

Evolution of grip at the Singapore F1 Grand Prix

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Agenda

- Overview of Singapore Grand Prix Event
- Differences between standard roads and racetracks
- The GripMap Method
- Evolution of grip through the race weekend
- Effect of rain on racetrack grip
- Impact of High Pressure Water Retexturing on new asphalt patch
- High friction paint on the racetrack
- Summary

Overview of Singapore Grand Prix Event

- First race held in 2008
- Night race
- Takes place in September through the streets of Singapore
- 30% dedicated race track, 70% raced on city streets
- Event planning takes 11 months
- Construction takes 6 months
- Race Event starts on the Thursday night
- Practise Sessions on the Friday
- Qualifying on the Saturday
- Race Event on the Sunday

Overview of Singapore Grand Prix Event

- 23 Corners
- Circuit length – 5.063 km
- Race length – 308 km
- Lap Record – Lewis Hamilton, AMG Mercedes Petronas 2018 (1:36.015)
- Lap record average speed – 179 km/h
- 110,000 spectators
- 1,500 lamps
- Biggest challenge to F1 Drivers due to heat, humidity and track geometry
- Drivers lose on average 3kg in mass



Courtesy of SGP Ltd

Overview of Singapore Grand Prix Event



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Overview of Singapore Grand Prix Event

- What are the problems?
- First race in 2008 issues with dust making the race appear dirty
- Road markings – unsightly for TV audience
- Uneven surface – a result of standard highway use
- Street track runs through main city routes
- Limited closures in order to limit impact on the public

Overview of Singapore Grand Prix Event

- There are no FIA mandated standards for racetrack surface materials
- Racetrack grip is not measured
- Singapore Grand Prix are one of the only racetracks to use High Pressure Water to prepare the surface
- Around 60% of the track is retextured with high pressure water
- New Asphalt is retextured to remove excess bitumen

Differences between standard roads and racetracks

- Motorsport refer to “grip” rather than skid resistance
- This paper will adopt the term “grip”
- Low wet grip = high race vehicle grip
- Racetracks have to handle extreme forces from tyre/surface interaction

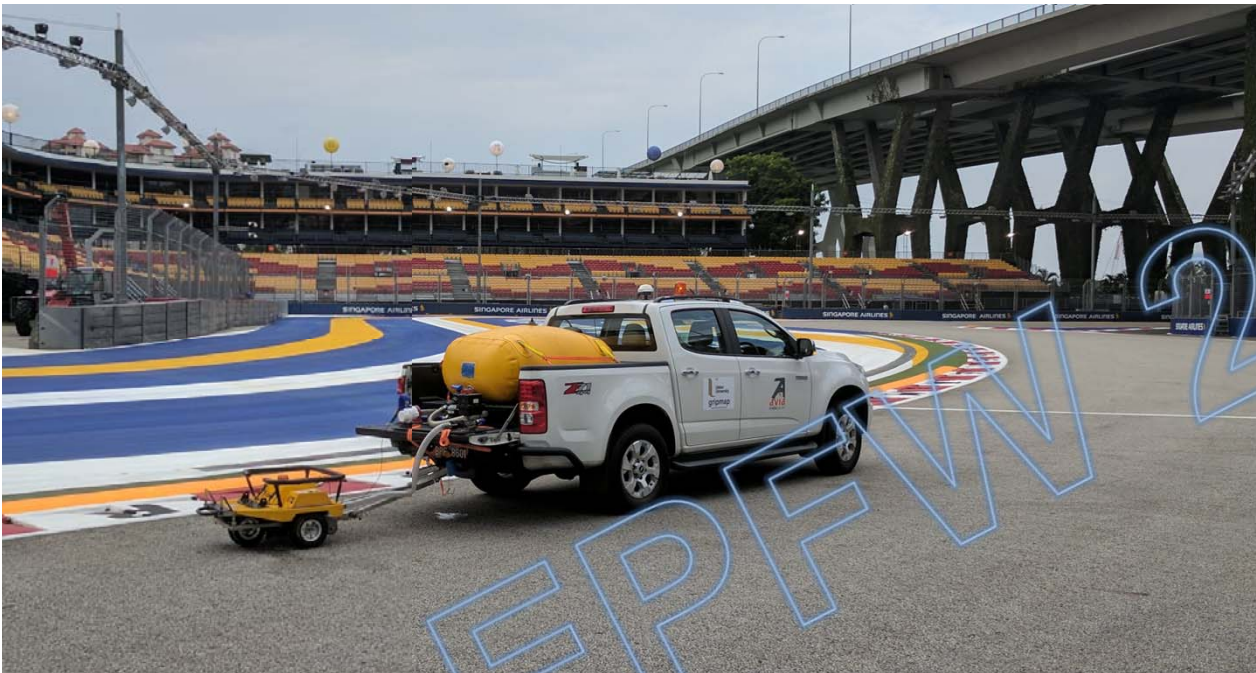
Differences between standard roads and racetracks

- Asphalt surface specifications, propriety and difficult to obtain
- Polymer modified bitumen's used
- No evidence of differences between road materials and those used on racetracks
- Most racetrack surface wear is in the “Racing Corridor”, extremities not subject to high levels of vehicle interaction
- Issues with Early-life Skid Resistance Phenomena

The GripMap Method

- A standardised method for measuring racetrack surface grip
- Longitudinal grip measurements covering the whole track
- Highlights:
 - Evolution of grip
 - Areas of surface concern
 - Different aged material
 - The racing line/corridor

