TEST REPORT

TW-TT13-MT550b

Benchmarking tests of 255/55R18 studded winter tyres

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1. Objective

The objective of the project was to test the performance of different studded winter tyres. The project consisted of tests on ice, snow, dry and wet surfaces.

2. Tyres

2.1. Tyre information

The tyre selection in the project was the following

Brand	Specification	Size	LI/SI	DOT	Date
Continental	ContiIceContact 4x4	255/55R18	109T	CP2T NVVD	2912
Goodyear	Ultragrip Ice Arctic SUV 4x4	255/55R18	109T	ND2T KF1R	4113
Michelin	Latitude X-Ice North XIN2	255/55R18	109T	FKFJ 00CX	2213
Nokian	Hakkapeliitta 7 SUV	255/55R18	109T	60CF	2013

- All tyres were delivered and run in by the customer
- Separate tyre sets were used for ice/snow and wet/dry tests to avoid wear problems

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2.2. Tread pattern photos

Continental

Goodyear

Michelin

Nokian

3. Tests

The following tests were carried out.

3.1. Ice tests

Test	Method
Braking	Measurement of braking distance
Acceleration	Measurement of acceleration
Handling, objective	Measurement of lap times on a circuit track
Handling, subjective	Subjective analysis of tyre behaviour

3.2. Snow tests

Test	Method
Braking	Measurement of braking distance
Acceleration	Measurement of acceleration time
Handling, objective	Measurement of lap times on a circuit track
Handling, subjective	Subjective analysis of tyre behaviour

3.3. Wet tests

Test	Method
Braking	Measurement of braking distance
Handling, objective	Measurement of lap times on a circuit track
Handling, subjective	Subjective analysis of tyre behaviour

3.4. Dry tests

Test	Method
Braking	Measurement of braking distance
Handling, subjective	Subjective analysis of tyre behaviour

3.5. Environment and comfort tests

Test	Method
Noise	Subjective inside car noise
Rolling resistance	Indoor rolling resistance on drum

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4. Test cars

The test car for all tests was BMW X5 (third generation F15) four wheel drive.

5. Test tracks

The tests were performed at three locations in different temperatures suitable for winter tyre testing.

Tests	Track	Test time	Test temperatures
Ice and snow	Test World Ltd, Ivalo, Finland	November-December 2013	-5 ... -10 °C
Wet and dry	Colmar-Berg, Luxembourg and Wittlich, Germany	November 2013	+1 ... +7 °C

6. Test team

Tests were carried out by Test World personnel, except of rolling resistance, which was performed by Goodyear under Test World observation.

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7. Results

Test results are displayed as

Index – larger index = better performance (reference tyre 100)
Grade – subjective grade between 4 = unacceptable to 10 = excellent
Coefficient – rolling resistance coefficient

