Infrastructure Asset Management Enterprise Software

E-circular Friction Management

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Introduction

- Road to Zero
- Vision to Zero
- Toward Zero Death

E-Circular: *Implementation of Pavement Friction Management Programs*

- *Highway Friction Management: A State perspective,* By Brian Schleppi, Ohio Department of Transportation, USA
- *TxDOT's Friction Management,* By Magdy Mikhail, Texas Department of Transportation, USA
- *Identification Of Suitable Friction Testing Equipment For Friction Management,* By Edgar de León Izeppi, Virginia Tech

E-Circular: *Implementation of Pavement Friction Management Programs*

- *Guidelines For Pavement Friction Management Program,* By Andy Mergenmeier, FHWA

- *Friction Management Programs International Perspective,* By Luc Goubert, Belgian Road Research Center, Belgium

- *Open Panel Discussion*

Highway Friction Management: A State Perspective

State Perspective from Ohio DOT

- Describe OH DOT’s proposed Highway Friction Management Program (HFPM)
- Discuss Components
- Focus on:
  - Proactive Highway Network Monitoring
  - Reactive Highway Network Monitoring
  - Uniform Process when Insufficient Available Wet Friction is Identified

State Perspective from Ohio DOT

- Evaluating and Determining Friction Demand
- Friction Evaluation & Measurement
- Materials: Design, Construction & Maintenance Operations
- Network Monitoring (Triggers for Friction Evaluation)
- Toolbox of Corrective Strategies
- Portfolio of Case Study sites and Lessons Learned
- Historic Database of Friction Measurements
- Process for Correcting Locations with Insufficient Friction

Components of HFMP

Friction Demand

- Site specific and can vary widely even within a highway segment or project. It's not one size fits all!

- Dependent on many factors: Speed, volume, traffic volumes, facility type, highway geometrics, sight distances, congestion, propensity to change lanes, acceleration, deceleration, turning movements, etc.

- Highest Friction Demand locations have potential to lose Friction the fastest

Components of HFMP

Friction Evaluation

So long as there are no surface drainage impediments, available wet friction (from the highway side) is exclusively a function of the microtexture and macrotexture properties of the surface.

Microtexture

- from the surface of the aggregate particles/paste (how rough vs. polished)
- more easily felt than seen with naked eye
- friction from adhesion (rubber adhering to surface particles)

Macrotexture

- degree of openness of the surface to deter dynamic hydroplaning (visible to the naked eye)
- works with tire tread to provide a system of water evacuation channels
- friction from hysteresis (tire rubber deformation)

Components of HFMP

Friction (micro and macro texture) Evaluation

Objective Evaluation: ASTM E-274 Locked Wheel Skid Tester

Photo courtesy of
Heidi Collins, OH DOT
Technical Services

Components of HFMP

Highway Network Monitoring

Proactive:

- Multi-Subsystem Highway Network Data Surveys
  - Rutting
  - Laser based macrotexture depth
- PCR Distresses (manual survey ratings)
  - Rutting
  - Bleeding/Flushing

Reactive:

- High Wet Crash Locations from GIS Crash Analysis Tool (GCAT)
- Traffic Monitoring Center (TMC) evidence
- Front Line Knowledge/Observation
  - Maintenance Staff
  - Law Enforcement

Identification Of Suitable Friction Testing Equipment For Friction Management

Sideway-Force Coefficient Routine Investigation Machine

SCRIM

- Friction
- Macrotexture
- IMU + GPS
  - Grade
  - Cross-slope
  - Curvature
- Video (front)
- 2,400 gallons
- 150 miles of Continuous Data per tank

Acceptance Testing/Demonstration CFME:

• Washington	575 miles
• Florida	875 miles
• Indiana	875 miles
• Texas	900 miles
EXTRA	
• North Carolina	550 miles
TOTAL	3,775 miles

Network Level PFMP

So, how should PFM be implemented?

