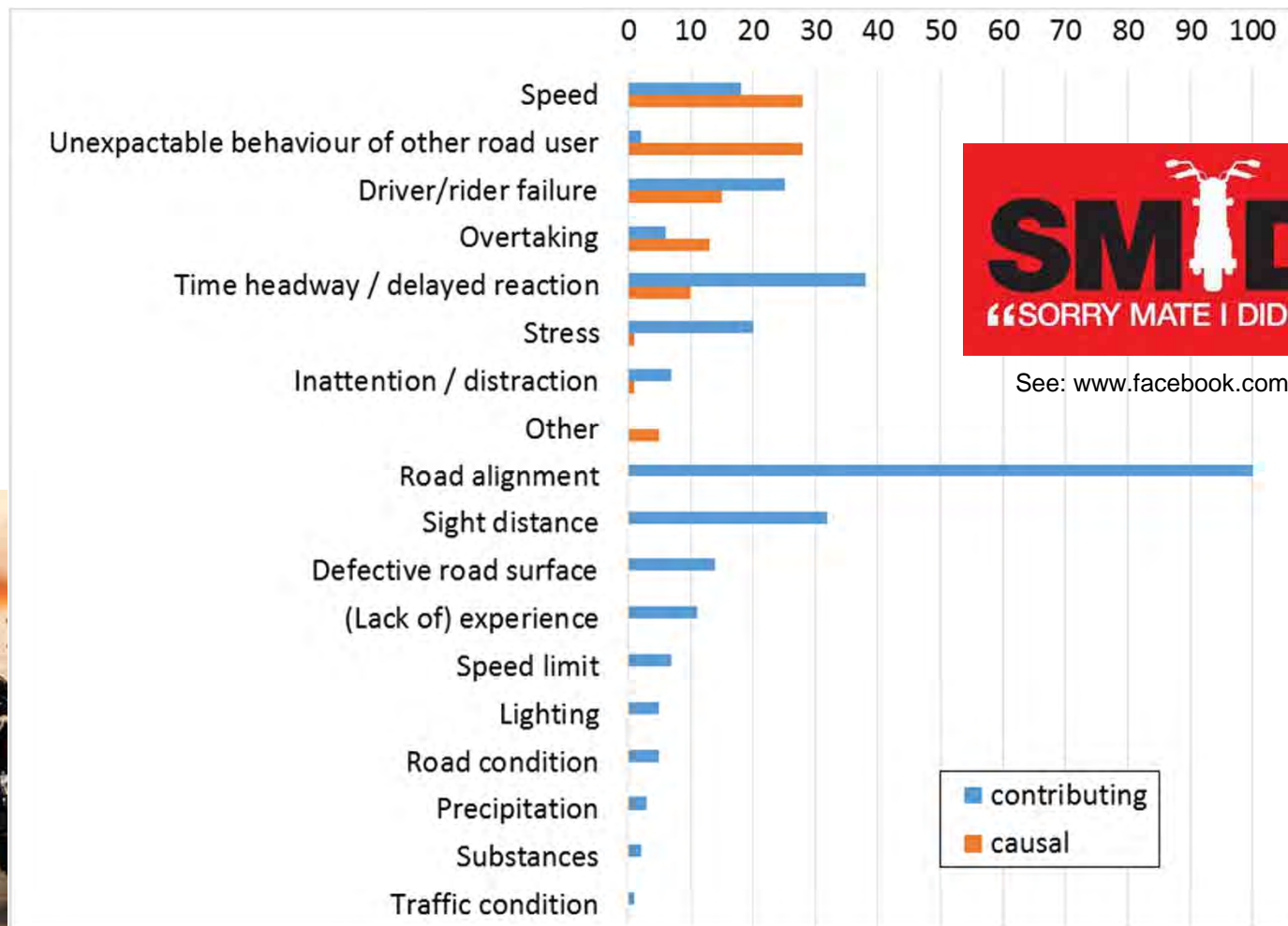
## **Infrastructure to Save Riders' Lives: Assessed Classics and Innovative Measures**

**Martin Winkelbauer | 2018 06 28 | Barcelona**

# Crash Causation

(or: What do we have to do?)

# Crash causes (KFV's in-depth study)



See: [www.facebook.com/stopsmidisy/](http://www.facebook.com/stopsmidisy/)



See: [bilder.4ever.eu/witzig/tiere/schnecke-164836](http://bilder.4ever.eu/witzig/tiere/schnecke-164836)

# I Three kinds of being too fast

(another kind of inappropriate speed)

# Too fast for the law



# Challenging Newton and Coulomb



# Too fast for yourself



Or just the road too narrow?





# Why?

„Schräglagenangst“

„Roll angle phobia“ or „lean ange phobia“?

**Our Hypothesis  
(according to  
international experts'  
educated guesses):  
20-22 degrees,  
except the ones,  
who have trained.**



# Stills from videos in 2 curves in Carinthia

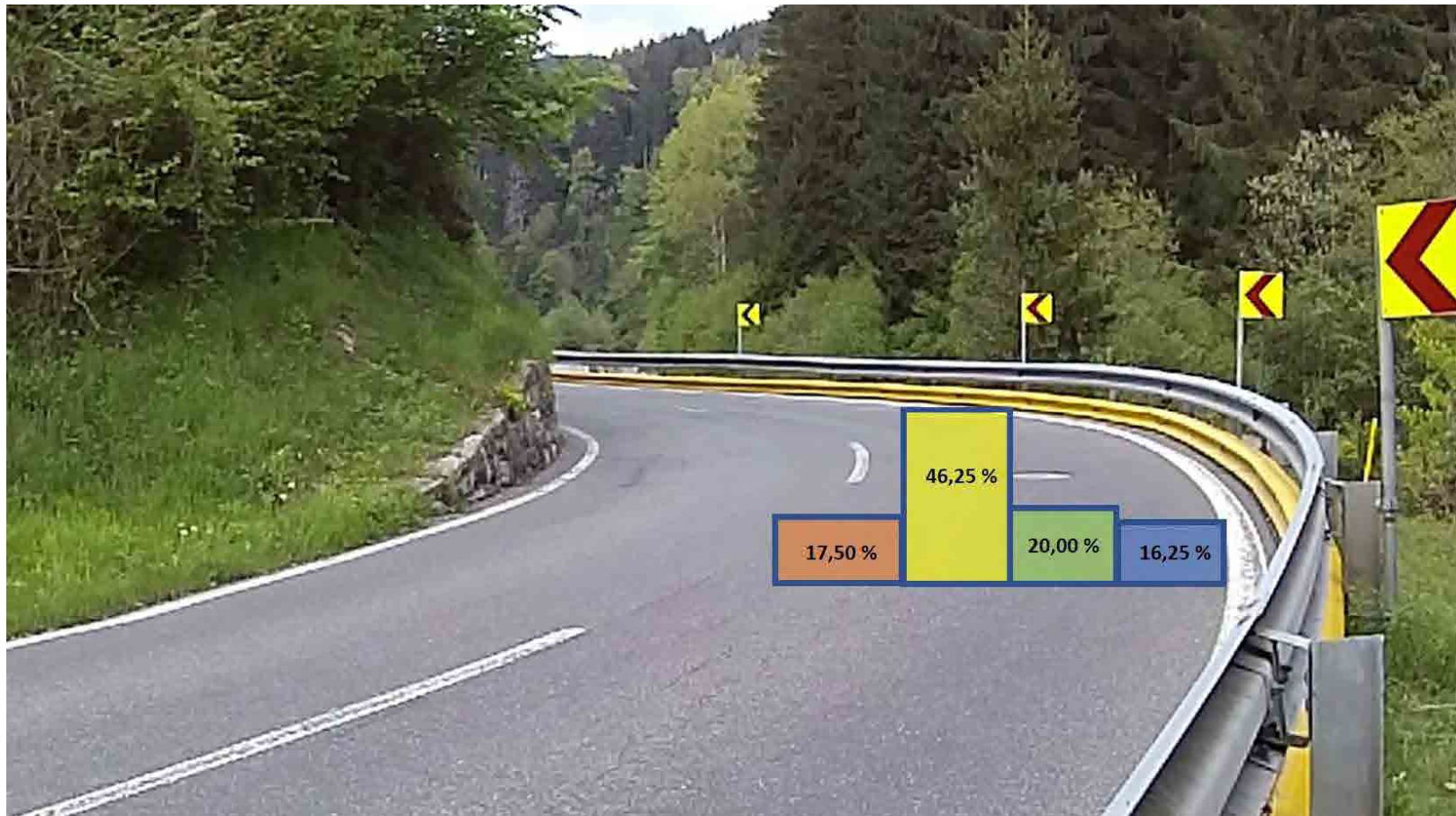
Transparency film with a compass rose on the screen



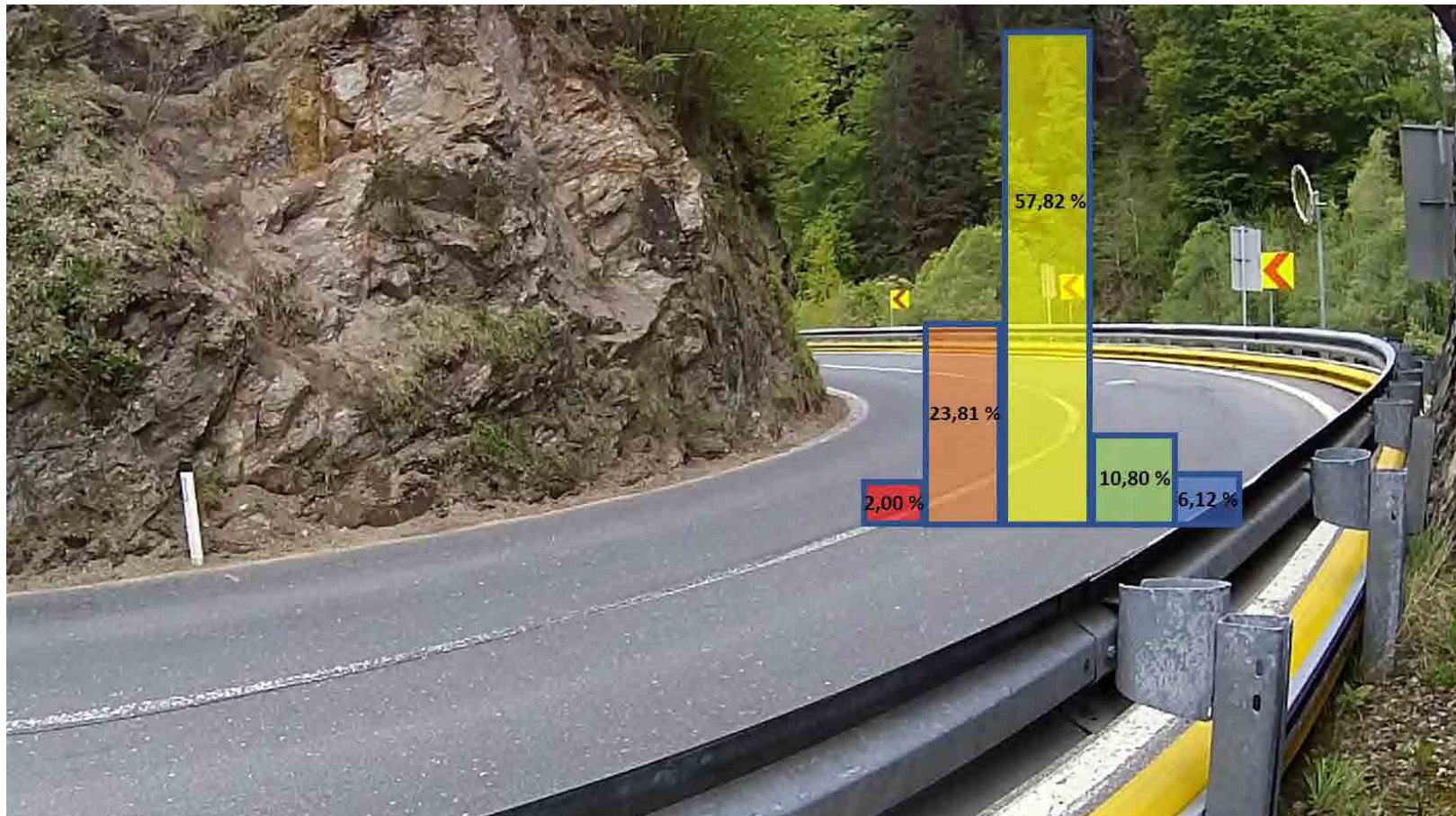
This is when the bus comes the other way



