Expert Statement

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DEKRA

DAkkS Deutsche Akkreditierungsstelle D-PL-17438-01-00

Client	Gustav Magenwirth GmbH & Co. KG Stuttgarter Str. 48 72574 Bad Urach	
Product	Brake distribution system for hydraulic brakes on EPAC	
Type	IBS (Integral Braking System), as of 05-2025	
Manufacturer	Gustav Magenwirth GmbH & Co. KG Stuttgarter Str. 48 72574 Bad Urach	
Task	Expert statement on the performance and practical suitability of a Magura IBS (= Integral Braking System) brake distribution system for hydraulic brakes on EPACs	
Tests / Test basis	Test bench measurement of brake distribution and braking force in accordance with DIN EN 15194:2023 Bicycles – Electrically assisted cycles – EPAC Section 4.3.5.9 Braking performance at 12.5 km/h	**Accredited**
	Measurement of braking deceleration and braking distance by test subjects in an open field test during emergency braking from 20 km/h Evaluation of braking behaviour in an open field test with high load weight and driving speeds of more than 40 km/h	**Not accredited**
Date	14-08-2025	

1. General information

1.1 Task and test programme

The aim of this investigation is to determine whether the braking system fulfils the functions, performance characteristics and safety-related properties guaranteed by the manufacturer.

These are essentially

- Measurably shorter braking distance and thus greater deceleration values during emergency braking compared to one-handed rear wheel braking with the same force
- Constant ratio of brake force distribution between front and rear wheels, regardless of the amount of handbrake force applied
- Intuitive one-hand braking without loss of control for inexperienced or uncertain riders with little or no riding experience
- Unrestricted switching between one-hand and two-hand braking without loss of functionality of two independently operating braking systems
- Unrestricted driving stability with one-handed all-wheel braking, even on longer downhill stretches with a high total load and fast cornering with tight radii

1.2 Functional principle of the tested system

The IBS from MAGURA is a hydraulic brake force distribution system that was also developed for use on cargo bikes (e-cargo bikes) and other L-vehicles.

The primary function of the system is to distribute the braking force between **the front and rear brakes** when the handbrake lever for **the rear brake** is actuated. In this system, the distribution ratio between the front and rear brakes is approximately 30:70.

The system is based on a purely hydraulic coupling of the front and rear brake lines (no additional electronic control elements). When the brake lever for the rear brake (installed on the right-hand side of the handlebars on the test bikes) is applied, a fixed proportion of the brake pressure is transferred to the front brake circuit. The braking effect is thus applied to both wheels, even though only the rear brake lever has been actuated.

If both brake triggers are used (two-handed braking), the brake pressure on the front wheel will act as if there were no brake pressure distribution system. The brake distribution function is then suspended or takes a back seat. This works from a hand brake force of approx. 20 N.

The IBS system is only designed for use with specific MAGURA brake systems. It is integrated into suitable EPAC brake systems at the factory and provides a solution for brake force distribution that is tailored to the intended use. In particular, individual adjustment to the braking requirements by the end user (customising) is not intended. This means that setting errors cannot occur.

Figure 1: Simplified representation of the brake distribution system; source: Gustav Magenwirth GmbH & Co. KG

