Harmonisation of Skid Resistance Measurements on Roads

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Contents

Project overview

ROSANNE –
ROlling resistance, Skid resistance, ANd Noise Emission measurement standards for road surfaces

- EC FP7 Small Collaborative Research Project
- Coordinator: AIT (Austria)
- Partners:

TRL (UK)	BRRC (Belgium)
DRD (Denmark)	TUG (Poland)
VTI (Sweden)	ZAG (Slovenia)
BASt (Germany)	DIN (Germany)
IFSTTAR (France)	FEHRL (Belgium)

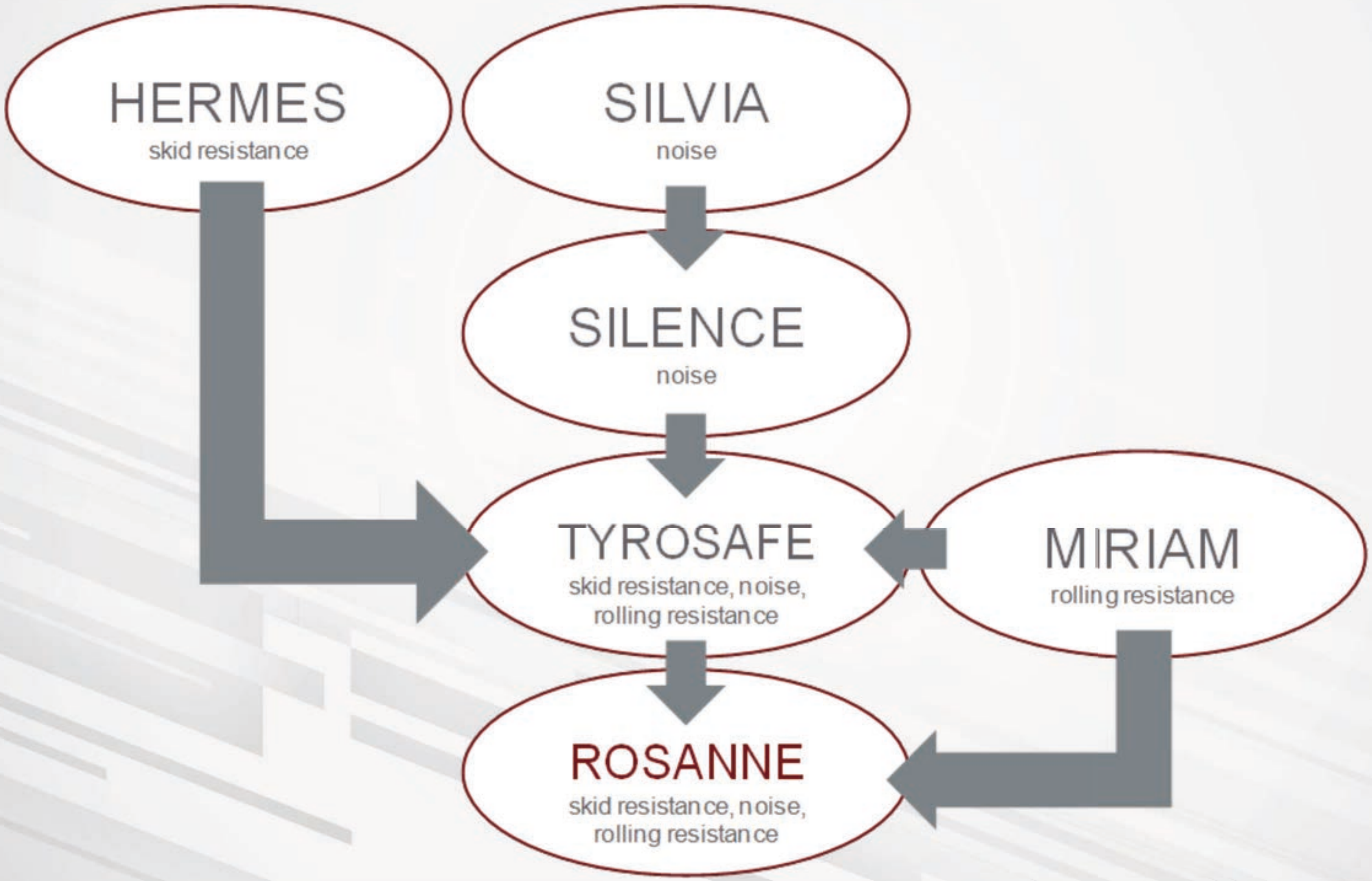
  Third parties: CETE Lyon, CETE de l'Est
- Duration: 36 months
- Start date: 1 November 2013

