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TOMORROW TODAY

SKID RESISTANCE POLICIES IN EUROPE (WITH A FOCUS ON GERMANY AND AUSTRIA)

15th National Conference on Transportation Asset Management

2025-08-28

Chicago, Illinois

Roland Spielhofer

TOPICS

- Policies and practices for skid resistance measurements in Europe
- Skid resistance management practice in Germany and Austria

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SKID RESISTANCE POLICIES AND PRACTICE

all data taken from Tyrosafe D06

[from 2009, sorry!]

TYROSAFE

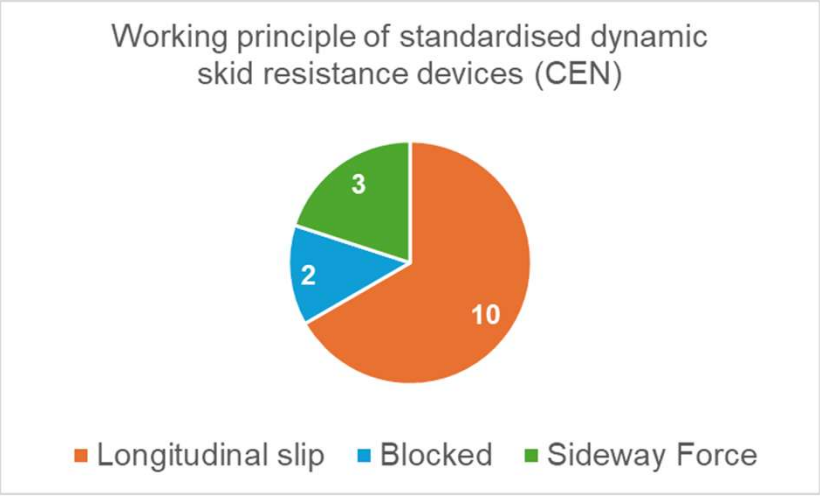
http://tyrosafe.fehrl.org/

STANDARDISED SKID RESISTANCE DEVICES

CEN TC 227 WG 5 “Road surface characteristics”

- Scope: “To prepare European Standards on test methods to measure surface characteristics as required by CEN/TC 227”

Currently **15** standards for dynamic devices: CEN TS 15901-1 … 15



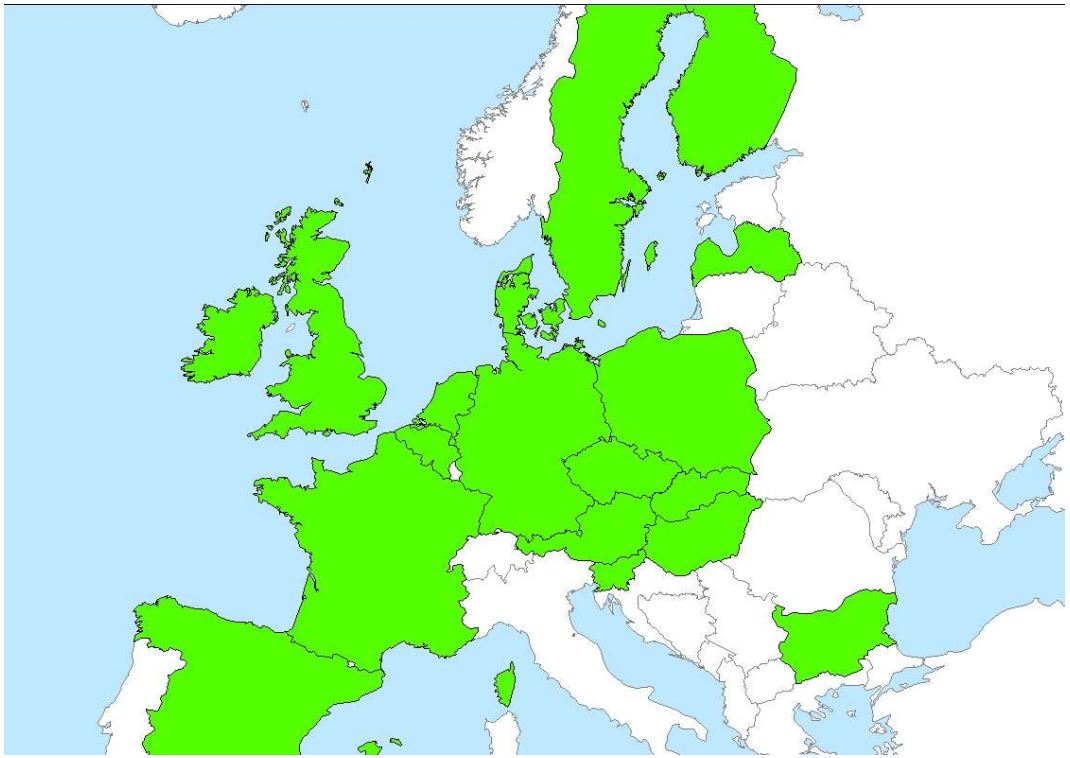
in reality: only longitudinal slip/sideway force principle used in routine survey