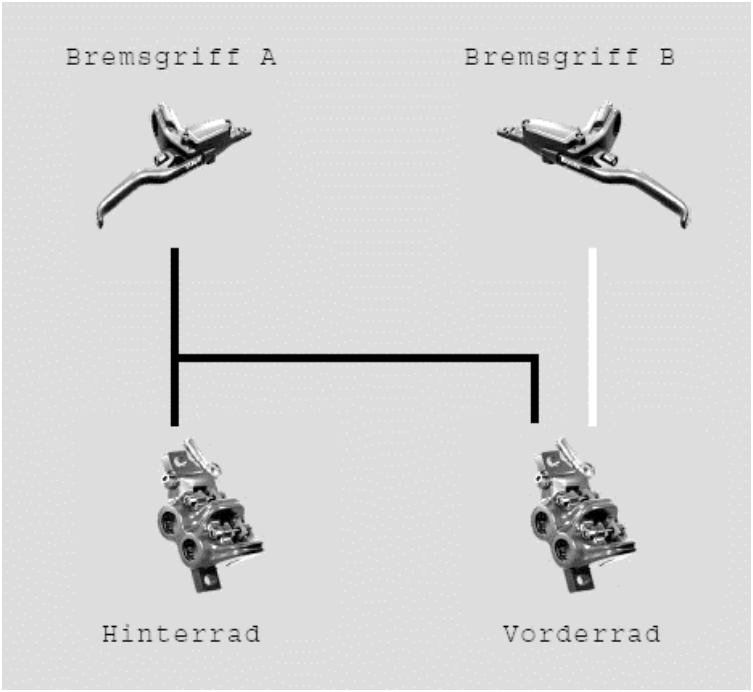


Figure 2: Schematic representation of the brake distribution system Source: Gustav Magenwirth GmbH & Co. KG

Installation situation using the example of the test model used (e-cargo bike of the type "CaGo FS 200 Family")

Figure 3 and Figure 4: Example bicycle with detailed view of the installed brake distribution system; source: Gustav Magenwirth GmbH & Co. KG

Description of the test samples	**Test sample 1**	**Test sample 2**
Test sample number	PM ST 06358	PM ST 06359
Model designation	CAGO FS 200 Family	CAGO FS 200 Family
Net weight / permissible total weight	70 kg/ 225 kg	70 kg/ 225 kg
Motor / battery capacity	Bosch Performance CX Cargo Line / 625 Wh	Bosch Performance CX Cargo Line / 625 Wh
Gear	Hub gears Enviolo Automatiq	Hub gear Enviolo Automatiq
Front fork:	SR SUNTOUR Mobie 32 suspension fork with thru axle	SR SUNTOUR Mobie 32 suspension fork with thru axle
Tyres	Front wheel: Schwalbe Big Ben Performance balloon tyre (55-406) Rear wheel: Schwalbe Super Moto-X balloon tyre (70-584)	Front wheel: Schwalbe Big Ben Performance balloon tyre (55-406) Rear wheel: Schwalbe Super Moto-X balloon tyre (70-584)
Brake distribution system	IBS	Not available
Brake system	Front wheel; hydraulic, 2-piston, Ø brake disc = 203 mm Brake pads as good as new, run in, MAGURA CMe 4 Rear wheel: hydraulic, 4-piston, Ø brake disc = 220 mm Brake pads as good as new, bedded in, model MAGURA CMe 5	Front wheel; hydraulic, 2-piston, Ø brake disc = 203 mm Brake pads as good as new, bedded in, MAGURA CMe 4 Rear wheel: Hydraulic, 4-piston, Ø brake disc = 220 mm Brake pads as good as new, bedded in, model MAGURA CMe 5

Table 1: Description of test samples

Figure 5: Test sample with IBS system installed

Figure 6: Test sample without IBS system

1.2 Testing and test results

The test results refer only to the tested samples or products from the same production facility that correspond to the sample.

1.3 Use of the expert statement

The expert statement may only be distributed in its entirety and without modification. The use of excerpts, reproduction or distribution of the expert statement itself by the client or its authorised representative requires the written consent of DEKRA Testing and Certification GmbH.

1.4 Procedure and description of the tests

As part of this expert statement, the IBS from MAGURA was tested and evaluated under defined conditions. The aim was to test the braking performance, responsiveness and system stability in realistic and technically defined scenarios. The assessment is based on the following methodologically different sub-tests.

1. Test bench measurement – braking force and brake distribution
2. Open field measurement with emergency braking
3. Open field test with experienced drivers on a downhill section with tight curve radii

1.5 Location and date of the tests

Test location 1: DEKRA Testing and Certification GmbH, EMM Laboratory Stuttgart, Handwerkstraße 17, 70565 Stuttgart Unless otherwise specified, all tests are carried out at 20 ± 5 °C and 35–65% relative humidity

Date: 7 May 2025 – 8 May 2025

Test location 2: Open field test track: Feldweg Stuttgart Möhringen-Süd, 70565 Stuttgart

Date: 20 May 2025 – 21 May 2025

Test location 3: Open field section: Alte Oberlenninger Steige, 73252 Lenningen

Date: 11 June 2025

1.6 Test categories

1.6.1 Test bench measurement – braking force and brake distribution

The braking performance was tested on the test bench in accordance with the current standard EN 15194:2023.