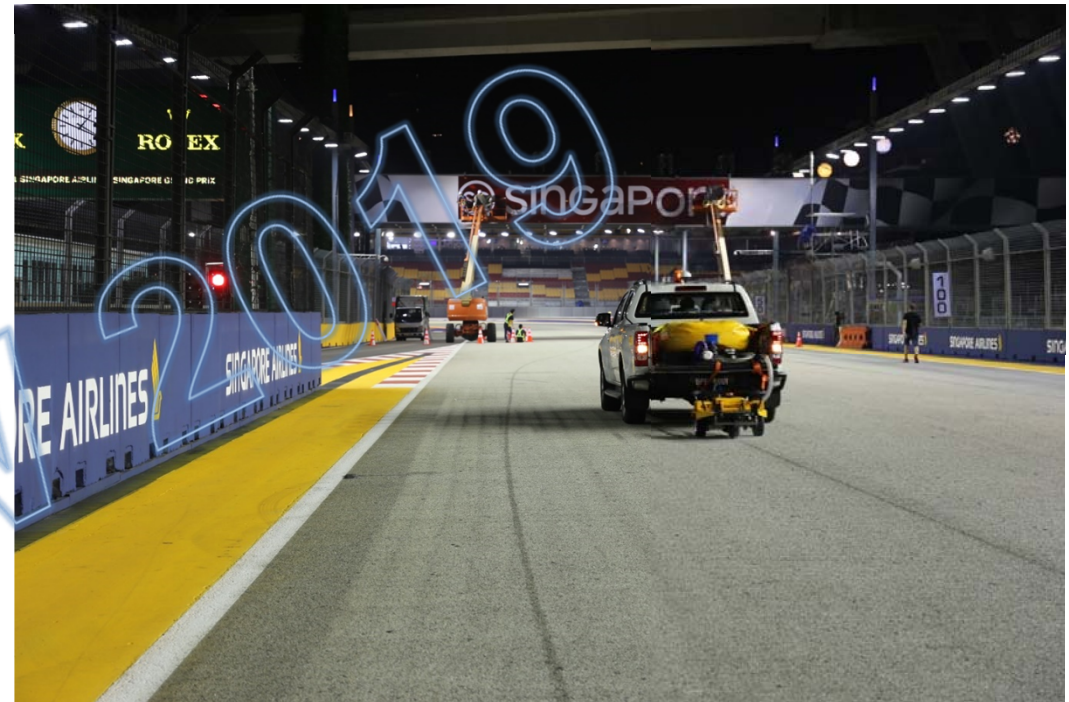
The GripMap Method



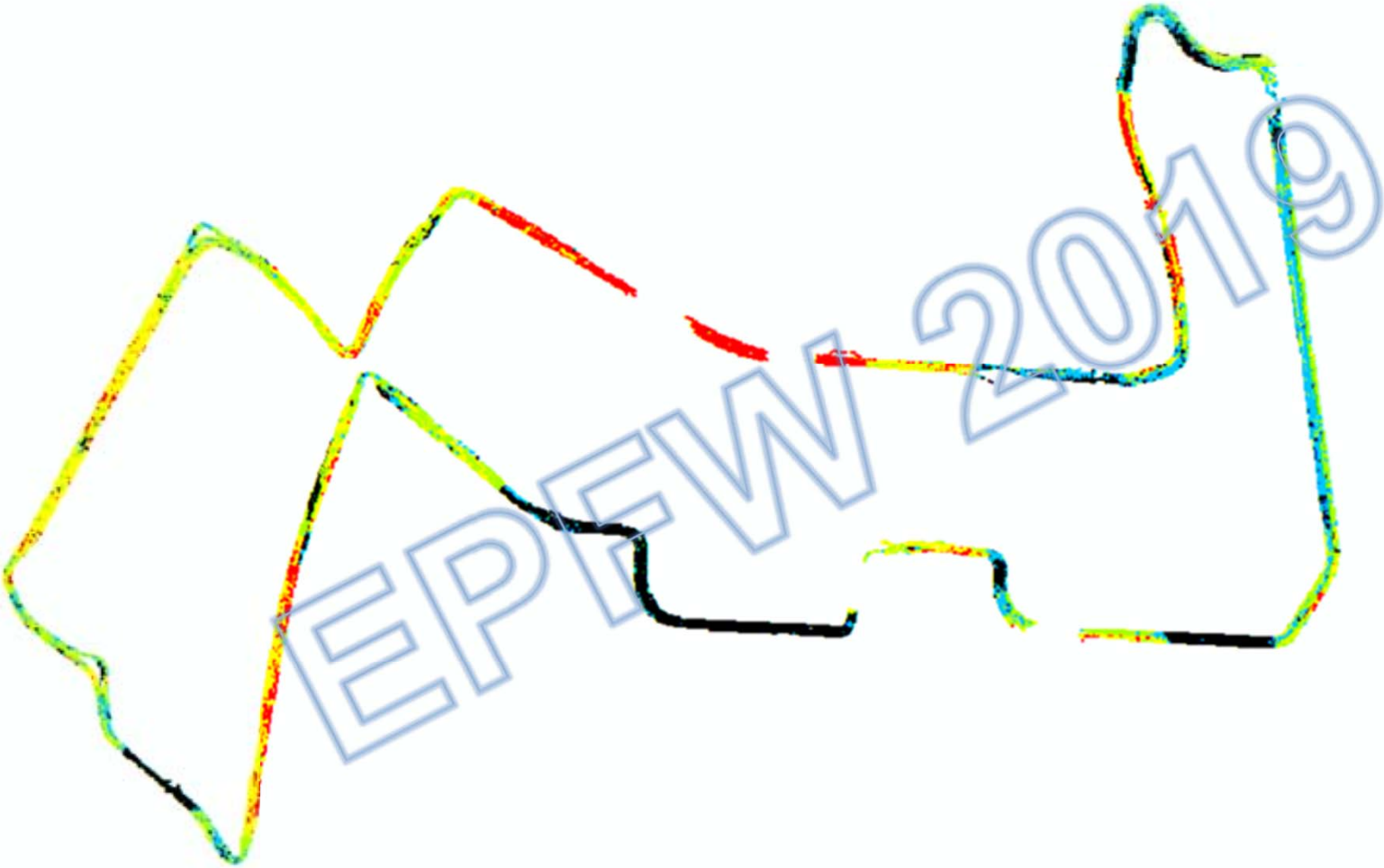
- Uses a Findlay Irvine GripTester MK2
- Water film depth of 0.25mm
- Test speed 30 km/h
- 10Hz GPS Receiver

The GripMap Method

- Covers the track in 1m intervals
- Data can be used to generate GripMaps
- GripMaps can be used for;
 - Improving Simulations
 - Driver training
 - Highlight areas of surface concern
 - Targeted maintenance
 - Improving performance
 - Improving safety
 - Surface treatment evaluation



