FIA FOUNDATION | FIA SAFE & SUSTAINABLE MOBILITY GRANTS PROGRAMME | ADAC

Tyre abrasion in the environment: Results from the ADAC tyre test and future legislation

Photo: ADAC | Uwe Rattay

As part of a study sponsored by the FIA and FIA Foundation, the current status will be evaluated on the basis of the measurements in the ADAC tyre test and recommendations for future Euro 7 legislation will be derived.

Introduction

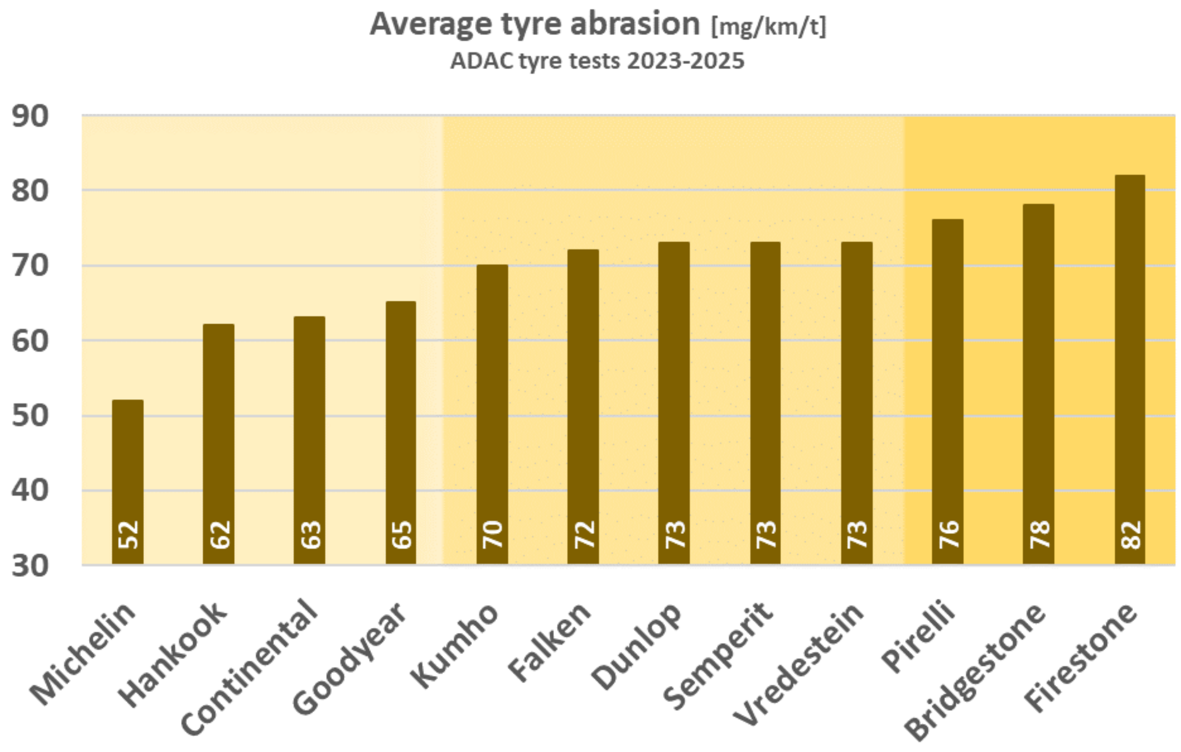
The ADAC addressed the issue of tyre wear for the first time back in 2021 and published a comprehensive overview of tyre wear data based on the data from the ADAC tyre wear test. The evaluations at that time showed that there were still major differences between the individual tyre manufacturers and that only a few manufacturers managed to offer tyres that were both low-wear and safe (good performance in terms of driving safety in the ADAC tyre test).

A lot has happened since the publication of the ADAC study. Not only has the subject of tyre abrasion been included in the future Euro 7 legislation and a separate UNECE working group (Task Force Tyre Abrasion) has been set up for this purpose, but a large number of national and international discussion forums and working groups have also been formed. The ADAC, with its many years of expertise in the field of tyre wear testing, has been actively involved in the exchange and development of test methods and measures to reduce tyre abrasion.

In the current study on tyre abrasion, the test method developed in the UNECE for determining tyre abrasion in road traffic was examined in a correlation test as part of an innovation project funded by the FIA in order to gather experience for the future Euro 7 legislation on tyre abrasion and to address consumer interests for the future legislation.

Results from the ADAC tyre test

The ADAC tyre test was fundamentally revised in 2023. In addition to the introduction of new criteria, the evaluation philosophy was also adapted. In order to give the topic of the environment and sustainability even greater visibility and relevance in our consumer protection test, the individual criteria were divided into two main categories for the first time. All safety-relevant criteria can now be found in the "Driving safety" chapter, while all environmental criteria are in the "Environmental balance" chapter. While the adjustments to the individual criteria in the "Driving safety" chapter were minor, a new standard was set in the area of environmental criteria in the field of consumer protection tests for tyres.
For the first time, an assessment of tyre wear was explicitly introduced in addition to the assessment of a tyre's durability (predicted mileage). While the mileage of a tyre up to the legally defined minimum tread depth is determined for durability, which is made up of the abrasion rate, usable tread height and the wear pattern, the assessment of tyre wear explicitly determines how much rubber ends up in the environment over a certain distance.
Since 2023, the ADAC has tested and published 160 different tyre models - 84 summer tyres, 60 winter tyres and 16 all-season tyres. As the calculation methodology has changed compared to the tests before 2023 and the abrasion is now given in mg per kilometre and standardised per tonne of vehicle weight, it is not possible to say whether the overall abrasion level has changed compared to 2020. However, a comparison of all tyre manufacturers that have been represented with at least five tyre models in the tests since 2023 shows that the manufacturer Michelin continues to offer by far the lowest abrasion tyres. According to the new calculation method, which
Based on the future UNECE methodology, the average abrasion of Michelin tyres is only 52 mg/km/t. The premium manufacturers Hankook (62 mg/km/t), Continental (63 mg/km/t) and Goodyear (65 mg/km/t) are well behind in second to fourth place.
All four premium manufacturers impressively demonstrate that it is possible to produce a safe and low-wear tyre using modern tyre technology. The other side of the coin: the premium tyres are largely in the upper price segment, as the comprehensive price research carried out for each tyre test shows.
This is followed, again with a somewhat clearer gap, by the quality brands, some of which are somewhat cheaper, such as Kumho (70 mg/km/t), Falken (72 mg/km/t), Semperit, Vredestein and Dunlop (73 mg/km/t each). The Vredestein brand is particularly conspicuous here, as it still stood out in the 2020 study with particularly low wear. However, the trend that the brand is increasingly moving away from the philosophy of low-wear tyres was also recognised in the study at the time.
Two premium manufacturers in particular stand out negatively, with significantly higher levels of abrasion in comparison. Both Pirelli (76 mg/km/t) and Bridgestone (78 mg/km/t) are still unable to offer a safe yet low abrasion tyre with their previous tyre generations. Both brands have, at least so far, clearly focussed on driving safety and not on abrasion.
Finally, in last place is the Firestone brand, which with an average of 82 mg/km/t can hardly score points in terms of the environment.