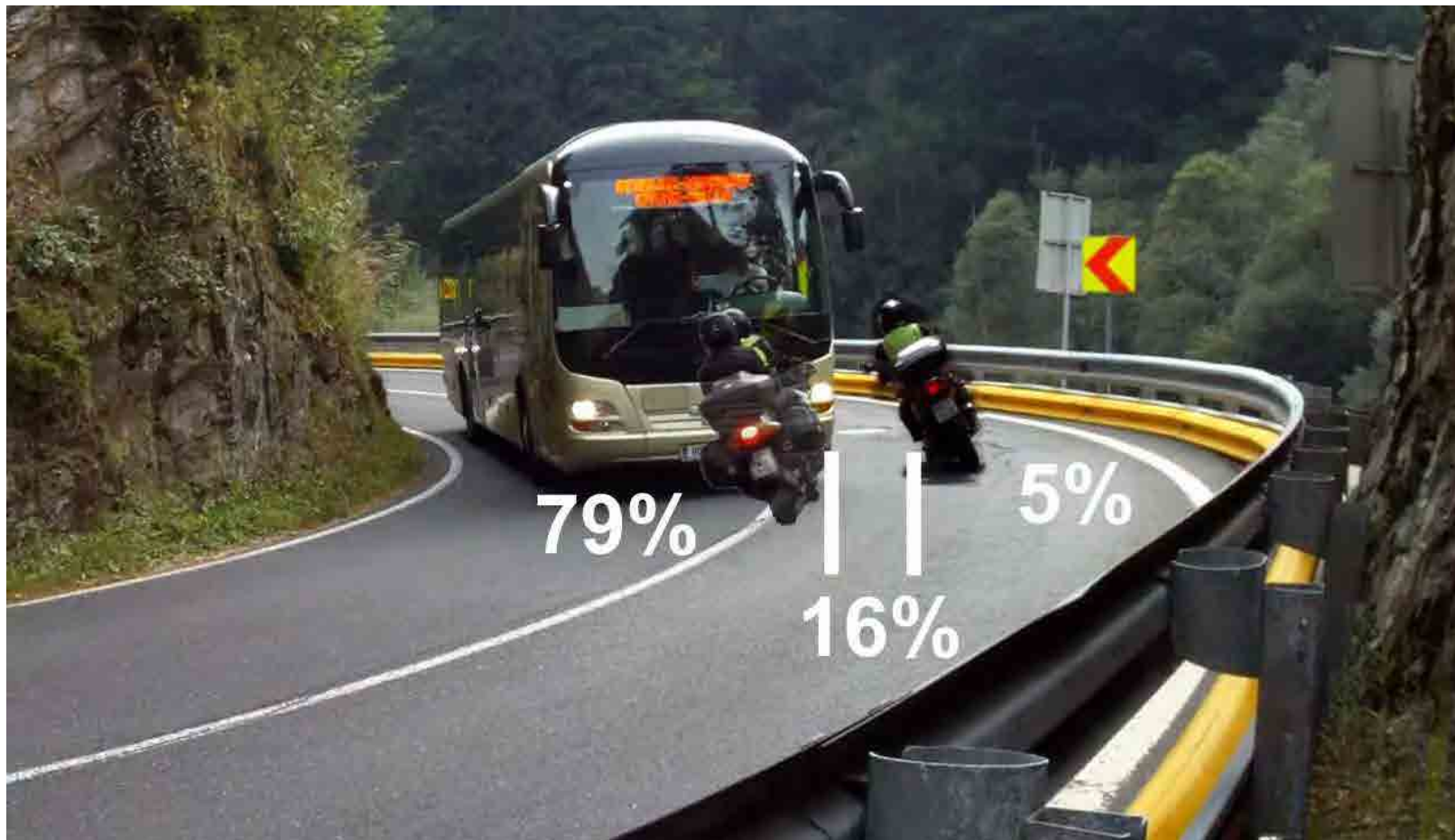
# Riders' lane choice in curve 1



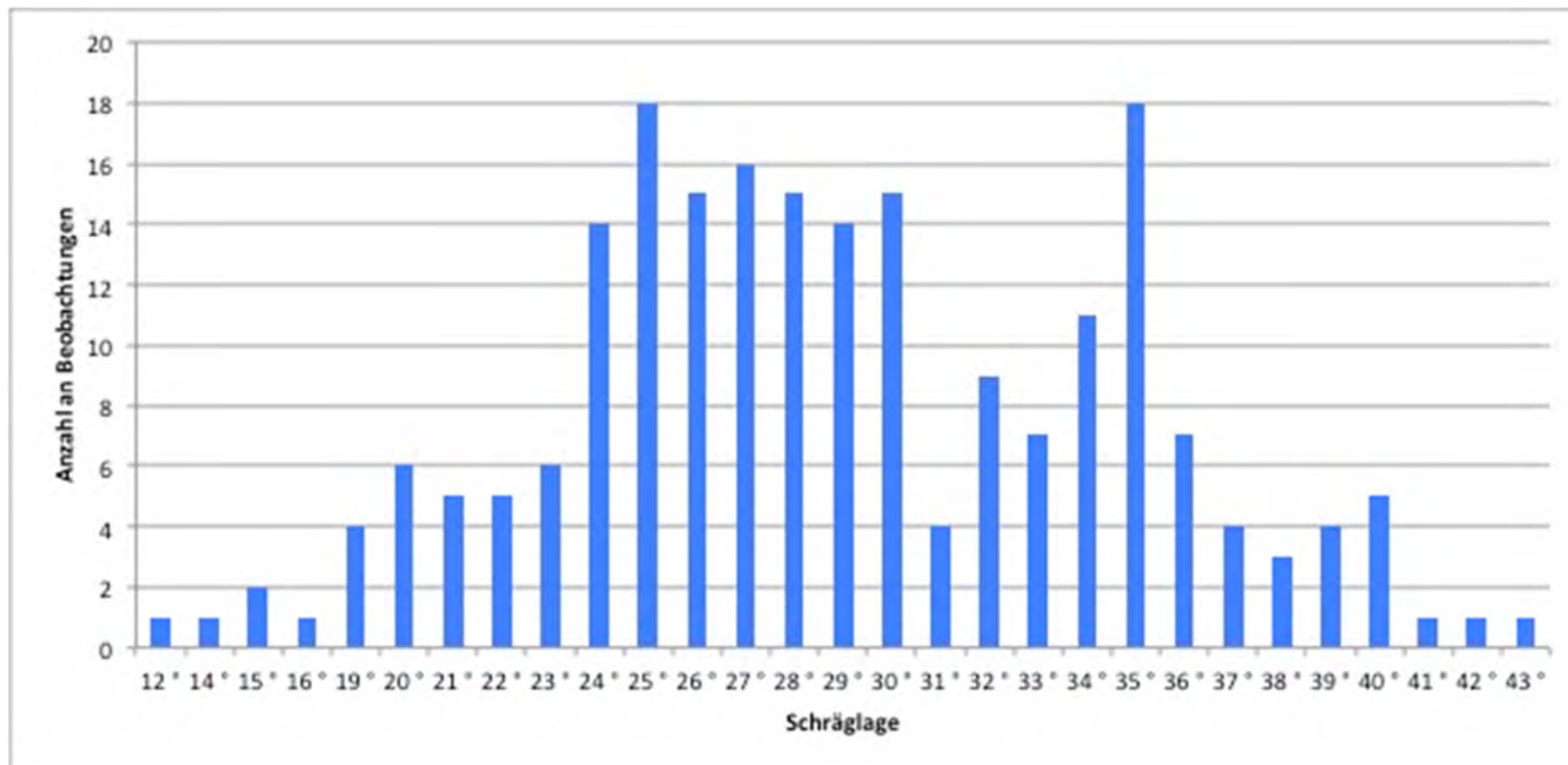
## Riders' lane choice in curve 2



## Riders' overall lane choice (811 cases)

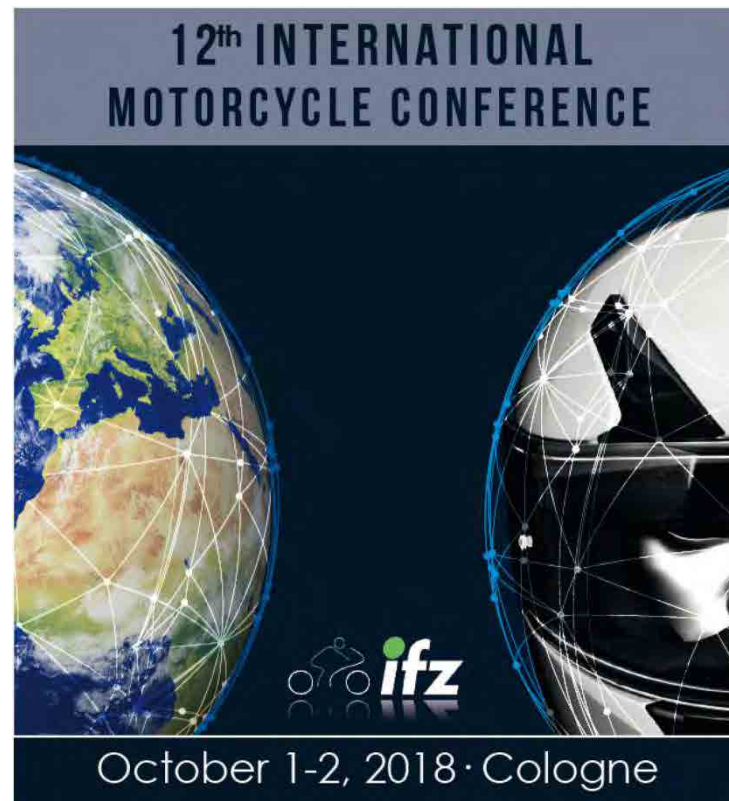


# Riders' overall roll angle (295 cases)



More about that ...

... at the ifz Motorcycle Conference



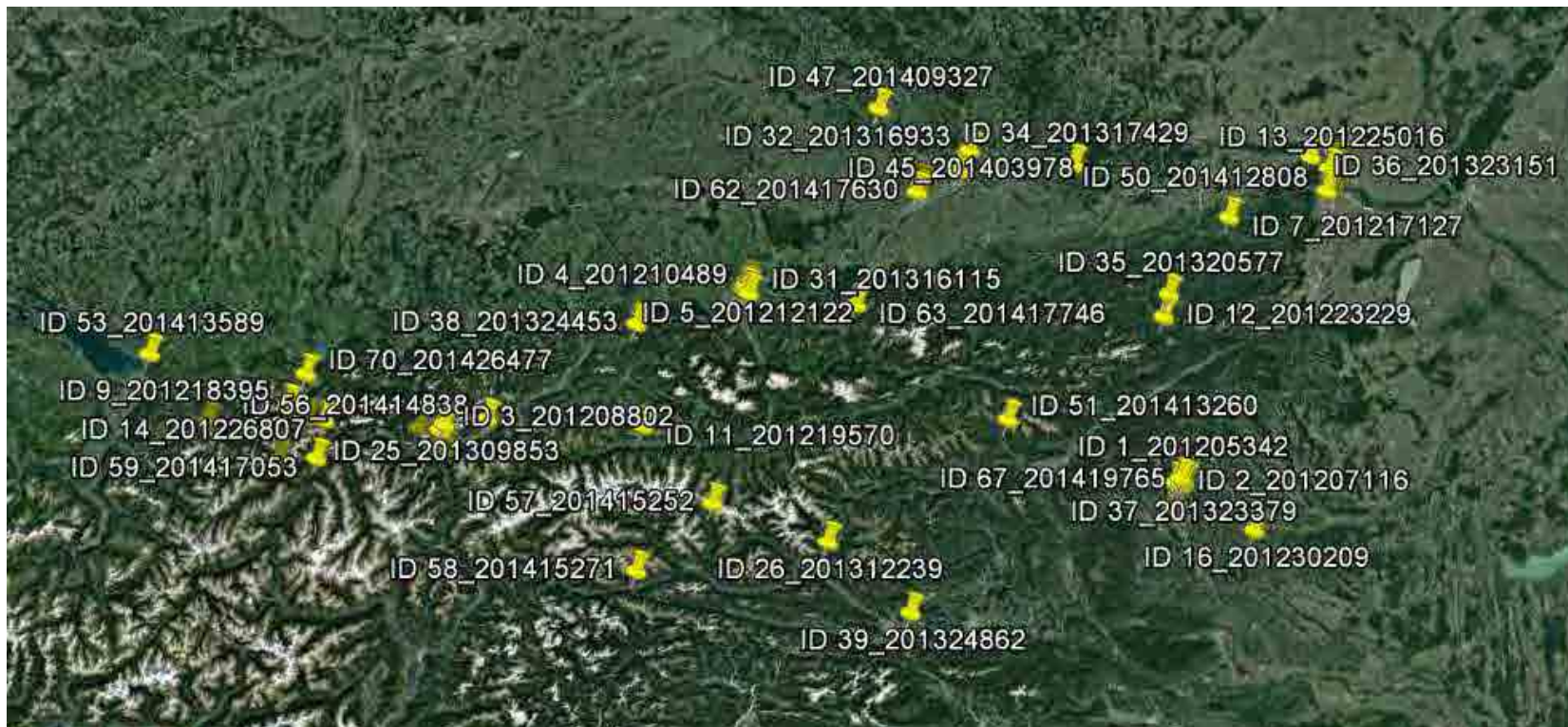


# I The Urban Traps

Results from Black Spot Analysis

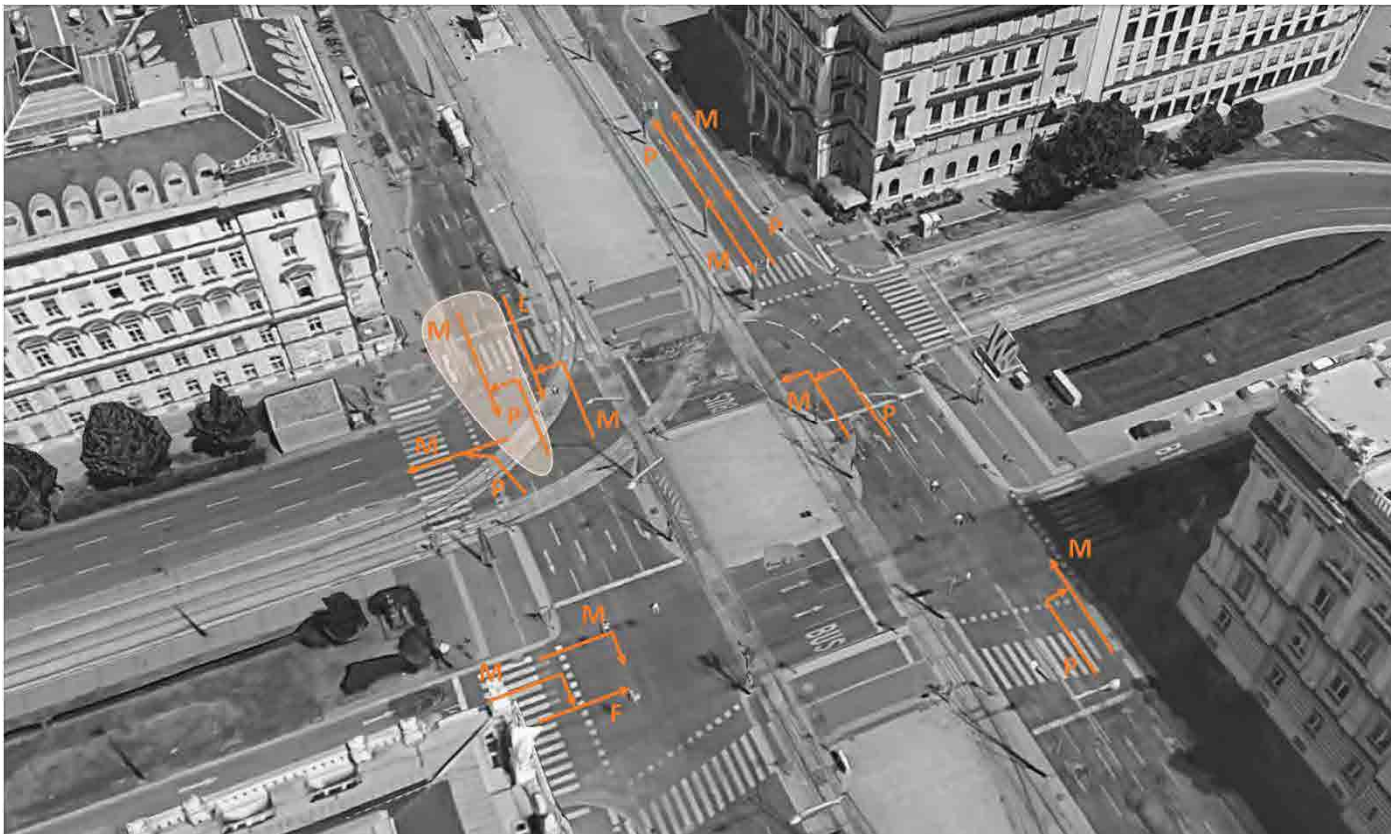
# High risk sites ...

