Driving Session Tread Depth Comparison

Tread Depth Study

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www.continental-tires.com
Where are winter tires mandatory in Europe?
Tread Depth Study
Current legislation

Minimum tread depth for winter tires in Europe:

- 6mm tread depth
- 4mm tread depth
- 3mm tread depth
- no extra tread depth requirement for winter tires (1.6mm = min)
## Tread Depth Study

### Grip Mechanism on Snow

#### 3 main grip mechanisms

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Description</th>
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| Shear strain                     | **Snow- / Snow Friction**
| Strong Groove effect             | The tread grooves fill with compacted snow. Grip is generated from the resulting snow shear forces. |
| Edge effect                      | **Milling action**
| Sipe influence                   | The tread blocks deform under force transmission, allowing the sipes to dig into the snow. |
| Surface interlocking             | **Interlocking**
| Compound effect                  | The highly flexible Winter compound adapts to the microscopic surface roughness |
Tread Depth Study
Braking on Snow

Tread depth vs. Braking on snow

Winter tires

Braking on snow [%]

Tread depth [mm]

R² = 0.98

95% confidence interval

single measurement
Tread Depth Study
Braking on Snow

Explanation

Loss of braking performance on snow
› Tread depth 8 mm – 4 mm: 2% per mm
› Tread depth 4 mm – 2 mm: 4% per mm

Doubling of reduction
› from 2 % per mm to 4 % per mm

Under 4 mm tread depth the braking performance on snow is disproportionately low

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Lateral Performance on Snow

Tread depth vs. Lateral performance

Winter tires

R^2 = 0.55

Tread depth [mm]

Lateral Performance [%]

Single measurement
Tread Depth Study
Lateral Performance on Snow

Technical background

› For lateral performance on snow the behaviour is less uniform
› Some products show a disproportionate decrease in performance below 4 mm remaining tread depth.
› The decrease is very high, around 4% per mm
› Pattern shear is the dominant effect in the lateral direction.
› Sipe effects are not as large as for braking
Tread Depth Study
Wet Braking

Tread depth vs. wet braking

Winter tires

R² = 0.99

Wet braking [%]

Tread depth [mm]

single measurement

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Wet Braking

Explanation

Wet performance decreases dramatically

› Tread depth 8 mm – 4 mm: 2% per mm
› Tread depth 4 mm – 2 mm: 8% per mm
› Larger micro hydroplaning influence

In comparison to snow
› Doubling of effect!
Tread Depth Study
Wet Braking

Explanation

› **Region I** : pure Hydroplaning

› **Region II** : crossover from hydroplaning to braking

› **Region III** : pure wet braking

Low tread depth + high speed = slippery as ICE!
Important properties of a winter tire are dependent on the tread depth.

This effect is inherent and does not depend on a particular design, brand or segment.

Some safety-relevant properties such as snow- and wet performance decrease with reduced tread depth.

This performance decrease is especially pronounced below 4 mm remaining tread depth.

Continental recommends on principle a minimum remaining tread depth of 4 mm for winter tires + snowflake marking!
Thank you for your attention!
Tread Depth Study

Test programm

Umfang der Studie
› 3 Winter tires (Premium- & Quality-Segment)

Representative test dimension
› 205/55 R 16 H
› test vehicle: VW Golf

Wear conditions
› New, 6, 4, 2 mm remaining tread depth
› by driving on public roads

Tire tests
› Braking on snow
› Lateral performance
› Wet Braking