Project objectives

- To advance harmonisation/standardisation of measurement methods for:
  - Skid resistance
  - Noise emission
  - Rolling resistance

  of road pavements
- Prenormative research creating the technical basis for draft standards
- Close cooperation with CEN TC227/WG5 (Road materials - surface characteristics)
  - Responsible for the standardisation process

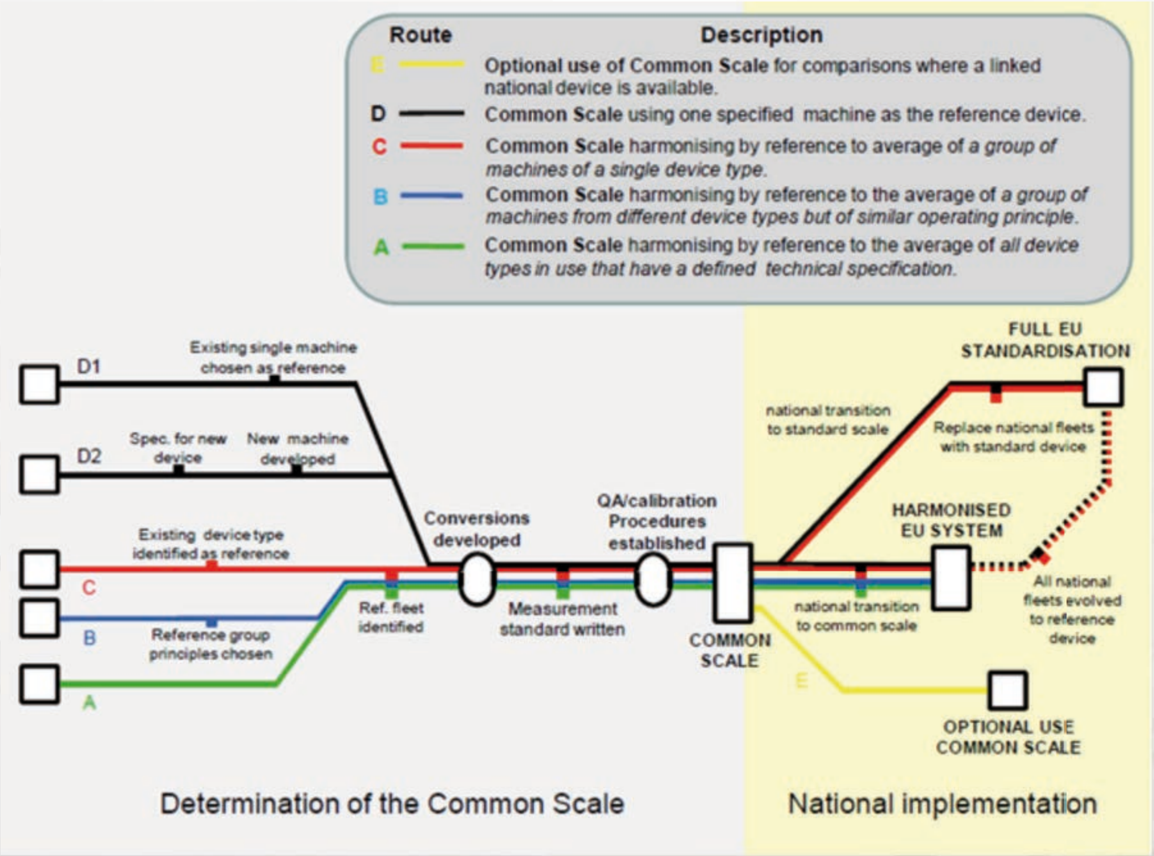
History


HERMES
skid resistance
SILVIA
noise
SILENCE
noise
TYROSAFE
skid resistance, noise, rolling resistance
MIRIAM
rolling resistance
ROSANNE
skid resistance, noise, rolling resistance

Skid Resistance Test Programme

Objective

- The harmonisation of skid resistance measurements across Europe
  - Following the TYROSAFE Roadmap



Objective

- Derive conversion factors for friction indices based on similar groups of devices based on operating principle
  - Side-force
  - Longitudinal fixed slip
    - Low slip
    - High slip
- Gather data that can be analysed to develop the Common Scale(s)
  - Two rounds of testing at IFSTTAR facility in Nantes and on surrounding roads