... all over Austria



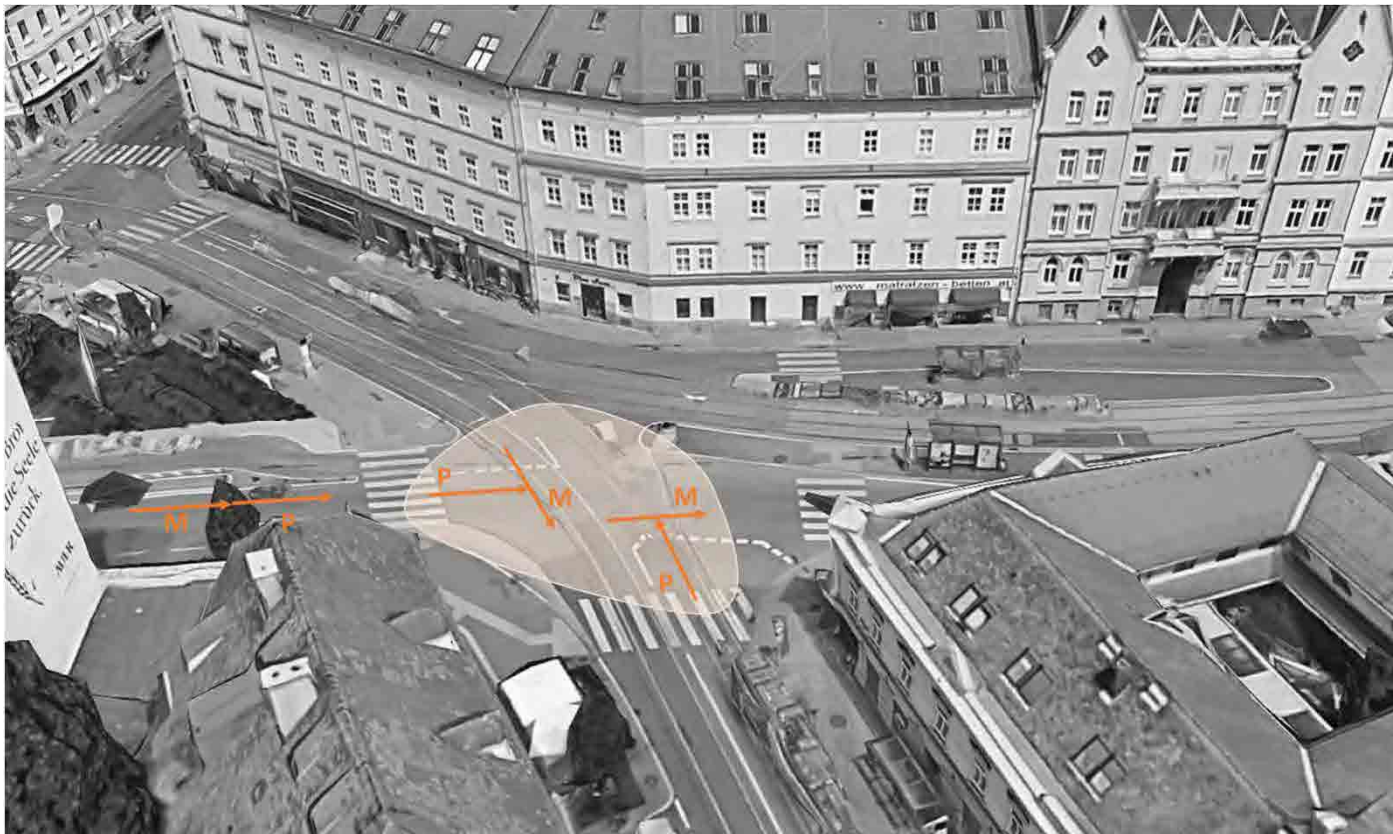
# Urban Trap 1

## Complexity of intersections



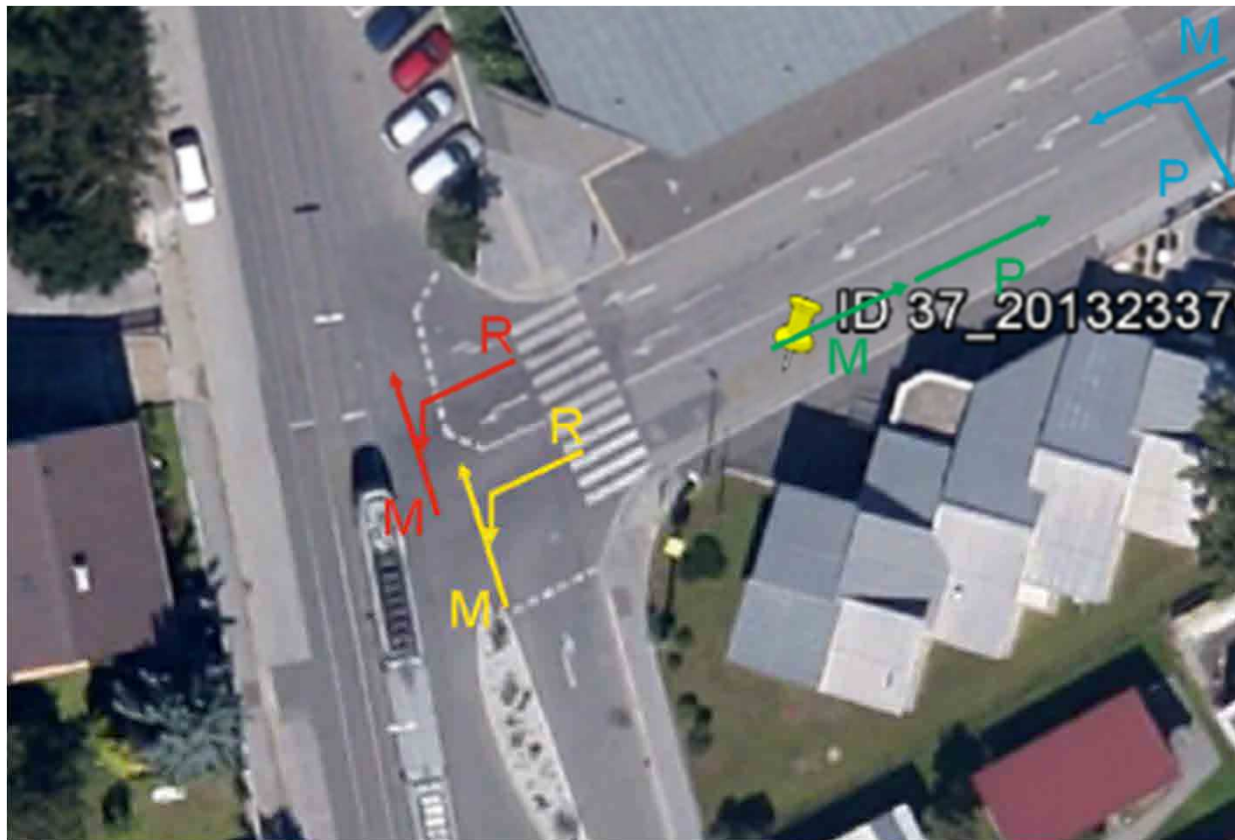
# Urban Trap 2

## Size of intersections



# Urban Trap 3

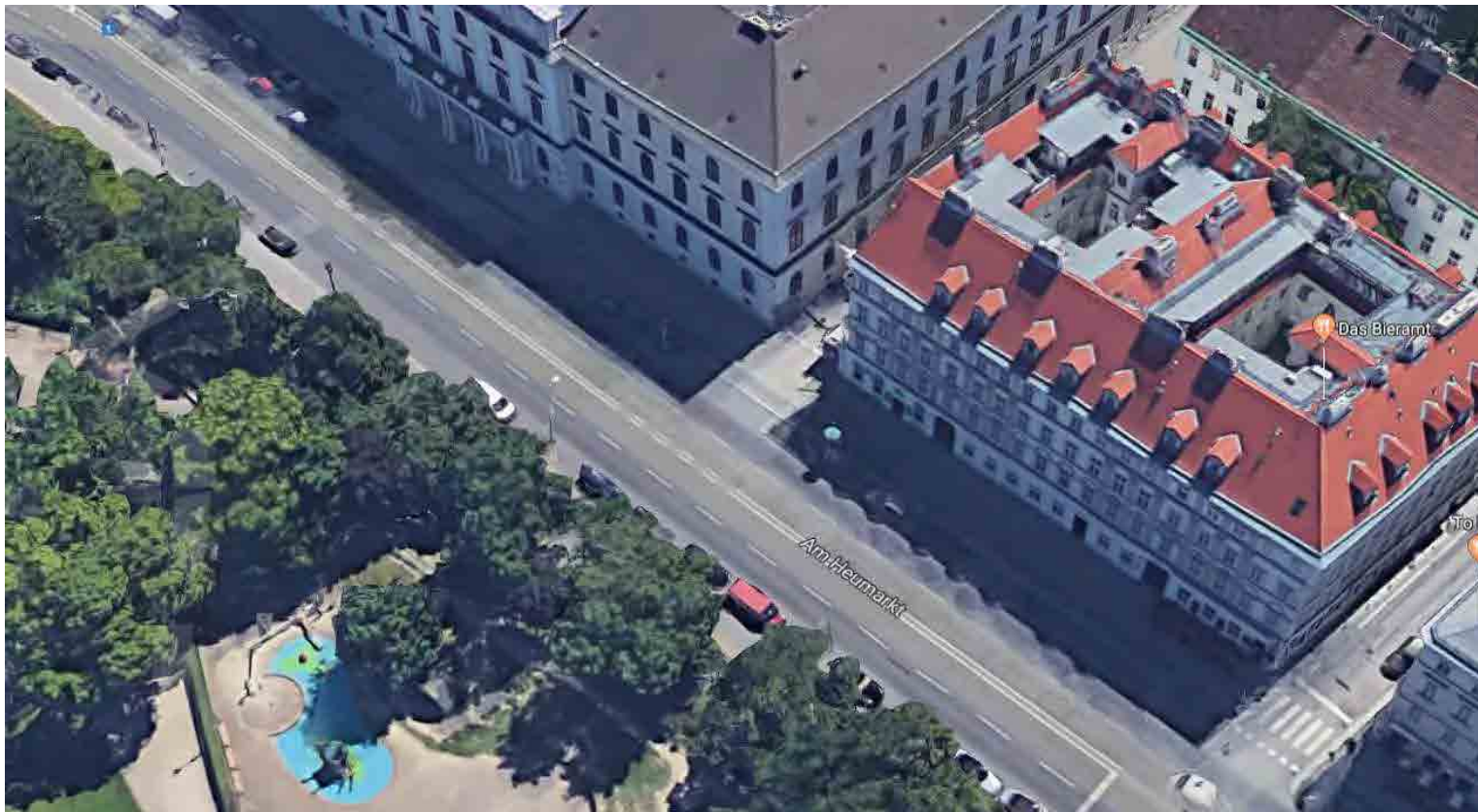
Intersections meant to be particularly smart



# Urban Trap 4

## Illegal Filtering

Grafik Quelle.: Google Maps



# II The Rural Challenges

More Results from Black Spot Analysis

# Rural Challenge 1

## Parking near curves





# Rural Challenge 2

## Impaired forward visibility / sight obstacles



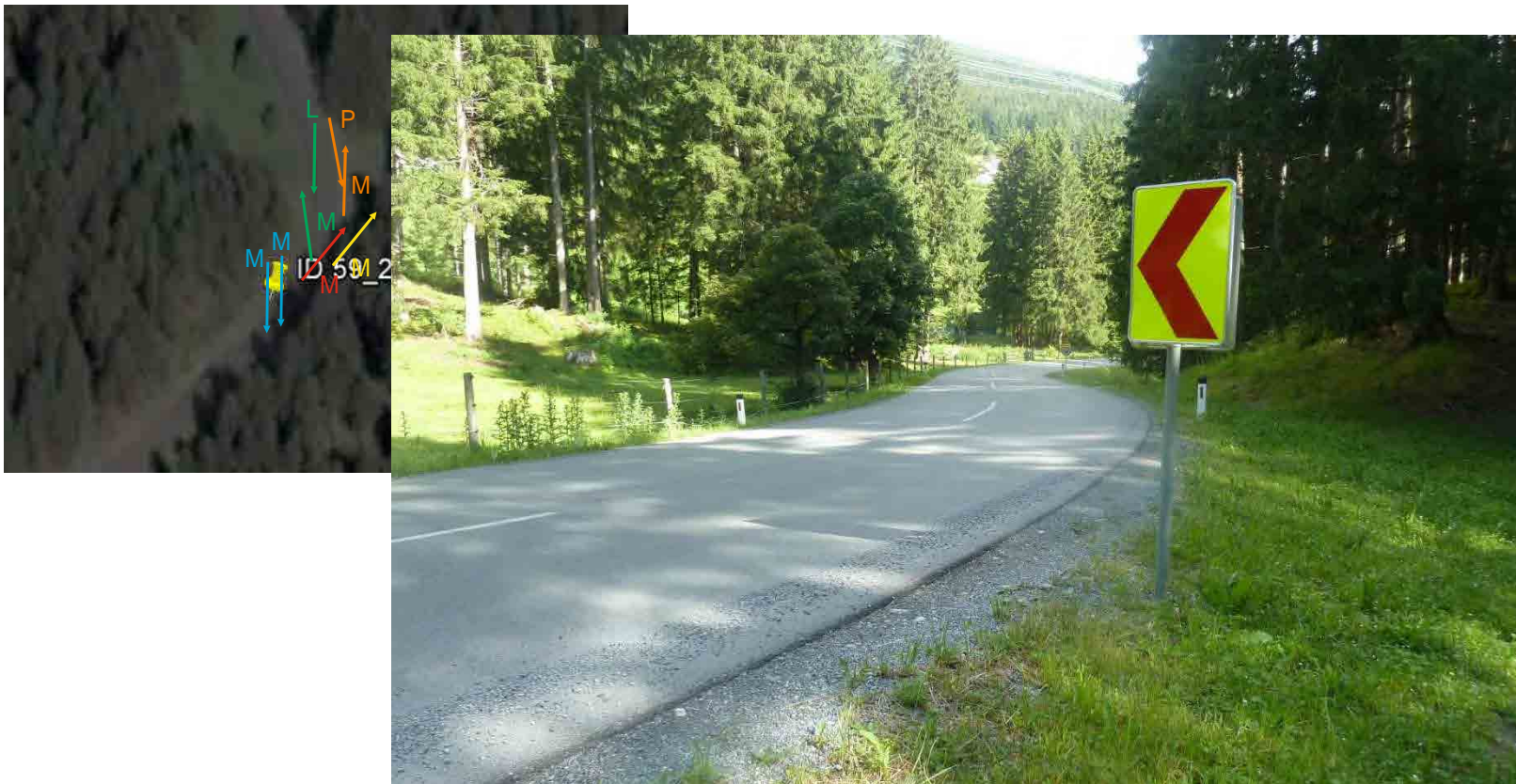
# Rural Challenge 3

## Agricultural paths



# Rural Challenge 4

## Negative crossfall



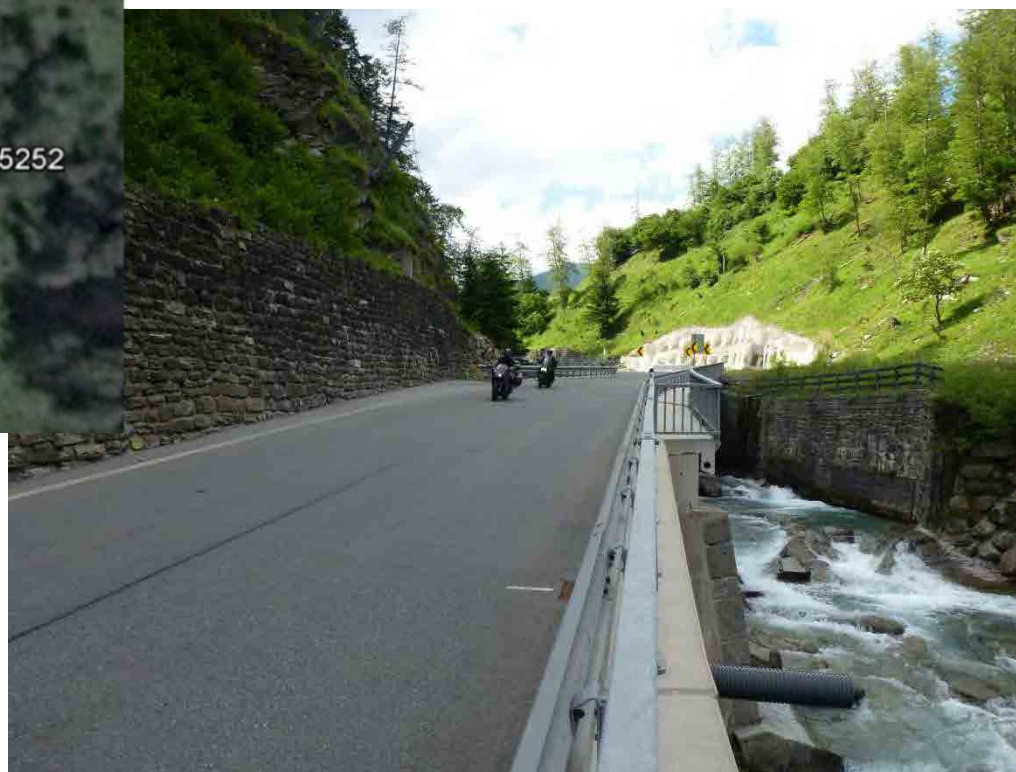
# Rural Challenge 5

## Complexity



# Rural Challenge 6

## Speed, approaching



# Rural Challenge 7

## The no-idea-cases



# **III Expert Assessment**

## **Road Safety Inspection for Motorcycle Safety**

# RSI – Road Safety Inspection

## A mandatory tool for the TERN

- „Infrastructure Directive“
- Systematic approach
- Preparation: Crashes, Exposure
- Checklist, on-site inspection
- Analysis, recommendations
- Follow-up!
- 2.500 km TERN vs 100.000 km secondary roads
- PTW vs all other vehicles-> Motorcycle routes
- Define motorcycle routes