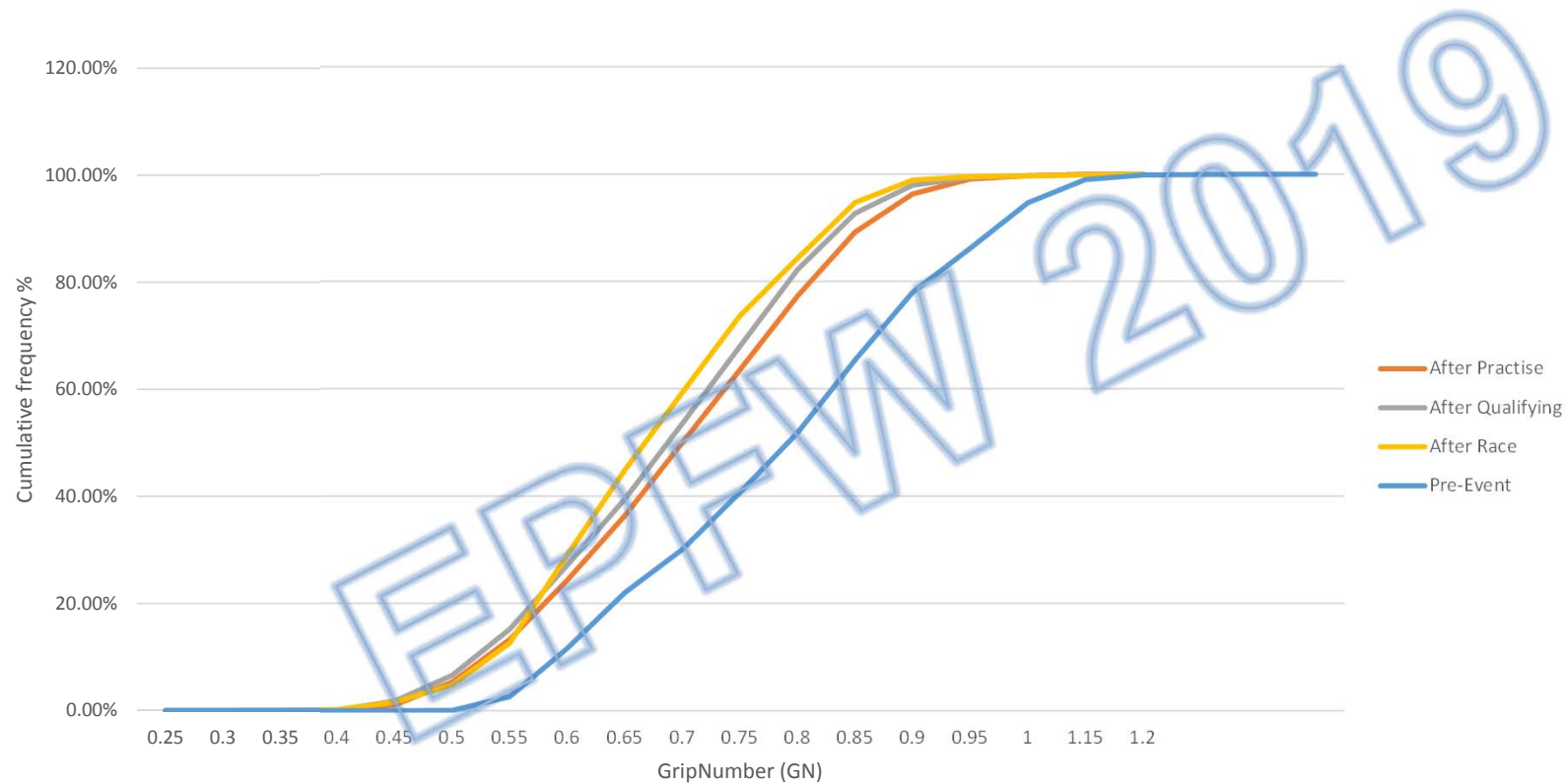
The GripMap Method



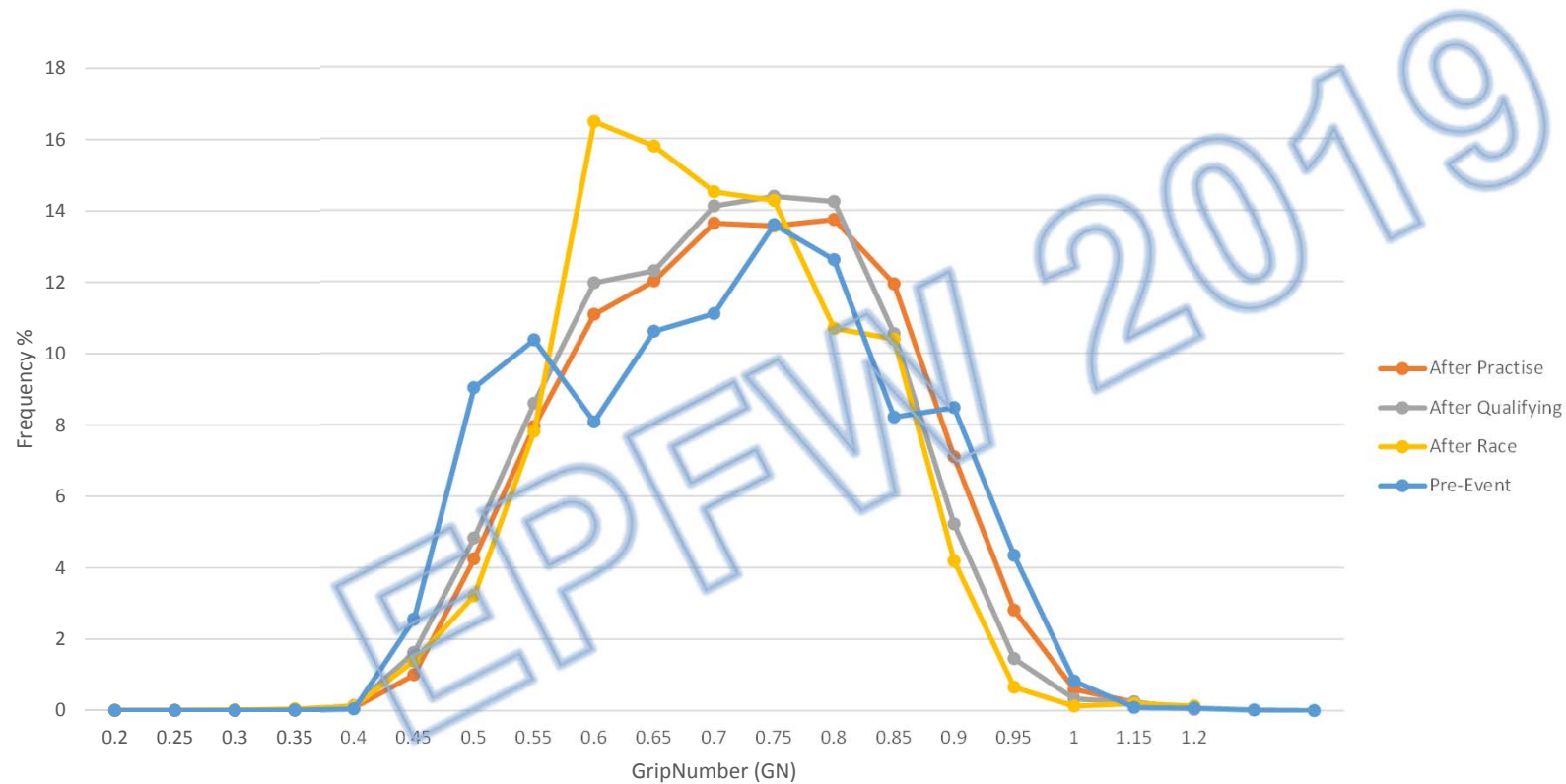
Evolution of grip through the race weekend

- Measured wet grip evolves through a race weekend
- Measured grip level typically decreases through a dry weekend
- A racetrack is considered to get faster as the grip level evolves
- Lower measured wet grip, is considered faster by drivers
- Rain throughout the event increases measured wet grip
- Rain is considered to make a race track slower