Graph 1: Average tyre wear by tyre manufacturer (all manufacturers represented with at least 5 models in the ADAC test are taken into account)

Although the detailed results show a number of other tyre models with significantly poorer abrasion values, it is not possible to make a generally valid statement at brand level due to the small number of model variants tested.

It is noticeable that the tyre with the highest abrasion, the Avon ZV7 (a summer tyre in size 205/55 R16), causes almost four times as much abrasion as the best tyre in the test, the Michelin e Primacy (35 mg/km/t), which was tested in the same dimension. Anyone who thinks that the Avon is safe is wrong. The Avon is hardly convincing in terms of safety characteristics either.

The two tested tyres from the budget brand Doublecoin also failed to impress in terms of safety. Although they are directly behind the front runner in terms of tyre wear, their safety characteristics are catastrophically poor. It is alarming that the Doublecoin tyres have nevertheless met the minimum safety requirements for approval and can therefore be sold on the European market. This clearly shows what the consequences of an excessively strict abrasion limit value could be. It will therefore be important to maintain a balance between environmental protection and road safety in any future legal limit value.

The detailed results of the 160 tyres tested can be found in Appendix 1.

Future test method for tyre wear in the context of Euro 7

The tyre abrasion methodology is defined by the UNECE in UN Regulation No. 117 Annex 10 "Procedure for determining the abrasion performance of tyres of class C1". In future, the document will describe a standardised procedure for determining the abrasion performance of passenger car tyres (C1 tyres). The aim is to evaluate the abrasion resistance of a tyre to be tested (candidate) in comparison with a specified reference tyre. The abrasion is measured as a loss of mass of the tyre over a defined distance and expressed in a so-called abrasion index (AICT).

The road test procedure for determining tyre wear is a practical approach that has been successfully tested for many years by the ADAC, among others. Here, car tyres are tested under real driving conditions on public roads. The aim is to compare the abrasion of a so-called candidate tyre with that of a standardised reference tyre in order to objectively assess abrasion resistance. For this purpose, a convoy of up to four vehicles is formed, one of which is equipped with reference tyres and the others with the tyres to be tested. Together, the vehicles cover a distance of around 8000 kilometres, consisting of one or more closed circuits. These routes must cover a variety of driving conditions, including urban traffic, country roads and motorways, with precise specifications regarding the distribution of driving styles and speeds.

Numerous parameters are continuously monitored during the test, including speed, longitudinal and lateral acceleration, outside temperature and tyre pressure. Before, during and after the test, the vehicles are checked for correct axle geometry (toe and camber) to ensure that all tyres are tested under comparable conditions. The vehicles must be comparable in terms of drive type (e.g. front or rear-wheel drive only), energy source (e.g. combustion engine only or hybrid only) and load. The tyres are weighed before and after the test, with the loss of mass serving as a measure of abrasion. This is set in relation to the distance driven and the load on the tyre in order to calculate the so-called abrasion index.

The test is only valid if all prescribed conditions are met - including temperature ranges, weather conditions and compliance with the specified driving style. The aim is to enable a standardised assessment of tyre wear resistance that is as close to reality as possible.

In the longer term, the aim must be to carry out tyre wear tests on a test bench in order to minimise the environmental and traffic impact in real-life operation. There is already a test procedure for this in the regulations, which must now be further trialled and implemented in practice.

Euro 7 limit value for tyre wear

According to the latest findings of the ADAC, there is a largely linear relationship between vehicle weight and tyre wear - at least in the usual passenger car weight range. This realisation is also important for the future Euro 7 legislation. The current UNECE proposal provides for a limit on tyre wear per tonne of vehicle weight. This enables an objective assessment of the tyre - regardless of the vehicle type.

Such an approach prevents tyre manufacturers from being forced to compromise safety-relevant properties such as braking performance or cornering stability in favour of lower abrasion on heavier vehicles.

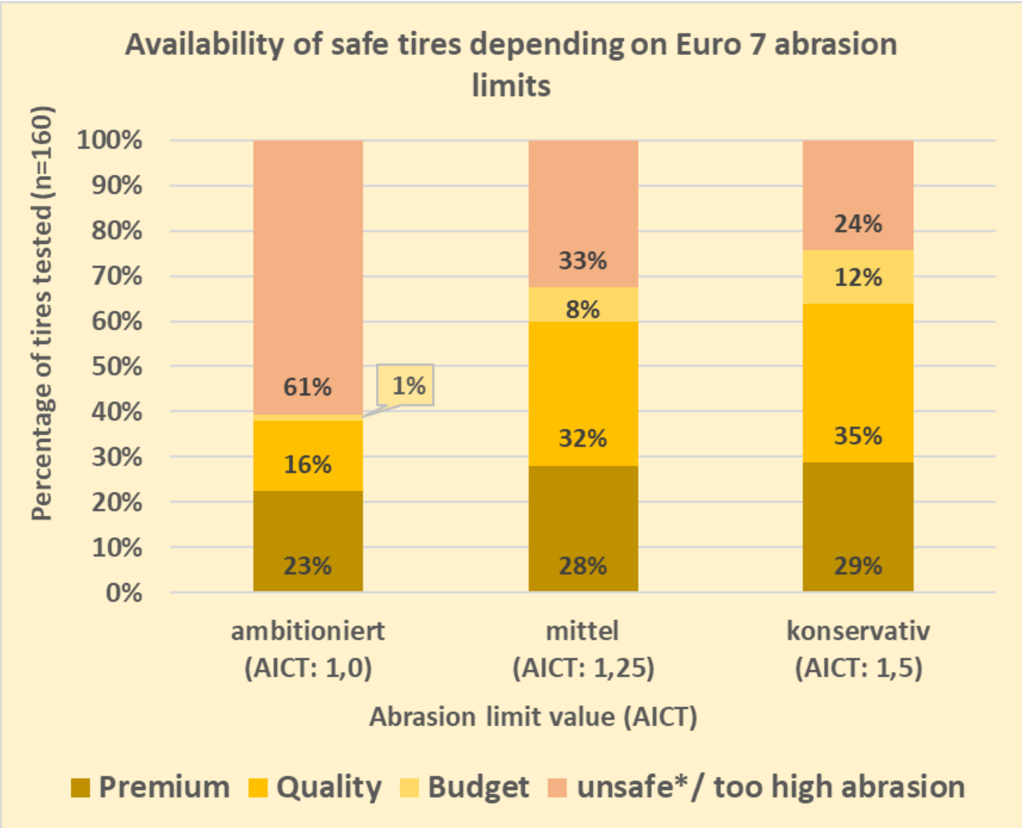


Figure 2: Illustration of available safe tyre models depending on the Euro 7 abrasion limit value [AICT = tyre abrasion index].

When establishing a future abrasion limit value, it must be taken into account that a limit value that is too strict can lead to a tyre deteriorating in the criteria relevant to driving safety and thus impairing road safety. On the other hand, a limit value that is too lax misses the target of significantly reducing tyre wear. And ultimately, it must also be ensured that mobility remains affordable. The ADAC tyre test clearly shows that premium manufacturers are already able to offer safe and environmentally friendly tyres with state-of-the-art tyre technology. However, it must be ensured that cheaper alternatives continue to be offered alongside the expensive premium tyres, which are particularly attractive for price-sensitive customers or infrequent drivers, without risking significant compromises in terms of driving safety.

