Bitte decken Sie die schraffierte Fläche mit einem Bild ab.

Continental SportContact 6
Maximum GRIP

www.continental-tyres.com
# Maximum GRIP – Driving Session

**Agenda**

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<th>Maximum Grip: Introduction to Grip Testing</th>
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<td>Maximum Grip: Wet braking driving session</td>
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<td>2</td>
<td>Result Evaluation</td>
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</table>
Maximum Precision
Target Conflict

Driving precision

Wet grip

Continenta
Maximum Precision
Performance Survey of Test Program

Wet grip

Driving precision

EVO 1

EVO 2

SportContact 6

- - +

+ - +

+ + +

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What is Grip?

› Grip
  is needed to transfer forces from the car to the road in the contact patch

› Grip Mechanisms
  are different on different surfaces
Construction of a Tyre
Grip is Generated in the Contact Patch (Grip Zone)

The Grip Zone is most important for grip generation, but finally the whole tyre construction is relevant, especially for lateral forces.
The SportContact 6 – Perfect Grip
New Generation of Black Chili Compounding for Perfect Grip

Maximum Grip in All Directions
Black Chili enjoyment for …
› Braking
› Acceleration
› Cornering
… on wet and dry roads.
Simplest Friction Measurements

Leonardo da Vinci
*1452 – 1519

Try it for yourself later!

Coefficient of friction $\mu$ is a measure of grip

$$\mu = \frac{F_x}{F_N} = \frac{m_2}{m_1}$$
Friction Coefficient $\mu$ of Different Road Conditions

Relative Contribution of Friction Mechanisms

<table>
<thead>
<tr>
<th>Road Condition</th>
<th>Dry</th>
<th>Wet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friction Coefficient $\mu$</td>
<td>1.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Hysteresis</td>
<td></td>
<td>0.2</td>
</tr>
<tr>
<td>Adhesion</td>
<td></td>
<td>0.6</td>
</tr>
<tr>
<td>Hydroplaning</td>
<td></td>
<td>0.4</td>
</tr>
</tbody>
</table>

Dry and Wet conditions compared with their respective friction mechanisms.
How Large is the Real Contact Area Between Tyre and Road?

Footprint size

Road roughness

Tire: 245/35 R19
Load: 4460 N
Infl.Press.: 2.5 bar

Gross Contact Area: 160 cm²

Pattern void

Netto Contact Area: 120 cm²

Footprint size

Road roughness
Let’s measure it!
How large is the real contact area between tire and road?

Only about 20% of tread in contact with road asperities*

→ A = 24 cm²/tire
~5 cm x 5 cm

› In reality, much smaller than people think
› Reason: rubber does not fully penetrate into the road

*: at the resolution of the foil used in the demonstration
Bitte decken Sie die schraffierte Fläche mit einem Bild ab.

Please cover the shaded area with a picture.

(24,4 x 7,6 cm)

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Maximum Grip: Introduction to Grip Testing

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Pathway: From Compound Recipe to Tyre Performance

Recipe → Viscoelastic Material Properties → Performance Simulation → Laboratory Performance → Tyre Manufacturing → Tyre Performance

Feedback loop

Recipe

Viscoelastic Material Properties

Performance Simulation

Laboratory Performance

Tyre Manufacturing

Tyre Performance

Pathway:
From Compound Recipe to Tyre Performance

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log ω

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Pathway: From Compound Recipe to Tyre Performance

Recipe → Viscoelastic Material Properties → Performance Simulation → Laboratory Performance

Pre-selection in lab

Faster Feedback Loop:
+ More variants
+ More conditions
+ Efficient
- No tyre performance
## Various Ways to Test Grip Today

<table>
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<tr>
<th>Laboratory</th>
<th>Laboratory on the Road</th>
<th>Vehicle Test</th>
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<tr>
<td>› High Speed Linear Friction Tester</td>
<td>› Portable Friction Tester</td>
<td>› Braking Car</td>
</tr>
</tbody>
</table>

- High Speed Linear Friction Tester
- Portable Friction Tester
- Braking Car
Modern Lab-Testing: High Speed Linear Friction Tester
Mimic Tread Block Conditions during Braking in the Lab

Test Parameter
› Precise control of environmental conditions
› Temperature range from -25 °C to +60 °C
› Defined friction surfaces e.g. concrete, asphalt (copy of braking tracks)
Lab-Testing: Friction Measurements
High Speed Linear Friction Tester

Dry & Wet Friction of Rubber Tread Block

\[ F_x(t), F_z(t) \]

Friction coefficient \( \mu \)

Friction Force
Normal Force
Coefficient of friction \( \mu \)
Outdoor Lab-Testing
Portable Friction Tester

Test Parameter
› Same principle as for the lab-device
› On actual braking tracks
› Normal loads up to 240 N
› Siding speed up to 2 m/s
› No control of ambient conditions

Try it for yourself later!
Pathway: From Compound Recipe to Tyre Performance

Feedback Loop
++ Tyre performance
- High costs
- Slower feedback

Recipe → Viscoelastic Material Properties → Performance Simulation → Laboratory Performance → Tyre Manufacturing → Tyre Performance
Introduction to Wet Braking Tests at Continental
Vehicle Based Outdoor Test

› Evaluation of stopping distance
› Reflecting daily life practice: emergency braking with ABS control
› Various test tracks (asphalt, concrete, different wet skid resistance levels)
› Rail guided system (higher reproducibility)
› Controlled water layer height
› GPS based measurement of stopping distance
› No control of environmental conditions
ABS Wet Braking
Data Recording and Measurement Chain

Digital Velocity Display

GPS-Antenna

Velocity Box

Digitalker III (Data Recorder)
Pathway: From Compound Recipe to Tyre Performance

Recipe → Viscoelastic Material Properties → Performance Simulation → Laboratory Performance → Tyre Manufacturing → Tyre Performance

Feedback loop

Recipe

Viscoelastic Material Properties

Performance Simulation

Laboratory Performance

Tyre Manufacturing

Tyre Performance

Tyre Lab Performance

AIBA

Recipe

Viscoelastic Material Properties

Performance Simulation

Laboratory Performance

Tyre Manufacturing

Tyre Performance

Tyre Lab Performance

AIBA
Rail guided wet braking

Rail guided aquaplaning
Automated Indoor Braking Analyzer
Vehicle based Indoor Test

› Equivalent procedures for in- and outdoor brake tests
› Temperature control
  › Ambient air
  › Road/water surface
› Controlled water layer height
› Exchangeable road surfaces
› Fully automatic braking
› All-year testing
AIBA
Automated Indoor Braking Analyzer

› Video AIBA
Bitte decken Sie die schraffierte Fläche mit einem Bild ab.

(24,4 x 7,6 cm)

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Maximum Grip: Wet Grip Performance Evaluation

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Agenda
Which Variants have the Highest Wet Grip in Lab & Outdoor?

› 3 Tyre Variants: EVO 1, EVO 2, SC6
› Tread compounds for laboratory based evaluation

Three parallel groups

<table>
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<td>Da Vinci</td>
</tr>
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<td>PFT</td>
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Rotation after 15 minutes