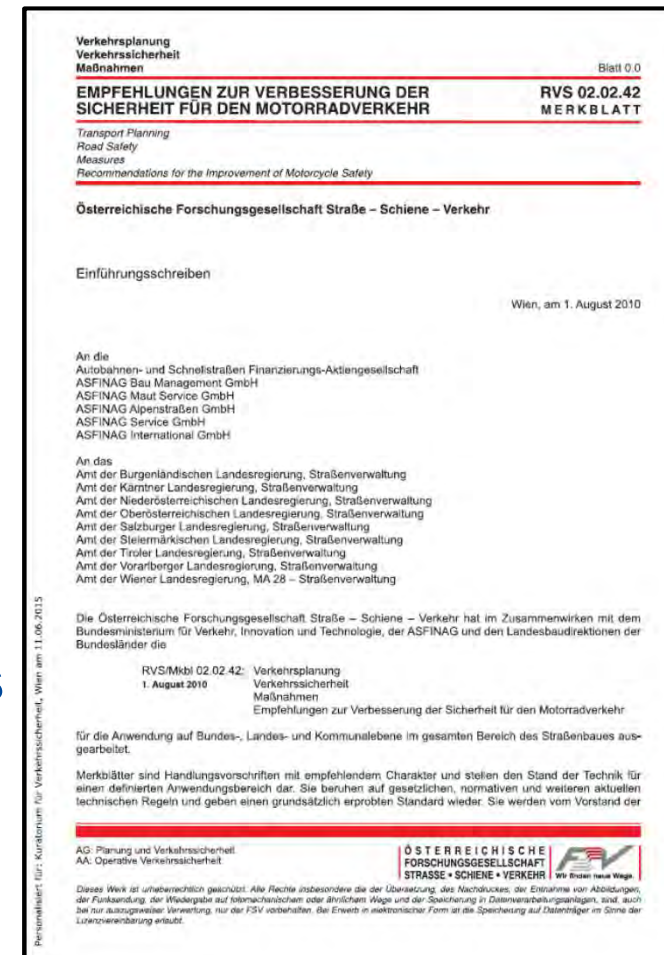




# Guidelines for motorcycle routes

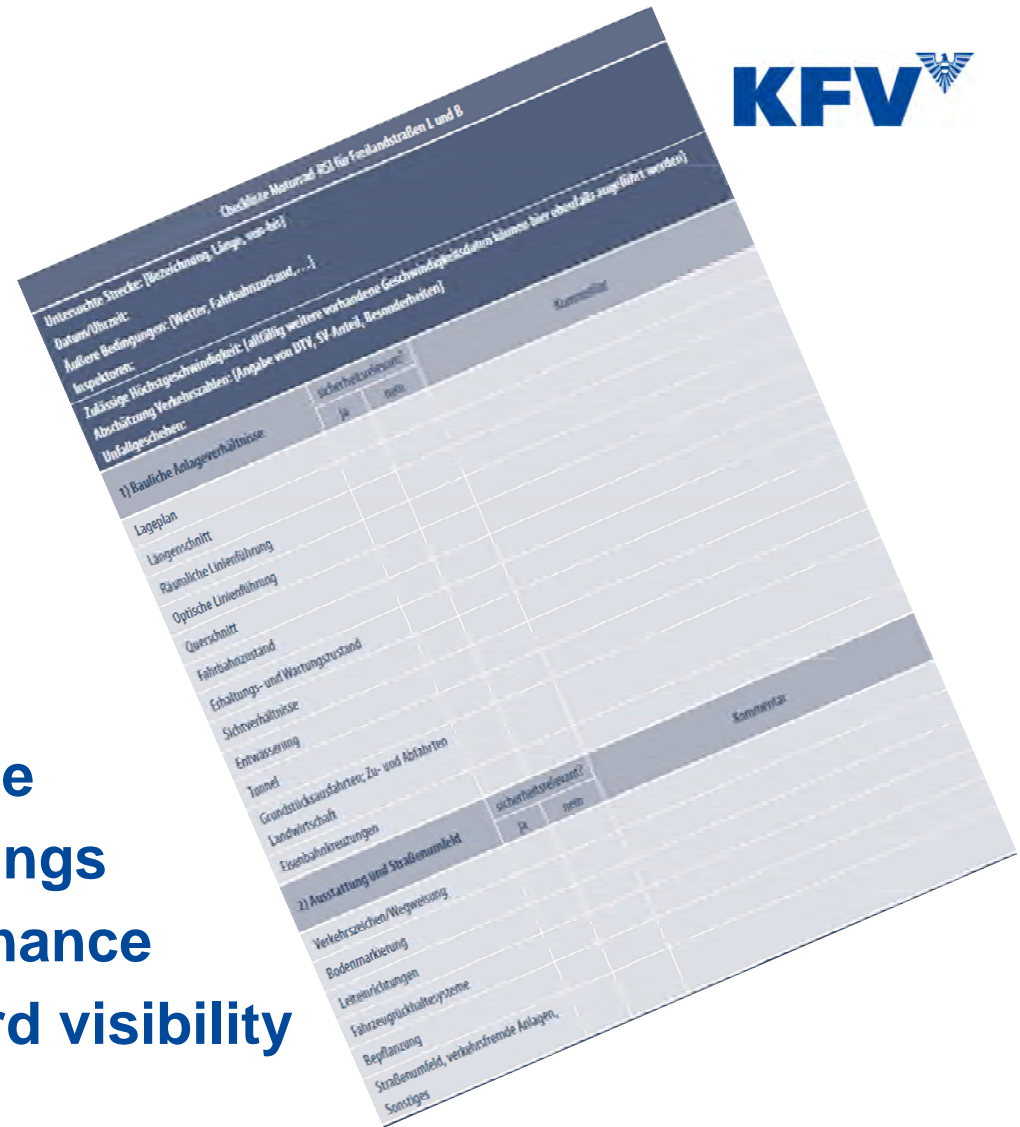
## Checklist

- Unsteady alignment
- Increasing curve radii
- Alignment provoking high speed
- Unsteady surface friction
- Gravel in right hand curves
- Milled surfaces, manholes, etc
- Dirty surface, large floor markings
- Wooden poles
- Inappropriate guardrails
- Unprotected obstacles



# A New Checklist

- **Basic Data**
- **3D alignment**
- **Intersections  
(road, rail, forest roads)**
- **Width, crossfall, drainage**
- **Traffic signs, floor markings**
- **Surface, general maintenance**
- **Optical guidance, forward visibility**
- **Guardrails, shoulder**
- **Periphery (e.g. flora)**



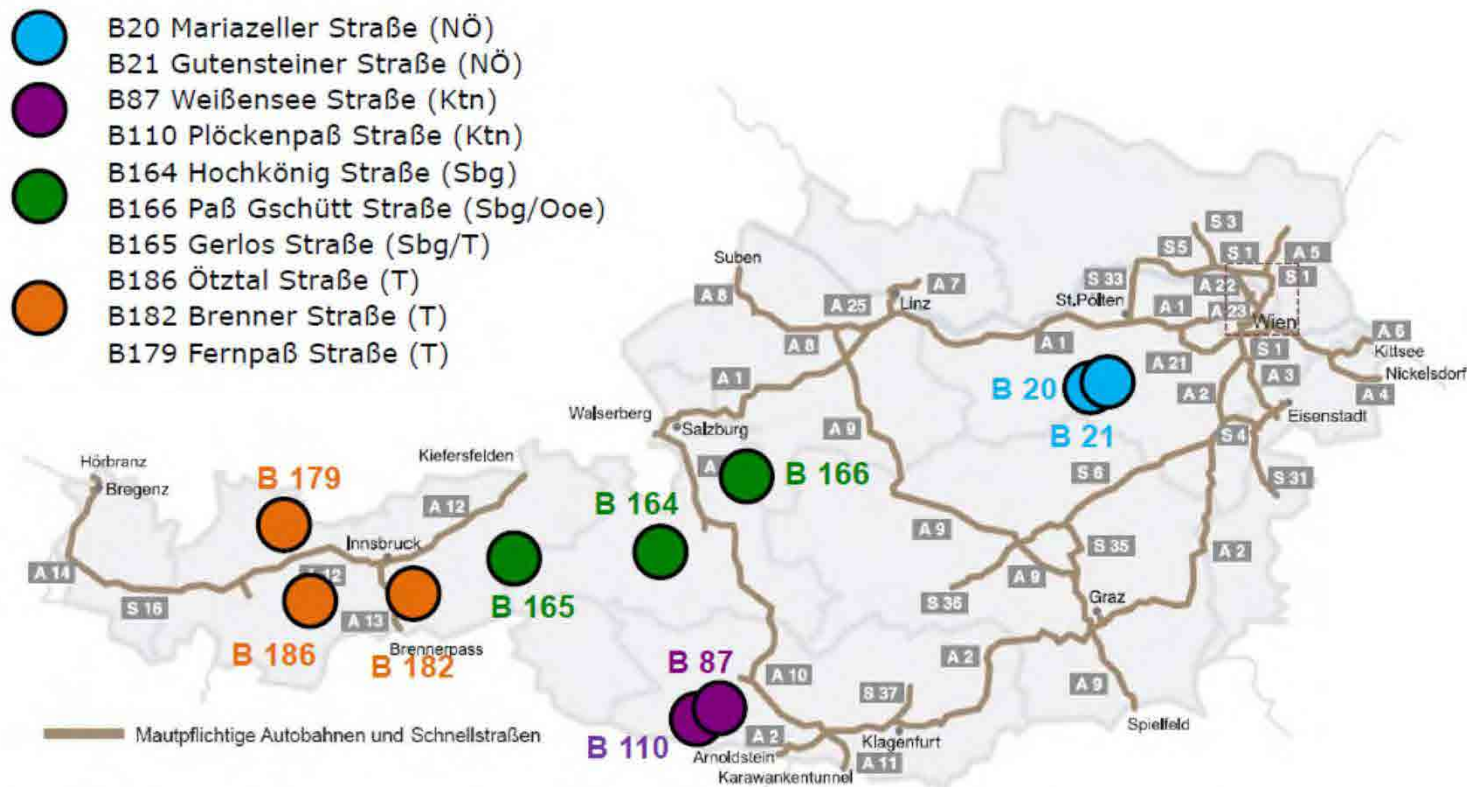
# An assessment report

RSI Maßnahmenvorschläge	Legende:	<span style="background-color: red; color: white;">■</span>	Hohe Sicherheitsrelevanz	Nr. 1
		<span style="background-color: orange; color: white;">■</span>	Mittlere Sicherheitsrelevanz	
		<span style="background-color: yellow; color: black;">■</span>	Geringe Sicherheitsrelevanz	
Straße / Strecke		FR	Örtlichkeit:	
Straße X / km XX,XX – km XX,XX		1	/km.xy	
Problem / Mangel	Unübersichtliche Kurve, starke Richtungsänderung			
Maßnahmenvorschlag / erwartete Verbesserung	<b>Kurzfristig:</b> Beschilderung, deutliche Gefahrensymbole, Sperrlinie <b>Mittelfristig:</b> Optische Führung durch rot-weiße Einfärbung FRS <b>Langfristig:</b> Radar, Videokontrolle, Section Control / Vermeidung von Unfällen Motorrad-Gegenverkehr, Geschwindigkeitsreduktion			
Abschätzung der Unfallgefahr	gering/mittel/hoch	häufig Motorradunfälle mit Gegenverkehr, in 3 Untersuchungsjahren bereits 6 VU, 1 Toter		
Abschätzung möglicher Unfallfolgen	gering/mittel/schwer	Aufgrund des starken Lkw-Verkehrs: schwer		
Beurteilung von Umsetzungshorizont & Sicherheitsrelevanz		<b>kurzfristig</b>	<b>mittelfristig</b>	<b>langfristig</b>
		Beschilderung, deutliche Gefahrensymbole, Sperrlinie	Optische Führung durch rot-weiße Einfärbung FRS	Radar, Videokontrolle, Section Control
Annäherungsphase Zeitpunkt 0, Kurve sieht zügig aus				
				



# Validation Study

10 routes, 240 km in total



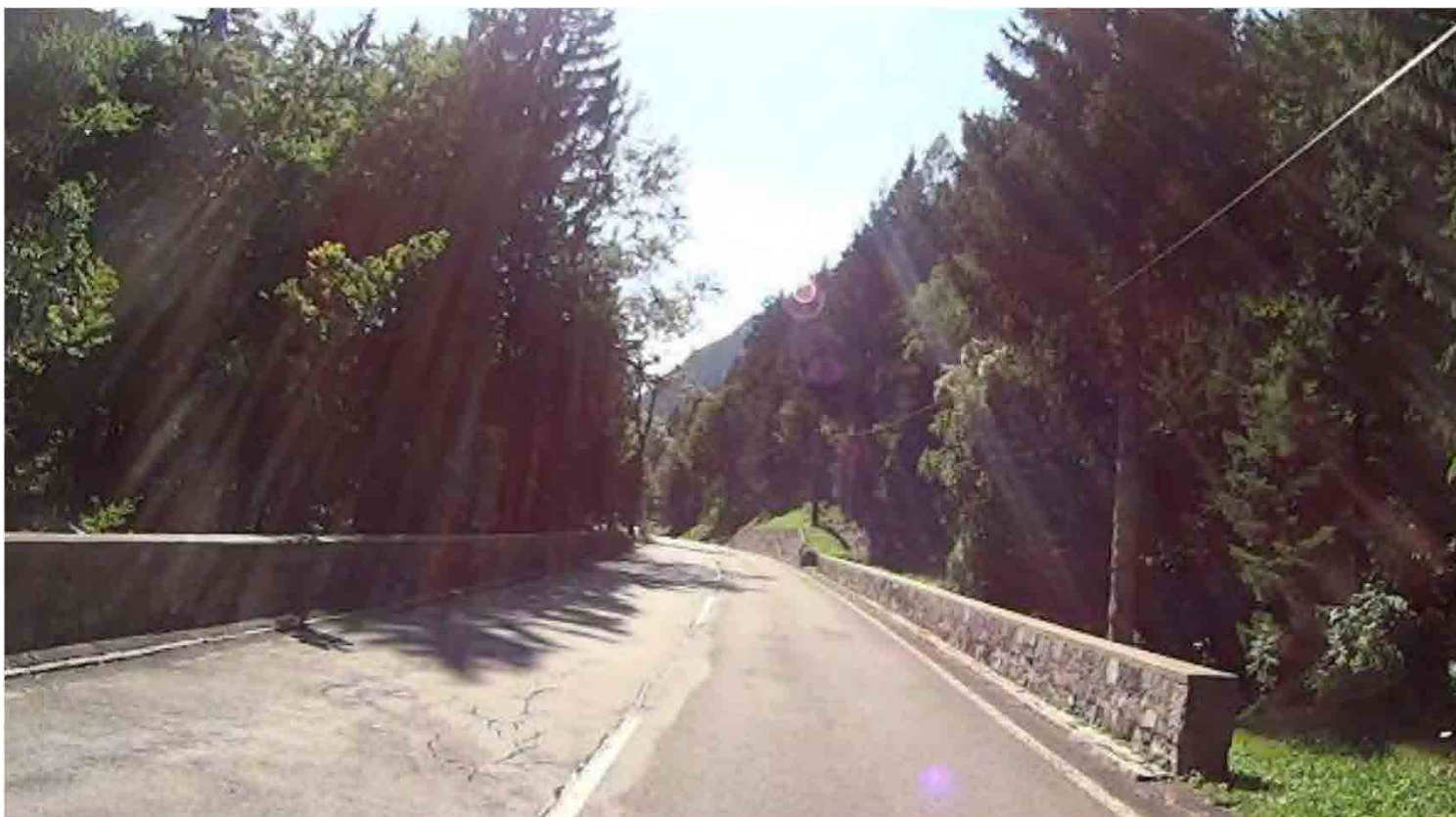
## Examples from the validation study

**Sharp edge, unprotected, short visual range**



## Examples from the validation study

**Roadside: beautiful but life threatening (and what for?)**



## Examples from the validation study

**Nice landscape – ugly surface, shadow, guardrail**



# Examples from the validation study

## Funny car drivers ...





# Examples from the validation study

## Change of crossfall ahead of a curve



# Examples from the validation study

## Patchwork surface



# **IV More Expert Assessment**

**An Almanach of Assessed Measures**



# The Almanach of Assessed measures

- **EC-funded Project „2BESAFE“**
- **WP6: Transversal analysis and guidelines**
- **144 Measure**
- **40 Experts**
- **14 categories of measures**
- **5 Stars max**
- **8 ratings + overall**
- **+ Riders' Perspective by**



The Federation of European Motorcyclists' Associations

Chapter	Fields Covered
Institutional Organisation of Road Safety	Road Safety Visions
	Road Safety Programmes and Targets
	Road Safety Guides and Studies
Road Infrastructure	Self-Explaining/Forgiving Roads
	Measures for Urban Traffic
	Pavement
Vehicles and Safety Devices	Brakes
	Passive Safety Devices
	Advanced Rider Assistance Systems
Conspicuity & Lights	Improvement of Conspicuity
	Installation and Type Approval of Lights
Environmental Issues	Issues concerning Air Pollution
	Issues concerning Noise Pollution
Protective Equipment	Standards
	Various Components of Protective Equipment
Driver Education, Licensing and Testing	Licensing, Basic Training
	Post Licensing Training
	Behaviour
Traffic Law & Enforcement	Enforcement (Strategies)
	Regulations concerning Driving Manoeuvres
Road Safety Education and Campaigns	Ways to Promote Motorcycle Safety
	Improvement of Awareness
Rehabilitation and Diagnostics	Rehabilitation of Severe/Young Violators
	Traffic Psychological Assessment
Post Accident Care	Improvement of Emergency and Post-Injuries Services
	Motorcycle Issues in Emergency and First Aid Trainings
Road Safety Data and Data Collection	Improvement of Data Collection
	Ways to Collect Data
Measures involving other Vehicles	Other Road Users' Responsibilities to Riders
	Use of ITS
Other Measures	Responsible Advertising Policy
	Issues concerning Electric Vehicles

## 6. Road Infrastructure (35 measures)



6.1. Organisational Measures

6.2. Measures supporting the Self-Explaining Nature of

6.3. Measures supporting the Forgiving Nature of Roads

6.4. Intersections

6.5. Organizational and Restrictive Measures

6.6. Measures for Urban Traffic

6.7. Pavement



Example:

## Signposting of Speed Limits at Dangerous Spots in Curves

Expert Assessment			
Overall		★★★★★	
Size	★★★★★	Transferability	★★★★★
Total impact	★★★★★	Implementation	★★★★★
Safety impact	★★★★★	Acceptance	★★★★★
Efficiency	★★★★★	Sustainability	★★★★★



Description:

Example

Clear definition of the problem

Size of the problem

Scientific Background

Expected impact

Implementation

Acceptance

Sustainability

Transferability

Costs and benefits

Priorities

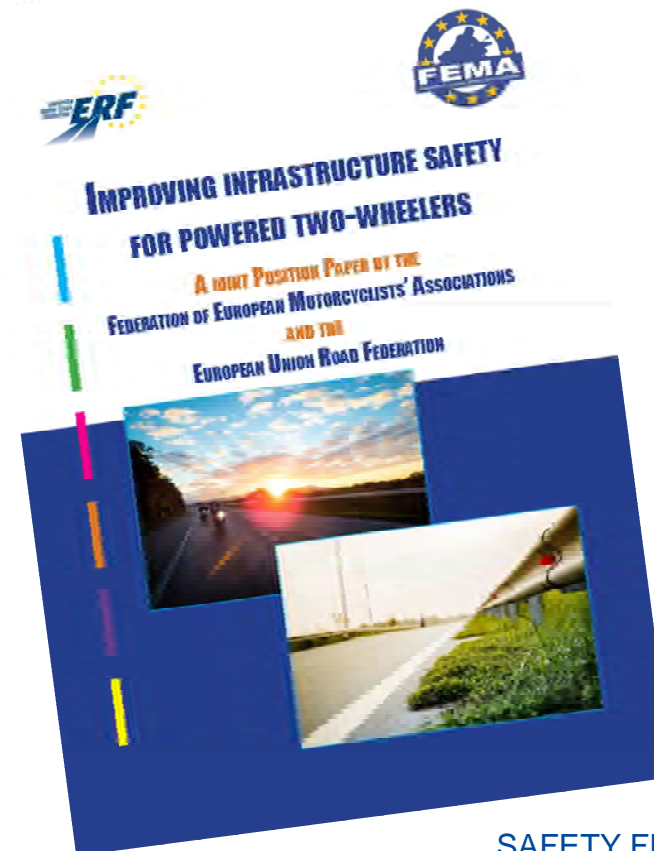


Find this paper at

[http://www.2besafe.eu/sites/default/files/deliverables/2BES\\_D28\\_GuidelinesPolicyRecommendationsAndFurtherResearchPriorities.pdf](http://www.2besafe.eu/sites/default/files/deliverables/2BES_D28_GuidelinesPolicyRecommendationsAndFurtherResearchPriorities.pdf)

... which includes

- 17 other almanachs,
- but there many more,
- some are more recent
- Like this one:



# The Safety Cube Decision Support System



The screenshot shows the homepage of the SafetyCube DSS. At the top, the logo reads "SafetyCube DSS" with a cube icon, followed by the text "European Road Safety Decision Support System". Below this is a navigation bar with five tabs: "Search", "Knowledge", "Calculator", "Methodology", and "Support". A paragraph of text describes the system as a European research project funded by the Horizons 2020 Programme, aimed at supporting evidence-based policy making. Below the text, there is a section for "Introductory Video:" with a play button icon. The main content area features five vertical panels, each with a representative image and a title: "Keyword Search" (a person on a road), "Risk Factors" (a speedometer), "Measures" (a road sign), "Road User Groups" (a cyclist and pedestrian), and "Accident Categories" (a road surface with red splatters). Each panel also includes an "Introductory Video:" link with a play button icon.



# What you get at <https://roadsafety-dss.eu/>

- Synopses & scientific papers, peer reviewed
- Information at any dose (from journalist to professor)
- Risks and measures, both quantified and linked

Risk Factors			Measures			
Behavior	Infrastructure	Vehicle	Behavior	Infrastructure	Vehicle	Post Impact Care
Traffic Rule Violations	Shoulder and roadside deficiencies	Relevant factors in crash data	Awareness raising and campaigns	Traffic signals treatments	Frontal Impact Longitudinal	Not Applicable
	Horizontal/vertical alignment deficiencies	Protective equipment design	Law and enforcement			
	At-grade junctions deficiencies		Driver training and licensing			
	Interchange deficiencies		Education and voluntary trainings/programs			
	Traffic flow					
	Poor junction readability					
	Adverse weather					

# **V Floor markings to save lives**

**An Almanach of Assessed Measures**



Example:

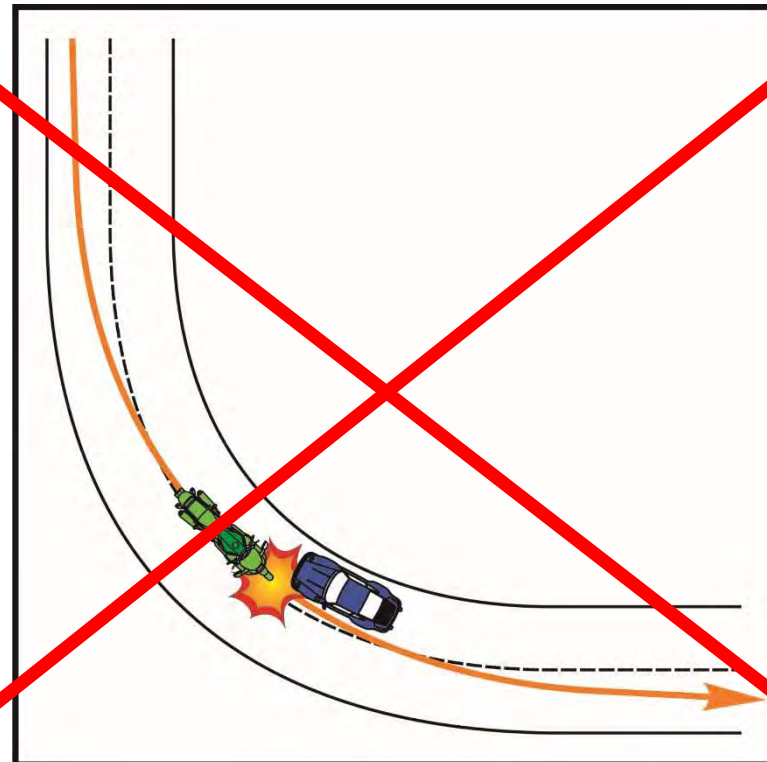
## Signposting of Speed Limits at Dangerous Spots in Curves

Expert Assessment			
Overall		★★★★★	
Size	★★★★★	Transferability	★★★★★
Total impact	★★★★★	Implementation	★★★★★
Safety impact	★★★★★	Acceptance	★★★★★
Efficiency	★★★★★	Sustainability	★★★★★



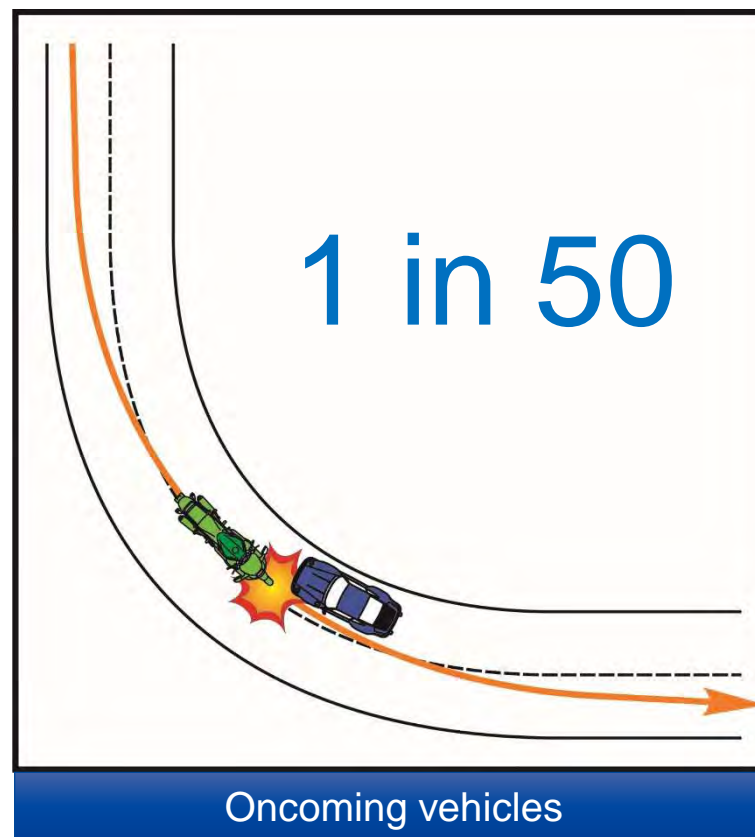
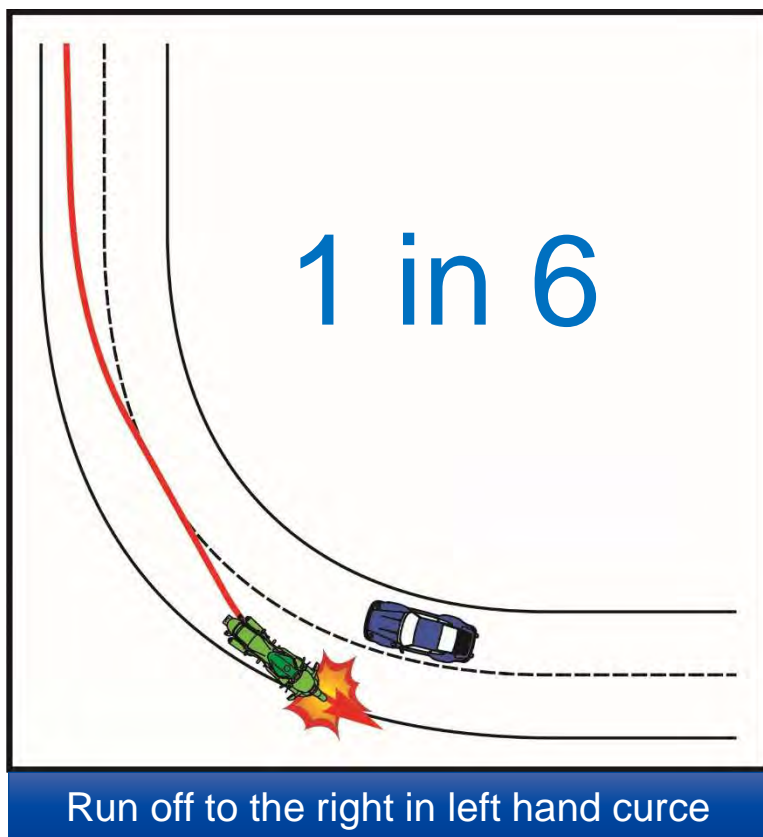
*Riders' perspective*  
★★★★★

# Typical crashes?



Unfälle im Begegnungsverkehr

## Typical crashes!



... half of them upright into guardrails

## Evaluation: What we did

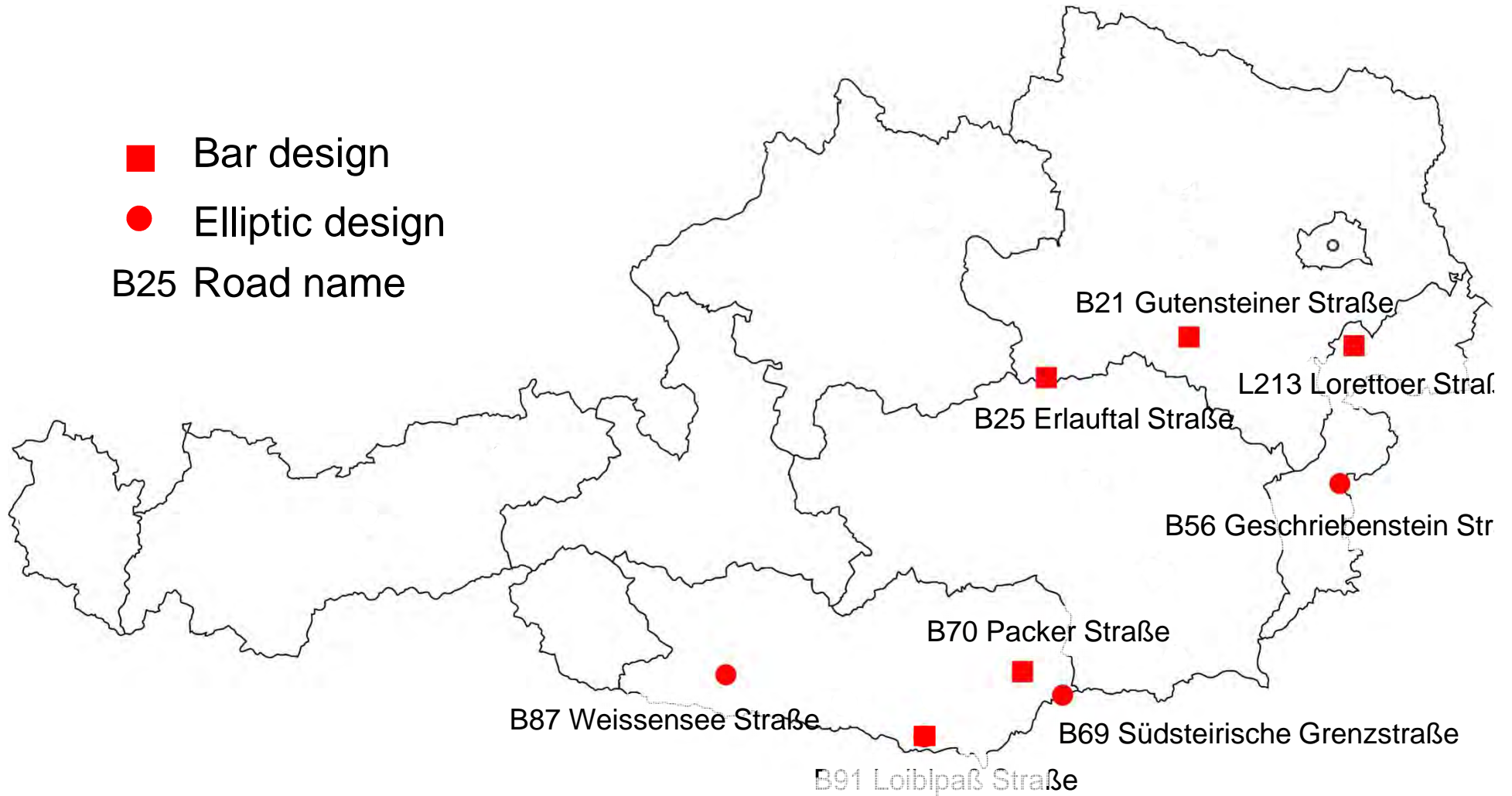
- **Literature survey**
- **Selection of locations**
  - 9 locations / min. 3 relevant crashes in 3 years
- **Selection of layout**
- **Before-after comparison**
- **Video observation**
- **Interview survey**



# Selection of locations

- Bar design
- Elliptic design

B25 Road name



# Selection of layout



**Elliptic design**

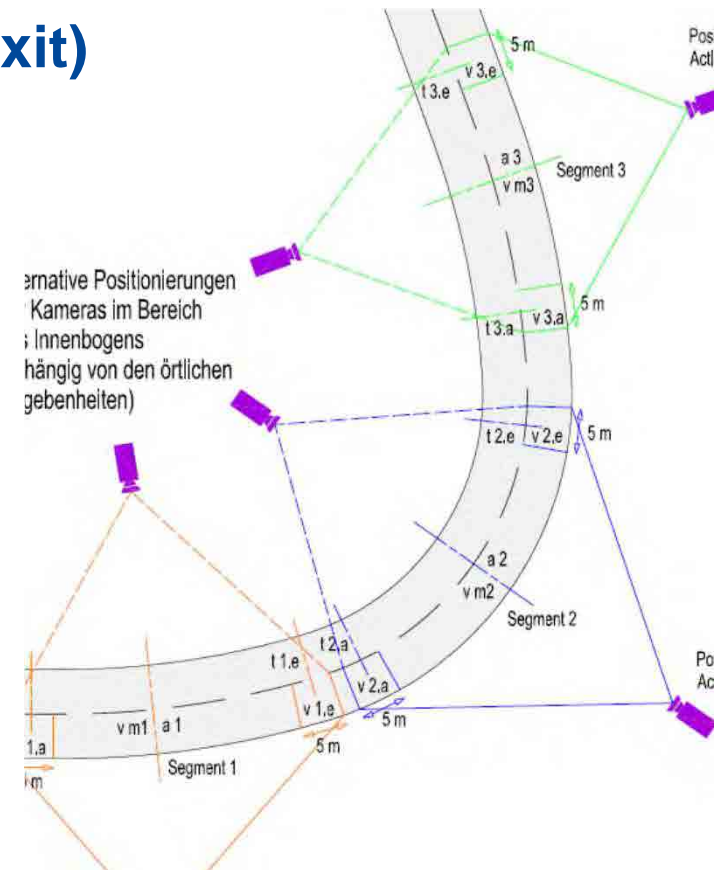
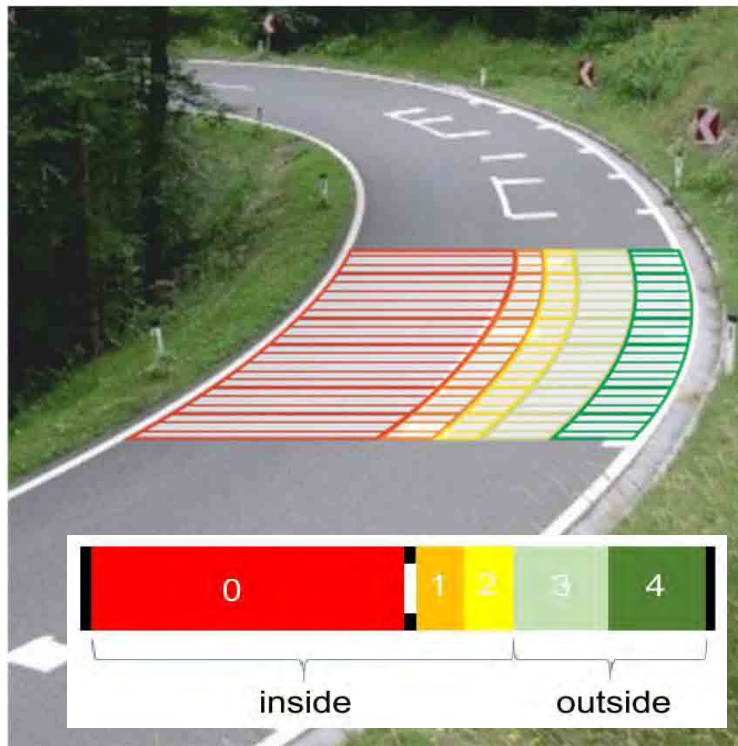