ADAC wear test vs. UNECE test methodology

The ADAC wear test runs almost twice as long compared to the future UNECE methodology (15,000 km vs. 8,000 km).

The long driving distance in the ADAC test is mainly used to reliably assess the mileage of a tyre, i.e. how long the tyre lasts before it has to be replaced because the tread depth has fallen below the minimum.

This is the most relevant value for consumers when buying tyres. The longer a tyre lasts, the less often it needs to be replaced - which reduces costs and tyre waste.

Tyre wear is only one element that is decisive for the mileage of a tyre. The tread height is also important, i.e. how much "rubber" is left on the tread, and the wear pattern of a tyre is also crucial. Tyres that wear very homogeneously over the entire tread are significantly more durable with the same loss of mass (abrasion) than tyres that have increased side or centre wear due to their design.

The UNECE methodology, on the other hand, focuses on distance-related wear. The abrasion settles much faster in a test, as neither the initial tread depth nor the abrasion pattern of the tyre, which only develops in the course of the test, are decisive.

The evaluation of the ADAC test after 7,500 km (comparable to the UNECE methodology) compared to the regular 15,000 km shows that the average tyre wear generally decreases slightly with longer driving distances. On average, around 5% less tyre wear was determined after 15,000 km of driving. The wear of a tyre is therefore higher at the beginning, but then levels off and stabilises over the course of the driving distance. The average tyre wear determined by the UNECE method is therefore slightly higher in absolute terms than in reality. However, according to the ADAC, the method is still permissible due to the use of the abrasion index, which always refers to the reference tyre.

The situation is different when determining the mileage. As the abrasion pattern has not yet fully developed at 8,000 km and the UNECE methodology does not provide for complex laser measurement of the tyre tread, the calculation of mileage based on the UNECE method is only possible to a limited extent. Here, the ADAC tyre test with its long driving distance in the wear test and the high-precision laser measurement technology for measuring each individual test tyre can provide significantly more reliable values than will presumably be possible with the UNECE methodology.

The evaluation and comparison of the abrasion data at 7,500 km and 15,000 km are shown in the following graph.

Con-voy no.	Dimension	Tyre type (summer tyres)	Tyre wear after 7,500 km [mg/km/t]	Tyre wear after 15,000 km [mg/km/t]	Abrasion index after 7,500 km	Abrasion index after 15,000 km	Difference 15,000 km to 7,500 km
1	**225 45 R17**	**Reference SRTT 1**	**70,7**	**71,9**			
1.1	225 40 R18	Syron Premium Performance	83,2	76,3	1,18	1,06	-11%
1.2	225 40 R18	Giti GitiSport S2	101,3	97,7	1,43	1,36	-5%
1.3	225 40 R18	Doublecoin DC-100	47,1	43,9	0,67	0,61	-10%
2	**225 45 R17**	**Reference SRTT 2**	**73,5**	**70,8**			
2.1	225 40 R18	Vredestein Ultrac Pro	80,0	75,5	1,09	1,07	-2%
2.2	225 40 R18	Falken Azenis FK520	67,7	61,9	0,92	0,87	-6%
2.3	225 40 R18	Nokian Tyres Powerproof 1	71,3	67,7	0,97	0,96	-1%
3	**225 45 R17**	**Reference SRTT 3**	**70,93**	**72,2**			
3.1	225 40 R18	Kumho Ecsta PS71	85,4	85,7	1,20	1,19	-1%
3.2	225 40 R18	Firestone Firehawk Sport	84,2	81,1	1,19	1,12	-6%
3.3	225 40 R18	Bridgestone Potenza Sport	62,3	63,8	0,88	0,88	0%
4	**225 45 R17**	**Reference SRTT 4**	**73,9**	**71,5**			
4.1	225 40 R18	Yokohama Advan Sport V107	100,9	95,0	1,37	1,33	-3%
4.2	225 40 R18	Toyo Proxes Sport 2	91,3	85,9	1,24	1,20	-3%
4.3	225 40 R18	Ceat SportDrive	88,2	80,5	1,19	1,13	-5%
5	**225 45 R17**	**Reference SRTT 5**	**78,7**	**74,5**			
5.1	225 40 R18	Nexen N Fera Sport	80,3	74,7	1,02	1,00	-2%
5.2	225 40 R18	Dunlop Sport Maxx RT2	97,5	91,0	1,24	1,22	-2%
5.3	225 40 R18	Goodyear Eagle F1 Asymmet-ric 6	78,9	74,2	1,00	1,00	0%
6	**225 45 R17**	**Reference SRTT 6**	**74,0**	**71,1**			
6.1	225 40 R18	Norauto Prevensys 4	87,9	80,5	1,19	1,13	-5%
6.2	225 40 R18	Michelin Pilot Sport 5	57,3	56,1	0,77	0,79	3%
6.3	225 40 R18	Continental SportContact 7	68,1	63,4	0,92	0,89	-3%

Graph 3: Average tyre wear after 7,500 km and 15,000 km

Tyre wear on electric vehicles

With the increasing proportion of electric vehicles on our roads, the question of their specific influence on tyre wear is also coming into focus. While the ADAC has so far only carried out its tyre tests on vehicles with combustion engines, the question arises as to what extent these results can be transferred to electric vehicles and what role vehicle weight and legal framework conditions will play in the future.

The ADAC tyre tests are currently based on wear measurements with conventional vehicles. Due to logistical and technical challenges - in particular the daily test route of over 600 kilometres with up to 12 vehicles in convoy - it has not yet been possible to carry out these tests with electric vehicles. A direct comparison of tyre wear between different drive types is therefore not yet available.

Nevertheless, generally valid statements can be derived from the tests to date: Tyres that show low wear on combustion vehicles also have a longer service life on electric vehicles. The type of drive therefore only has a minor influence on the ranking of tyre models.

Absolute tyre wear depends largely on vehicle-specific characteristics:

- **Vehicle weight:** Higher weight leads to increased abrasion**.**
- **Torque behaviour:** The high torque of electric vehicles has a particular impact on wear when starting off.
- **Axle adjustment:** An axle geometry that is not optimally adjusted can further increase wear.

In addition, external factors such as driving behaviour (e.g. frequent acceleration and braking, fast cornering) and weather conditions also have a significant impact on tyre wear. An anticipatory, defensive driving style can significantly reduce tyre wear - regardless of the drive concept.

Outlook for the future: GreenNCAP as a new assessment standard

From 2025, the ADAC will evaluate the individual influence of the vehicle on tyre wear as part of the revised GreenNCAP test procedure [https://www.greenncap.com]. In addition to the vehicle weight, parameters such as the accelerator pedal characteristics, torque output and axle geometry will also be included in the assessment. This methodology goes well beyond the requirements of the Euro 7 standard and sets new standards for the environmental assessment of vehicles.
Tyre wear is a complex interplay of vehicle technology, driving behaviour and external conditions. While the ADAC tyre tests are currently still limited to combustion vehicles, many of the findings can also be transferred to electric vehicles. Future legal regulations and test procedures such as GreenNCAP will enable a more differentiated assessment - so that both environmental aspects and road safety will continue to take centre stage.