Evolution of grip through the race weekend

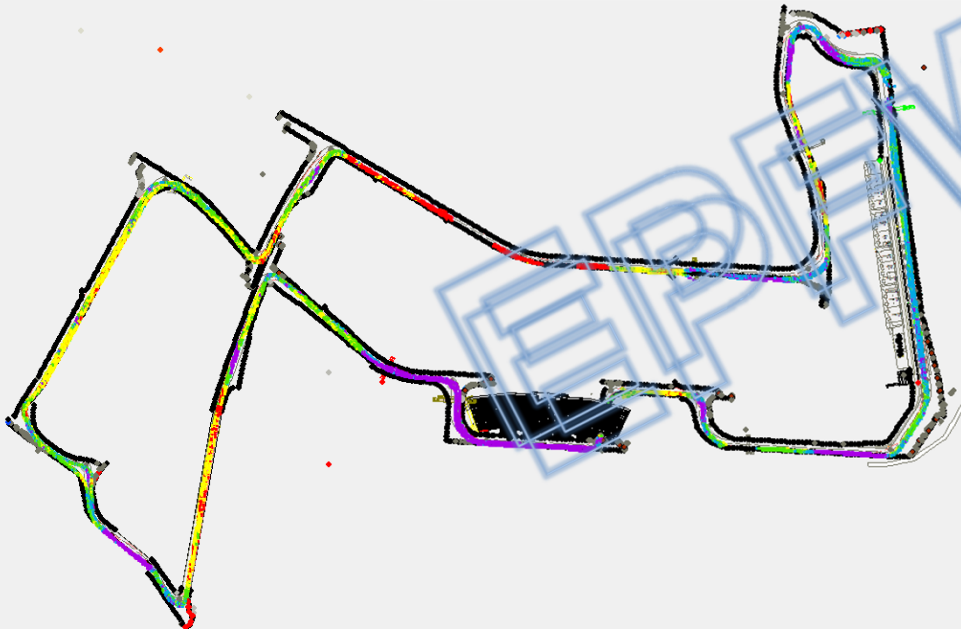


Evolution of grip through the race weekend



Evolution of grip through the race weekend

Before Event & Surface Treatments



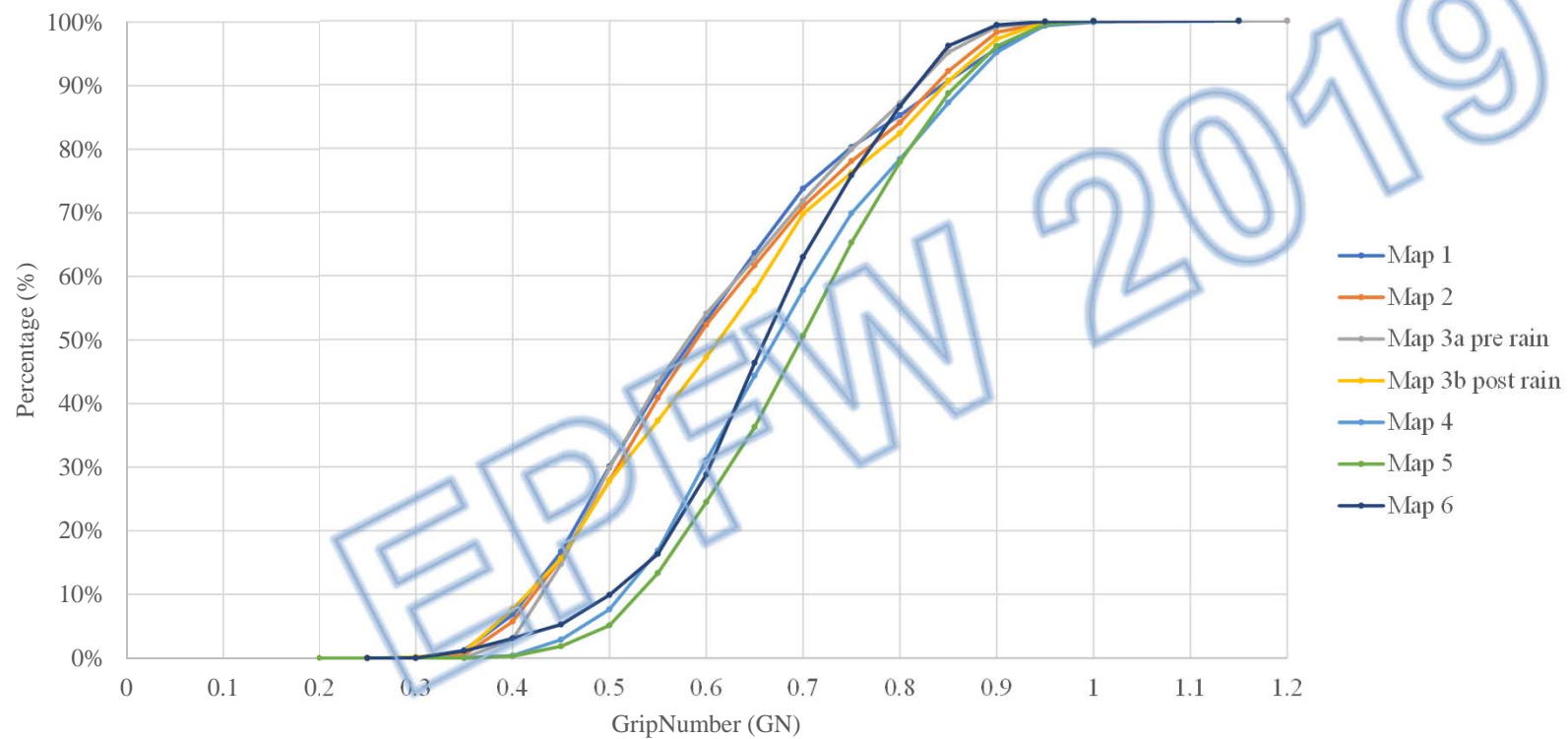
After Event & Surface Treatments



Effect of rain on racetrack grip

- An untrafficked racetrack is known as a “Green Track”
- A race track is said to get faster through a race event
- Tyre/surface interaction thought to lay rubber on the track reducing lap time
- Rain during a race event is said to return the track to “Green”
- Anecdotal evidence without any prior academic research