Data collection

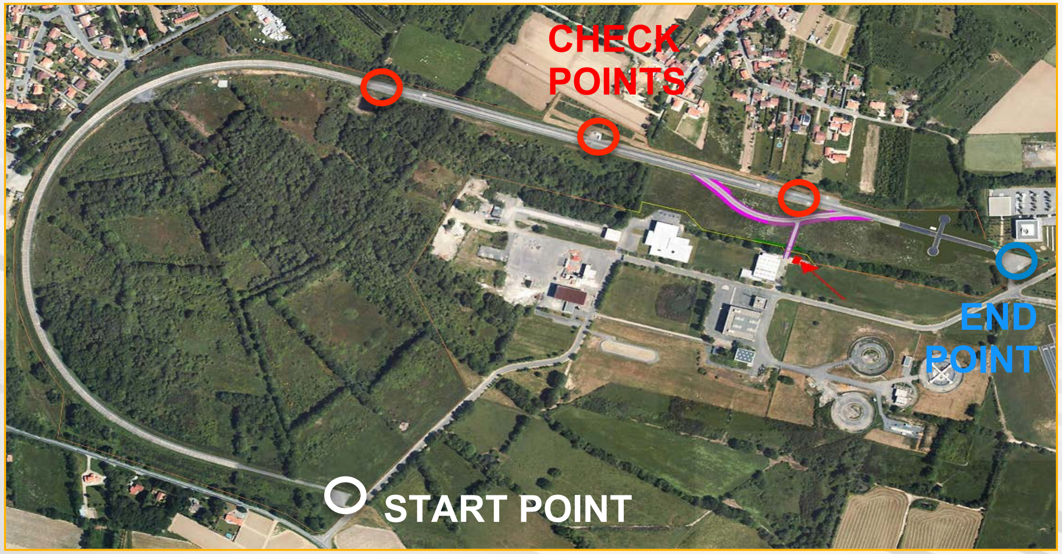
- First round of testing completed May 2014
  - 11 devices
    - 5 Side-force
    - 6 Longitudinal fixed slip
- Second round of testing completed April 2015
  - 18 devices
    - 8 Side-force
    - 10 Longitudinal fixed slip
- All devices from 1st trail also attended 2nd trial
  - Enables stability of the common scale to be assesses

Calibration

- Devices checked prior to testing
  - Tyre
    - Hardness, profile and pressure
  - Static load and wheel angle
  - Wetting system
  - Speed/distance