ADAC activities in the field of tyre wear

The following is a selection of working groups and projects that ADAC e.V. has supported or is currently supporting:

- Participation in the UNECE working group "Task Force Tyre Abrasion" as representative of FIA Region I, which is developing a future internationally valid test methodology within the framework of Euro 7 [https://unece.org/transport/vehicle- regulations]
- Participant in the international working group CSR-Europe Tyre and Road Wear Particles [https://www.csreurope.org/trwp]
- Associated partner in the research project "Tyre abrasion in the environment (RAU)" [https://www.bmbf-plastik.de/de/node/3.html]
- Participation in the dialogue forum "Microplastics from tyre abrasion" of the Environmental Alliance Hesse [https://www.umweltallianz.de/dialogforen.html]
- Technical support of the Karlsruhe Institute of Technology (KIT) in the funded project "Tyre abrasion measurement and simulation" (RAMUS) [https://www.fast.kit.edu/lff/Projekte_17488.php]
- Participation as external consultant in the research project "TERIS - Technology platform for tyre abrasion and its emission identification in road traffic" of the Fraunhofer LBF [https://www.lbf.fraunhofer.de/de/projekte/teris-technologieplattform- reifenabrieb-emissionsidentifikation.html]

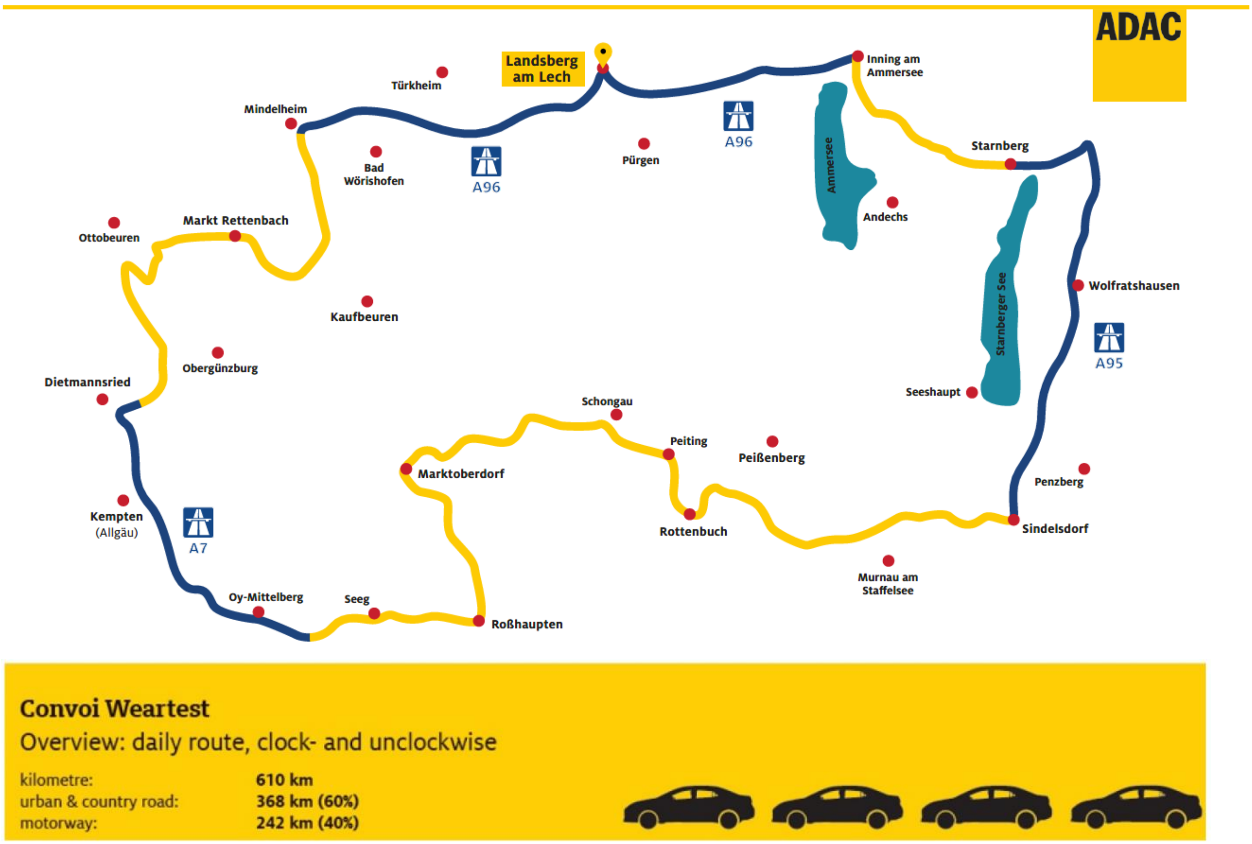
ADAC tyre wear route

As part of the project, the ADAC route layout for determining tyre wear was also compared with the requirements of the UNECE methodology.

The result: The recordings show that the ADAC track layout complies very well with the UNECE requirements and is therefore suitable as an approved track for future tyre wear measurements.

The track validation (details in Appendix 2) has shown that the track used in the ADAC wear test meets the requirements of future abrasion legislation and can therefore be used for UNECE tyre abrasion tests. The track fulfils the UNECE criteria in terms of speed, distance and distance travelled as well as lateral and longitudinal acceleration.

Graphic 4: Illustration of the ADAC tyre wear route



Appendix 1 - Individual results of ADAC tyre wear measurements 2023 - 2025

Manufacturer	Dimension	Type	Tyre abrasion [mg/km/t]	Estimation of abrasion index according toUNECE method*
Michelin e Primacy	205 55 R16	SR	35	0,5
Doublecoin DC-100	225 40 R18	SR	44	0,6
Doublecoin DC99	205 55 R16	SR	46	0,6
Hankook Winter i*cept RS3	205 55 R16	WR	48	0,7
Michelin Alpin 6	205 55 R16	WR	48	0,7
Michelin Primacy 4+	215 55 R17	SR	48	0,7
Michelin Alpin 6	205 60 R16	WR	51	0,7
Goodyear Efficient Grip Performance 2	215 55 R17	SR	52	0,7
Michelin Cross Climate 2	205 55 R16	AS	52	0,7
Continental Ultra Contact	205 55 R16	SR	53	0,7
Michelin Primacy 4+	205 55 R16	SR	54	0,8
Goodyear Ultra Grip Performance 3	215 55 R17	WR	55	0,8
Kumho Ecsta HS52	215 55 R17	SR	55	0,8
BF Goodrich G-FORCE WINTER 2	205 60 R16	WR	56	0,8
Hankook Kinergy 4S²	205 55 R16	AS	56	0,8
Infinity Ecofour	205 55 R16	AS	56	0,8
Kleber KRISALP HP3	205 60 R16	WR	56	0,8
Michelin Alpin 6	225 45 R17	WR	56	0,8
Michelin Pilot Sport 5	225 40 R18	SR	56	0,8
Viking WinTech	215 55 R17	WR	56	0,8
Dunlop Winter Sport 5	205 55 R16	WR	57	0,8
Goodyear Ultra Grip Performance 3	205 55 R16	WR	57	0,8
Goodyear Vector 4Seasons Gen-3	205 55 R16	AS	57	0,8
Hankook Winter i*cept RS3	215 55 R17	WR	57	0,8
Triangle WinterX TW401	215 55 R17	WR	58	0,8
Continental Winter Contact TS 870	205 55 R16	WR	59	0,8
Hankook Ventus Prime4	215 55 R17	SR	59	0,8
Kenda Kenetica 4S	205 55 R16	AS	59	0,8
Kenda Wintergen 2 KR501	215 55 R17	WR	59	0,8
Kumho WINTERCRAFT WP52	225 45 R17	WR	59	0,8
Semperit Speed-Grip 5	215 55 R17	WR	59	0,8
Toyo Celsius AS2	205 55 R16	AS	59	0,8
Continental Premium Contact 7	215 55 R17	SR	60	0,8
Vredestein Quatrac	205 55 R16	AS	60	0,8
Goodyear Efficient Grip Performance 2	205 55 R16	SR	61	0,8
Kormoran SNOW	225 45 R17	WR	61	0,8
Winrun Winter-max A1 WR22	205 55 R16	WR	61	0,8

