Seasonal Influence on Skid Resistance

2nd European Pavement Friction Workshop

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Trust
Quality
Progress

- Introduction Kiwa KOAC;
- Measuring principles Dutch Skid Resistance Trailer (DSRT);
- Measuring principles Side Way Force (SWF);
- Collected dataset;
- Seasonal influences;
- Conclusions.

Why we do it

Society needs independent and impartial assessments

We want to contribute to improving the quality of the roadnetwork

How we can help you

One-stop shop

Our expertise

Our knowledge

Our services

To help you progress

Cooperation as partners in long-term partnership

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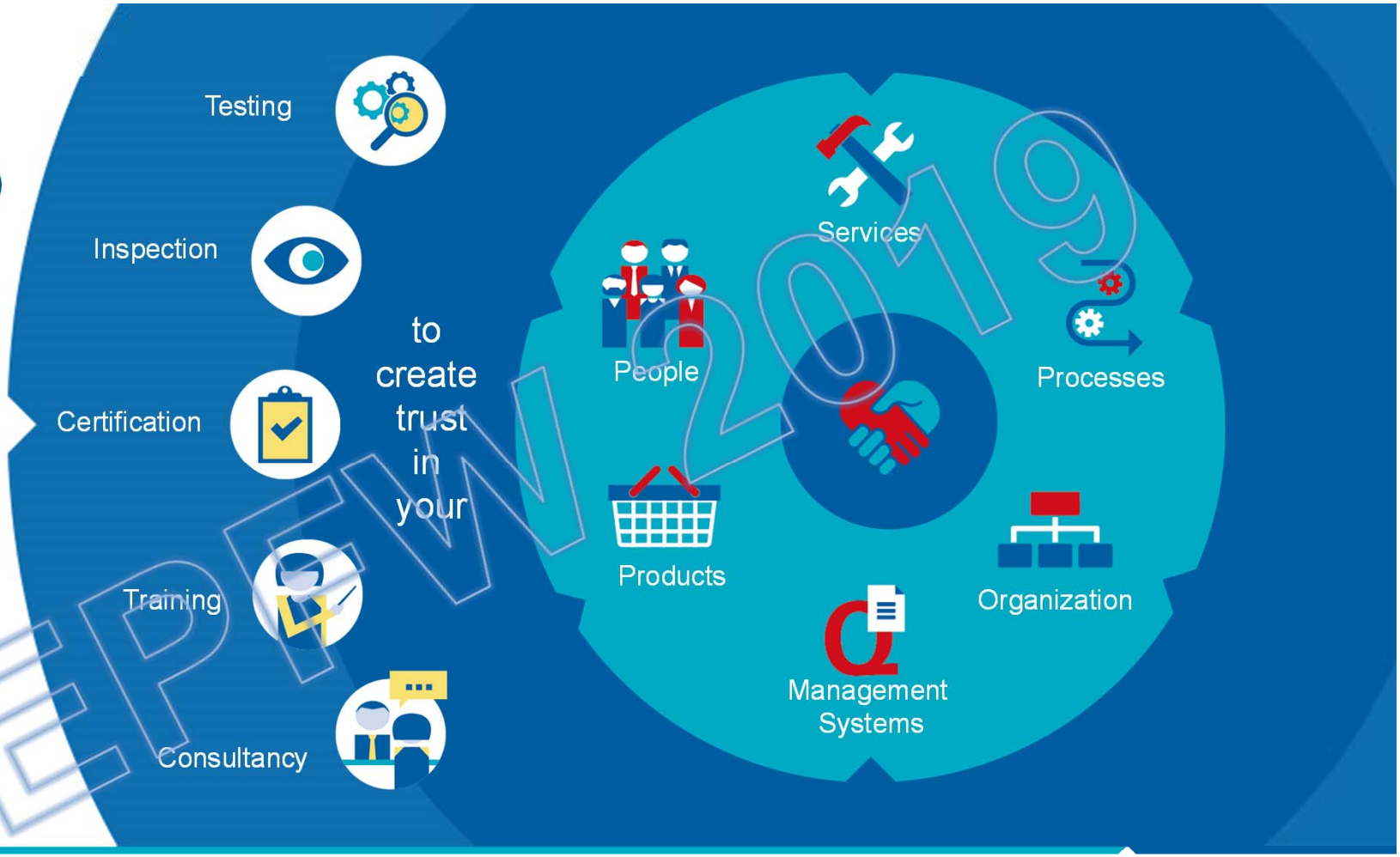
Constantly innovating our products & services