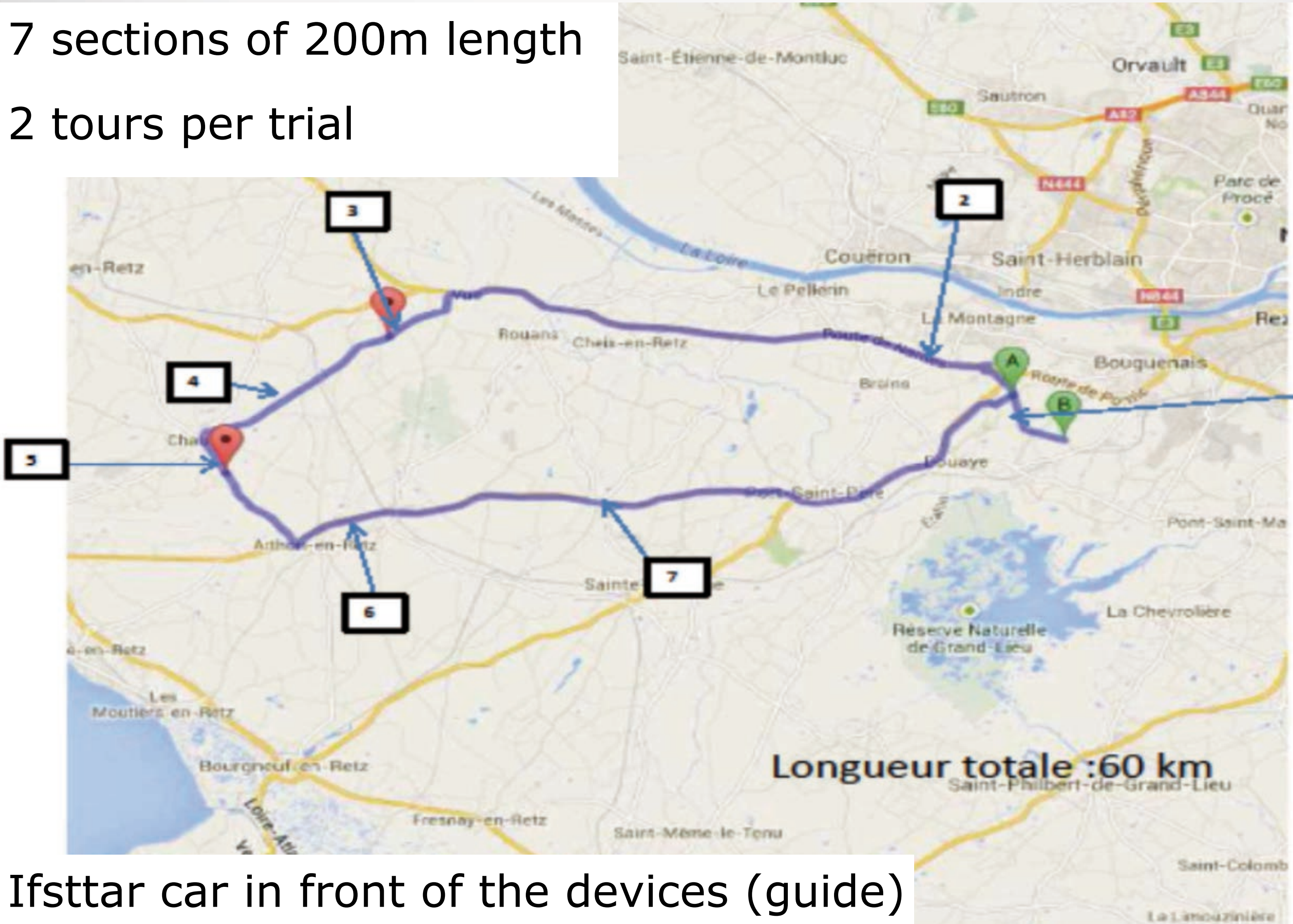
Friction tests

- Test speeds: 20 to 100 km/h (depending on the devices)
  - All devices tested at 40, 60 & 80 km/h
- 12 surfaces with a range of skid resistance and texture
- 5 repetitions for each surface and speed
- Test line of 50 cm



Tour on trafficked roads

- 7 sections of 200m length
- 2 tours per trial



- Ifsttar car in front of the devices (guide)

Data Analysis and Results

Analysis

- The devices were placed into 3 groups for the analysis
  - Based on operating principle
  - Represent different road user situations

Device group	Representative slip ratio
Side-force	34 %
Longitudinal – low slip	15-25 %
Longitudinal – high slip	over 60%

- Data reviewed to remove anomalies and outliers in accordance with ISO 5725-2

Analysis

- Based on Skid Resistance Index (SRI) approach
  - DD CEN/TS 13036-2

$$SRI=BFe^{S-S_{Ref}/S_0} \qquad S_0=aMPD^b$$

Where

- a, b, and B are device-specific calibration parameters
- *F* is the measured skid resistance value
- *S* is the vehicle operating speed
- S_{Ref} is the reference speed at which SRI values are reported
- S_0 represents the speed gradient of the skid resistance values, related to the surface texture
- *MPD* is the Mean Profile Depth, a measure of the surface texture

Analysis

- Used vehicle operating speed rather than tyre slip speed
- Not practical for all the different device groups to achieve a single reference slip speed within the normal range of vehicle operating speed
  - requires large, and error-prone, speed corrections to be applied

Device group	Representative slip ratio	Slip speed at 50km/h vehicle speed	Slip speed at 80km/h vehicle speed
Side-force	34%	17	27
Longitudinal – low slip	20%	10	16
Longitudinal – high slip	75%	37.5	60