7.1. Ice tests

7.1.1. Ice braking

Tyre	*Index*
Goodyear	100
Continental	95
Michelin	85
Nokian	73

7.1.2. Ice acceleration

Tyre	*Index*
Goodyear	100
Continental	96
Michelin	84
Nokian	83

7.1.3. Ice handling, objective

Tyre	*Index*
Goodyear	100
Continental	100
Michelin	91
Nokian	85

7.1.4. Ice handling, subjective

Tyre	*Grade*
Goodyear	9.0
Continental	8.0
Michelin	7.5
Nokian	7.0

7.2. Snow tests

7.2.1. Snow braking

Tyre	*Index*
Goodyear	100
Continental	98
Nokian	98
Michelin	91

7.2.2. Snow acceleration

Tyre	*Index*
Goodyear	100
Continental	100
Nokian	99
Michelin	91

7.2.3. Snow handling, objective

Tyre	*Index*
Goodyear	100
Continental	99
Nokian	97
Michelin	92

7.2.4. Snow handling, subjective

Tyre	*Grade*
Goodyear	9.0
Continental	8.5
Nokian	8.0
Michelin	7.5

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7.3. Wet tests

7.3.1. Wet braking

Tyre	*Index*
Michelin	103
Goodyear	100
Nokian	96
Continental	95

7.3.2. Wet handling, objective

Tyre	*Index*
Michelin	105
Continental	103
Goodyear	100
Nokian	97

7.3.3. Wet handling, subjective

Tyre	*Grade*
Continental	8.5
Michelin	8.0
Goodyear	7.5
Nokian	7.0

7.4. Dry tests

7.4.1. Dry braking

Tyre	*Index*
Nokian	102
Michelin	101
Continental	101
Goodyear	100

7.4.2. Dry handling, subjective

Tyre	*Grade*
Nokian	8.0
Goodyear	7.5
Continental	7.5
Michelin	7.0

7.5. Environment and comfort tests

7.5.1. Noise

Tyre	*Grade*
Michelin	8.0
Nokian	7.5
Goodyear	7.0
Continental	7.0

7.5.2. Rolling resistance

Tyre	*Coeff*
Nokian	7.40
Goodyear	8.10
Michelin	8.50
Continental	9.21

* test done without studs

8. Test protocols

8.1. Braking

8.1.1. Results

- Braking distance for a selected speed interval
- Ice 25-5 km/h
- Snow 35-5 km/h
- Wet asphalt 80-5 km/h
- Dry asphalt 100-5 km/h
- Snow and ice tests done 2-3 times, final result average of test runs

8.1.2. Car systems

- ABS on

8.1.3. Measurements

Ice and snow

- Reference tyre used after two test tires (REF-A-B-REF-C-D-REF)
- 12-16 brakings per tyre
- Brakings always on a new spot

Wet and dry

- Reference tyre used in the beginning and at the end (REF-A-B-C-D-REF)
- 8 brakings per tyre
- Brakings always on the same spot

8.1.4. Driving protocol

- Accelerate the vehicle over the chosen speed
- Put the clutch down and let the vehicle roll freely for a short time
- Brake hard, from 2-3 km/h over the target speed
- Steer straight
- Wait for the vehicle to stop
- Check the data after each braking
- Mark and repeat any faulty measurements

8.1.5. Measuring unit

- Racelogic VBox

8.2. Acceleration

8.2.1. Results

- Acceleration time for a selected speed interval
- Ice 5-25 km/h
- Snow 5-35 km/h
- Snow and ice tests done 2-3 times, final result average of test runs

8.2.2. Car systems

- Traction control on

8.2.3. Measurements

- Reference tyre used after two test tires (REF-A-B-REF-C-D-REF)
- 12-16 accelerations per tyre
- Accelerations always on a new spot

8.2.4. Driving protocol

- Stay still
- First gear, clutch down
- Lift clutch, throttle bottom
- Steer straight
- Wait for the vehicle to accelerate 2-3 km/h over the chosen speed
- Check the data after each acceleration
- Mark and repeat any faulty measurements

8.2.5. Measuring unit

- Racelogic VBox

8.3. Handling

8.3.1. Results

- Sector times
- 2-4 sectors on a track
- Subjective comments
- Snow and ice tests done 2-3 times, final result average of test runs

8.3.2. Car systems

- ABS on
- Traction control on
- ESC off

8.3.3. Measurements

Ice and snow

- Reference tyre used after two test tires (REF-A-B-REF-C-D-REF)
- 3-4 laps (12-16 sector times) per tyre

Wet

- Reference tyre used in the beginning and at the end (REF-A-B-C-D-REF)
- 2-3 laps (12-16 sector times) per tyre

Dry

- No timing for dry

8.3.4. Driving protocol

- Drive normally finding the limit of grip
- No left foot braking / hand brake etc allowed
- Subjective comments of
  - steering
  - controllability on and over limit
  - behaviour during acceleration/braking in straight/curves

8.3.5. Measuring unit

- Racelogic VBox

8.4. Noise

8.4.1. Results

- Subjective analysis of inside car tyre noise

8.4.2. Car systems

- All systems on

8.4.3. Measurements

- Reference tyre used after two test tires (REF-A-B-REF-C-D-REF)

8.4.4. Driving protocol

- Accelerate until 100 km/h
- Change to neutral gear
- Steer straight
- Let the car coast down freely until 40 km/h

8.4.5. Measuring unit

- Racelogic VBox for speed control

8.5. Rolling resistance

8.5.1. Results

- Rolling resistance coefficient

8.5.2. Measuring unit

- Rolling resistance drum

8.6. Result calculation methods

8.6.1. Indexes

- In all tests the reference tyre was given an index of 100%
- Values above 100% = better
- Values below 100% = worse