- Developing innovative new measuring technieks:
  - 2005: Europe's first combi skid resistance, longitudinal unevenness and texture;
  - 2006: NL's First contactless unevenness measurement (Dutch viagraaf) at traffic speed;
  - 2015: Europe's largest SWF combined with longitudinal unevenness and texture;
  - 2018: World's first SWF/LCMS combination.

What we do

Our offer to you



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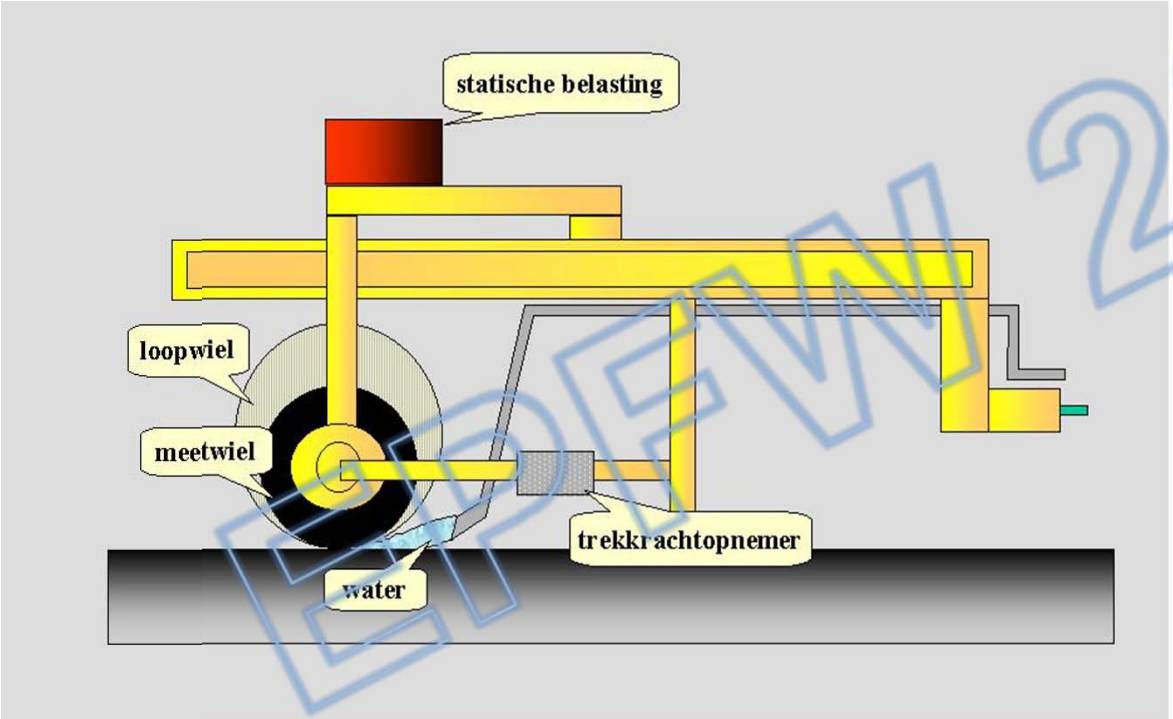
Large variety of different devices

Measuring principal Dutch Skid Resistance Trailer

Measuring principal DSRT



- 86% slip ratio;
- In driving direction;
- Top load of 1962 ± 9,81N;
- Slick PIARC test tyre (165R15);
- Tyre pressure 200 ± 10 kPa;
- Water layer thickness 0,5mm.