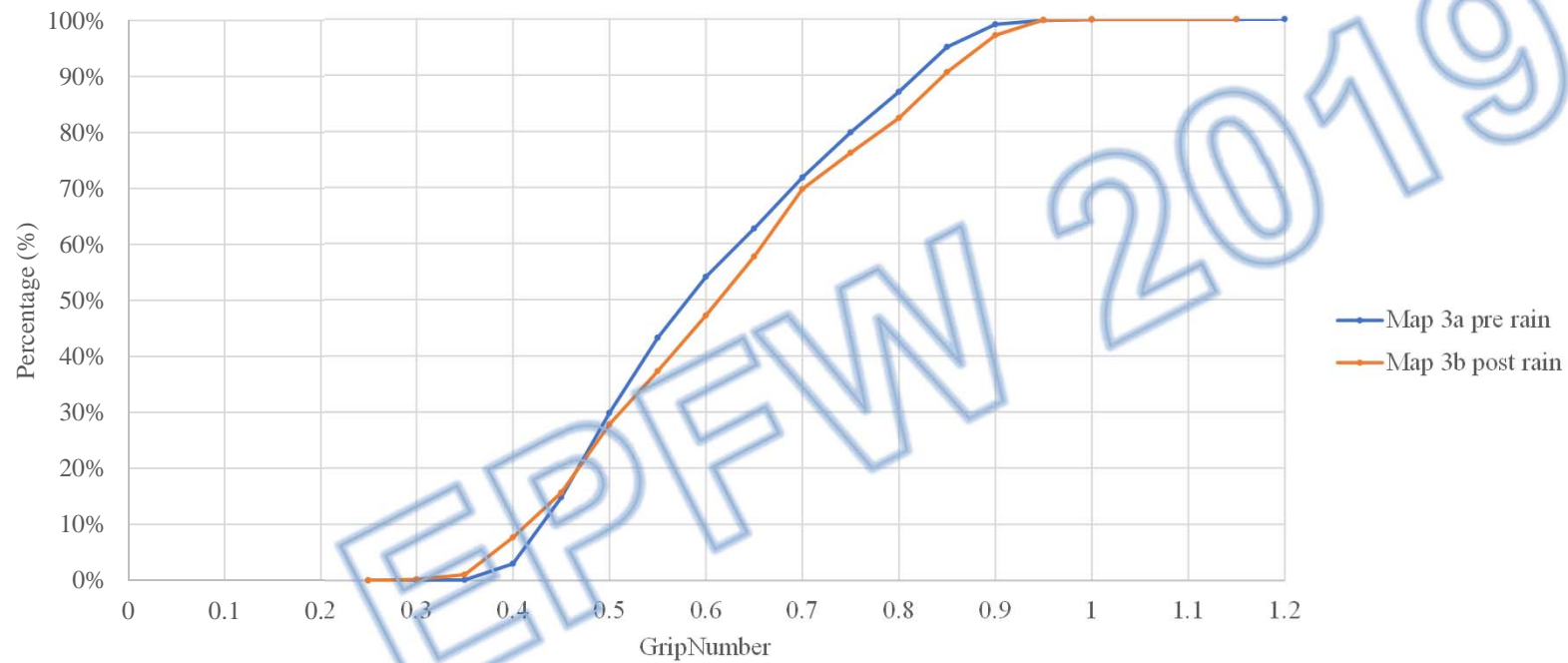
Effect of rain on racetrack grip



Effect of rain on racetrack grip

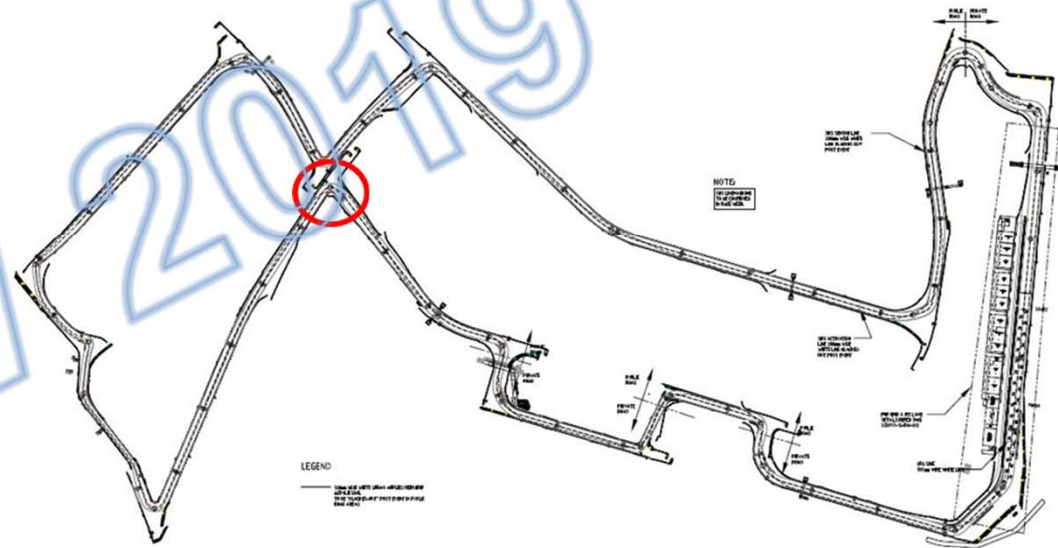


Effect of rain on racetrack grip



Impact of High Pressure Water Retexturing on new asphalt patch

- Turn 14 Marina Bay Circuit
- End of a long straight
- 90 degree corner
- Fast acceleration zone
- Extreme forces on a street section of the track



Impact of High Pressure Water Retexturing on new asphalt patch

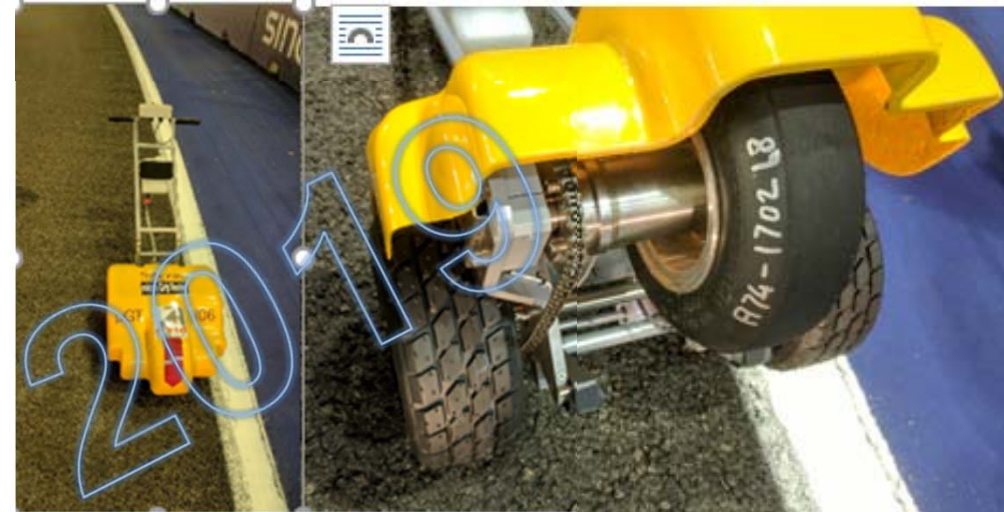
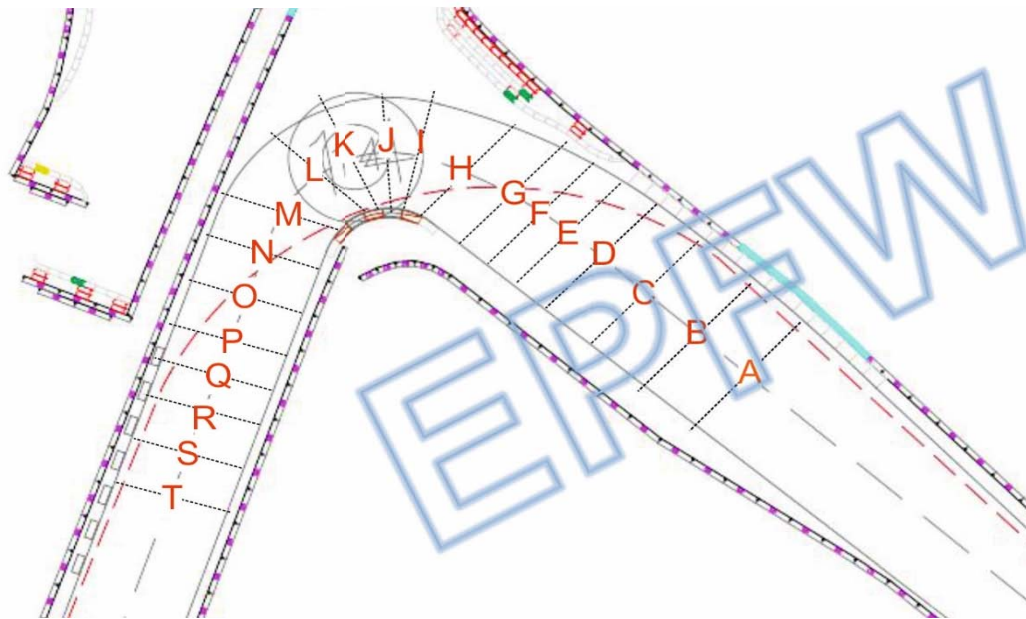