CEN TC 227/WG 5 site:

https://standards.cencenelec.eu/dyn/www/f?p=205:7:0::::FSP_ORG_ID:7551&cs=112515793A66B611592D6D9079FE4D3DB

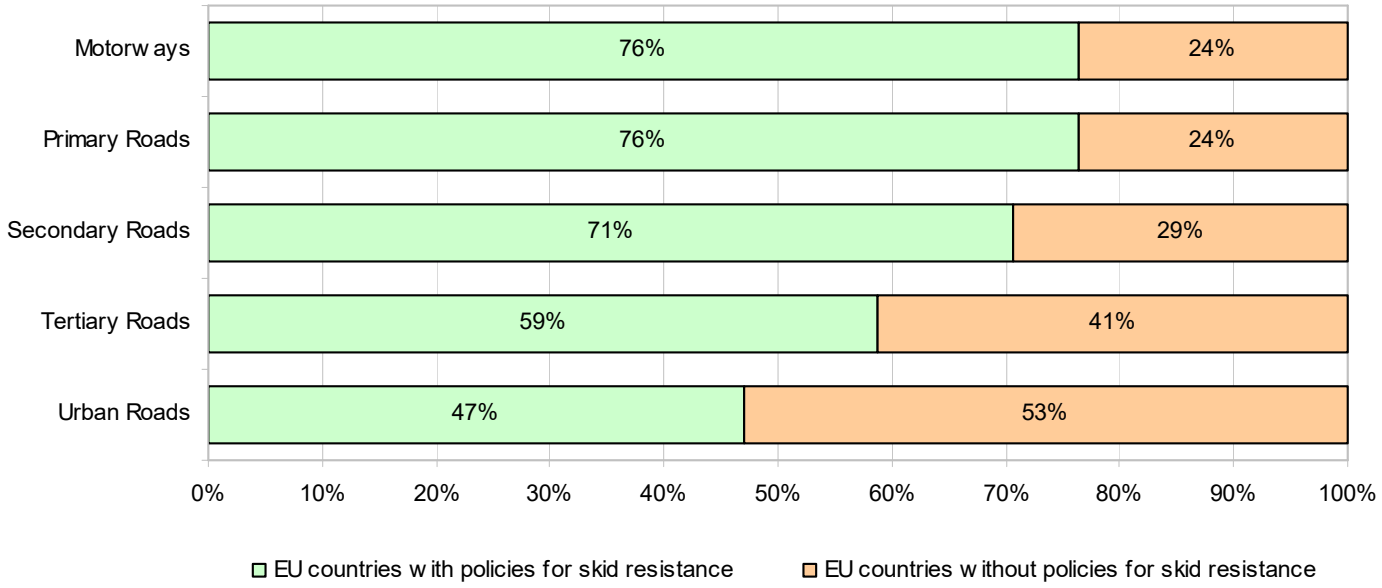