The braking force and brake distribution are measured at defined handbrake forces (40 N, 60 N, 80 N). The braking force describes the force actually acting on the wheel that decelerates the vehicle. The brake distribution, on the other hand, provides information about how this force is distributed between the front and rear wheels.

1.6.2. Open field measurement with emergency braking

As part of this open field measurement, emergency braking was carried out with several test subjects under realistic conditions.

1.6.3. Open field test with experienced riders on a downhill section with tight curve radii

As part of this test section, the brake distribution system was evaluated by experienced e-bike and e-cargo bike riders on a steep descent approximately 4 kilometres long. The descent was chosen so that high descent speeds in combination with tight cornering could be achieved under realistic conditions.

Following the test rides, the test subjects were asked about their riding behaviour, the responsiveness of the brakes and their subjective feeling of safety using a standardised questionnaire. No measuring systems were used.

2. Testing and test results

2.1. Test bench measurement – braking force and brake distribution

The test was carried out on a test bench in accordance with the test procedure specified in standard EN 15194: 2023, section 4.3.5.9.5, Test procedure for brake tests.

Figure 7: Test specimen 1 on the brake test bench

Test parameters:

Speed of the brake roller:	12.5 km/h
Handbrake force on rear wheel brake lever:	40 N, 60 N, 80 N
Laboratory conditions Temperature	21 °C
Weight load sample:	130 kg

