



# ABS IS STILL SUPERIOR ON GRAVEL

The ABS on is still superior to driving without ABS on gravel. MC-Folket proved it in 2011 and confirms it further now in 2020. It is obvious that the ABS systems have been significantly developed and provide superior stability when braking on gravel. However, the differences between the different settings for ABS were not as remarkable as we thought they would be.

■ TEXT MAGNUS KLYS ■ PHOTO JOACHIM SJÖSTRÖM ■ TRANSLATION CHRISTIAN PARAL





**A**s is well known, MC-Folket did an ABS test on gravel as early as 2011. The background was firstly that ABS on gravel bikes began to come and that many felt they did not need ABS on gravel and that it was even worse to brake than to drive completely without ABS. Many simply considered it better to brake on gravel without ABS.

Elving Solli, formerly at MC-Folket and a gravel guru of rank, plus the undersigned acted guinea pigs in a parking lot at the ski resort Säfsen Alpin. Together with the researcher Matteo Rizzi, then employed by Folksam, an insurance company, a cone track was put together. The idea was a test with a speed of 70 kilometres per hour, braking at a pair and at that moment getting a reference in which direction to turn.

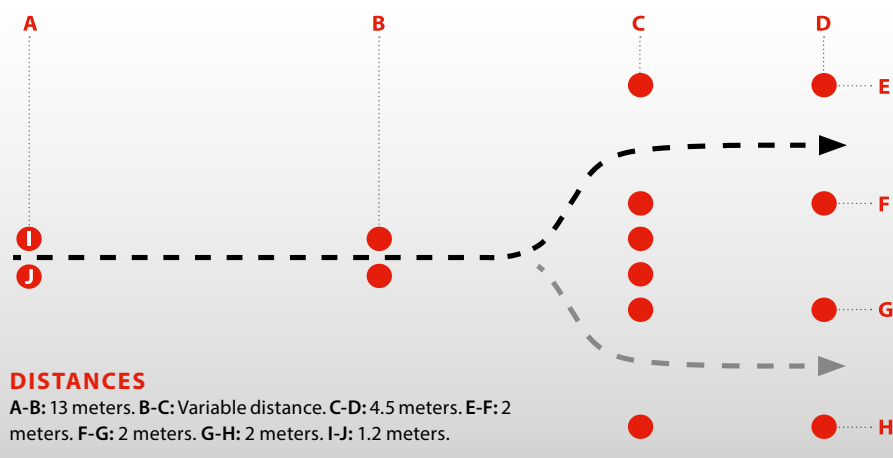
The task was to see if ABS gives the opportunity to reduce the speed so much that you can do an evasive manoeuvre and thus avoid driving into an obstacle that appears or that you reduce the speed so much that you do not die or injure yourself severely in the collision.

The evidence that ABS on gravel can beat even a very good driver without ABS on was, to say the least, clear.

And we promised already in 2011 to come back and do another test, then with rough-patterned tires and several bikes. So better late than never, we came to the fore in the autumn of 2020.

With the help of SMC School:s very experienced gravel instructors Niklas Lundin and Anders Ljungqvist Malm, we headed to

**TRACK**



Lidköping and a large gravel plan to repeat the test. Exactly the same cone path was set up. This time, however, we chose to measure braking from 50 kilometres per hour.

Hasse Näslund at Triumph Sweden lent two Tiger 900 Rally Pros for the test.

-It was a matter of course. It sounds like a project well worth carrying out because many people are just discussing braking with ABS on gravel and it sounds really interesting. I look forward to the result, Näslund explains.

Maria Lind, accustomed to riding road bikes on asphalt, quite above gravel as a base, and Niklas Lundin, gravel instructor and co-author of, among other things, the gravel document that SMC produced as guidelines for

the gravel courses, acted as guinea pigs this time. A very experienced one and a newbie on gravel, just like the test in 2011.

-Normally I drive a Ducati Panigale, preferably on a large track where gravel does not exist. I have only ridden cross a few times and felt that I was probably a good beginner candidate as gravel roads are something I do not directly appreciate. I unconditionally agreed to participate, says Maria.

**EXPERIENCE**

As said, Niklas Lundin has a completely different experience.