Coverage:	**Network Level vs. Hot spots**
Crashes:	**All vs. Wet-only (15%)**
Measurements:	**Full Extent vs. Sample (1%)**
Response:	**Proactive vs. Reactive**

PFMP

START

Collecting and maintaining crash, traffic, vehicle, and highway data.	Crash Database
Advance the State's capabilities for safety data collection and analysis.	Measurements
Analyze safety data and develop a HSIP, develop and maintain a data driven SHSP, and develop a High Risk Rural Roads program.	Analysis (SPF + EB)
Conduct engineering studies to develop highway safety improvement projects.	Cost and Benefit Analysis
Establish priorities for implementing highway safety improvement projects.	Plan

END

Guidelines For Pavement Friction Management Program

FHWA Pavement Friction Management Program Project -

- Friction Testing Equipment of In-Service Pavements for Network-Level Safety Analysis
- Pavement Friction Management Programs
- Sample vs Continuous Friction Testing
- Case Studies
- Importance of Continuous Measurements
- Importance of Macrotexture

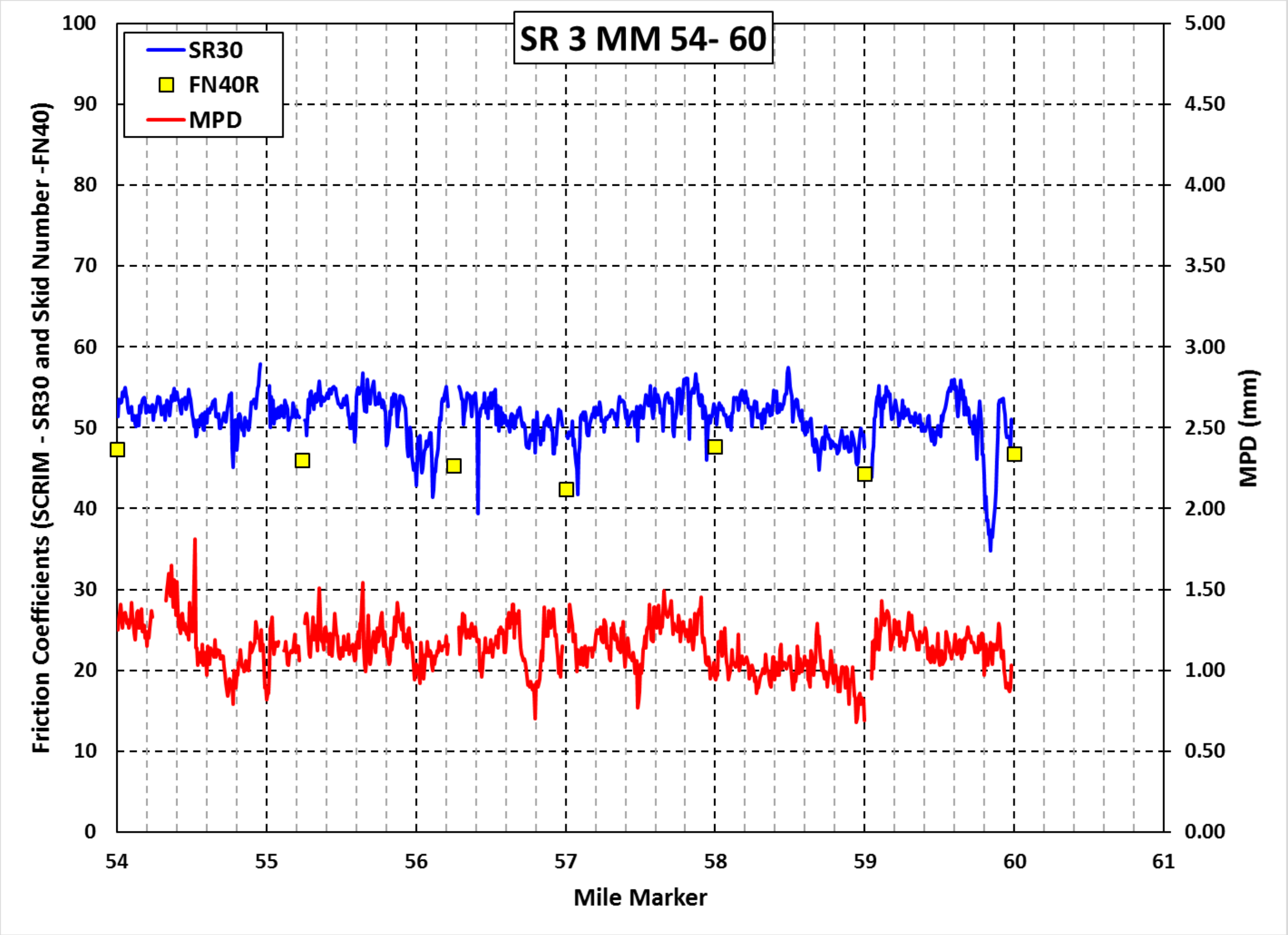
FHWA Pavement Friction Management Study (Virginia Tech)