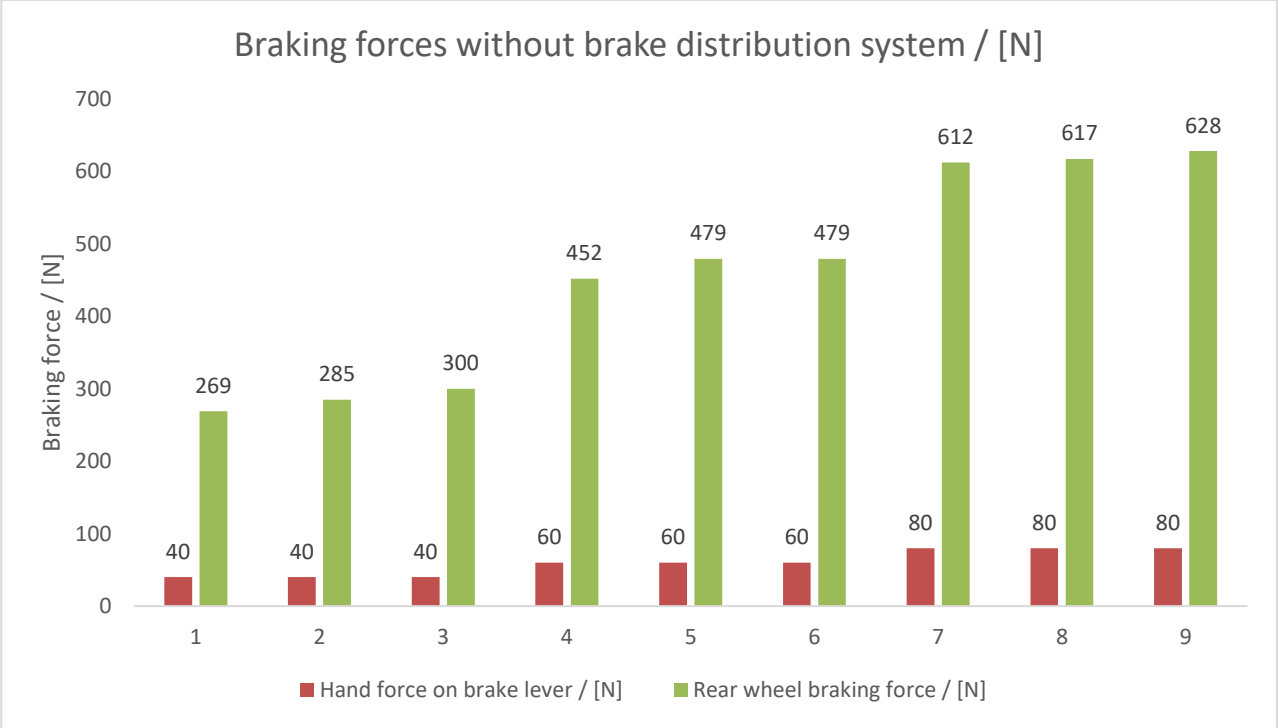


Diagram 1: Braking performance without brake distribution system

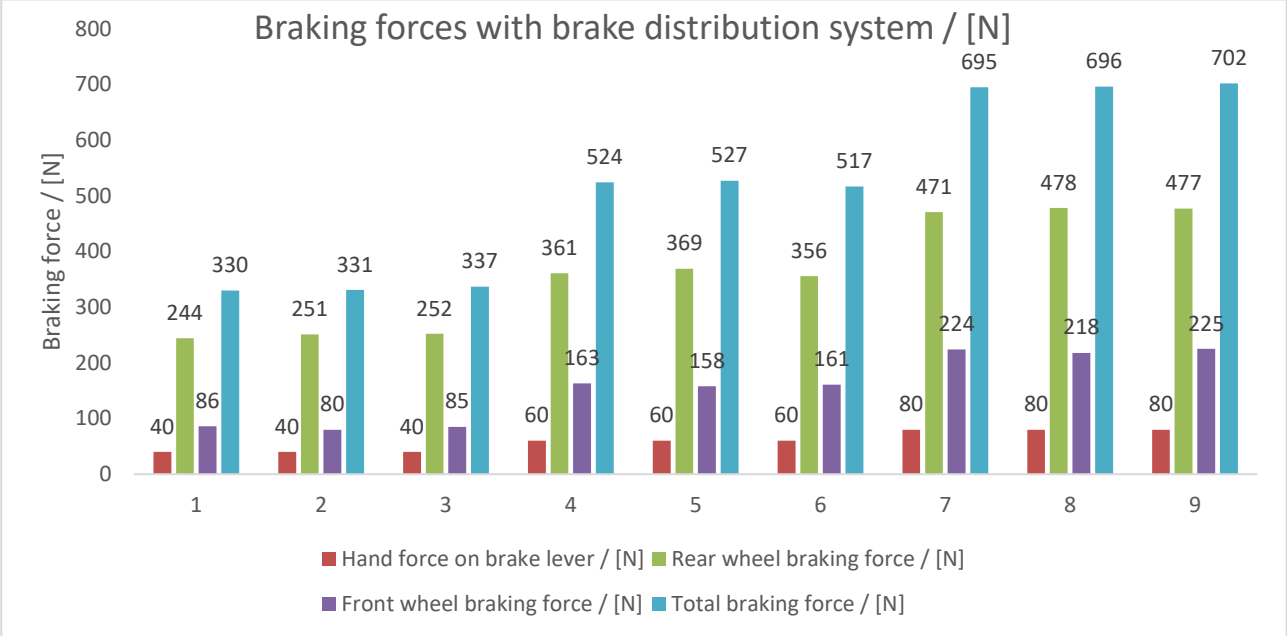


Diagram 2: Braking performance with brake distribution system

Result:

The measurable total deceleration when applying the rear brake with IBS results in a higher overall braking force with constant handbrake forces.

The distribution thus not only results in all-wheel braking, but also higher resulting braking forces in relation to the same contact area of the tyres.

The brake force distribution works reliably within the specified parameters. The response was precise and reproducible. No abnormalities or failures were detected.

Compared to manual two-hand braking, the system is superior when the user's ability to coordinate the handbrake forces cannot rule out front wheel lock-up.

The braking force of a brake force distribution system can also be achieved by experienced drivers using two-hand braking.

2) Open field measurement with emergency braking

To analyse the braking behaviour, both cargo bikes were tested in a second test section with the following parameters:

Test location: The driving and braking tests were carried out on a clear, level, asphalted dirt road approx. 300 m as the crow flies from the DEKRA laboratory, Handwerkstr. 17, 70565 Stuttgart.

Image 8: Aerial photograph, source: Google Maps

Each test person was given ample opportunity to familiarise themselves with the test bikes. This was done through test rides without measurement.