SKID RESISTANCE POLICIES AND PRACTICE

Countries included in survey



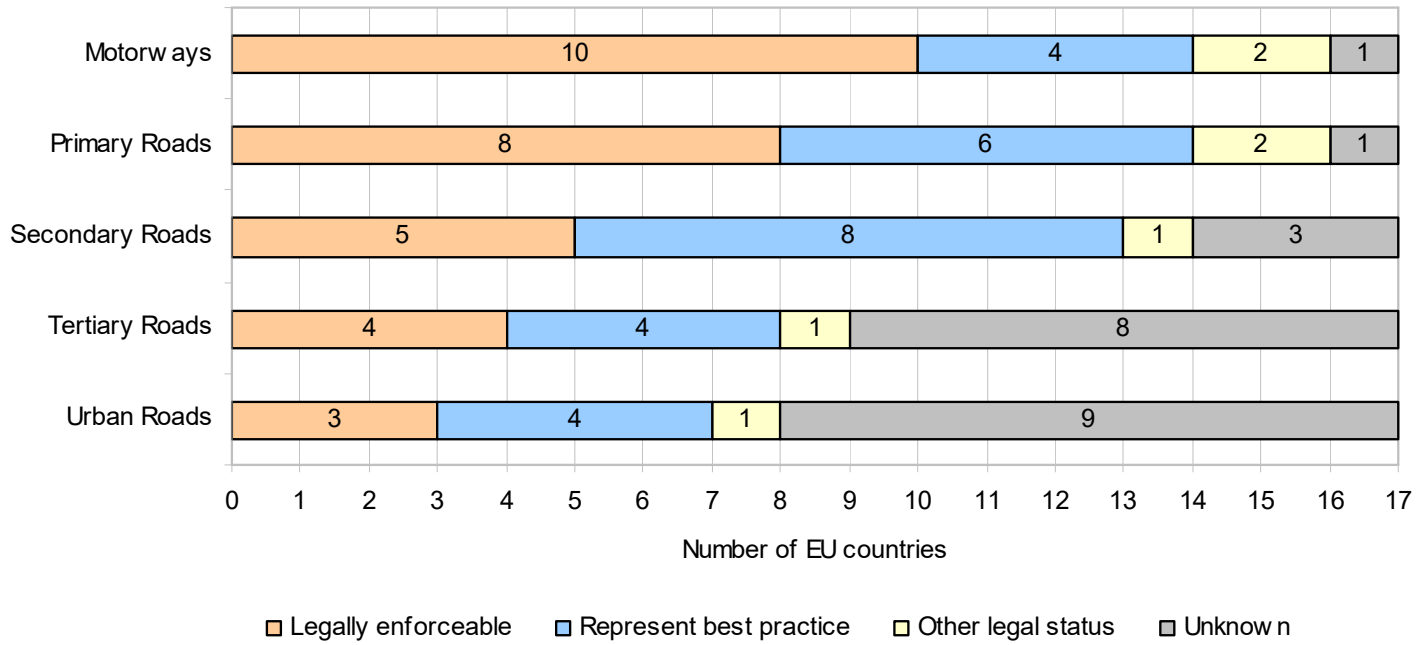
SKID RESISTANCE POLICIES AND PRACTICE

Skid resistance policy in place?