Manufacturer	Dimension	Type	Tyre abrasion [mg/km/t]	Estimation of abrasion index accord-ing toUNECE method*
Falken Azenis FK520	225 40 R18	SR	62	0,9
Nokian Tyres Snowproof 2	205 55 R16	WR	62	0,9
Vredestein Wintrac	205 60 R16	WR	62	0,9
Continental Sport Contact 7	225 40 R18	SR	63	0,9
Sava All Weather	205 55 R16	AS	63	0,9
Bridgestone Potenza Sport	225 40 R18	SR	64	0,9
Continental Winter Contact TS 870 P	215 55 R17	WR	64	0,9
Kleber Dynaxer HP4	205 55 R16	SR	64	0,9
Maxxis Premitra Snow WP6	215 55 R17	WR	64	0,9
Continental Winter Contact TS870	225 45 R17	WR	65	0,9
Dunlop Winter Sport 5	225 45 R17	WR	65	0,9
Fulda Kristall Control HP 2	205 60 R16	WR	65	0,9
Vredestein Wintrac Pro	225 45 R17	WR	65	0,9
Austone Athena SP-901	205 60 R16	WR	67	0,9
Goodyear Ultra Grip Performance +	225 45 R17	WR	67	0,9
Riken Road Performance	205 55 R16	SR	67	0,9
Semperit Speed-Life 3	215 55 R17	SR	67	0,9
Hankook Ventus Prime4	205 55 R16	SR	68	0,9
Nokian Tyres Powerproof 1	225 40 R18	SR	68	0,9
Nokian Tyres WR Snowproof	225 45 R17	WR	68	0,9
Dunlop Winter Sport 5	205 60 R16	WR	69	1,0
Dunlop Winter Sport 5	215 55 R17	WR	69	1,0
Firestone Roadhawk	205 55 R16	SR	69	1,0
Kumho Solus 4S HA32+	205 55 R16	AS	69	1,0
Continental Premium Contact 6	205 55 R16	SR	70	1,0
Fulda Eco Control HP2	205 55 R16	SR	70	1,0
Hankook Winter i*cept RS3	205 60 R16	WR	70	1,0
Linglong Sport Master	215 55 R17	SR	70	1,0
Semperit Speed-Grip 5	225 45 R17	WR	70	1,0
Vredestein Wintrac Pro	215 55 R17	WR	70	1,0
Apollo ASPIRE XP WINTER	225 45 R17	WR	71	1,0
Barum POLARIS 5	205 60 R16	WR	71	1,0
BF Goodrich Advantage	205 55 R16	SR	71	1,0
Continental Winter Contact TS 870 P	205 60 R16	WR	71	1,0
Falken Eurowinter HS02	205 55 R16	WR	71	1,0
Kumho Winter Craft WP52	215 55 R17	WR	71	1,0
Uniroyal AllSeason Expert 2	205 55 R16	AS	71	1,0
Evergreen EH 226	205 55 R16	SR	72	1,0

Manufacturer	Dimension	Type	Tyre abrasion [mg/km/t]	Estimation of abrasion index according to UNECE method*
Falken Ziex ZE 310 EcoRun	215 55 R17	SR	72	1,0
GT Radial WinterPro2 Evo	205 55 R16	WR	72	1,0
Pirelli Cinturato All Season SF2	205 55 R16	AS	72	1,0
Vredestein Wintrac	205 55 R16	WR	72	1,0
Zeetex WH 1000	205 55 R16	WR	72	1,0
Bridgestone Turanza 6	215 55 R17	SR	73	1,0
Bridgestone Turanza T005	205 55 R16	SR	73	1,0
Petlas Imperium PT515	205 55 R16	SR	73	1,0
Pirelli Cinturato Winter 2	215 55 R17	WR	73	1,0
Rotalla RH 01	205 55 R16	SR	73	1,0
Debica Presto HP 2	205 55 R16	SR	74	1,0
ESA+TECAR SPIRIT PRO	205 55 R16	SR	74	1,0
Falken EuroAll Season AS210	205 55 R16	AS	74	1,0
Goodyear Eagle F1 Asymmetric 6	225 40 R18	SR	74	1,0
Goodyear UltraGrip 9+	205 60 R16	WR	74	1,0
Hankook Winter i*cept RS3	225 45 R17	WR	74	1,0
Hifly HF 201	205 55 R16	SR	74	1,0
Minerva F 209	205 55 R16	SR	74	1,0
Nexen N´Fera Primus	215 55 R17	SR	74	1,0
Pirelli Cinturato Winter 2	225 45 R17	WR	74	1,0
Premiorri Solazo	205 55 R16	SR	74	1,0
Nexen N Fera Sport	225 40 R18	SR	75	1,0
Sava eskimo hp2	225 45 R17	WR	75	1,0
Falken Eurowinter HS02	205 60 R16	WR	76	1,1
Falken ZIEX ZE310 ECORUN	205 55 R16	SR	76	1,1
General Tire Altimax One S	205 55 R16	SR	76	1,1
Lassa Driveways	205 55 R16	SR	76	1,1
Syron Premium Performance	225 40 R18	SR	76	1,1
Tomket Sport	205 55 R16	SR	76	1,1
Toyo Proxes Comfort	205 55 R16	SR	76	1,1
Vredestein Ultrac Pro	225 40 R18	SR	76	1,1
Nankang Cross Seasons AW-6	205 55 R16	AS	77	1,1
Lassa Snoways 4	205 60 R16	WR	78	1,1
Viking Protech Newgen	205 55 R16	SR	78	1,1
Davanti Wintoura +	215 55 R17	WR	79	1,1
King Meiler Sport1	205 55 R16	SR	79	1,1
Kumho Ecsta HS52	205 55 R16	SR	79	1,1