Each of the test subjects then performed emergency braking manoeuvres with each of the two test bikes. For this purpose, the test subjects were instructed to accelerate to 25 km/h in the area marked in yellow and then brake to a standstill. The front brake lever was not usable on either of the test bikes. The test bike was equipped with the following measurement technology.

- Acceleration sensor
- GPS transmitter
- Data logger with power supply

This measurement technology allowed the measurement of acceleration or deceleration, travel time and position during each test ride.

The total weight of the rider, load and test bike was always set to 180 kg by adding or removing weight bags. This meant that the individual body weight of the test subjects was irrelevant to the system weight.

The tyre pressure was set to 90% of the maximum permissible tyre pressure.

Setup of the test sample for open field measurement:

Figure 9: CAGO FS200 Family test bike equipped with data logger and GPS tracker

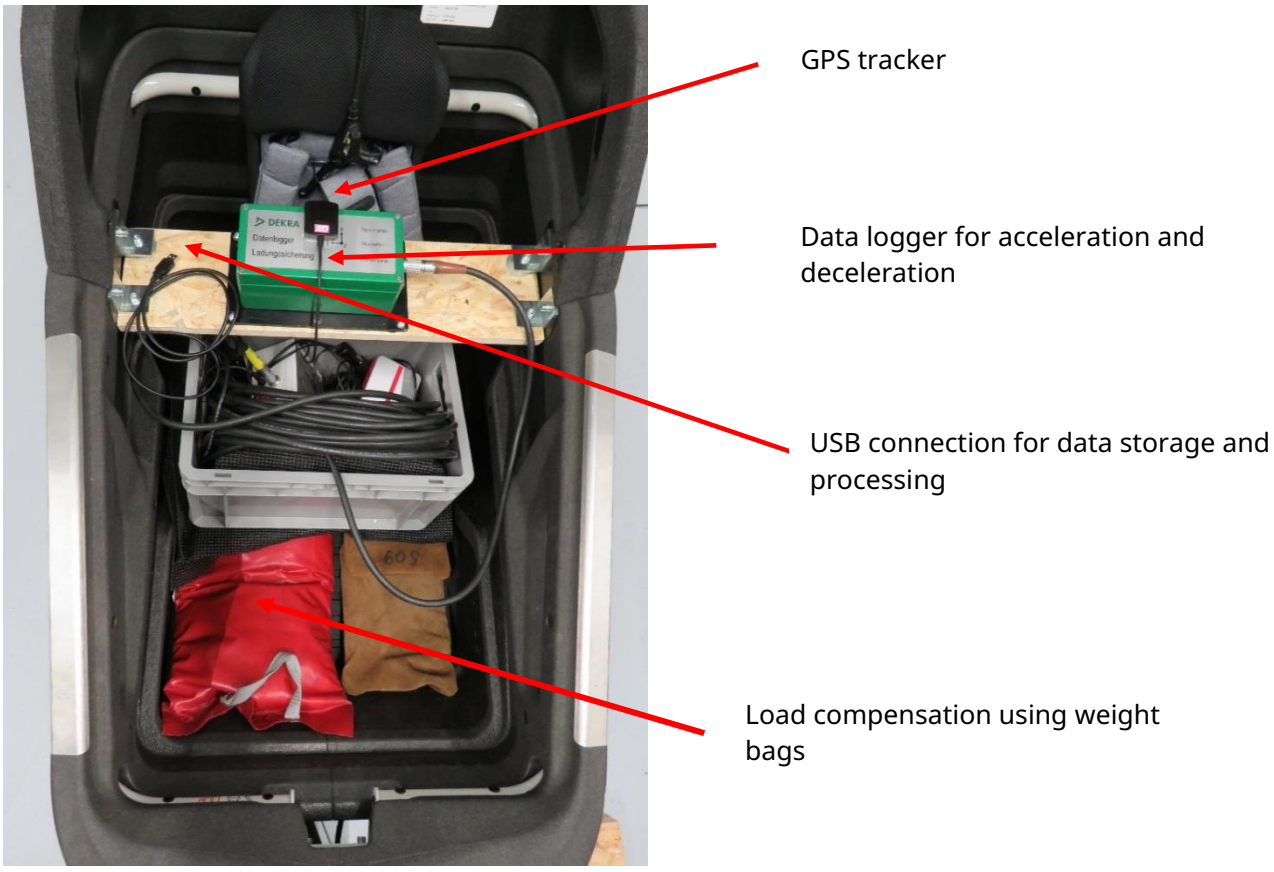


Figure 10: Loading the transport box – detailed view from above

The test was carried out in dry driving conditions. The brakes were fully applied on the brake test bench. The outside temperature was approximately 25 °C.