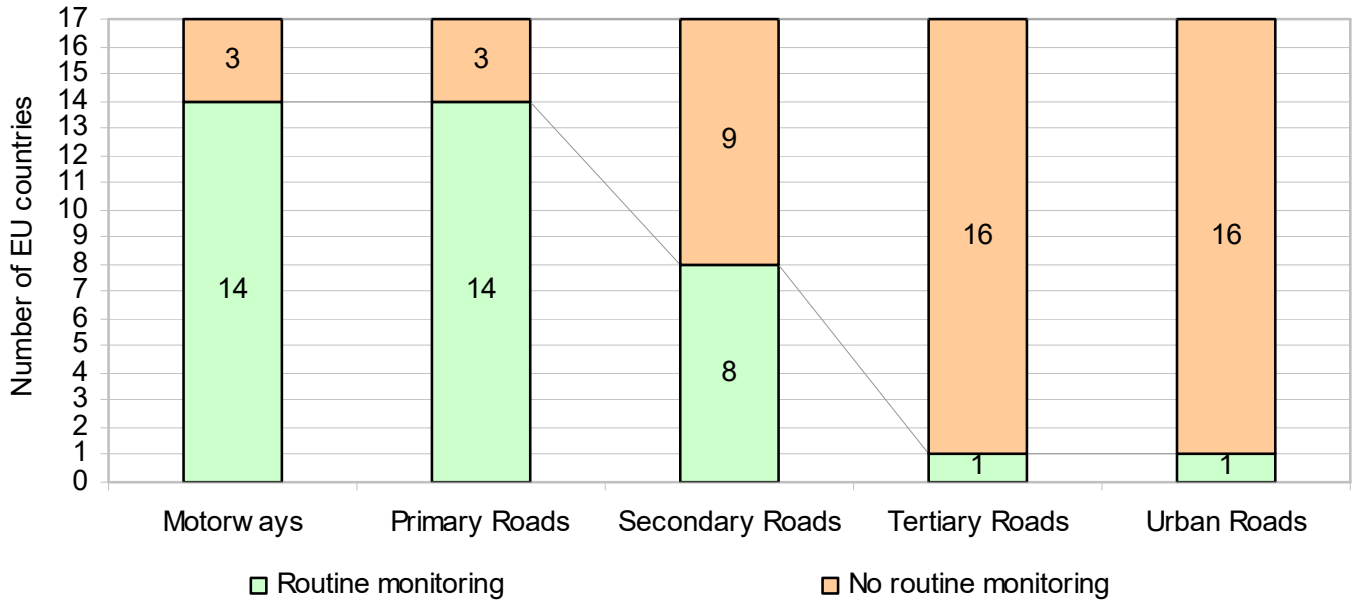
SKID RESISTANCE POLICIES AND PRACTICE

Legal status of policy



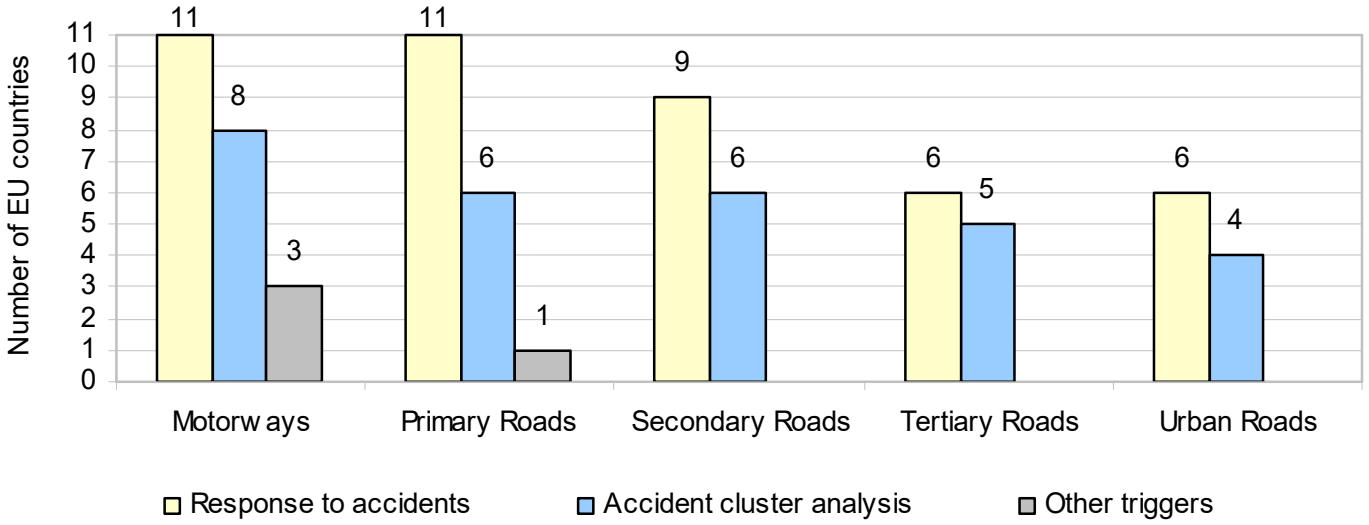
SKID RESISTANCE POLICIES AND PRACTICE