- Assist 4 States in developing Pavement Friction Management Programs (using continuous pavement friction and texture* measurements, crashes, and other data)
  - Develop and demonstrate methods Obtain friction, texture, crash, traffic, road geometrics, other data.
  - Define friction demand categories.
  - Set investigatory levels of friction/texture.

Continuous Friction Measurement

- Rubber Tire test continuously measuring every foot of pavement (study – microtexture)

- Laser based texture measurement system measuring every foot of pavement (macrotexture)


SR 3 MM 54- 60
SR30
FN40R
MPD
Friction Coefficients (SCRIM - SR30 and Skid Number -FN40)
MPD (mm)
Mile Marker
100
90
80
70
60
50
40
30
20
10
0
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
54
55
56
57
58
59
60
61


31740

Conclusion

- The collection of continuous friction and macrotexture data through the adoption of CFME instead of the traditional sampling approach using a LWST can have a significant impact on crash reductions.

- The analysis of the friction data collected show that the typical friction testing frequency of one test per mile is insufficient to identify the most critical sections with friction deficiencies.

Friction Management Programs European Perspective

Policy and Standards

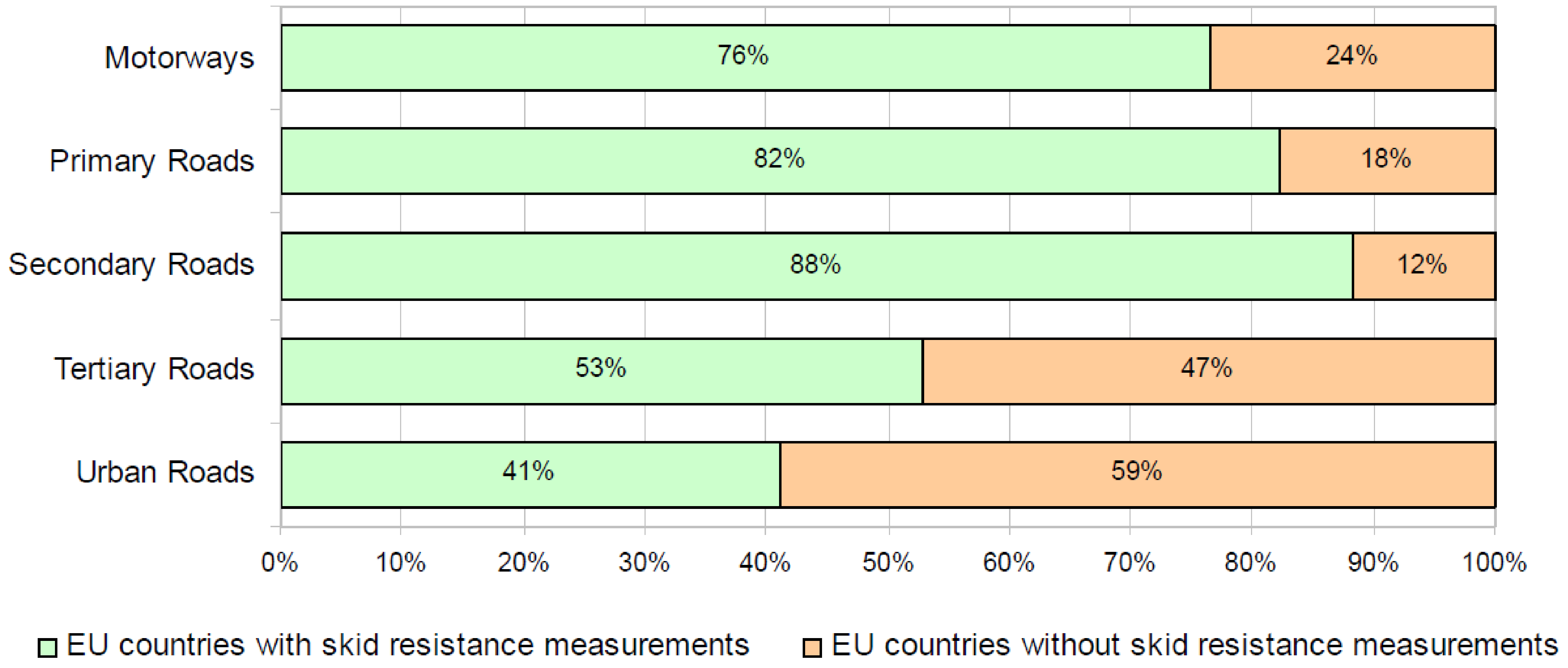
- Policy:
  - Application area of devices
  - Monitoring intervals
  - Threshold values (friction classification/acceptance/warranty)
  - Measures to be taken if below threshold