The test subjects consisted of 6 males and 1 female. Their ages ranged from 25 to 60. Both experienced and inexperienced e-bike riders were included in the test group.

The test subjects were not aware of whether or not a brake distribution system was installed. They were only told that one of the test bikes had a brake distribution system and the other did not.

Braking deceleration and braking distance per test subject and test ride				
Test subject/ Test subject	Braking deceleration without IBS / [m/s²]	Braking deceleration with IBS / [m/s²]	Braking distance without IBS / [m]	Braking distance with IBS / [m]
1	3.5	6.0	8.1	7.7
1	3.3	5.8	8.8	6.5
1	3.4	5.4	8.4	7.9
2	3.5	6.0	8.3	5.5
2	3.7	5.9	8.0	5.3
2	3.1	6.5	9.0	4.8
3	3.7	4.6	10.0	6.0
3	3.6	4.3	10.6	7.8
3	*	*	*	*
4	3.7	6.3	6.7	5.7
4	3.7	6.5	8.0	5.3
4	3.7	6.5	7.2	5.3
5	3.7	5.9	13.9	5.2
5	3.7	6.7	12.4	5.6
5	3.9	6.3	11.8	6
6	2.8	5.6	11.2	5.6
6	2.8	5.1	8.6	6.8
6	*	5.8	*	5.6
7	3.5	5.8	7.5	6.1
7	3.0	6.0	8.5	5.6
7	3.4	5.6	8.4	6.5

Table 1: Presentation of deceleration values and braking distances by test subject

* *Note on data evaluation:*
Not all of the recorded measurement data could be evaluated in the series of tests carried out. Due to technically incomplete signal transmission (e.g. connection problems) or incomplete emergency braking, individual data sets are only available in fragmentary form or not at all. For this reason, certain measured values are missing from the evaluation.

Calculation of the mean values for braking deceleration and braking distance across all test subjects:

Average braking deceleration with IBS:	**5.8 m/s²**
Average braking distance with IBS:	**5.9 m**
Average braking deceleration without IBS:	**3.5 m/s²**
Average braking distance without IBS:	**8.8 m**

Result:

With IBS active, a significantly higher average braking deceleration of 5.8 m/s² was achieved, resulting in a significantly shorter average braking distance of 5.9 m per emergency braking manoeuvre. In comparison, the braking deceleration without IBS was 3.5 m/s² and the average braking distance was 8.8 m.

This difference demonstrates the safety-related potential of IBS, especially for fully loaded cargo bikes in urban traffic, compared to one-handed rear wheel braking alone.

3) Open field test with experienced riders on a downhill section with tight curve radii

Two highly experienced e-cargo bike test riders were used for this open-field test to evaluate the brake distribution system in a direct comparison under realistic conditions.

Both test riders took turns riding both e-cargo bikes on a defined test route. This included an approx. 4 km long downhill section with asphalt pavement in dry weather. It included various riding situations such as tight corners, partial braking and emergency braking due to oncoming traffic.