**Bar design („psychological brake“)**



# Video observation (image processing)

- 2 phases: before/after (weekend, typ. 1 day)
- 3 sections (beginning / vertex / exit)
- 5 segments



# Sample

- Total 18.753 Observations

	Vorher	Nachher	$\Sigma$
Elliptic	1.546	4.581	6.127
Bar design	4.052	3.987	8.039
<i>Bars 1 side</i>	598	3.165	3.763
<i>No intervention</i>	824	-	824
$\Sigma$	<b>7.020</b>	<b>11.733</b>	<b>18.753</b>

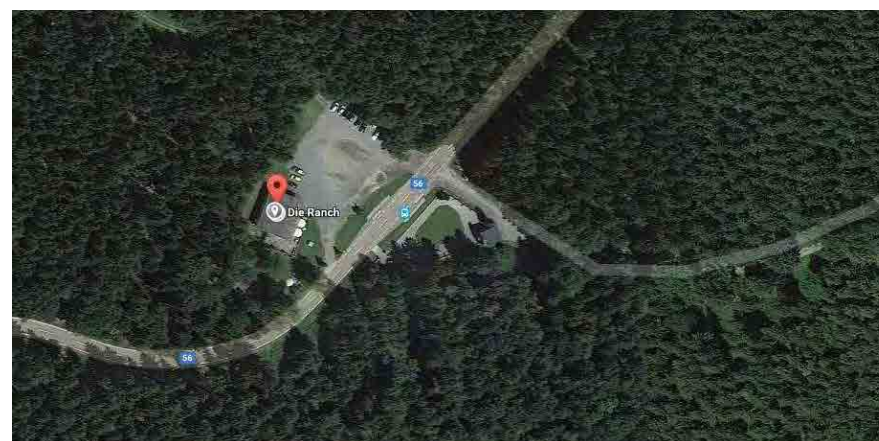
# Interviews

## 2 cases:

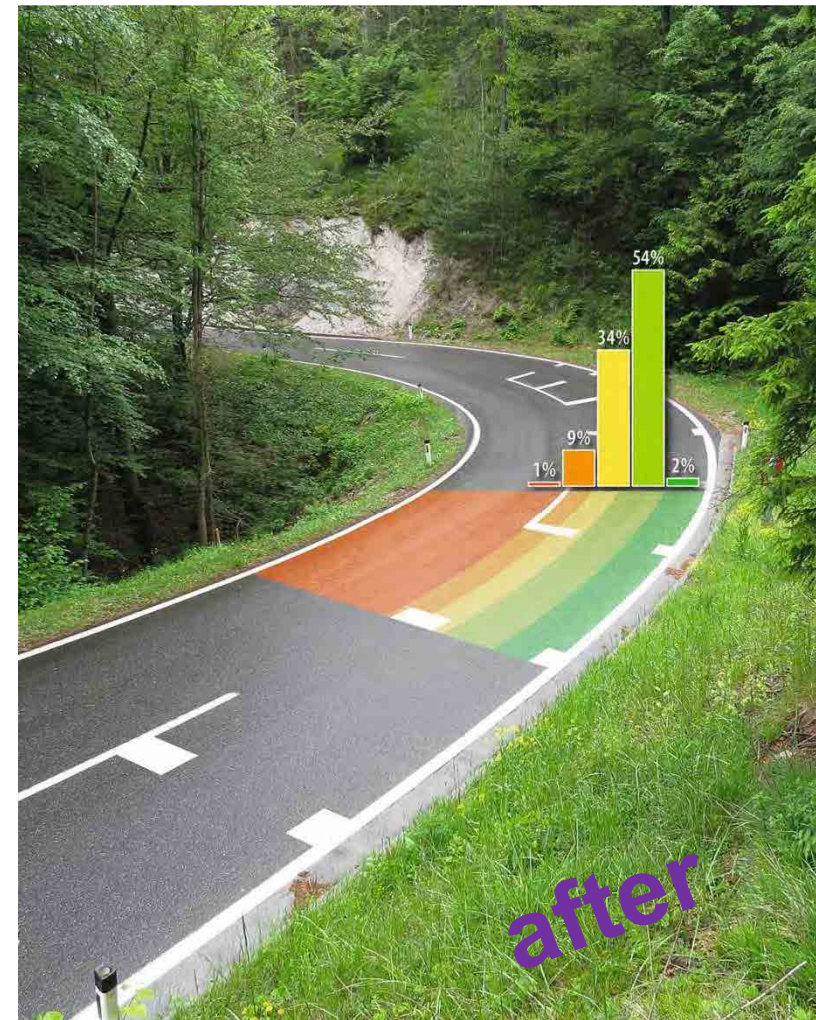
- „experience“ (n=106)  
had run over themselves
- „acceptance“ (n=123)  
picture had been shown

## Questions:

- lane position
- meaning
- usefulness
- effectiveness

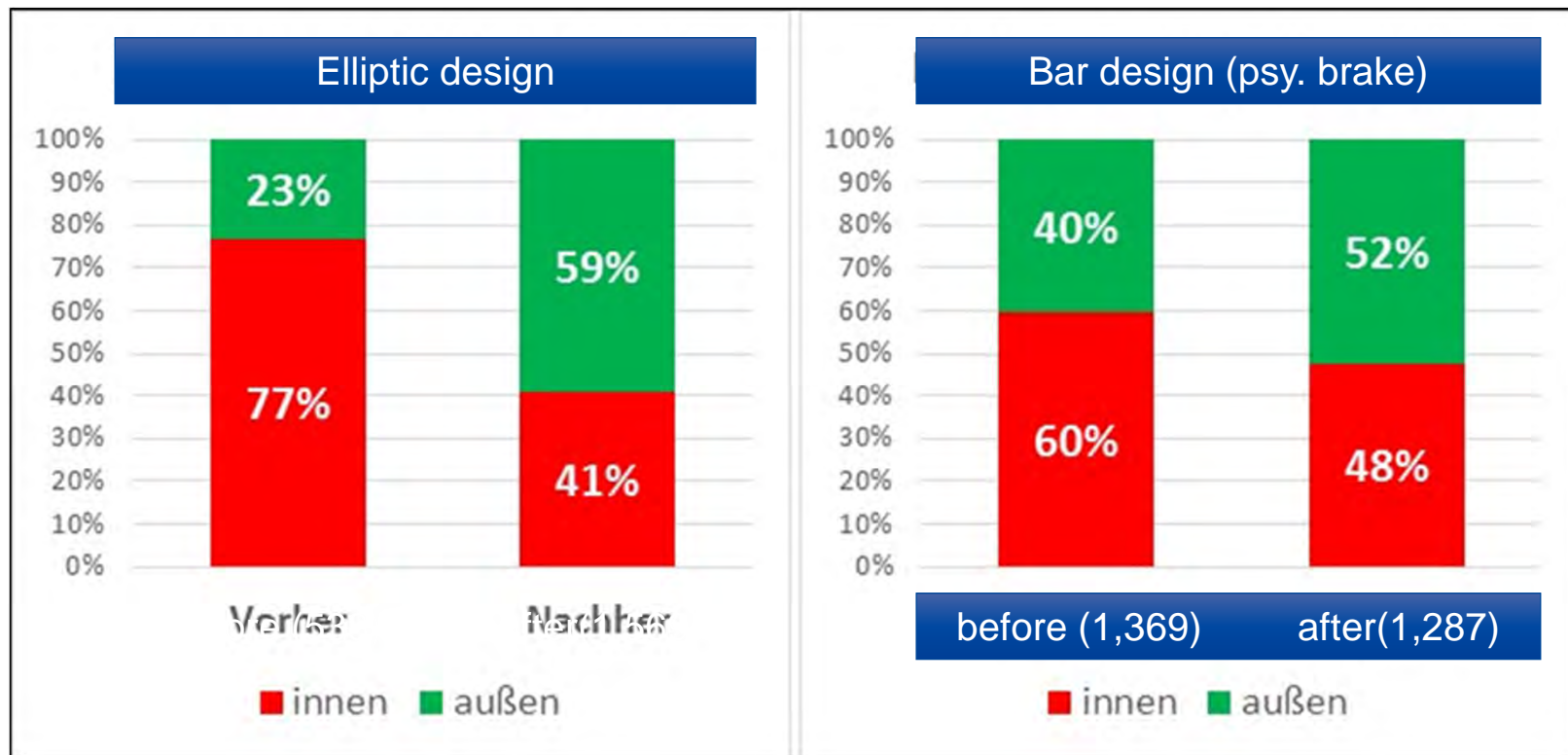


# Lane positions before/after overall



diàlegs sobre motocicletes | 28.6.2018 |

# Lane position moved outside in section 2 (at vertex)



## More effects

- **Further right at the entrance**
- **Further left at the exit**
- **No change of speed**
- **Well accepted by riders**
- **Strong positive feedback by riders**
- **Bar design more intuitive**
- **Elliptic design considered more effective**