Impact of High Pressure Water Retexturing on new asphalt patch

- Patch re-laid 48 hours before racing
- Previous reinstatement rutted under street traffic
- Treated with high-pressure water retexturing



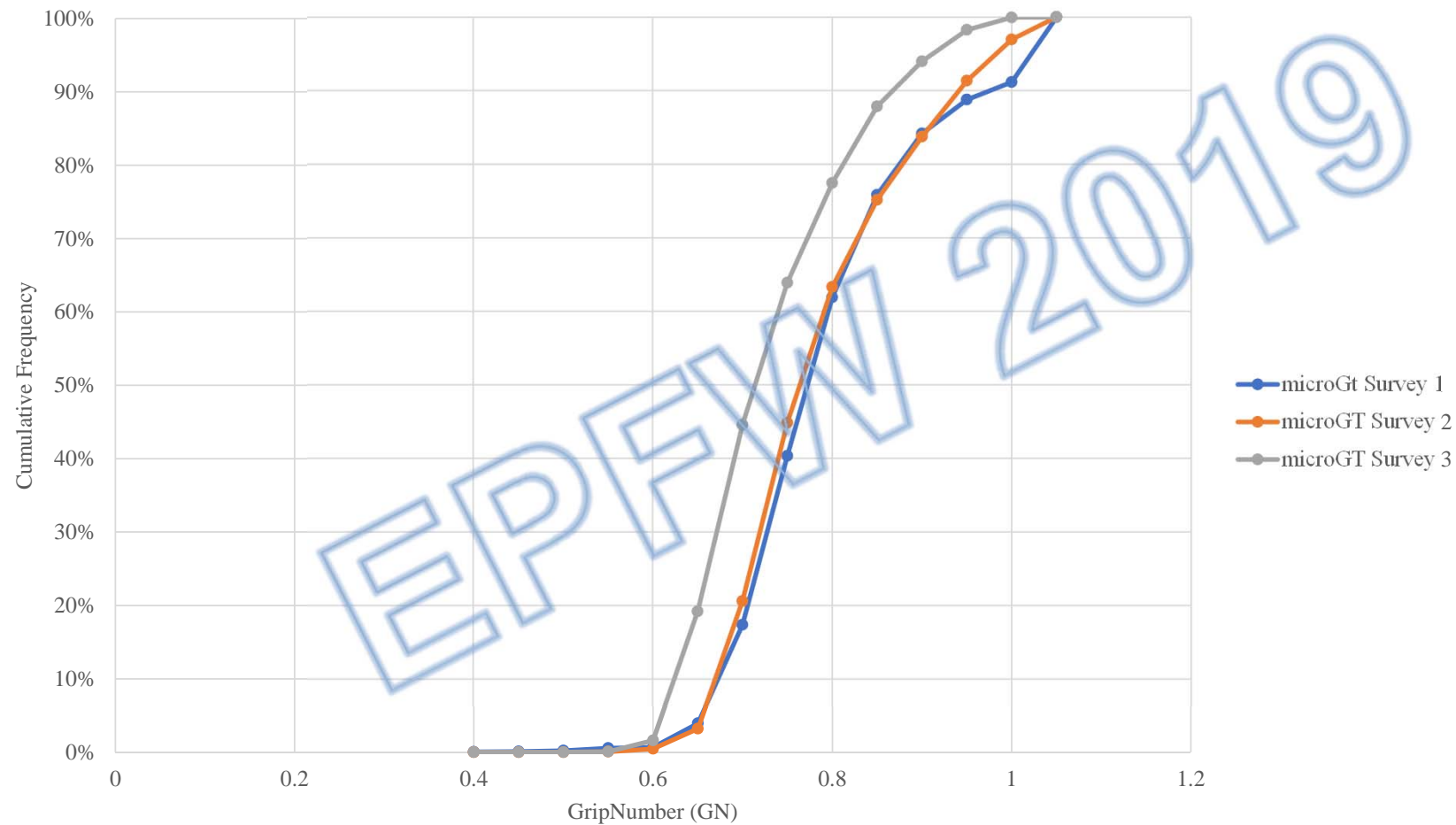
Impact of High Pressure Water Retexturing on new asphalt patch