Network monitoring



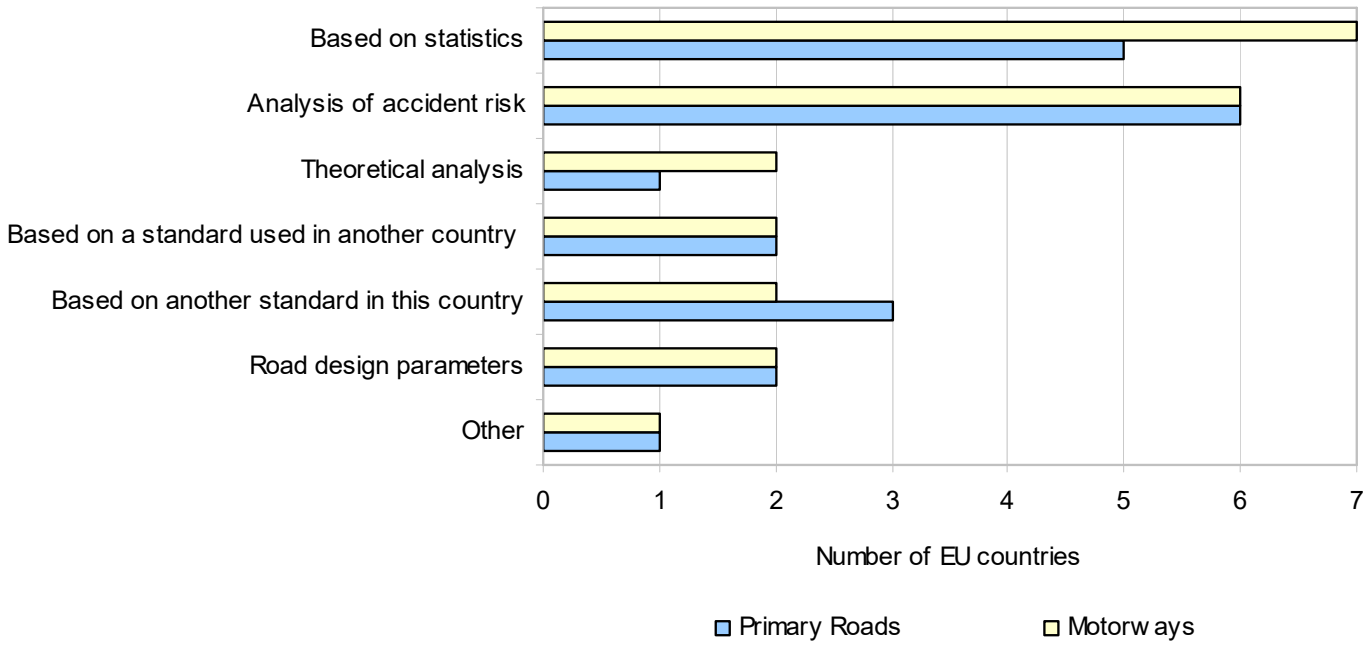
SKID RESISTANCE POLICIES AND PRACTICE

Triggers for skid resistance measurements (beside monitoring)