# Slowenia works even with this kind of riders

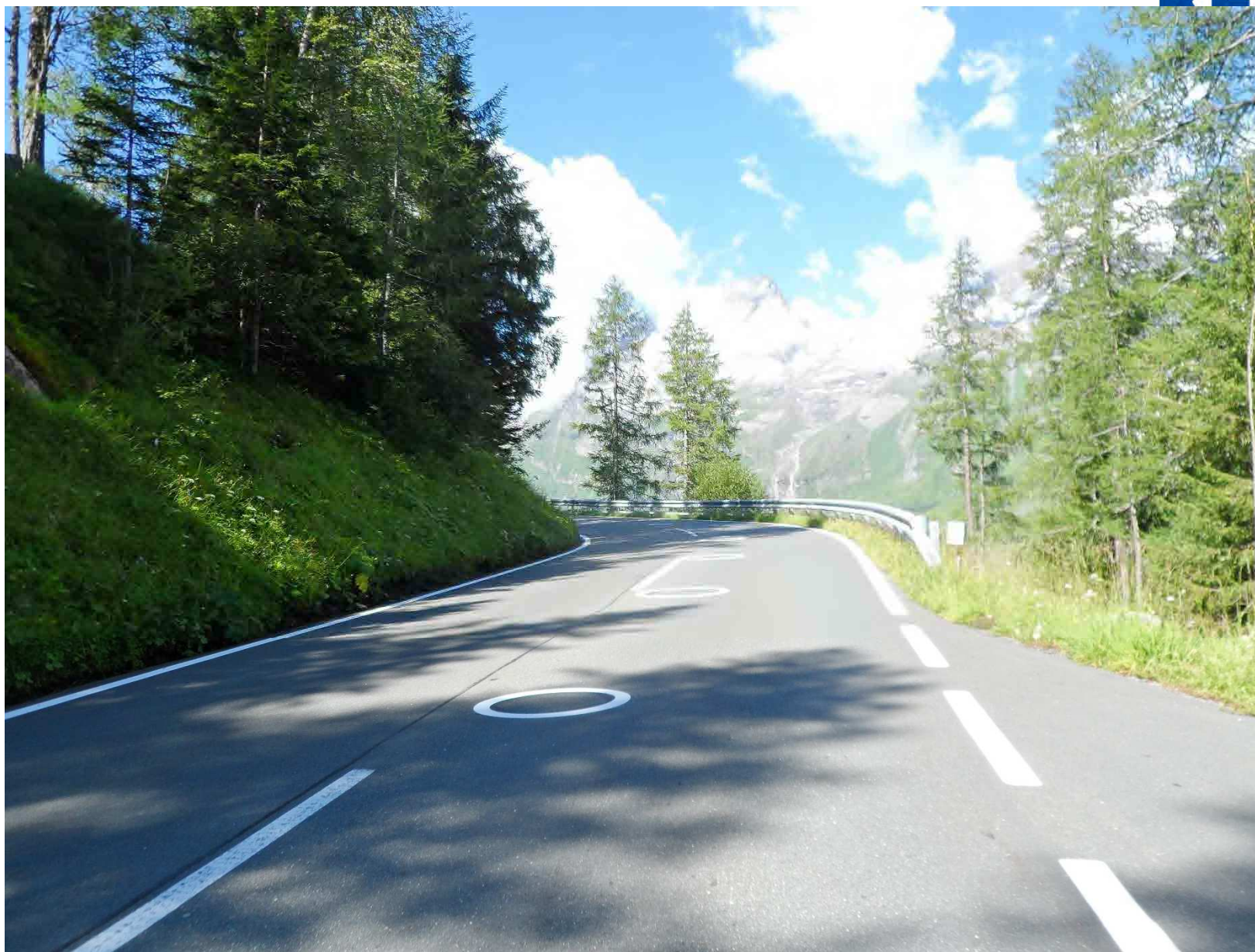


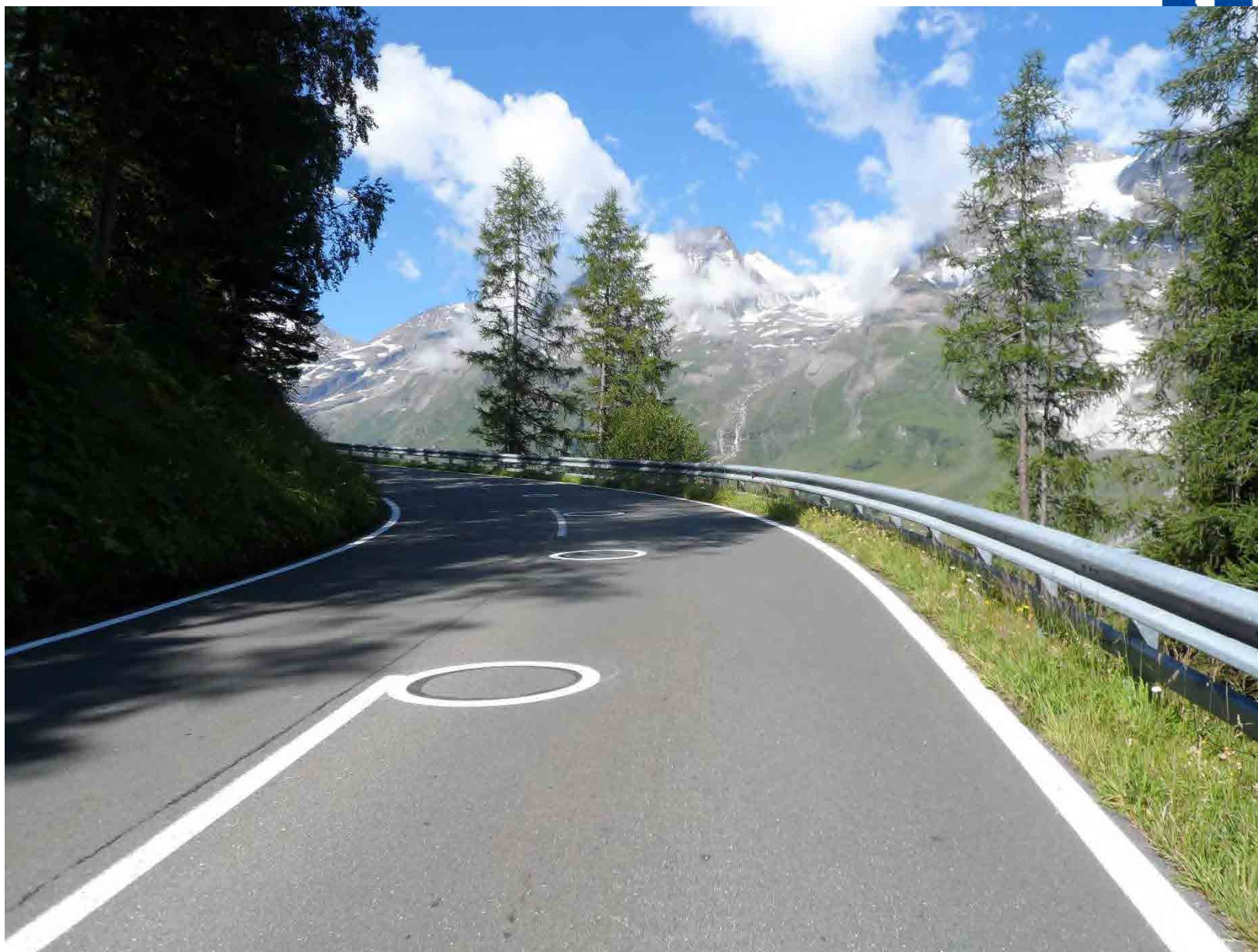










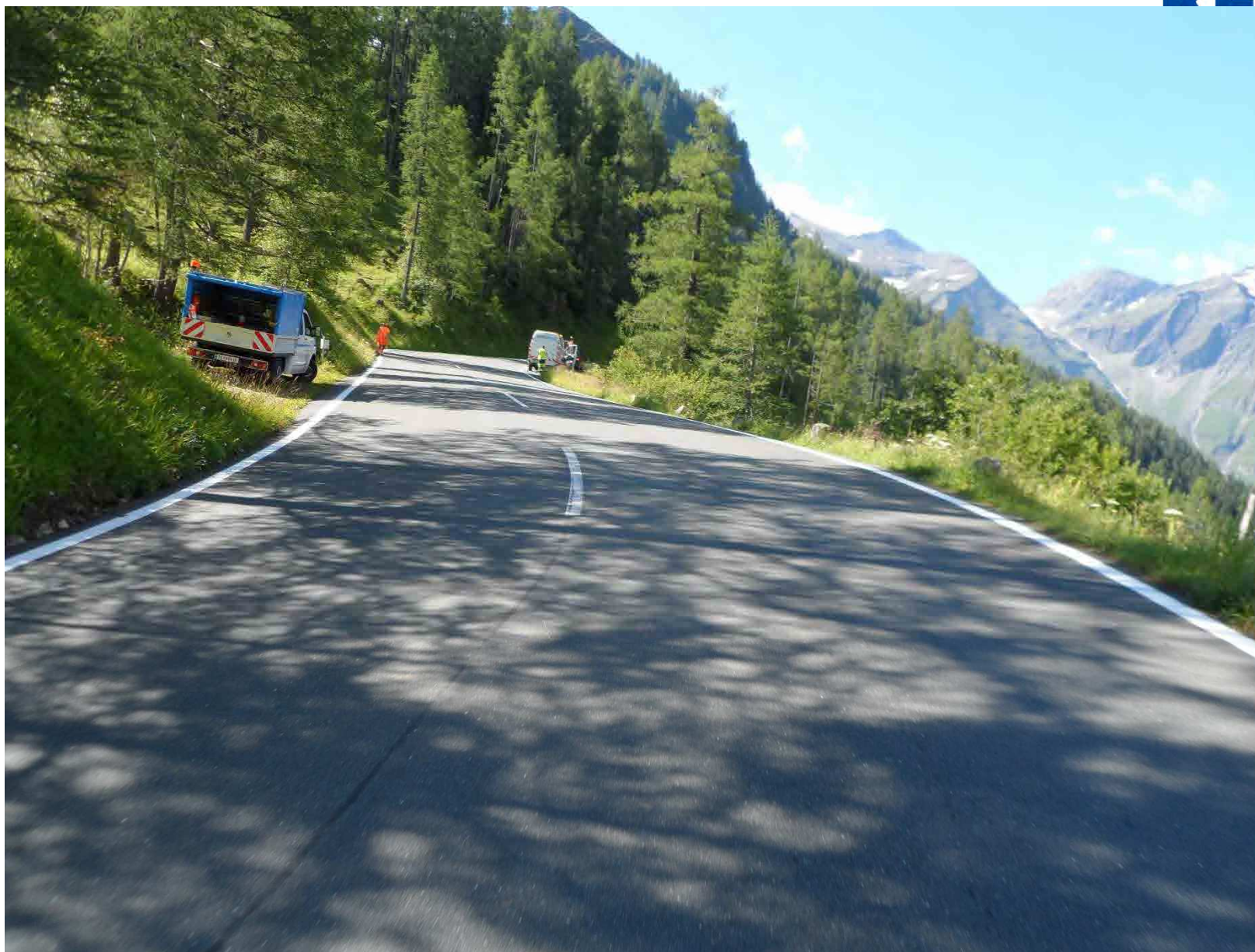






KFV | diàlegs sobre motocicletes | 28.6.2018 |

SAFETY FIRST! |









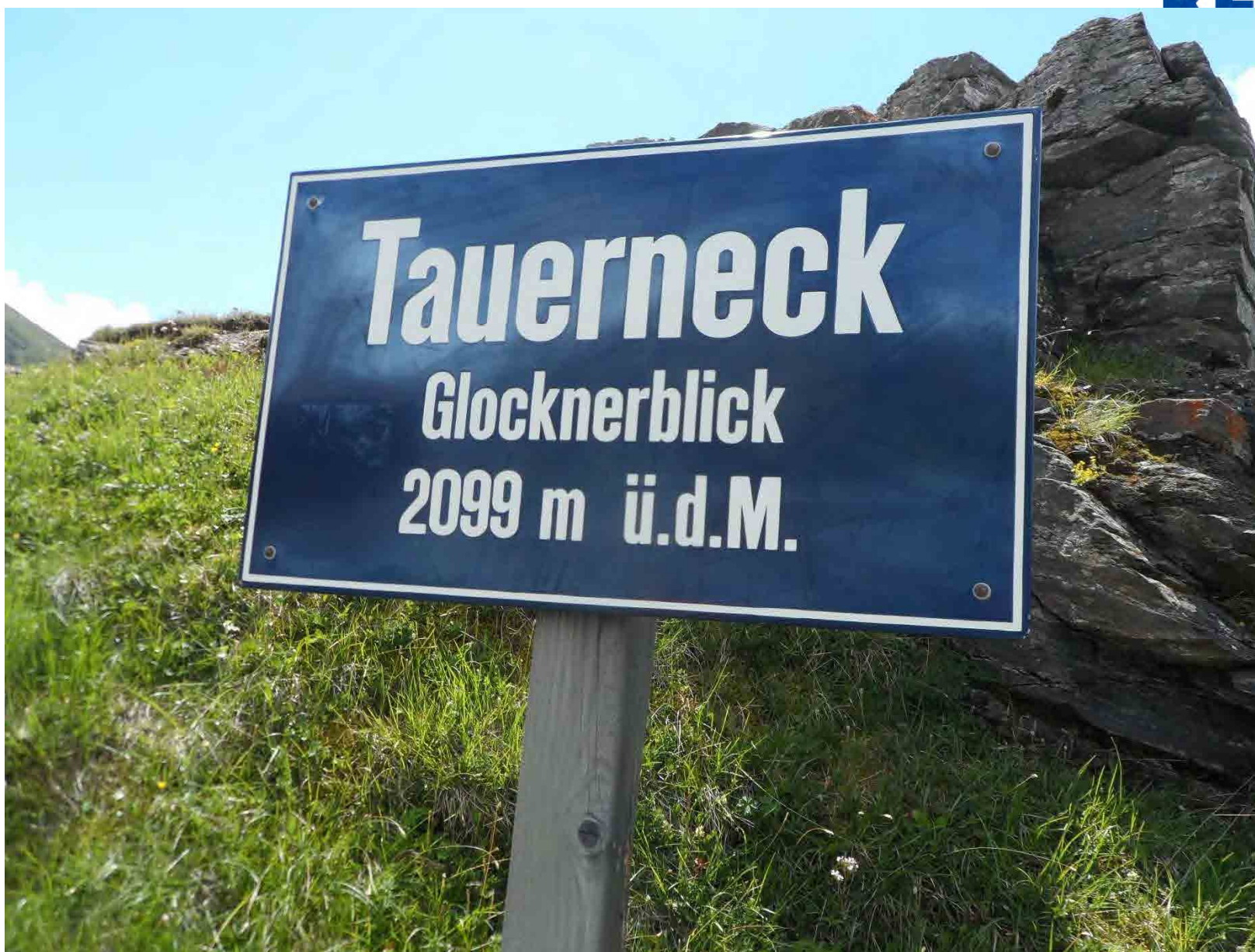


















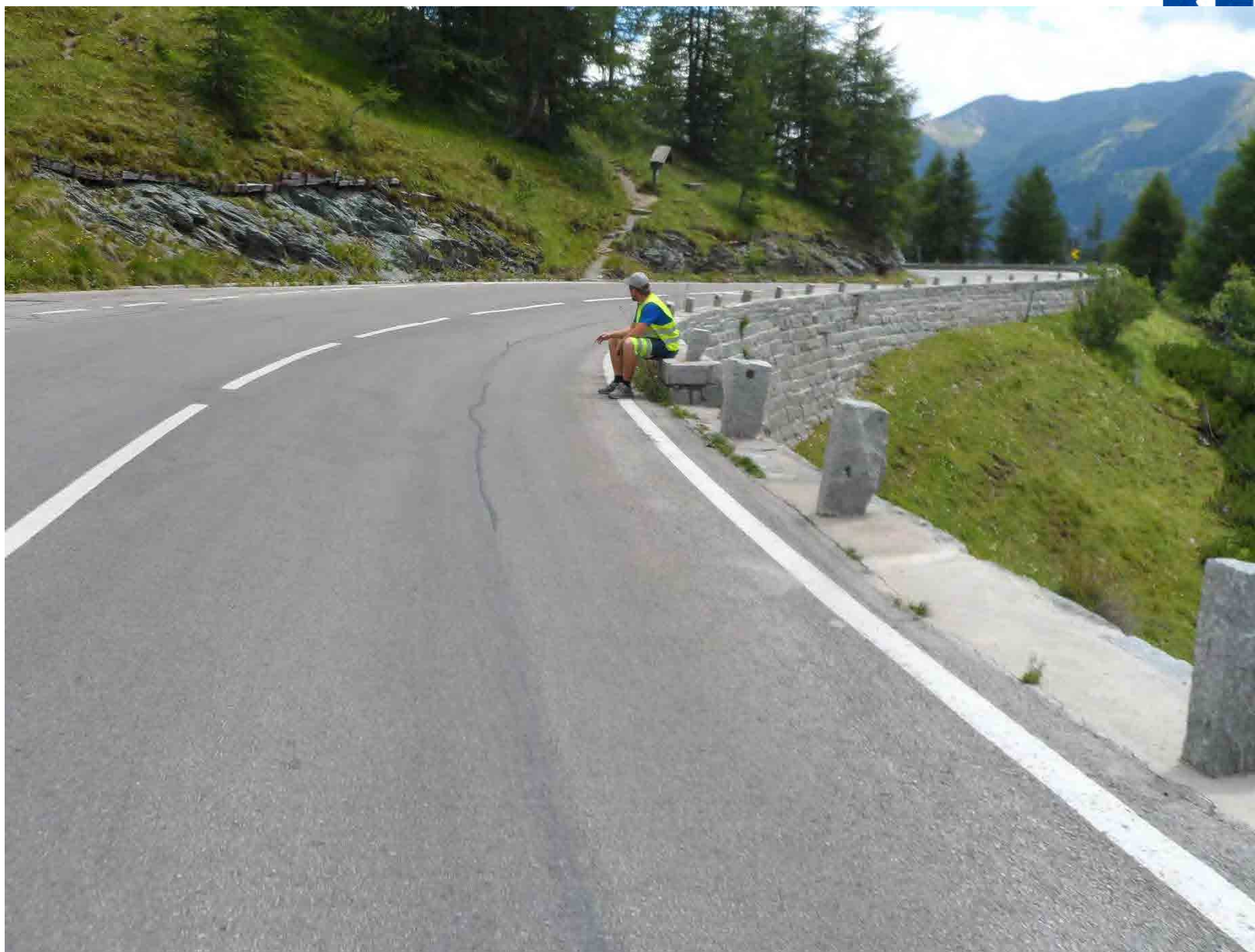










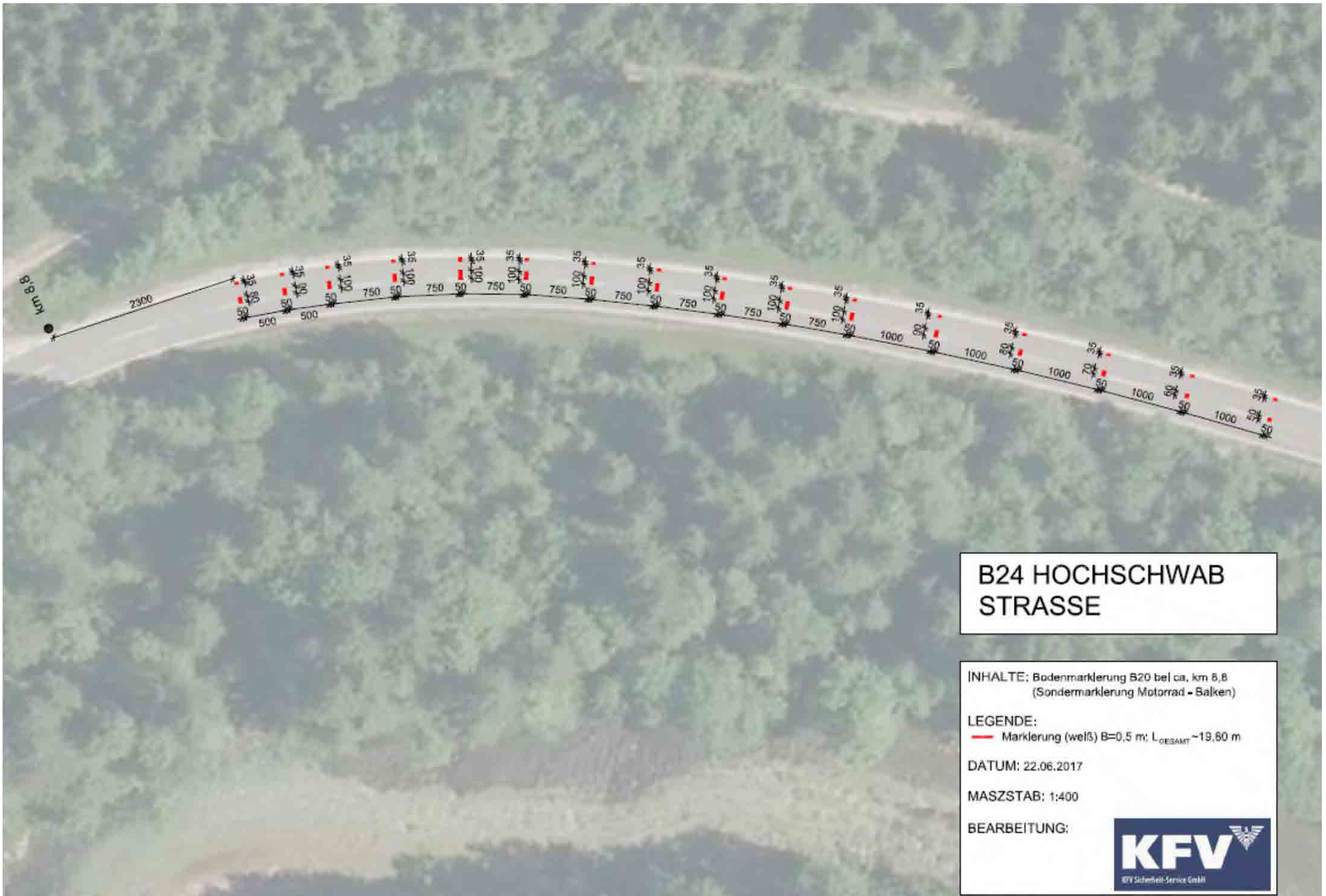




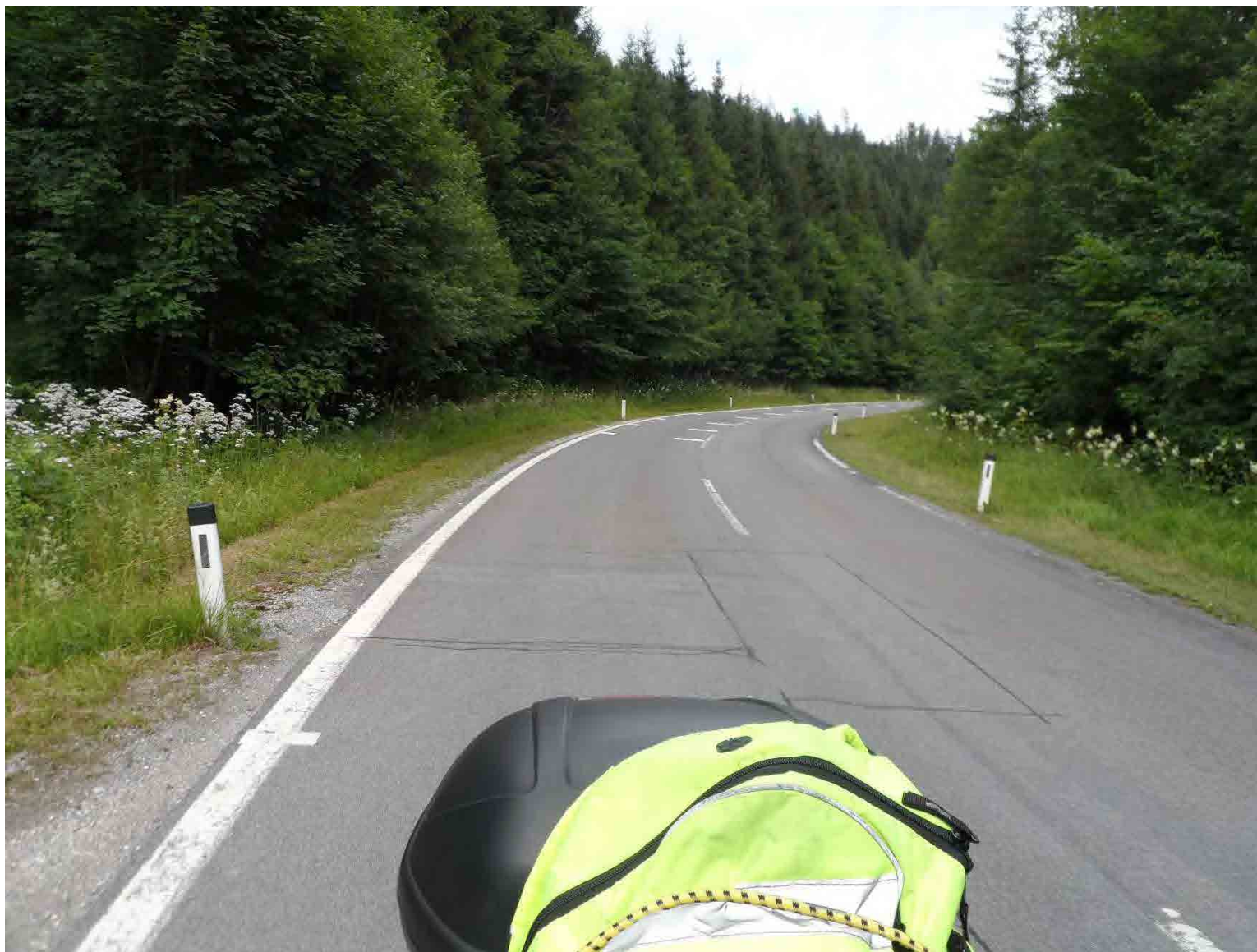




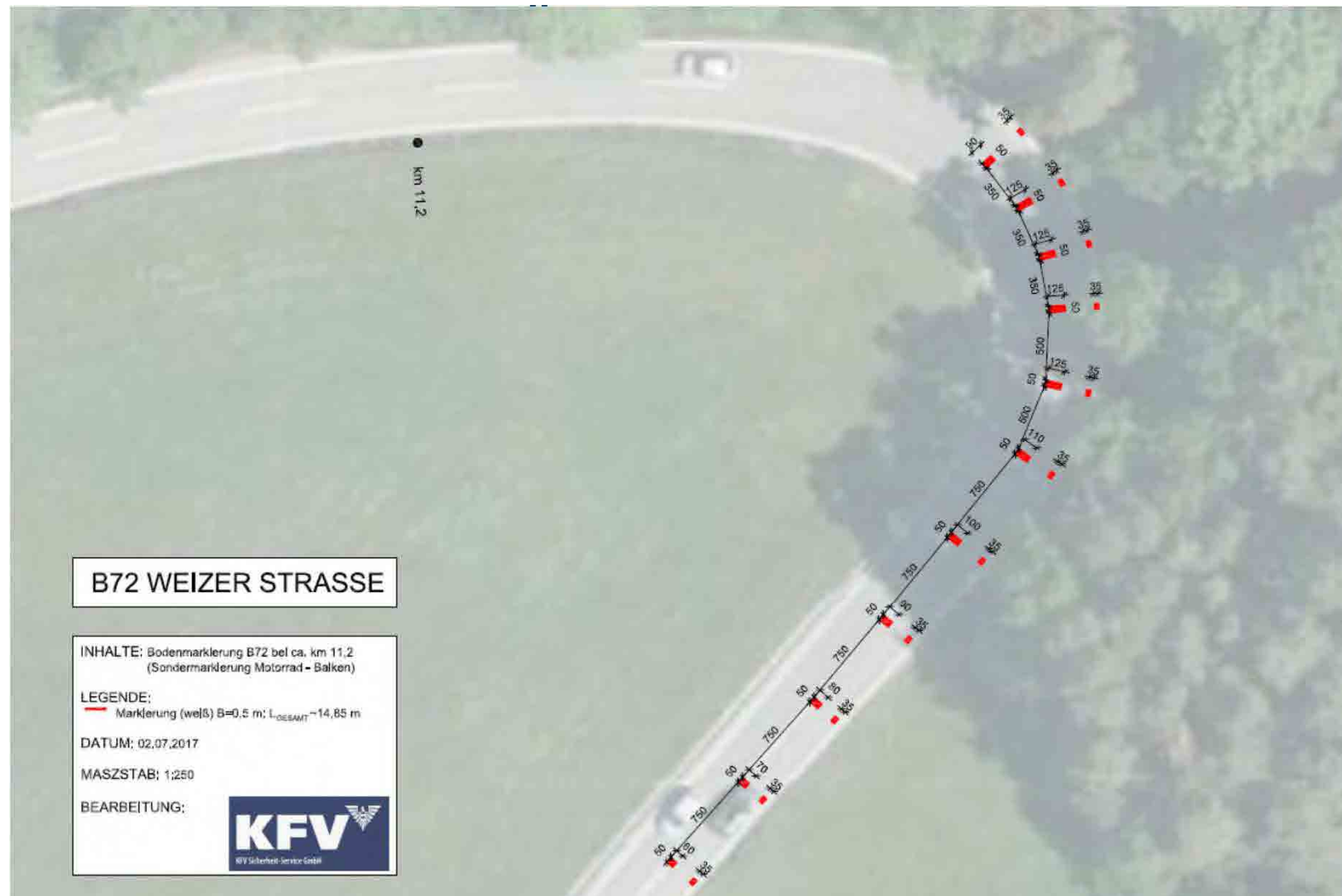






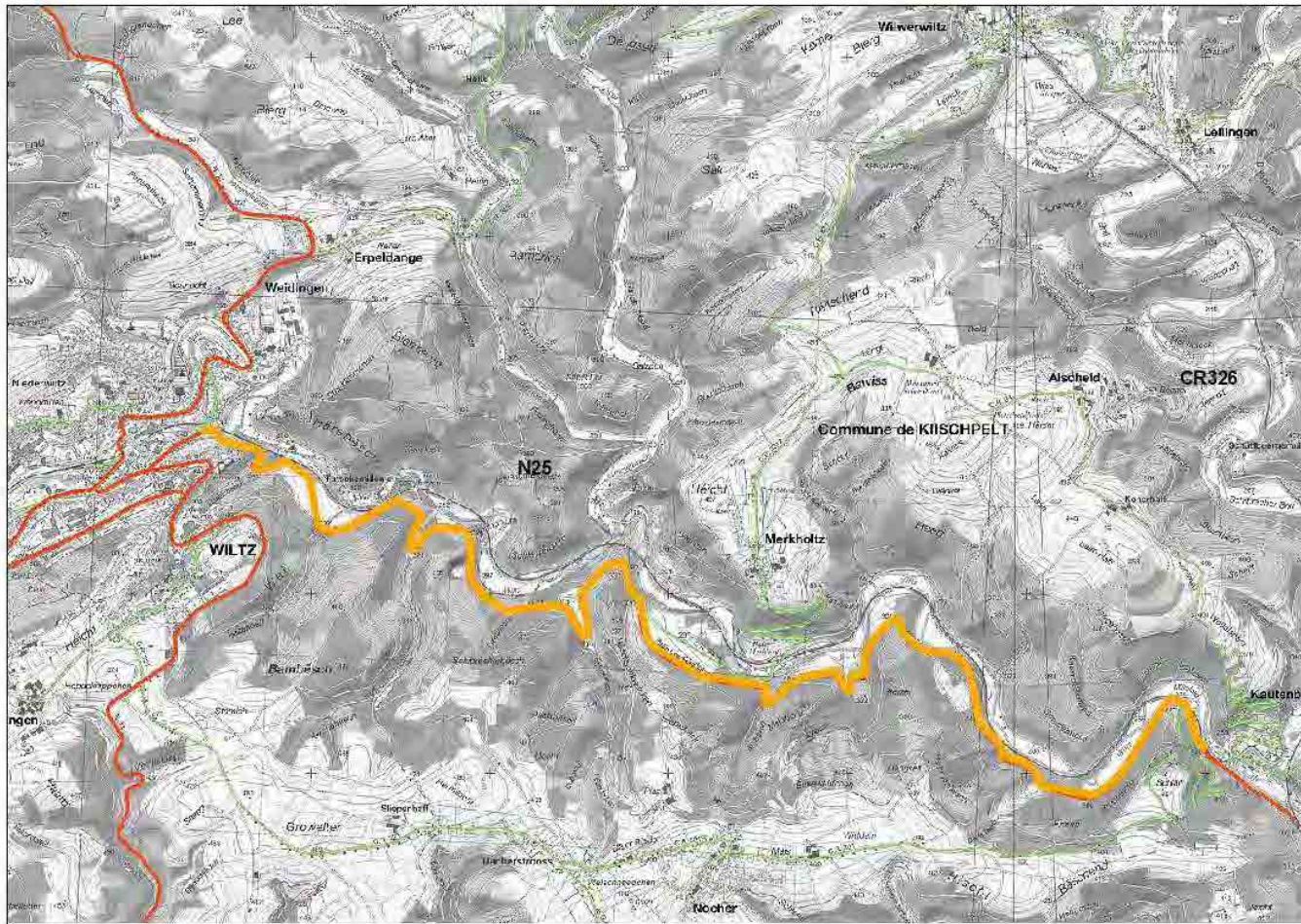


# Umsetzung der Idee in Luxemburg





# Export to Luxembourg







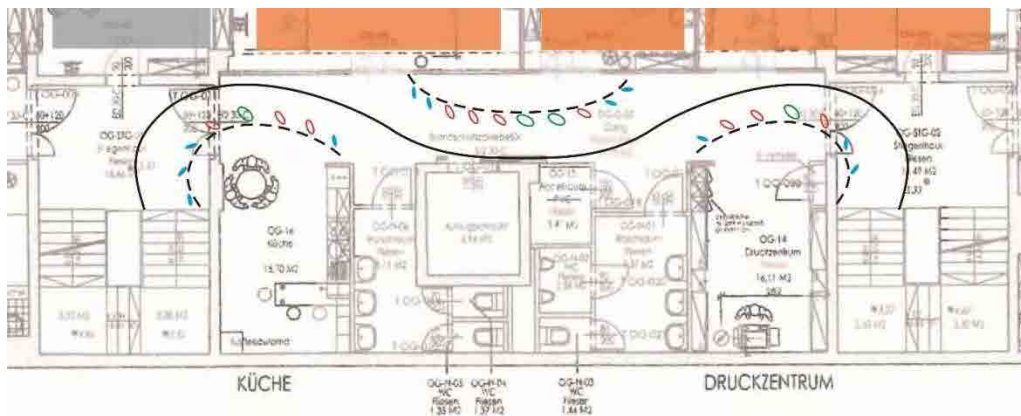