Manufacturer	Dimension	Type	Tyre abrasion [mg/km/t]	Estimation of abrasion index according to UNECE method*
Pirelli Cinturato Winter 2	205 55 R16	WR	79	1,1
Semperit SPEED-LIFE 3	205 55 R16	SR	79	1,1
Berlin Tires Summer UHP 1 G2	205 55 R16	SR	80	1,1
Dunlop Sport BluResponse	205 55 R16	SR	80	1,1
Dunlop Sport Maxx RT2	215 55 R17	SR	80	1,1
Ceat SportDrive	225 40 R18	SR	81	1,1
Debica Presto UHP 2	215 55 R17	SR	81	1,1
Firestone Firehawk Sport	225 40 R18	SR	81	1,1
Giti GitiSynergy H2	205 55 R16	SR	81	1,1
Norauto Prevensys 4	225 40 R18	SR	81	1,1
Sailun Atrezzo ZSR2	215 55 R17	SR	81	1,1
Sava Intensa HP2	205 55 R16	SR	81	1,1
Barum Bravuris 5HM	205 55 R16	SR	82	1,1
Giti GitiWinter W2	215 55 R17	WR	82	1,1
Pirelli Cinturato P7 C2	205 55 R16	SR	82	1,1
Bridgestone Blizzak LM 005	205 60 R16	WR	83	1,2
Firestone Winterhawk 4	215 55 R17	WR	83	1,2
Fulda SportControl 2	215 55 R17	SR	83	1,2
GT Radial FE2	205 55 R16	SR	84	1,2
Yokohama BluEarth-WINTER V906	225 45 R17	WR	84	1,2
Kumho Ecsta PS71	225 40 R18	SR	86	1,2
Toyo Proxes Sport 2	225 40 R18	SR	86	1,2
Apollo Alnac 4G	205 55 R16	SR	87	1,2
Goodride Solmax 1	215 55 R17	SR	87	1,2
Kenda Kenetica Pro KR210	205 55 R16	SR	87	1,2
Firestone Multiseason2	205 55 R16	AS	88	1,2
Giti GitiWinter W2	225 45 R17	WR	88	1,2
Nexen N´Fera Primus	205 55 R16	SR	88	1,2
Semperit AllSeason-Grip	205 55 R16	AS	88	1,2
Firestone WINTERHAWK 4	205 60 R16	WR	89	1,2
Uniroyal Winter Expert	205 60 R16	WR	90	1,3
Dunlop Sport Maxx RT2	225 40 R18	SR	91	1,3
Nokian Tyres Wetproof	205 55 R16	SR	91	1,3
Westlake Z-107	205 55 R16	SR	92	1,3
Yokohama BluEarth-4S	205 55 R16	AS	92	1,3
Uniroyal RainSport 5	205 55 R16	SR	93	1,3
Norauto Prevensys 4	205 55 R16	SR	94	1,3

Manufacturer	Dimension	Type	Tyre abrasion [mg/km/t]	Estimation of abrasion index accord-ing toUNECE method*
Yokohama Advan Sport V107	225 40 R18	SR	95	1,3
Yokohama BluEarth-Winter V906	215 55 R17	WR	95	1,3
Delinte DH 2	205 55 R16	SR	96	1,3
Laufenn S Fit EQ+	205 55 R16	SR	97	1,3
Cooper ZEON CS8	205 55 R16	SR	98	1,4
Giti GitiSport S2	225 40 R18	SR	98	1,4
Bridgestone Blizzak LM005	225 45 R17	WR	99	1,4
Radar RPX 800	205 55 R16	SR	101	1,4
Vredestein Ultrac	215 55 R17	SR	103	1,4
Zeetex ZT 1000	205 55 R16	SR	113	1,6
Avon ZV7	205 55 R16	SR	126	1,8

* The test methodology used in the ADAC tyre tests from 2023 and 2024 does not consistently correspond to the specifications of the UNECE test methodology, and no corresponding UNECE reference tyre was used in the earlier tests. The calculated tyre abrasion index (AICT) is therefore only an estimate. A uniform abrasion value of 72 mg/km/t was assumed for the reference tyre as the basis for the calculation. This corresponds to the average abrasion value of the SRTT reference tyre from the 2025 summer tyre test after a driving distance of 15,000 km.
SR = summer tyres, WR = winter tyres, AS = all-season tyres

Appendix 2 - Route validation

The route validation was carried out with a vehicle convoy consisting of four vehicles. In addition to the reference tyre (SRTT) approved by the ETRTO, three other summer tyres were selected, which were defined by the TFTA during the validation phase of the test method. The four tyres achieved the following abrasion values: Brand

Brand	Model	Tyre dimension	Abrasion [mg/km/t]	Abrasion index
Reference tyres	**SRTT**	**225/45 R17**	**69,8**	**-**
Goodyear	Efficient Grip Performance 2	225/45 R17	71,8	1,03
Continental	Premium Contact 6	205/55 R16	75,3	1,08
Pirelli	P Zero	235/35 ZR19	102,9	1,47

Test no.	Manufacturer	Name	DOT	LI	SI	Convoy No.
5	BF Goodrich	Summer SRTT				2
6	Goodyear	Efficient Grip Performance 2	1DL7R JKXR 1824	94	W	2
7	Continental	Premium Contact 6	HW0F D8P0 0522	91	V	2
8	Pirelli	P Zero	XB V0 019H 1123	91	Y	2

The measurements were taken between April and May 2024. In total, data from around 7700 km was recorded and analysed. The following diagrams show the recorded forces and the evaluation over the entire route.

Note: Until the end of 2024, the ADAC documented the distance travelled and the forces occurring in the vehicle using a measuring system from Messwerk. However, the file type generated is not compatible with the ETRTO evaluation tool. To ensure that the recorded values can still be analysed with the ETRTO tool, the Racelogic V-Box was used to document the test. This was due to some GPS failures that led to gaps in the track during compression. Despite the difficulties in data acquisition, it was possible to create and merge most of the high-quality data from the summer SRTT. However, this led to a delay in the completion of the project.

Test conditions

Test period: 04.2024 - 05.2024

Test vehicle: VW Golf VIII 1.5 TSI

Vehicle weight vehicles 1 and 2: 1,663 kg

Vehicle weight Vehicles 3 and 4: 1,596 kg

Loaded weight 1: Car 1 & 2

FL: Driver

FR: Dummy+ Water tank 30L RR:

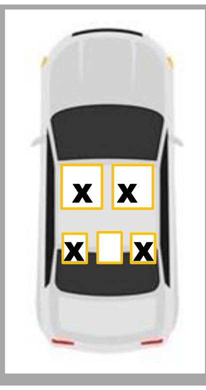
Dummy

RL: Dummy

Total weight [kg]: **1.663**

Position: FL
Target load [kg]
500
Real load [kg]
470

Position: FR
Target load [kg]
500
Real load [kg]
457



Position: RL
Target load [kg]
365
Real load [kg]
368

Position: RR
Target load [kg]
365
Real load [kg]
368

Car 1	**SRTT**
Car 2	**EGP 2**

Loaded weight 2: Car 3 & 4

FL: Driver

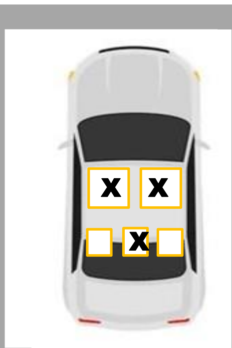
FR: Dummy+ Water tank 30L

Rear Centre: Dummy

Total weight [kg]: **1.596**

Position: FL
Target load [kg]
480
Real load [kg]
464

Position: FR
Target load [kg]
480
Real load [kg]
454



Position: RL
Target load [kg]
325
Real load [kg]
339

Position: RR
Target load [kg]
325
Real load [kg]
339

Car 3	**PC 6**
Car 4	**PZERO 4**

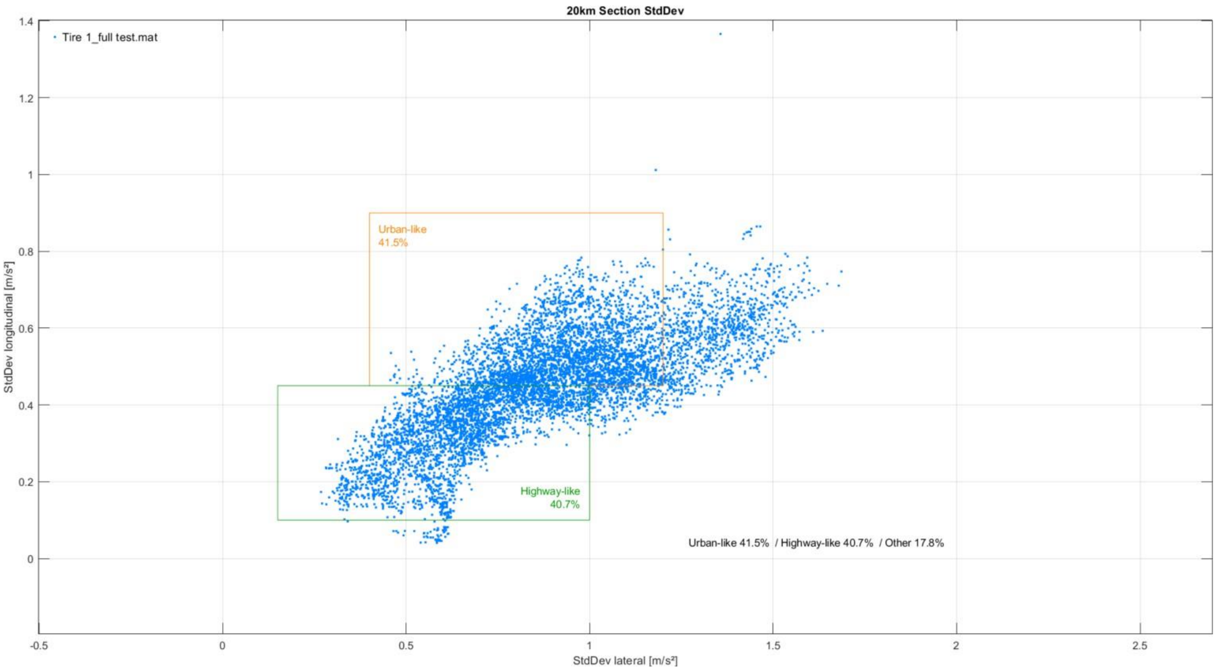
Chassis adjustment Wheel alignment before and after the tests
Conspicuousness none

Details Wheel alignment protocols are available

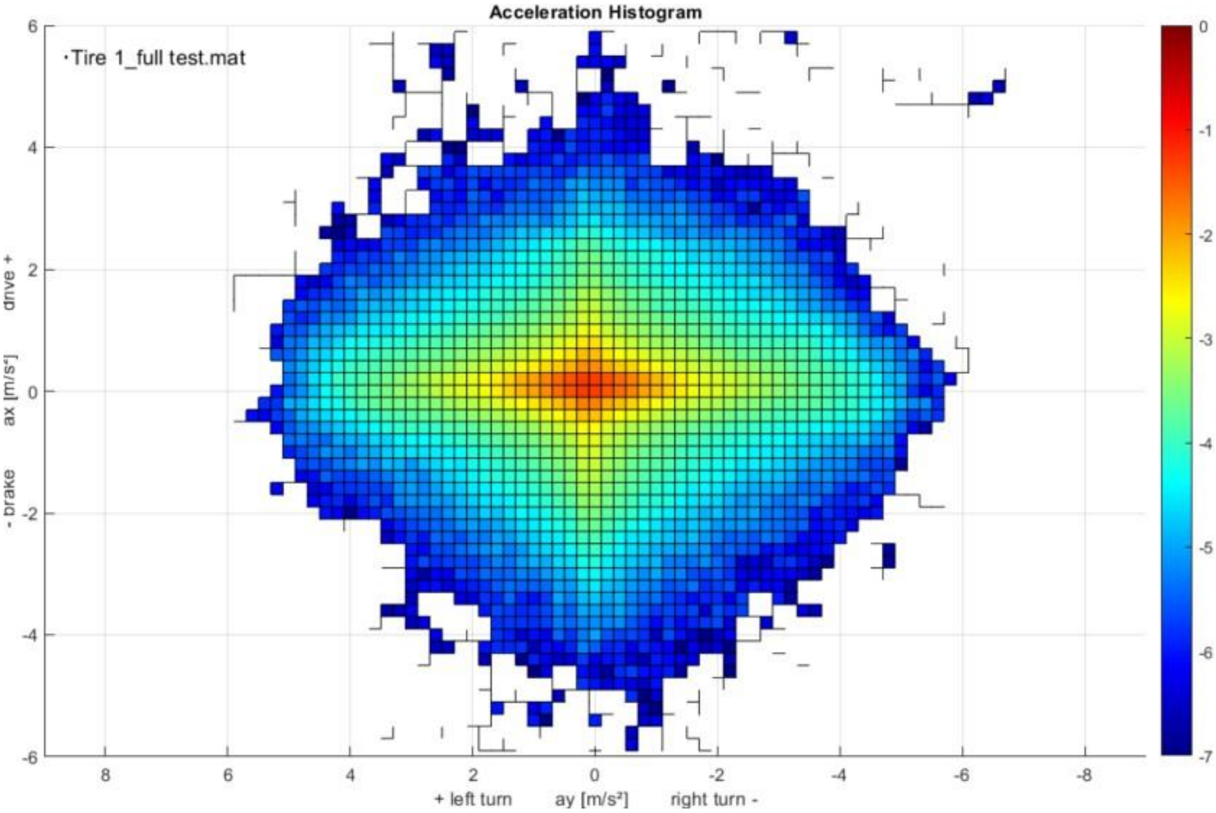
Tyre/rim size Summer tyres SRTT:	225/45 R17 on 7.5 J x 17 H2 ET51
Tyre/rim size Goodyear:	225/45 R17 on 7.5 J x 17 H2 ET51
Tyre/rim size Continental:	205/55 R16 on 6.5 J x 16 H2 ET46
Tyre/rim size Pirelli:	235/35 ZR19 on 8 J x 19 H2 ET49

Tyre pressure front/rear:	2.5 bar / 2.5 bar
Tyre pressure check:	daily before departure