Correction for seasonal effect

- Seasonal correction was introduced in 2009;
- Seasonal correction only used on older road surfaces (aged > 1 year old);
- Skid resistance value: $f_{measured} = F_{w1}/F_{Nst}$;
- Correction formula for seasonal influence:

  $f = f_{measured} - 0.022 \times \sin((360/365) \times \text{measuring day} + 60)$;
- Not based on specific measured values like temperatures;
- Sinusoidal correction based on a large dataset of measured DSRT-values (over 7 years).

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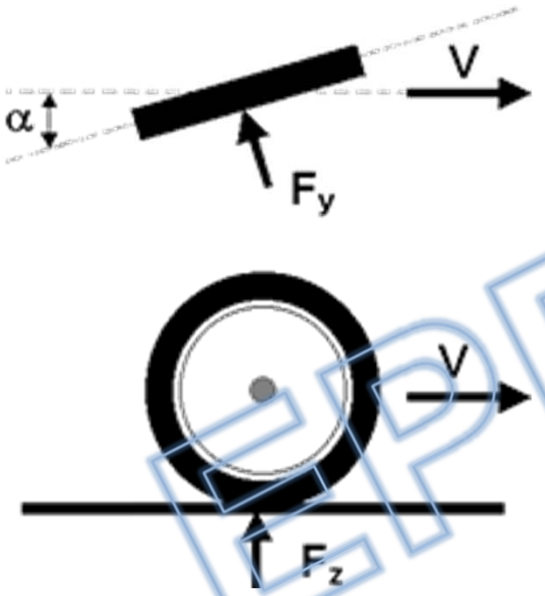
Measuring principal Side Way Force (SWF)

Measuring principal SWF



$$\mu_y = \frac{F_y}{F_z}$$

- 0% slip ratio;
- Skew position 20° left according to driving direction;
- Top load 1960 ± 10N;
- Slick test tyre (3x20 inch);
- Tyre pressure 3,5 ± 0,1 bar;
- Water layer thickness 0,5 mm.

Correction for seasonal effect

- Correction is used under all circumstances;
- Skid resistance value: $\mu_y = F_y/F_Z$;
- Correction formula for seasonal influence:
  $m_{v,T} = m_v + (TW - 20°C) * 0.002/°C + (TF - 20°C) * 0.0012/°C$;
- Based on measured temperature values for road surface and water.

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Collected dataset

Quantity of the used DSRT dataset

- Usage of data collected for quality control reasons;
- One road section of 200 m;
- Three/two different DSRT devices;
- Measured over 5 years time (2013 – 2018);
- Over 1000 datapoints.

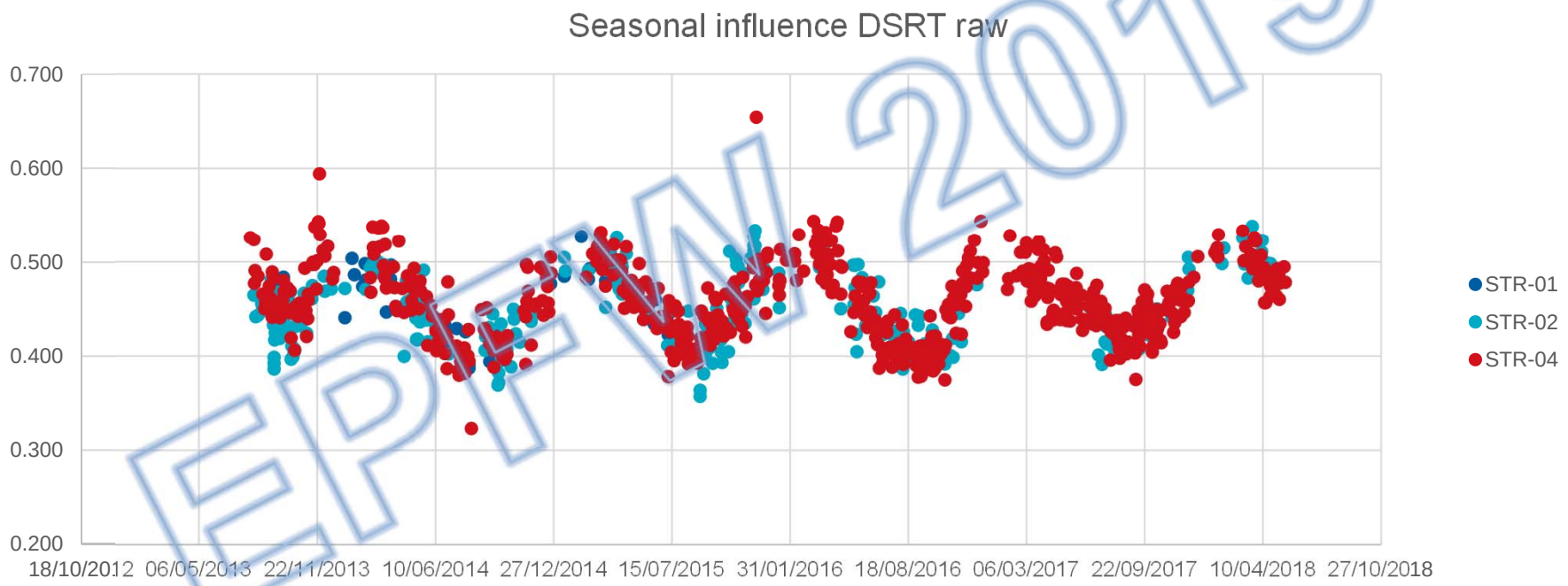
- For this study only the mean skid resistance value of the total road section is used.