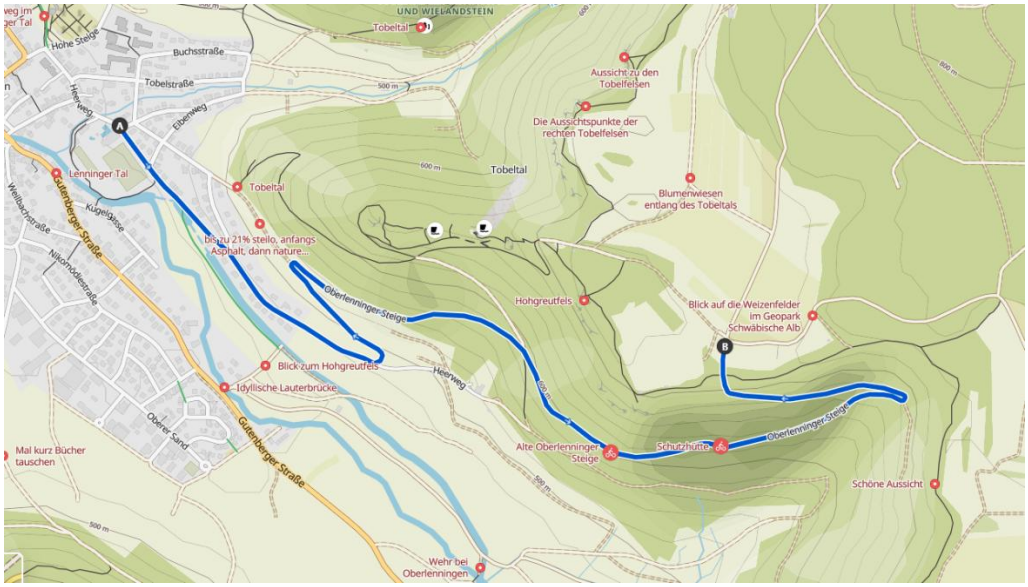


Image 11: Illustration of the downhill route, source: Komoot)

The total load of the bikes was 180 kg, regardless of the rider's weight. The aim was to determine and compare the braking behaviour of both systems in real driving conditions under high loads – especially during longer descents.

During the first test descent, it was already apparent that the bicycle equipped with the IBS system subjectively exhibited more consistent and controlled deceleration. The automatic distribution of braking force between the front and rear wheels led to increased riding stability, especially in cornering situations and during abrupt braking manoeuvres.

In comparison, the bicycle without IBS required manual braking force modulation by the test riders. This placed increased demands on experience, especially at higher speeds.

Result:

In practical use, the cargo bike tested with IBS showed a clear advantage in terms of ease of use and riding safety. Especially in challenging riding situations – such as downhill slopes or sudden braking manoeuvres – the rider no longer needs to actively adjust the front and rear brakes.

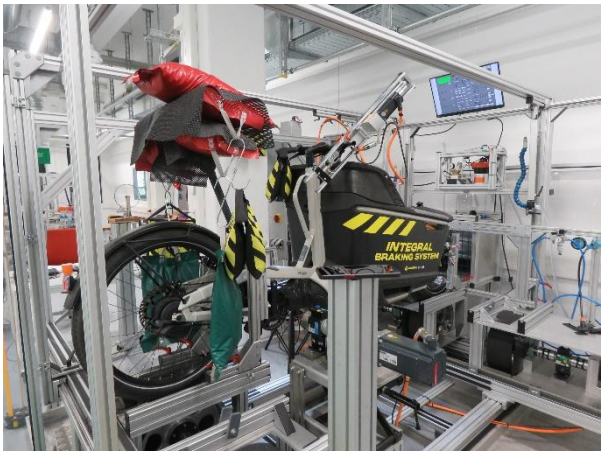
With IBS, it is no longer necessary to apply the front and rear brakes simultaneously and in a measured manner in order to achieve a balanced braking effect and prevent individual wheels from locking.

The system reliably performs this task through automatic and coordinated brake force distribution.

It was possible to switch to two-hand braking at any time.

4. Photo documentation

	
CaGo FS 200 Family with IBS	CaGo FS 200 Family with IBS; front wheel brake disc
	
CaGo FS 200 Family with IBS, rear wheel brake disc	CaGo FS 200 Family with IBS brake test bench setup
	

CaGo FS 200 Family with IBS assembly; brake test bench	CaGo FS 200 Family without IBS
	
CaGo FS 200 Family without IBS, Front brake disc	CaGo FS 200 Family without IBS, Rear brake disc
	
CaGo FS 200 Family without IBS - Brake test bench setup	CaGo FS 200 Family without IBS - Brake test bench setup
	
Open field measurement Emergency braking	Open field measurement Emergency braking

	
Downhill driving	Asphalting and gradient, weather conditions

Tester / Inspector		**Approver**
Ralf Blum		**Giovanni Mancuso**

-- End of test report --