Analysis

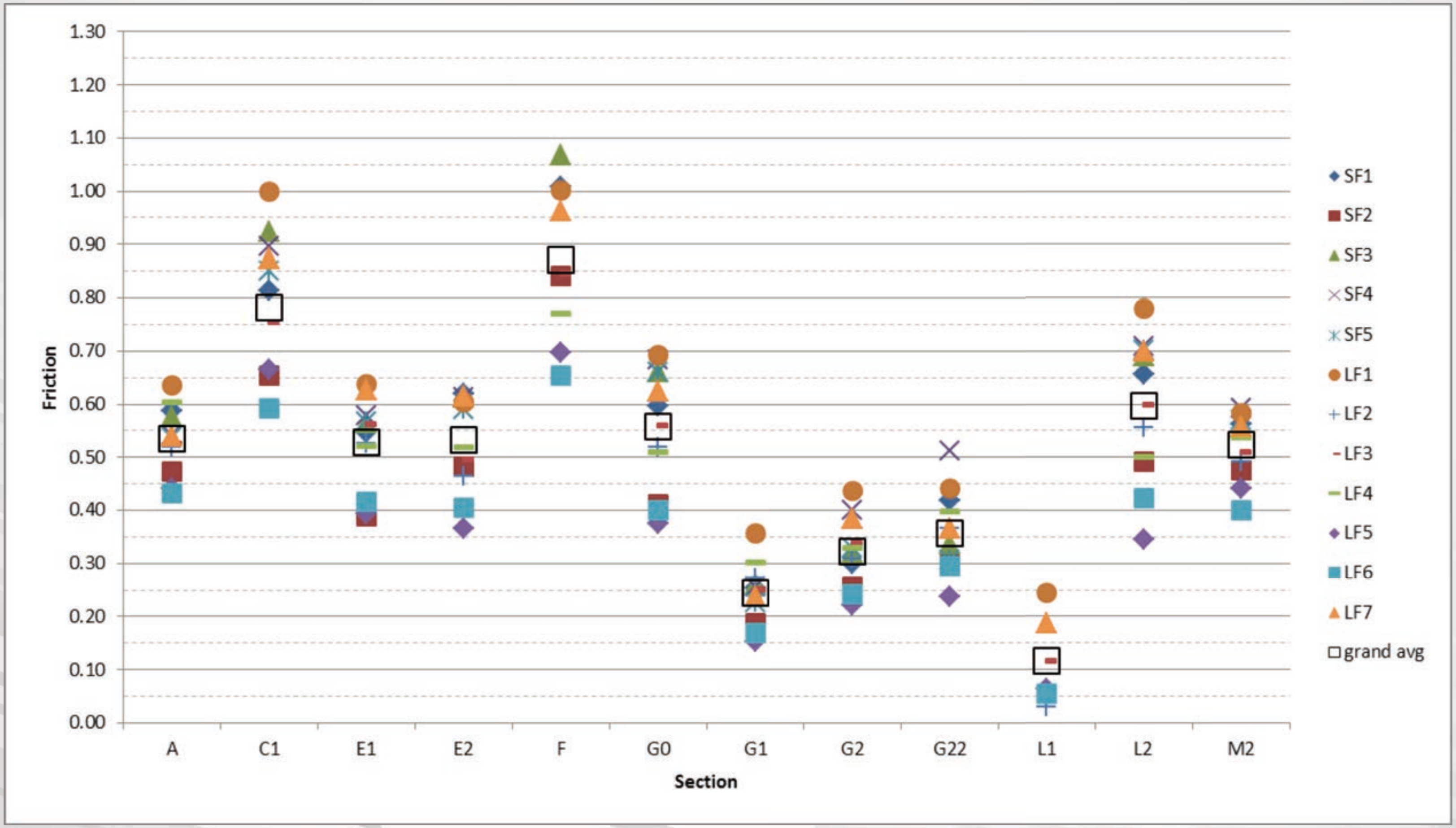
- When operating speed equals reference speed then:

  $SRI = BF$

  - This is the simplest form of harmonisation
  - No need to correct for changes in friction with speed