Thanks for listening!

KfV

Schleiergasse 18 | A-1100 Wien

Tel: +43-(0)5 77 0

E-Mail: [kfv@kfv.at](mailto:kfv@kfv.at) | [www.kfv.at](http://www.kfv.at)

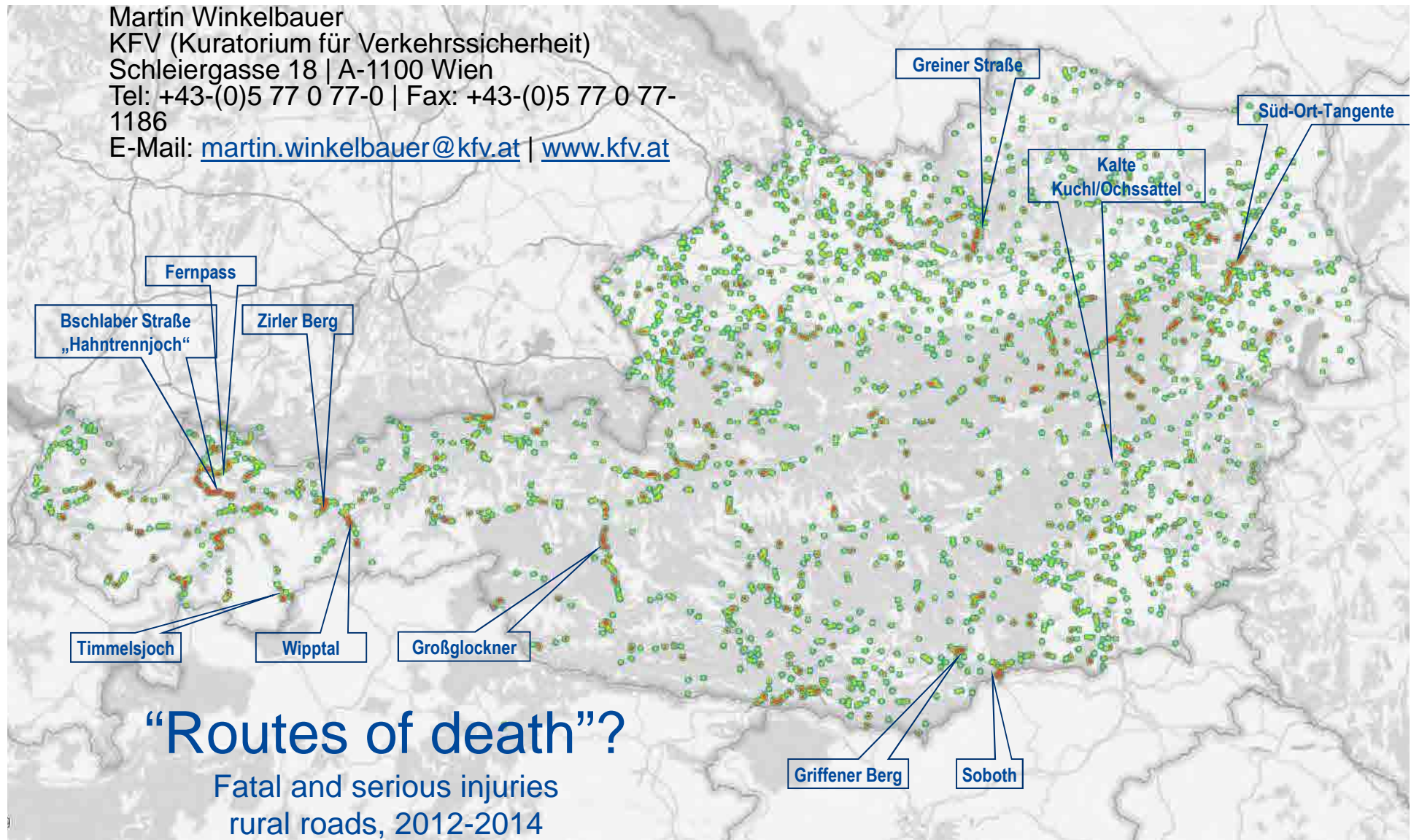


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# Thanks for listening!



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E-Mail: [martin.winkelbauer@kfv.at](mailto:martin.winkelbauer@kfv.at) | [www.kfv.at](http://www.kfv.at)



## “Routes of death”?

Fatal and serious injuries  
rural roads, 2012-2014

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