approach differs per EU member state and even per federal state/region/county

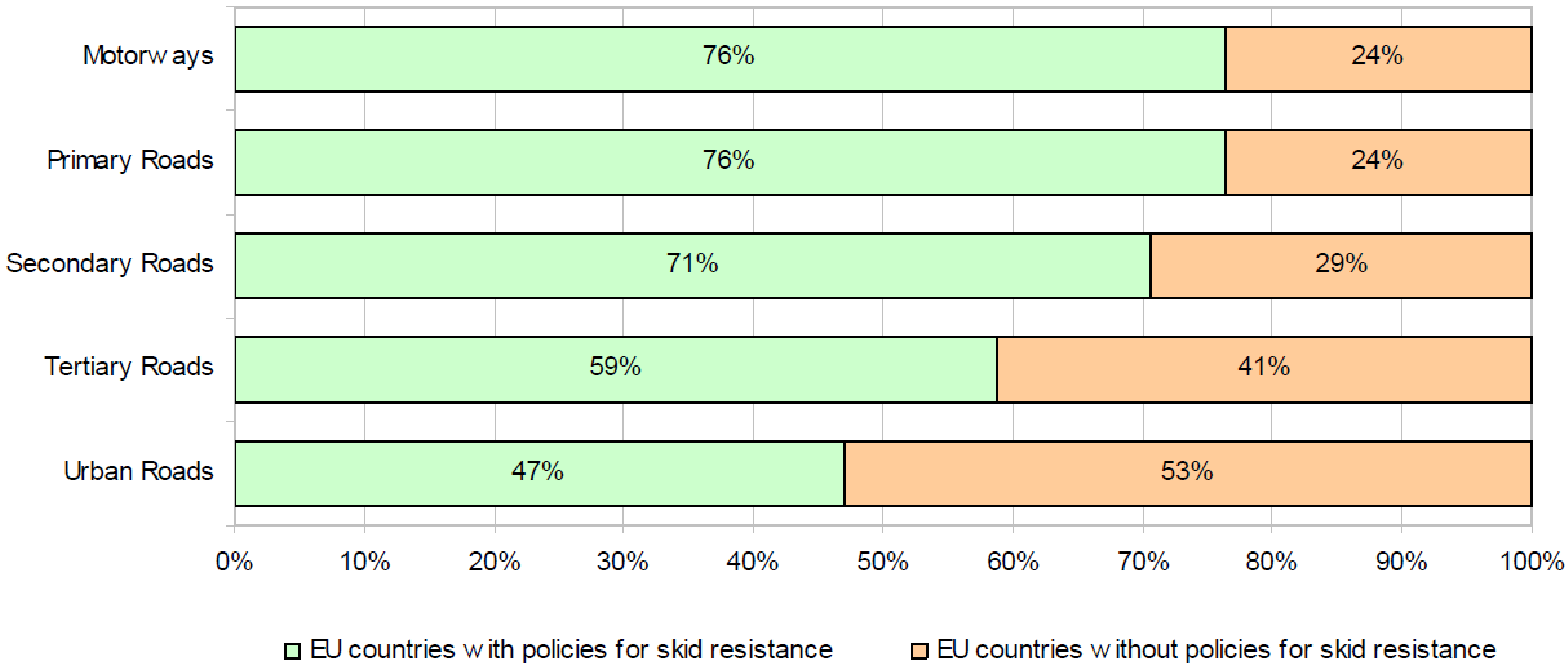
- Standards:
  - Measurement principle
  - Technical specifications of devices
  - Calibration of devices

approach differs per EU member state and even per federal state/region/county

How many EU countries measure skid resistance?