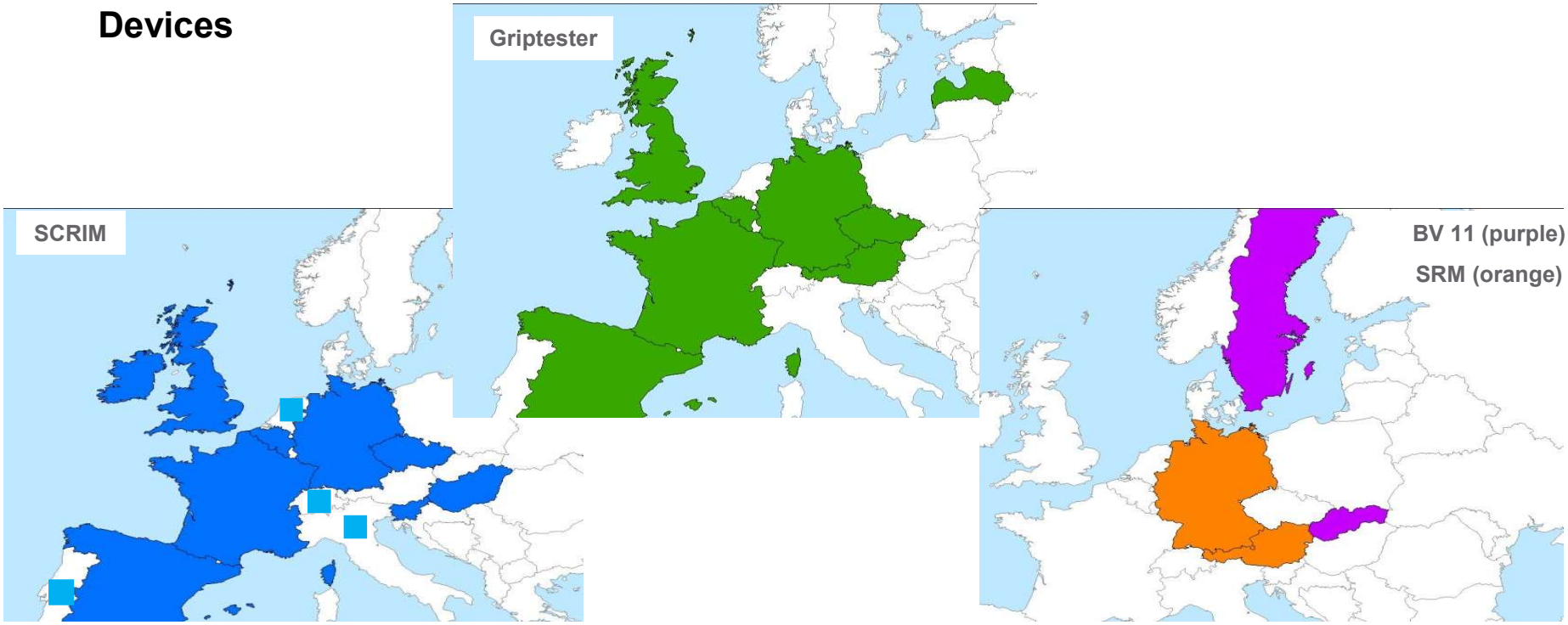
SKID RESISTANCE POLICIES AND PRACTICE

Skid resistance thresholds origins



SKID RESISTANCE POLICIES AND PRACTICE

Devices



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SKID RESISTANCE MANAGEMENT IN AUSTRIA AND GERMANY

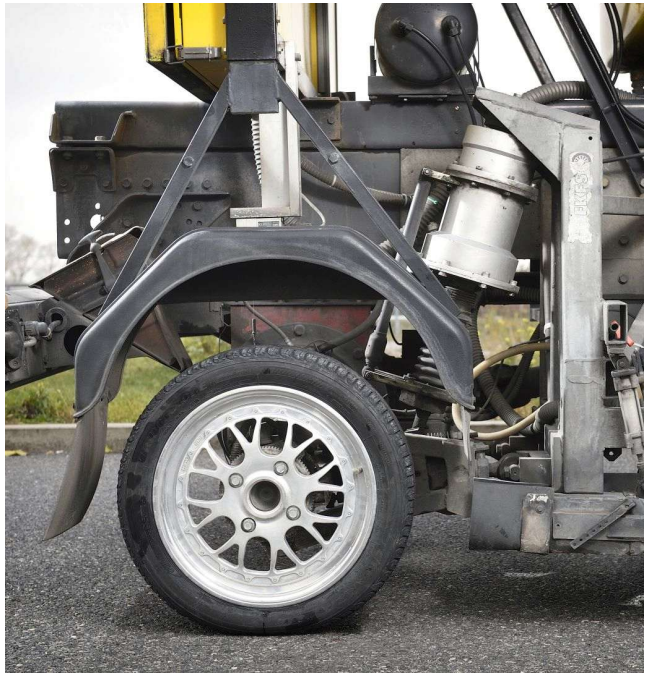
SKID RESISTANCE MANAGEMENT IN AUSTRIA

Motorway network maintained by ASFINAG

- toll for all vehicles – trucks pay dependent on milage and no. of axles and emission class (since 2004) motorcycles/cars: toll sticker (since 1997)
- liability @ slight negligence
- 2250 km network length
- 220 km tunnels

- network monitoring: since 1999
- since 2004: new work approval using an LFCS device (RoadSTAR) on motorways
- since 2004: warranty testing at the end of the warranty period (5 years) on motorways