Quantity of the used SWF dataset

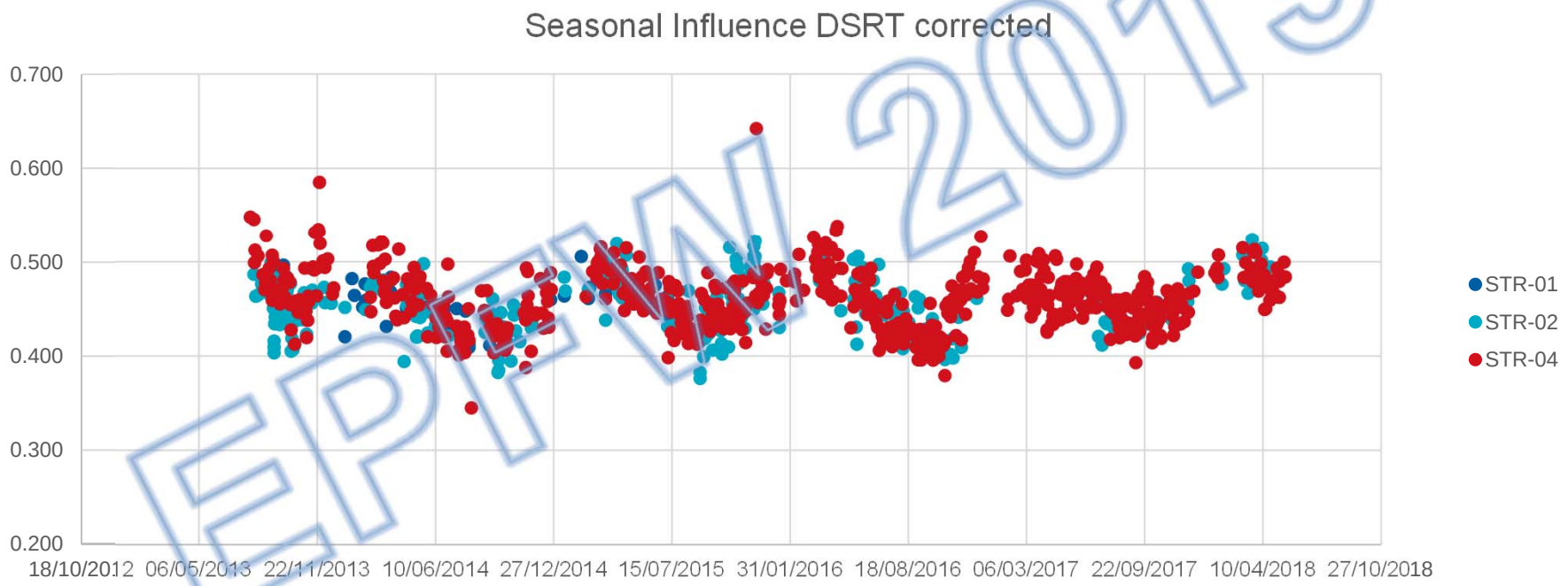
- Usage of data collected for quality control reasons;
- Two road sections of each 2 km;
- One/two different DSRT devices;
- Measured over 2 years time (2016 – 2018);
- Over 375 datapoints per road section.