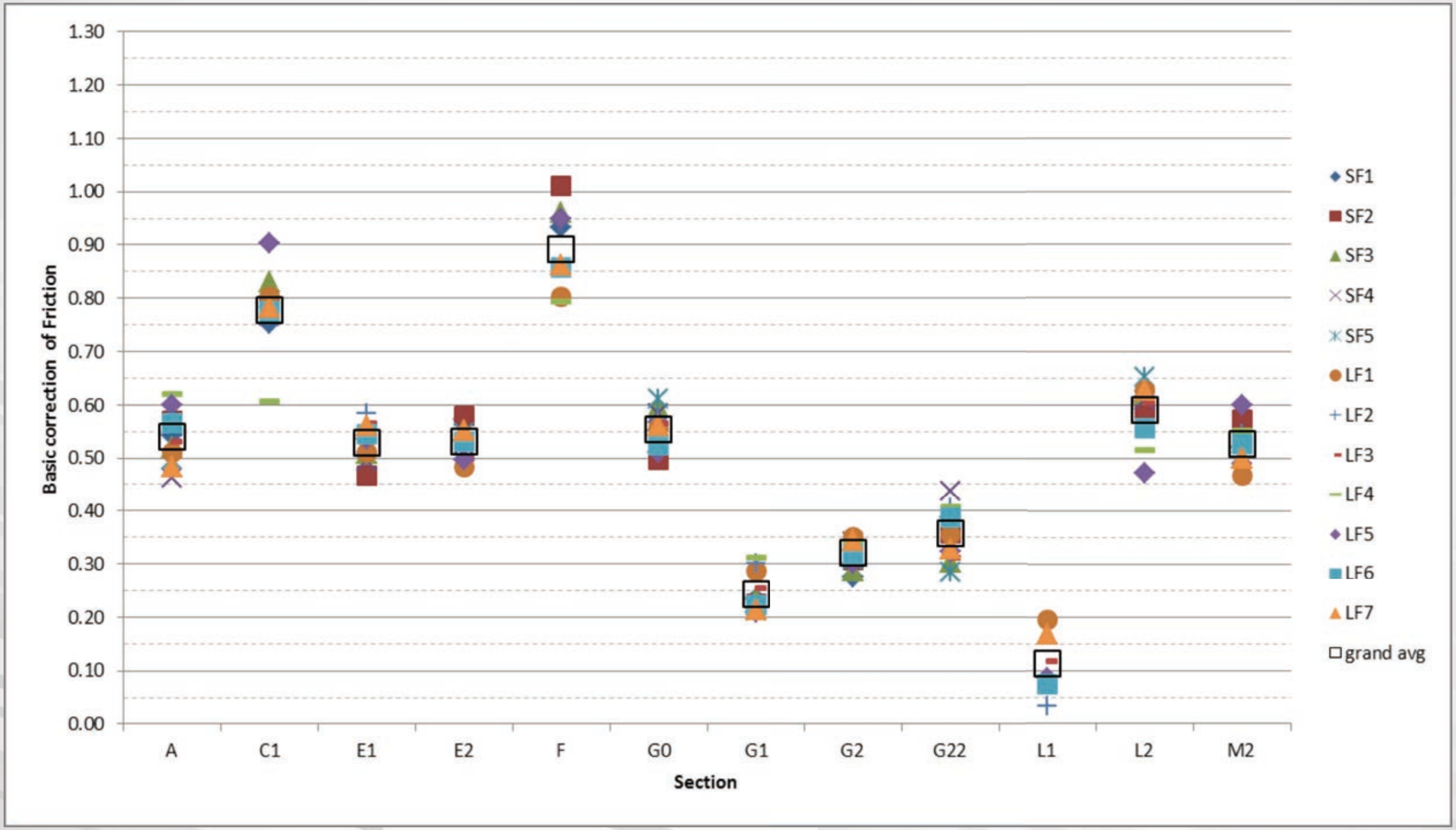
- To determine the device-specific calibration factors, B, the value of the common scale for each test surface needs to be fixed
- Reference friction value for each surface based on average of all devices within a Group weighted by the number of each device type