How many EU countries do have a policy for skid resistance?

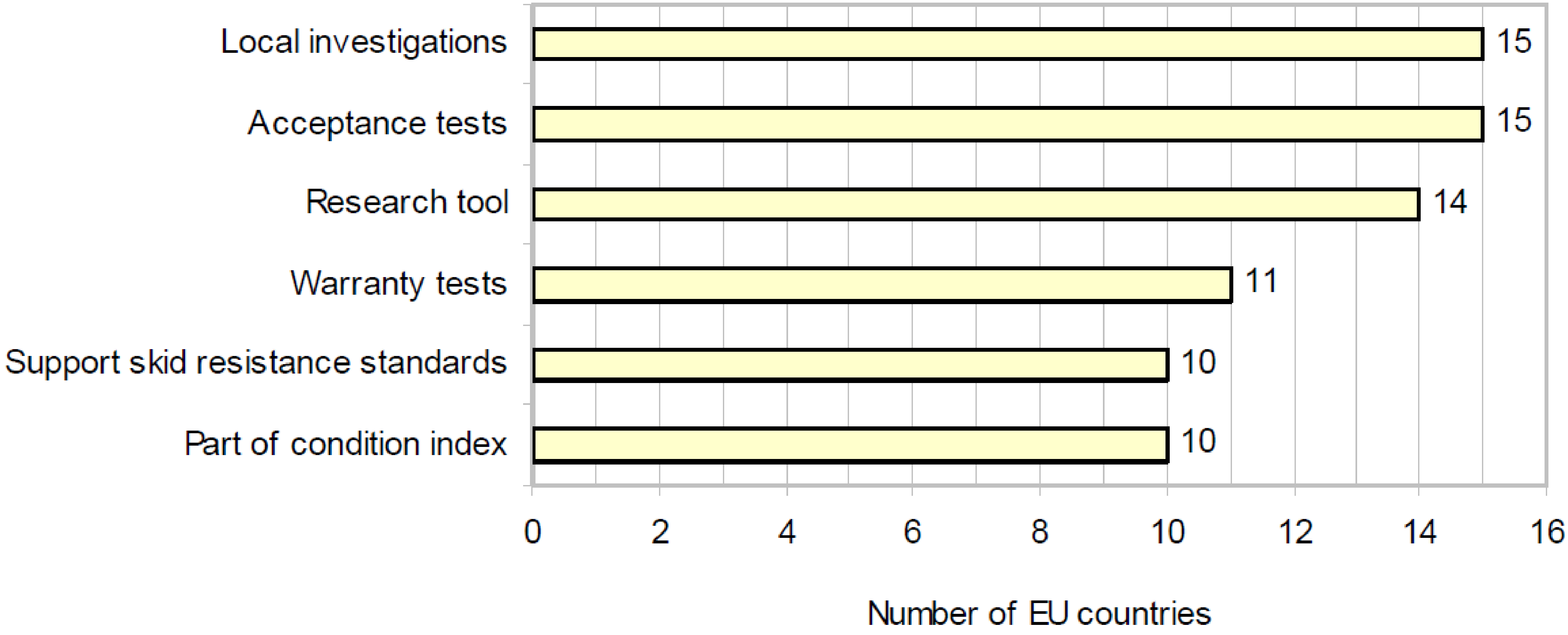


Devices to measure friction in Europe

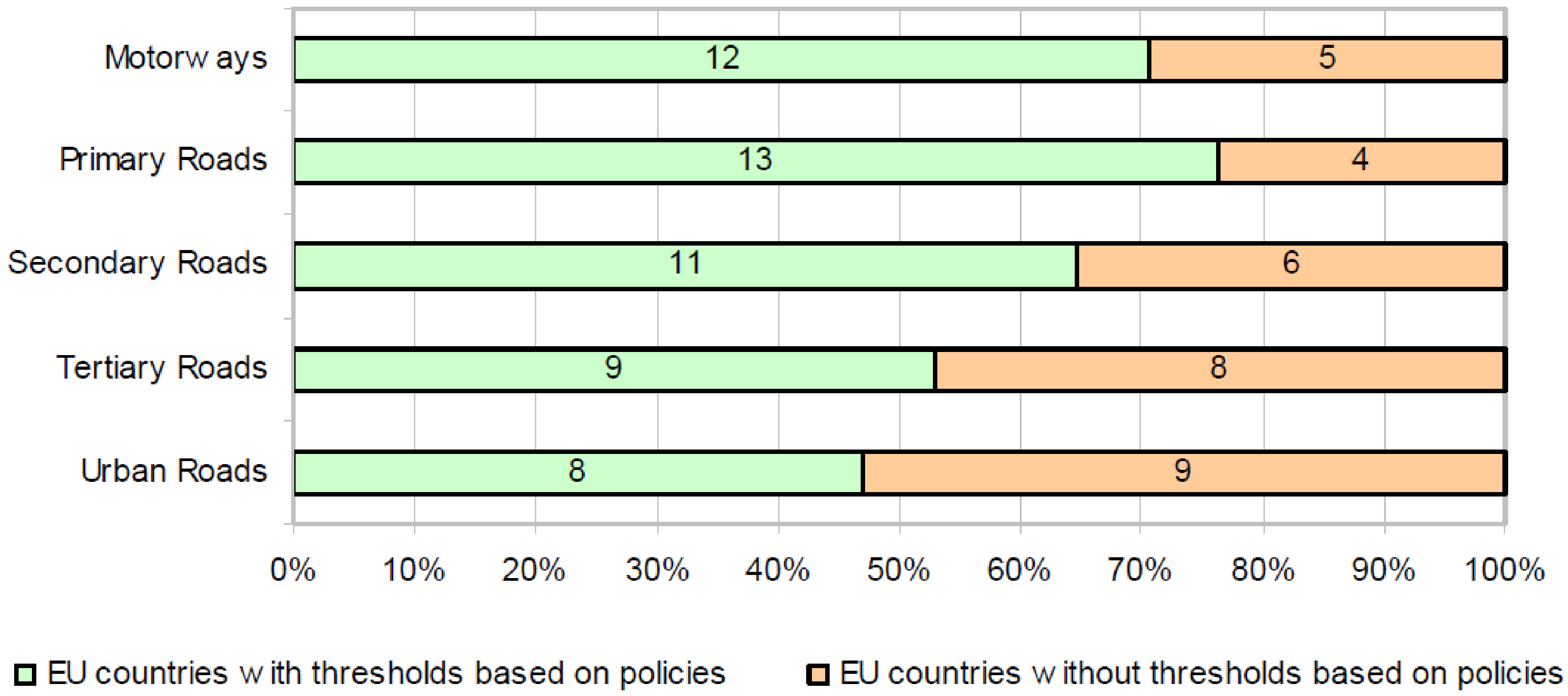
- Sideforce friction coefficient(SFC)
  - SCRIM
  - SKM
  - Odoliographe
  - Pavetesting
  - …
- Longitudinal friction coefficient (LFC)
  - RoadSTAR –18% et 62,5%
  - Griptester
  - Roar
  - Adhéra
  - IMAG – 18 et 85%
  - TRT
  - Oscar
  - ROAR5
  - Viafriction

≈ 25 different devices

What are they used for?



Thresholds: how many countries have them?



Conclusions From European Update:

- Big variety of approaches for skid resistance in Europe!
- Most countries do measure it and have some kind of policy
- Most common device is SCRIM/SKM measuring SFC and SRT
- Monitoring is widespread practice, mostly annually and on most important roads
- Thresholds are common, based on “statistics” or accident risk
- A majority has acceptance tests for new pavements on highways
- About half of countries does warranty testing on highways
- Standardization efforts are ongoing for common scales: SFC, LFC (high G) and LFC (low G)

E-circular Friction Management

- Address comments from TRB
- Published soon

Questions