SKID RESISTANCE MANAGEMENT IN AUSTRIA

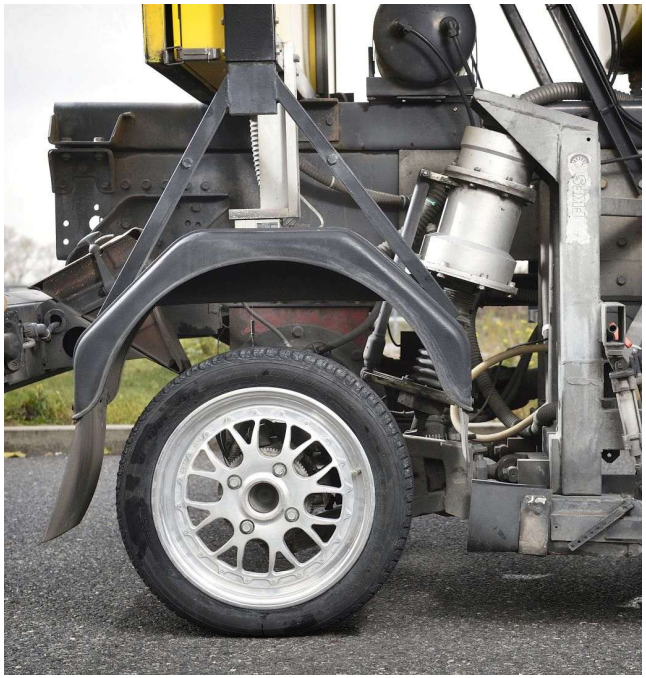


SKID RESISTANCE MANAGEMENT IN AUSTRIA

- 18 % fixed slip
- 3500 N vertical load
- 0.5 mm water film
- PIARC ribbed tyre and commercial tyres

- essentially the simulation of a quarter car at full ABS braking
- established correlation to deceleration/braking distance of passenger cars

- minimum section length 5 m
- aggregated to 50 m sections



SKID RESISTANCE MANAGEMENT IN AUSTRIA

In situ monitoring

- 1999 first network measurement campaign (right lane only)
- since 2009 five-year cycle with all lane covered
- since 2016 ramps are covered
- since 2022 four-year cycle (year 1: right lane, year 2: all other lanes, year 3: ramps, year 4: only acceptance/warranty testing)

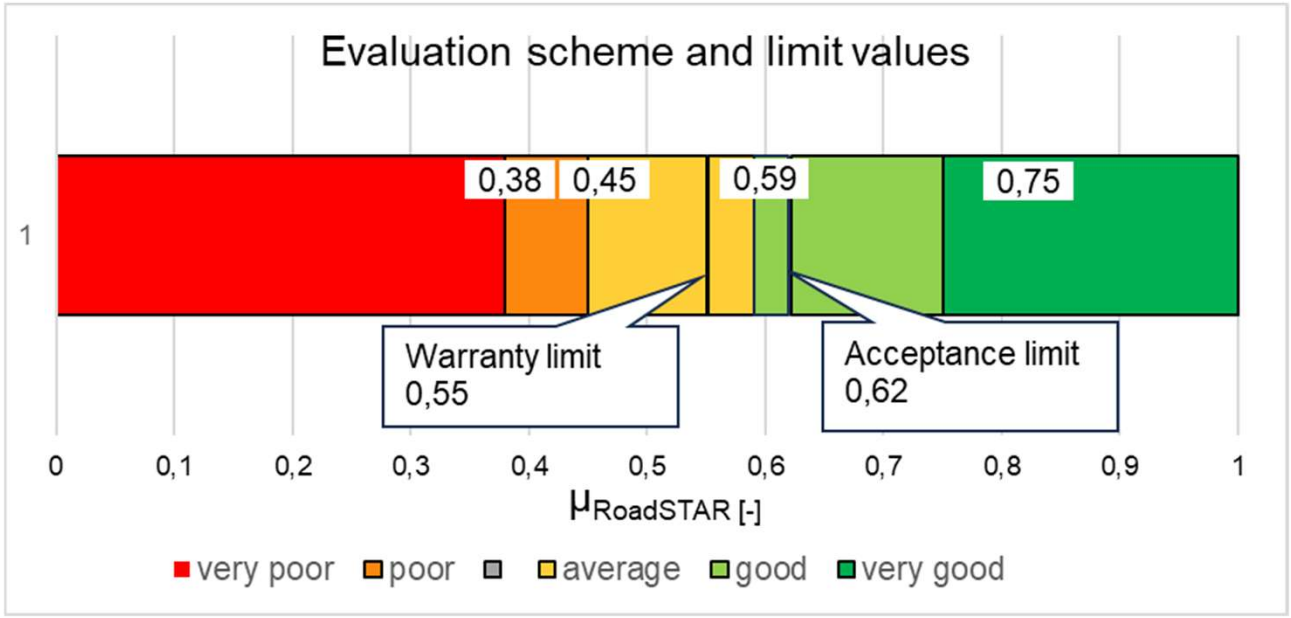
- continuous friction measurement – 50 m sections