- For this study only the mean skid resistance value of each road section is used.

Uncorrected DSRT-values



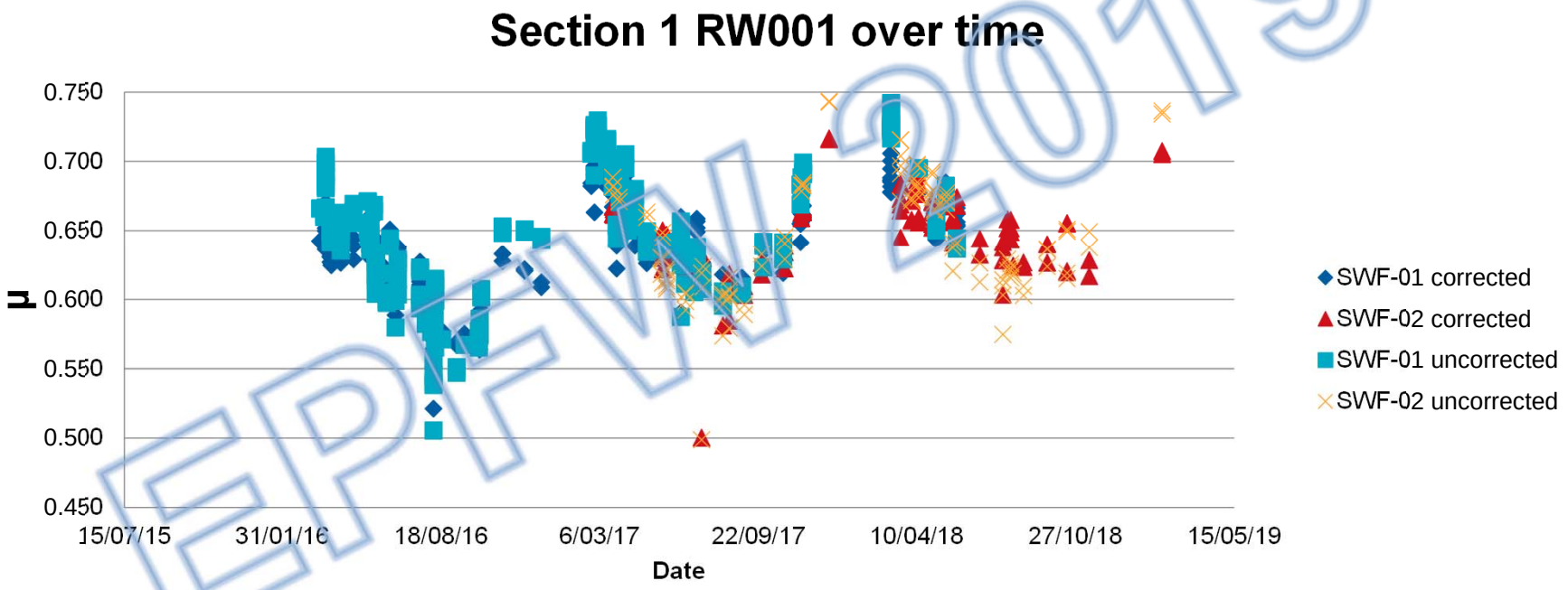
Corrected DSRT-values



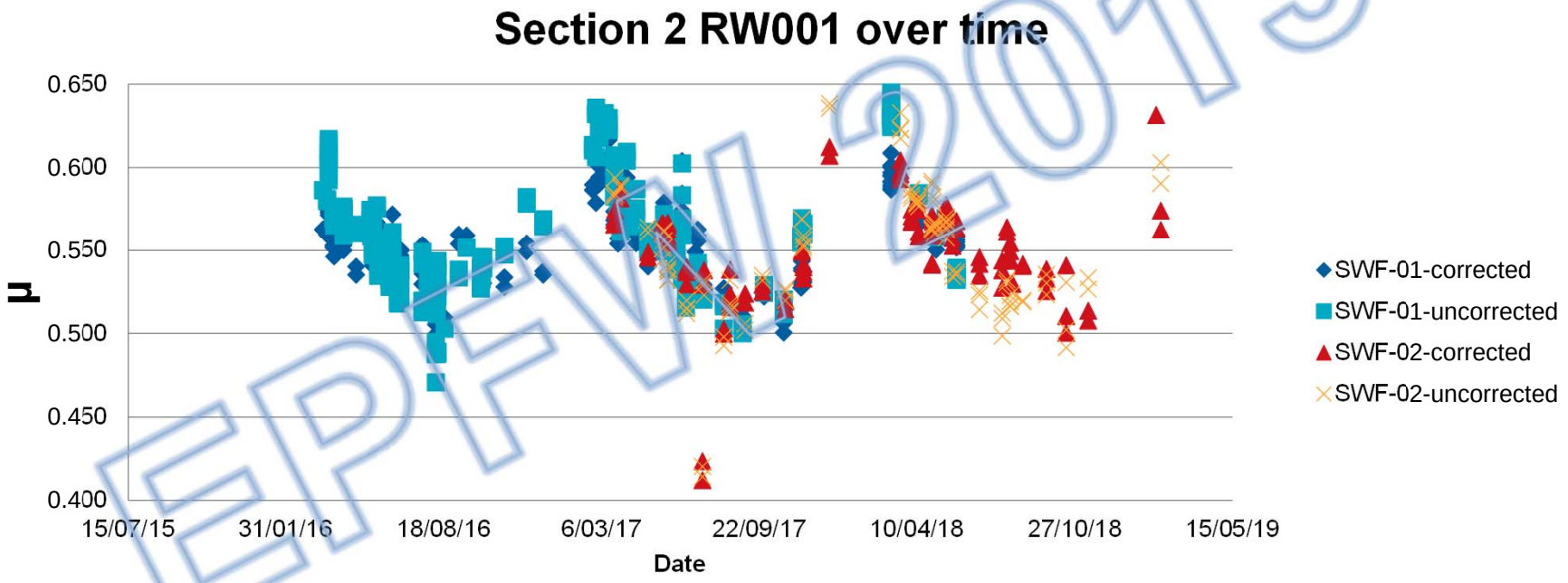
Observations DSRT

- Clear sinusoidal trend throughout the year;
- Maximum value around March;
- Minimum value around August/September;
- Uncorrected skid resistance value varies about 0,15 through the year;
- Sinusoidal trend don't disappears despite usage of the seasonal correction;
- Decline of the amplitude is around 0,05;
- Unless usage of a seasonal correction skid resistance values still vary 0,1 through the year.

SWF-values section 1



SWF-values section 2



Observations SWF

- Clear sinusoidal trend throughout the year;
- Maximum value around March;
- Minimum value around August/September;
- Uncorrected skid resistance value varies about 0,12 through the year;
- Sinusoidal trend don't disappears despite usage of the seasonal correction;
- Decline of the amplitude is around 0,05;
- Unless usage of a seasonal correction skid resistance values still vary 0,07 through the year.

Conclusions

- Used corrections don't rule out seasonal influences completely;
- No real difference between an overall correction (DSRT) or a temperature correction (SWF);
- Difficult to determine the real cause of seasonal influences:
  - Temperature effects (water-, surface-, tyre- and/or air-);
  - Surface characteristics (pollution during summer- and corrosion during wintertime).
- Different influences are very difficult to isolate and therefor difficult to quantify individually;
- Use of an overall correction (like with DSRT) seems more easy;
- When one wants to substantiate temperature boundaries a temperature based correction is needed;
- More extensive study is needed in order to fully understand and unravel the seasonal effect.

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