Tyre 1, 20km Section StdDev, 7,700km:



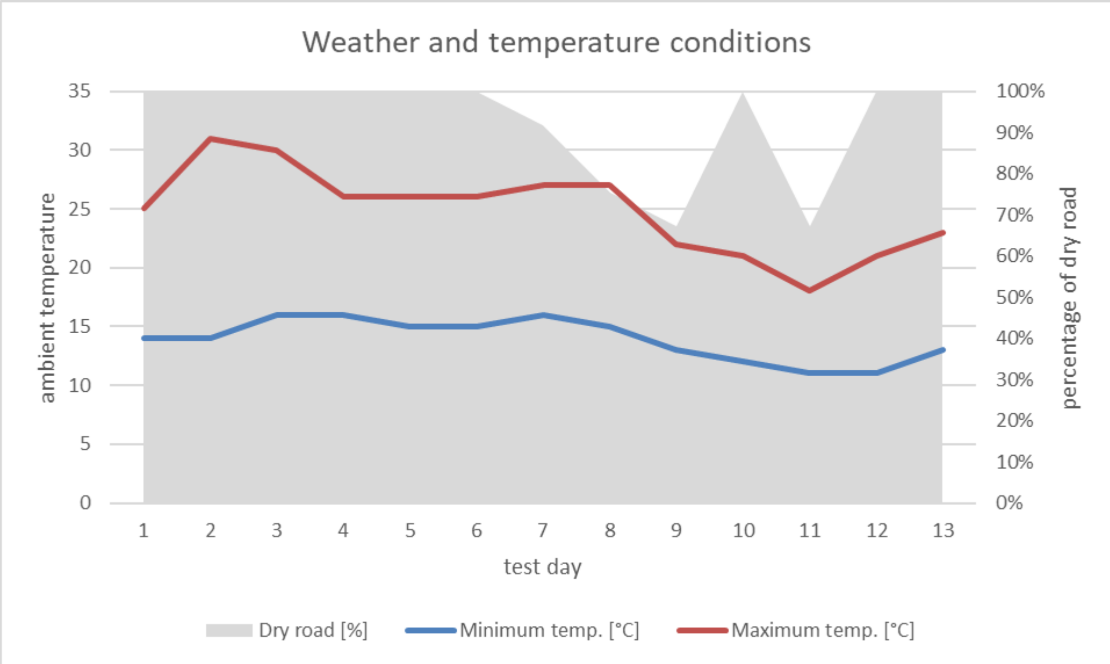
Tyre 1, acceleration histogram, 7,700 km:



Tyre 1, StdDev evaluation, 7,700km:

	StdDev Acc long	StdDev Acc Lat	Max Acc Long	Max Acc Lat	Urban-like Acc	Highway-like Acc	Max Speed	<60 km/h	60-90 km/h	>90 km/h
Limit	0.45 m/s²	0.93 m/s²	5 m/s²	5 m/s²	≥ 25%	≥ 35%	140 km/h	≥ 10%	≥ 25%	≥ 35%
Tolerance	±10%	±10%	< 0.02% distance	< 0.1% distance			< 0.5% distance			
Tire 1_full test.mat	0.479 m/s²	0.922 m/s²	9.49 m/s²	6.76 m/s²	41.5 %	40.7 %	289 km/h	15.0 %	27.0 %	58.0 %
	6.4 %	-0.9 %	0.016 %	0.018 %			0.020 %			

Weather conditions :



Summary of track validation tyre wear

Summary abrasion									
Fire	**Model**	**Tyre size**	**Vehicle weight [kg]**	**distance [km]**	**FL [mg/km*t]**	**FR [mg/km*t]**	**RL [mg/km*t]**	**RR [mg/km*t]**	**Vehicle [mg/km*t]**
BF Goodrich	**Summer SRTT**	**225/45 R17**	1.663	7.930	24,5	24,1	10,5	10,8	**69,8**
Goodyear	**Efficient Grip Performance 2**	**225/45 R17**	1.663	7.930	26,2	25,8	9,9	9,9	**71,8**
Continen-tal	**Premium Con-tact 6**	**205/55 R16**	1.596	7.930	27,6	29,6	9,0	9,1	**75,3**
Pirelli	**P Zero**	**235/35 ZR19**	1.596	7.930	37,8	38,2	13,3	13,6	**102,9**

The axle settings of the test vehicles were checked and documented before the start and after the end of the test. All axle setting values were consistently within the specifications.

Detailed test track

Total distance:	610 km
Distance travelled city/country road:	368 km
Motorway distance:	242 km
Proportion of urban/rural road journeys:	60%
Proportion of motorway journeys:	40%

Tour 1: Unclockwise, starting direction: Memmingen	**total: 305 km**	
Sector	**Country Road**	**Motorway**
ADAC workshop tyre test Landsberg BAB 96 - entrance ramp no. 25: Landsberg am Lech Nord	3 km	
BAB 96 - entrance ramp no. 25: Landsberg am Lech Nord BAB 96 - exit ramp no. 19: Mindelheim		28 km
BAB 96 - exit ramp no. 19: Mindelheim BAB 7 - entrance ramp no. 132: Dietmannsried	54 km	
BAB 7 - entrance ramp no. 132: Dietmannsried BAB 7 - exit ramp no. 138: Nesselwang		30 km
BAB 7 - exit ramp no. 138: Nesselwang BAB 95 - entrance ramp no. 9: Sindelsdorf	103 km	
BAB 95 - entrance ramp no. 9: Sindelsdorf BAB 952 - exit ramp no.1: Starnberg		40 km
BAB 952 - exit ramp no.1: Starnberg BAB 96 - entrance ramp no. 30: Inning a. Ammersee	24 km	
BAB 96 - entrance ramp no. 30: Inning a. Ammersee BAB 96 - exit ramp no. 25: Landsberg a. Lech		23 km
Total kilometres Tour 1: 184 km 121 km		

Tour 2:	Clockwise, starting direction: Munich	total: 305 km	
Sector		**Country Road**	**Motorway**
BAB 96 - entrance ramp no. 25: Landsberg am Lech Nord BAB 96 - exit ramp no. 30: Inning a. Ammersee			23 km
BAB 96 - exit ramp no. 30: Inning a. Ammersee BAB 952 - entrance ramp no.1: Starnberg		24 km	
BAB 952 - entrance ramp no.1: Starnberg BAB 95 - exit ramp no. 9: Sindelsdorf			40 km
BAB 95 - exit ramp no. 9: Sindelsdorf BAB 7 - entrance ramp no. 138: Nesselwang		103 km	
BAB 7 - entrance ramp no. 138: Nesselwang BAB 7 - exit ramp no. 132: Dietmannsried			30 km
BAB 7 - exit ramp no. 132: Dietmannsried BAB 96 - entrance ramp no. 19: Mindelheim		54 km	
BAB 96 - entrance ramp no. 19: Mindelheim BAB 96 - exit ramp no. 25: Landsberg am Lech Nord			28 km
BAB 96 - exit ramp no. 25: Landsberg am Lech Nord ADAC workshop tyre test Landsberg		3 km	
Total kilometres Tour 2:	**184 km 121 km**		

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