- 500 – 700 lane km per year of acceptance and warranty testing

SKID RESISTANCE MANAGEMENT IN AUSTRIA

Evaluation Scheme

- at the beginning based on statistics
- later re-evaluated using braking tests and skid resistance measurements



SKID RESISTANCE MANAGEMENT IN AUSTRIA

New work approval limit value

- $\mu_{RoadSTAR}$ = 0.62 [-]

- since 2004: every newly laid surface needs new work approval using an LFCS device (RoadSTAR)
  - within 12 weeks after opening / 2 weeks before opening
  - April – November
  - all sites that are finished later than November are tested in next spring

SKID RESISTANCE MANAGEMENT IN AUSTRIA

What happens if the test fails:

μ 0,45 – 0,59	→ money deduction or measure by contractor
μ < 0,45	→ measures by the contractor, new test
μ < 0,38	→ immediate measures to ensure safety

Experience: very good!

- In the first two years after introduction, no penalties, just informational
- In the meantime, skid resistance problems have (more or less) vanished
- What problems remain:
  - tunnels, sharp curves on ramps
  - countermeasures: high friction surface courses in some tunnels, on some very tight ramps

SKID RESISTANCE MANAGEMENT IN AUSTRIA

Warranty test limit value

- $\mu_{RoadSTAR}$ = 0.55 [-]

- since 2004: every newly laid surface approval using an LFCS device (RoadSTAR) at the end of the warranty period – usually 5 years!
  - within 16 weeks to 4 weeks before end of warranty period
  - April – November

- Consequence on failure
  - measures to improve skid resistance (grinding, milling, re-surfacing, …)
  - extension of warranty period for two years

SKID RESISTANCE MANAGEMENT IN AUSTRIA

Material

- requirements only for top layer for motorways
- **Asphalt**
  - coarse aggregates: PSV ≥50 (EN 1097-8)
  - fine aggregates (0,2/0,4 mm): PWS ≥ 0,5 (EN 12697-49)

  Concrete
  - coarse aggregates (> 4mm): PSV ≥ 50
  - fine aggregates (< 4 mm): PWS ≥ 0.55

SKID RESISTANCE MANAGEMENT IN GERMANY

Federal roads in Germany

- Motorway network maintained by Deutsche Autobahn GmbH
- Primary roads (“Bundesstraßen”) maintained by federal states

- toll for trucks >3,5 t dependent on mileage, no toll for cars/motorcycles
- 13.000 km of motorways
- 38.000 km of primary roads
- 270 km tunnel
- 2100 km bridges

SKID RESISTANCE MANAGEMENT IN GERMANY

Difference between SCRIM and SKM?

- tire
- controlled wheel load @ SCRIM, static wheel load @ SKM

Currently 19 SKM machines are operating in Germany

- 13 for construction contracts
- 6 doing network monitoring

QA

- yearly qualification at BASt (German federal highway research institute)
- principle: golden device
- external control by BASt during the year
- self control by operators

SKID RESISTANCE MANAGEMENT IN GERMANY

- since 2001: every newly laid surface needs new work approval → SKM
- since 2001: warranty testing at the end of the warranty period after 4 years → SKM

- on motorways, primary roads, local roads with different speeds (80, 60, 40 km/h)

SKID RESISTANCE MANAGEMENT IN GERMANY

Material

- requirements defined depending on pavement type
- coarse aggregates: PSV
- Examples:
  - open porous asphalt PA 8 D: PSV ≥ 54
    SMA 11 D S: PSV ≥ 51
    AC 8 D N: PSV ≥ 42
    SMA 5 D S: PSV ≥ 48
    EAC: PSV ≥ 53

D … top layer
S … heavy load

- fine aggregates – discussion on use of FAP

CONCLUSIONS

- Routine monitoring with continuous friction is well established
- Acceptance testing and warranty testing as well (at least on motorways)

- Acceptance and warranty testing really helps maintaining skid resistance over the life cycle
- Material specifications target the skid resistance at the later stage

- Future improvements / Research needs
  - Polishing simulation on the final pavement, not on the aggregate
  - Establish better correlation between lab polishing (FAP) and in-situ polishing by traffic (and climate) → lab prediction of skid resistance

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THANK YOU!

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