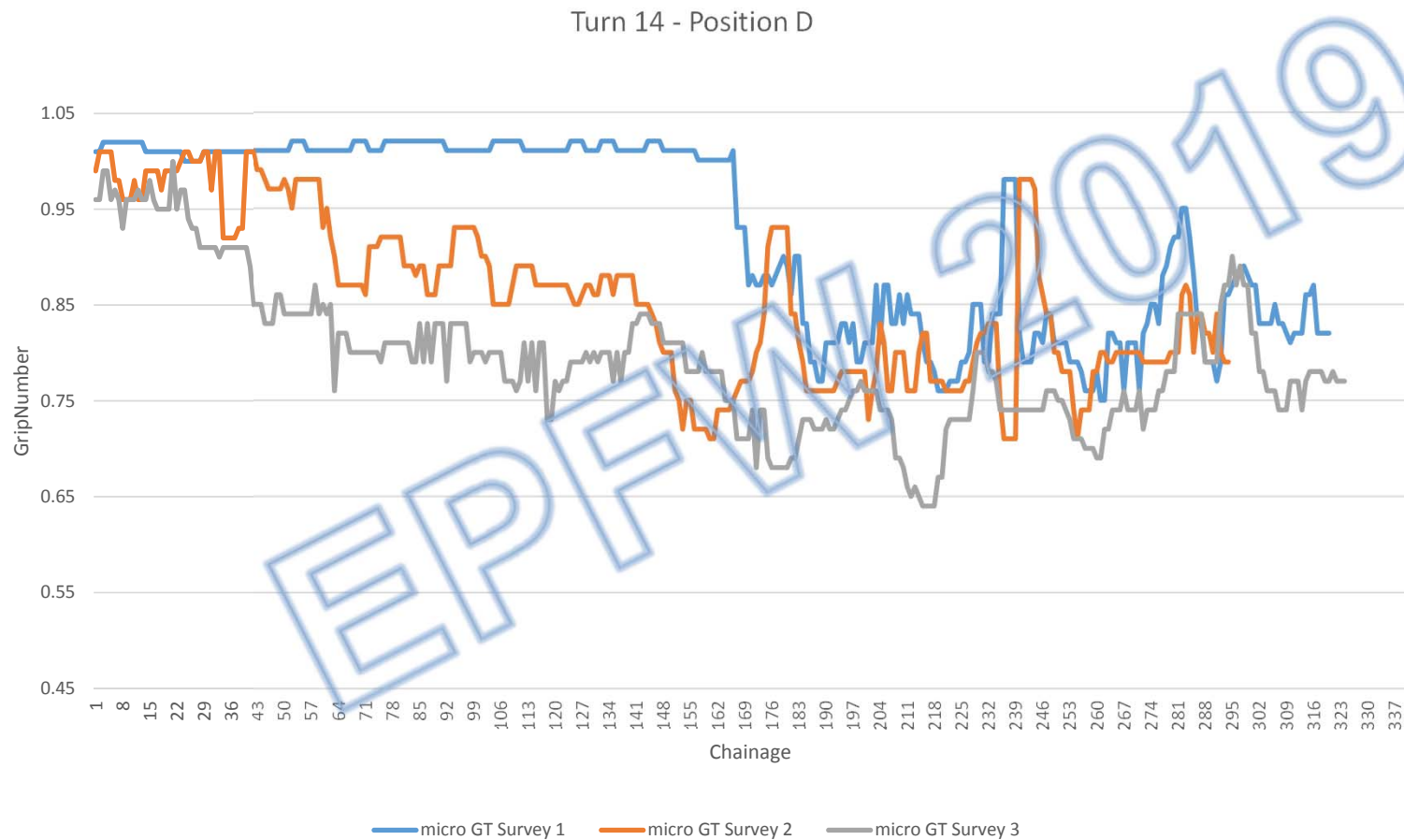
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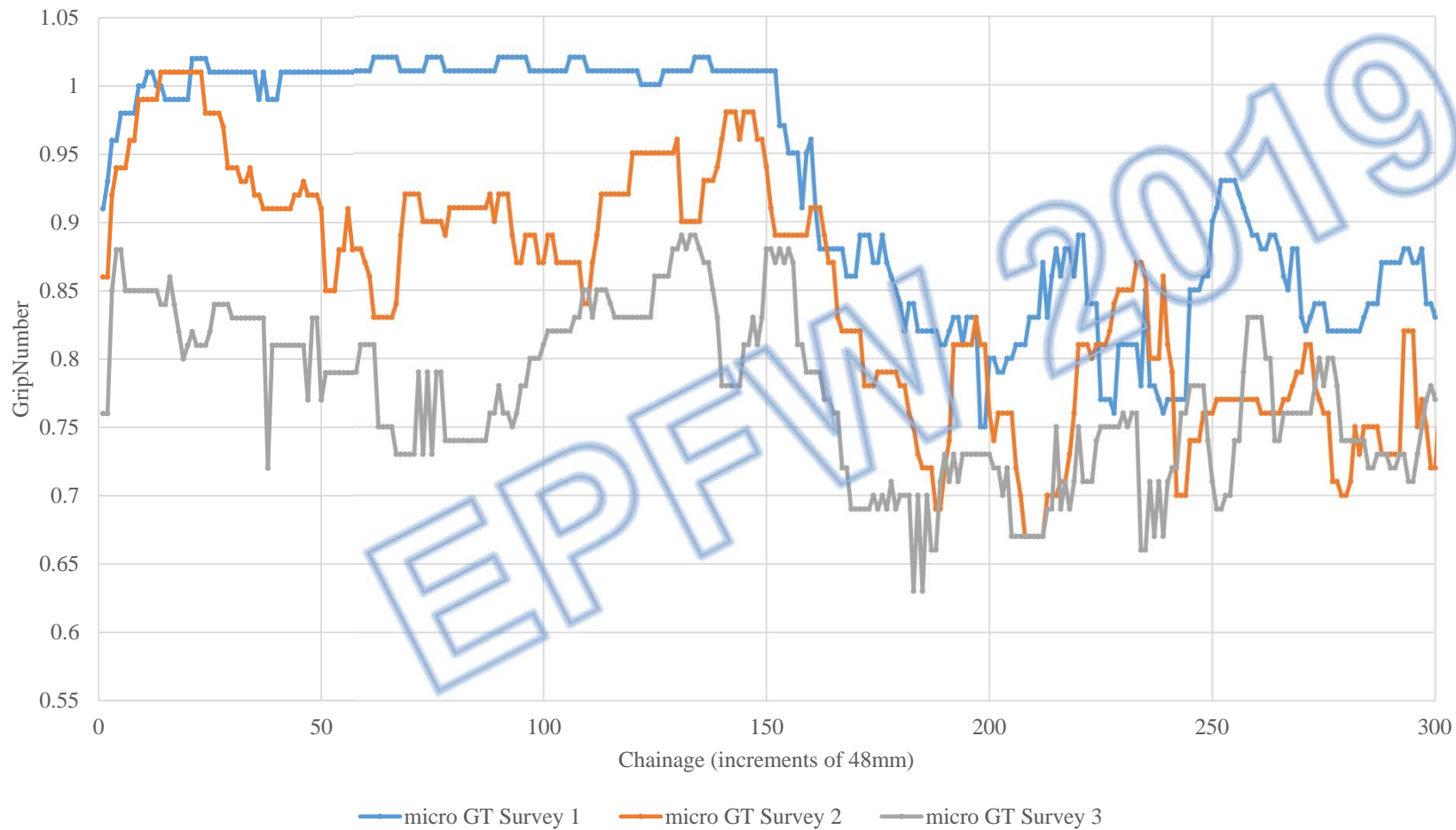
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Impact of High Pressure Water Retexturing on new asphalt patch