8.6.2. Grades

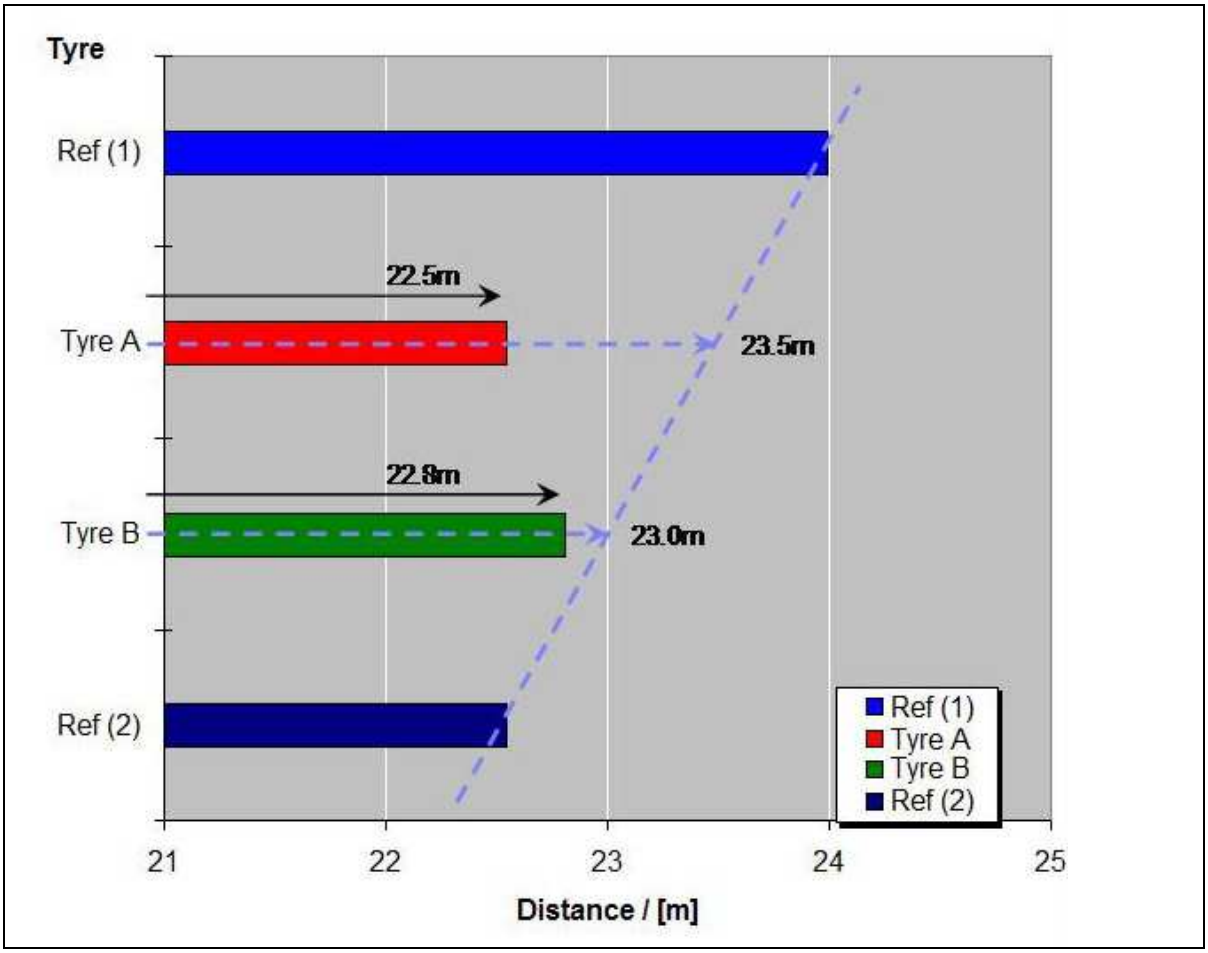
- In subjective tests a grading scale was used.
- The scale is from 4 = unacceptable to 10 = excellent.
- A one point grade difference can normally be recognized by a normal driver

8.6.3. Position correction

- In all tests position correction was applied
- In the method, any systematic effects caused by the track are eliminated

8.6.4. Reference calculation

- In all tests the reference method was used in calculations
- In the method, a reference tyre is driven at certain intervals to control any change in conditions



9. Conclusion

All tests have been executed applying Test World quality systems and requirements for test conditions, deviation, methods and security. Tests were executed using the same test methods as normally for magazines.

Test World Ltd hereby claims that the test results are representative for the tyre selection when tested under outlined conditions, cars, tracks and methods. Test World Ltd does not take responsibility for any liabilities from the conclusions drawn from the test results.

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