Results – track measurements



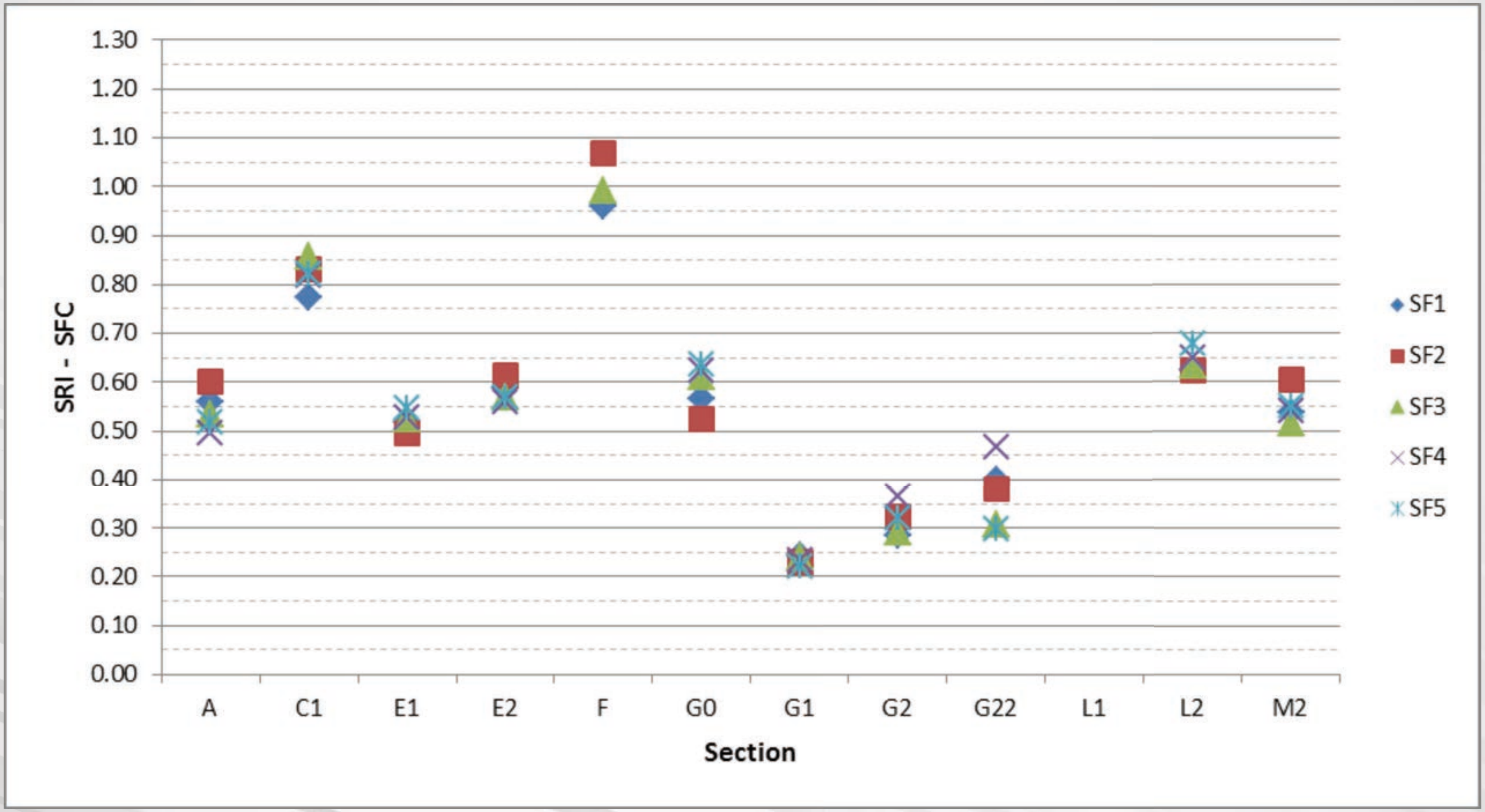
Original data collected at 60km/h – all devices