Impact of High Pressure Water Retexturing on new asphalt patch



Impact of High Pressure Water Retexturing on new asphalt patch



Lap 29 / 61

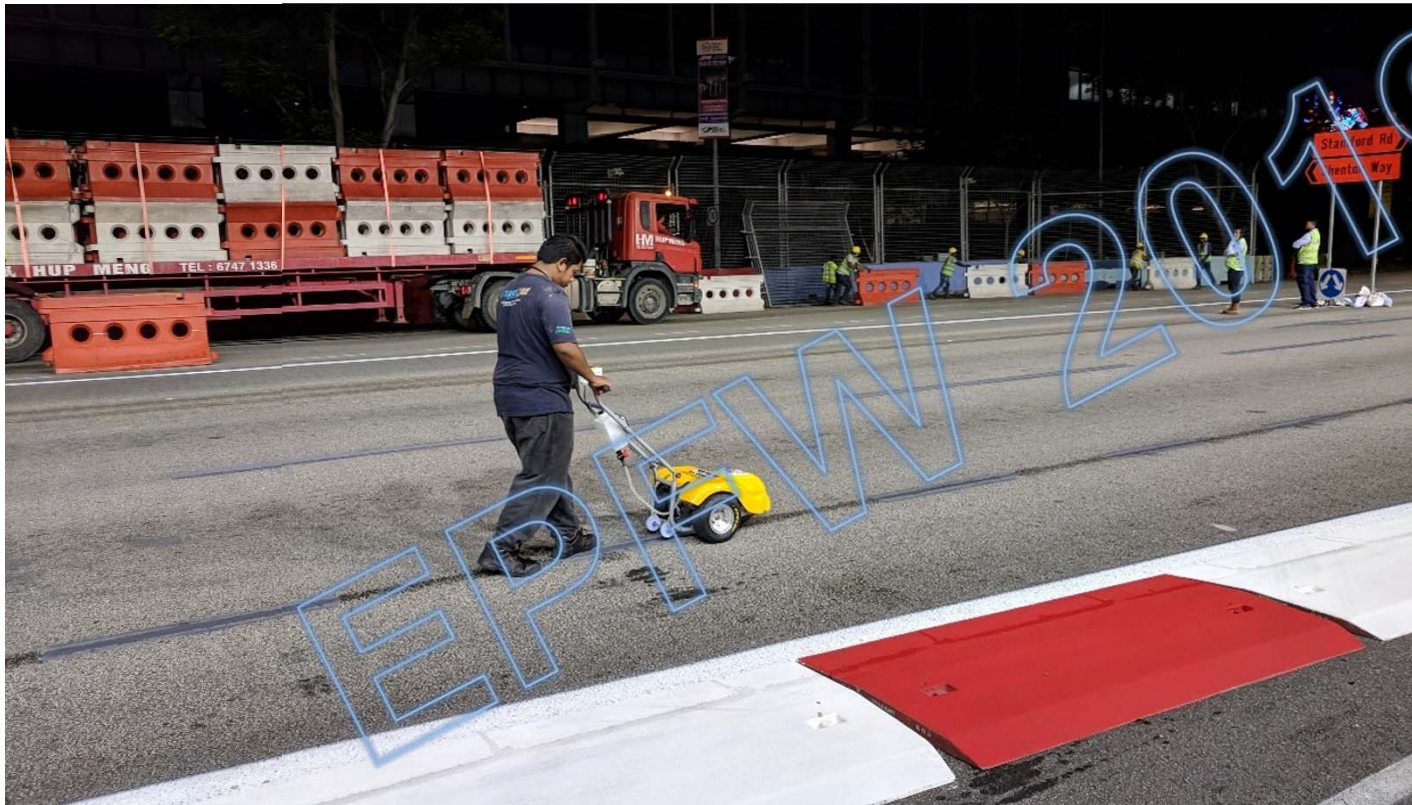
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7	PER	+2.380
8	VAN	+13.901
9	STR	+7.346
10	MAG	+3.247
11	GRO	+3.084
12	OCO	+0.776
13	MAS	+26.658
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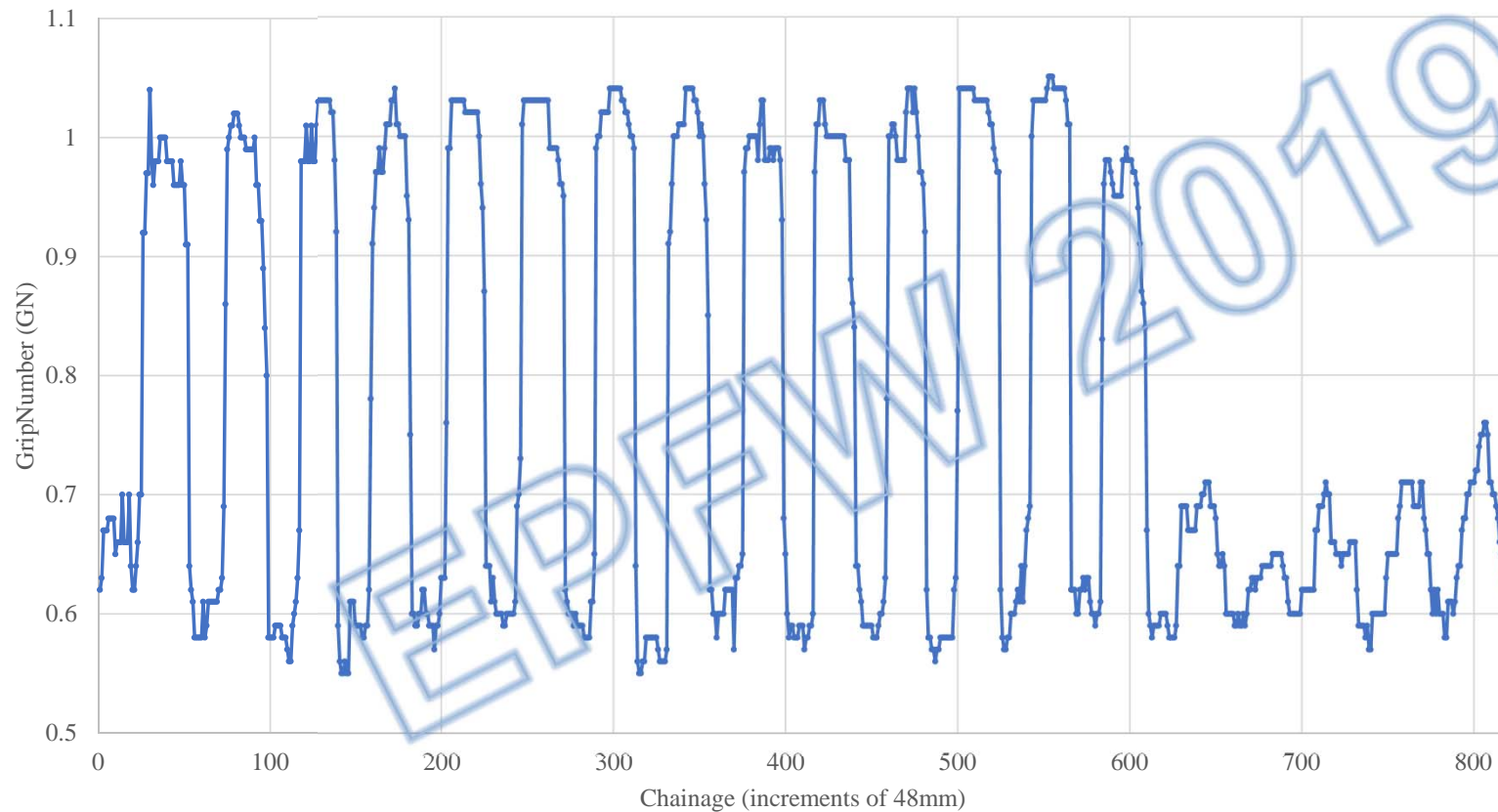
High friction paint on the racetrack



High friction paint on the racetrack

- Used to cover standard highway white lines
- More aesthetically pleasing for TV
- Drivers complained about inconsistent grip in braking and acceleration zones
- Micro GT highlighted step changes between high friction paint and asphalt concrete

High friction paint on the racetrack



Summary

- GripMap Method is a system of measuring racetrack surface grip
- Racetrack grip has to be thought of in the opposite way to roads and airports
- Water retexturing can prepare new surfaces for racing
- Water retexturing increases measured wet grip
- High friction paint can cause issues with extreme forces of motorsport vehicles

Thank you for listening.

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