Results – track measurements



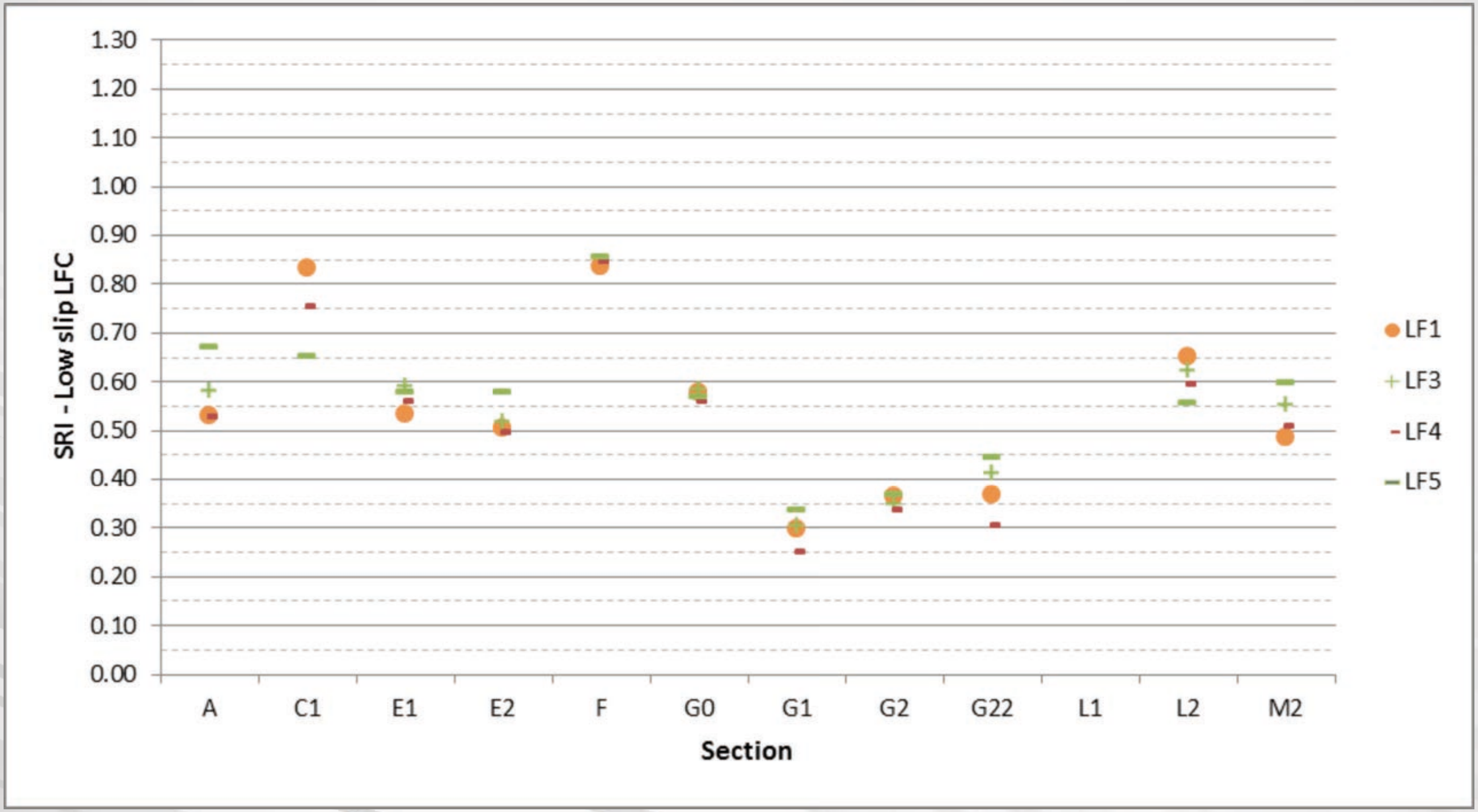
Simple correction at 60km/h – all devices

Results – track measurements



Full SRI correction – side-force devices

Results – track measurements



Full SRI correction – longitudinal devices (low slip)

Results – track measurements

- Common scale developed for each device group
- Device specific parameters (a, b & B) calculated
- Precision of common scale assessed by calculation of the reproducibility standard deviation, σ_R
  - σ_R around 0.05
    - compared to about 0.03 for fleets of the same device type
    - compared to about 0.1 for previous harmonisation experiments
  - Similar results from simple and full SRI approach
  - Similar results from both trials

Results – road circuit

- a, b & B values derived from test track results applied to measurements on trafficked roads
- Similar reproducibility values obtained
- Common scales do not appear to be influenced by "real world" test conditions

Next steps

Next steps - analysis

- Compare results for devices that took part in both trials
  - Different a, b & B values from each trial
  - Assessing whether these give significantly different results over the typical range of measurements
- Calculation of a, b & B values for device “families”
  - Grouping similar devices within a group (mainly on test tyre)
  - Gives similar levels of reproducibility as applying device specific values
  - This approach would help with implementation and maintenance of the common scale
- Impact of individual device types on precision
  - Basis for developing precision classes in the future

Next steps – Quality Assurance

- Develop procedures to maintain reliability in applying a Common Scale
- Will require robust QA procedures
  - Individual devices
  - Fleets of devices
  - Maintaining the common scales
    - Should remain stable if first two QA procedures are well maintained and any systematic drift is identified
    - Will still be some need for periodic checks to ensure that a, b & B values are still applicable
- Independent auditor role?

Conclusions

Conclusions

- Measurements made by different devices can be converted to a common scale
- Assumptions made in developing the TYROSAFE roadmap have been proven correct
  - Precision is improved by developing a common scales for different groups of devices based on their operating principle
  - Precision is at a “usable” level
- Robust QA procedures required

More information

- Visit the website http://rosanne-project.eu/
  - Overview of the project and Work Packages
  - Published deliverables

Thank you

The ROSANNE project: Harmonisation of Skid Resistance Measurements on Roads

Runway Surface Conditions Assessment and Reporting Symposium – 1 April 2016

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