-I have ridden a bike for 38 years on the street and track, in gravel and forest. The

## THE DRIVERS

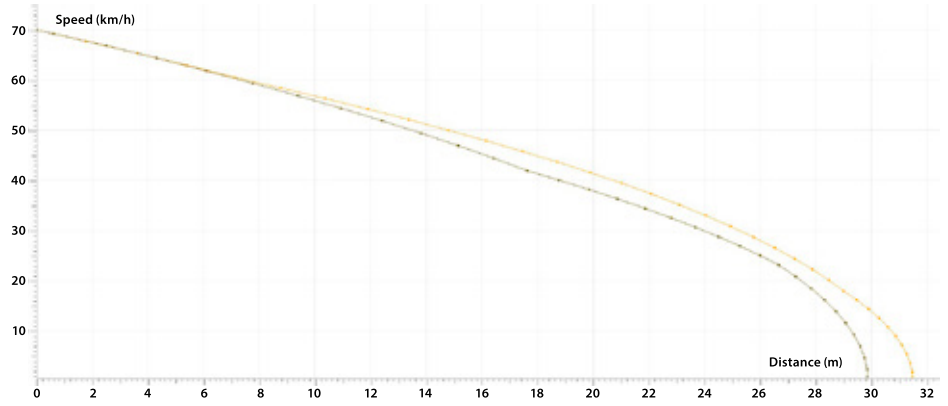


**Above:** Maria "The Rookie" Lind. Gravel experience: Small. **Below:** Niklas Lundin. Gravel experience: Large.



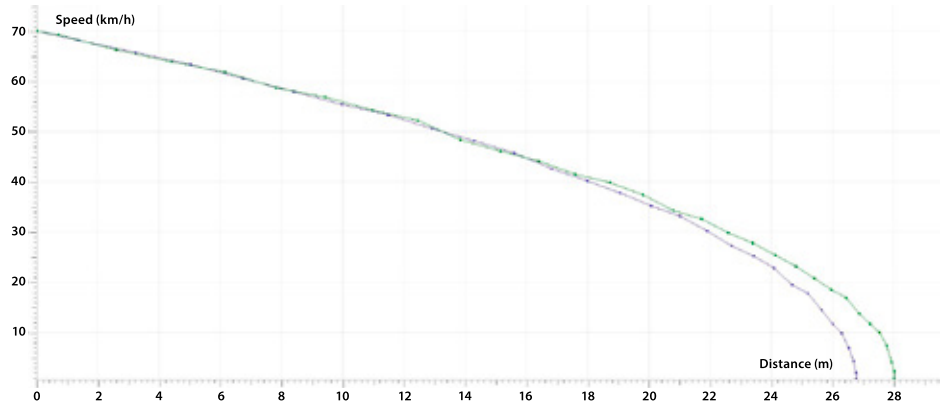
only thing I have not tested is speedway, yet. I have been a motorcycle instructor since 1997 and have been an SMC instructor since 2005. Of course, I can probably be called experienced, says Niklas.

So now it has been nine years and the systems have developed enormously. We have got integrated gyros, curve ABS, which measures all the slopes of the motorcycle and can control ABS and Traction control, anti-spin, much more accurately than you could before. We have also got programmable ABS where you as a driver can choose in which way ABS and anti-spin should work depending on where to drive. Dry or wet asphalt, track, street or gravel.



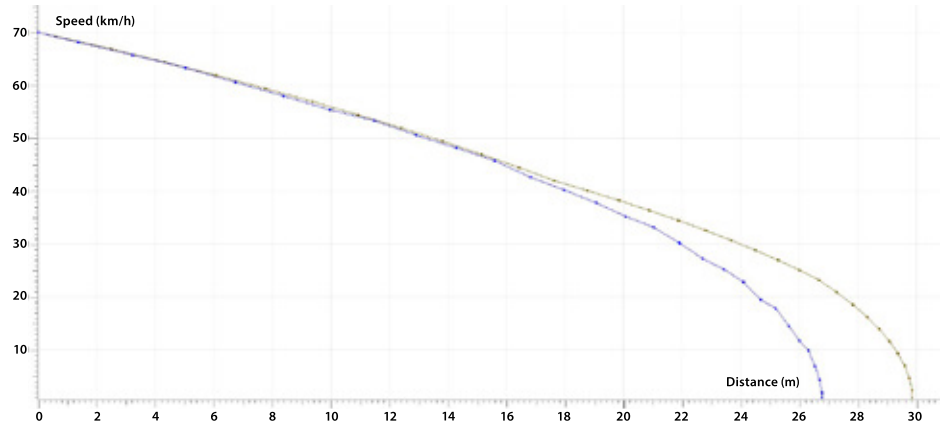
### Road tires-Street-ABS vs Off-road-ABS

Tiger 900 with the smooth original tires. The shorter braking distance is achieved with the Off road-ABS (Enduro Pro) setting. Also note that the curve for Street-ABS is much smoother, which feels clear to the driver. It becomes more stable when the rear tire does not lock.



### Off-road tires Street-ABS vs Off-road-ABS

Tiger 900 with real gravel tires. The shorter braking distance is achieved with the Off-road-ABS (Enduro Pro) setting. Here you can see that the gravel tires certainly have a better grip but also throw more even with Street-ABS set.

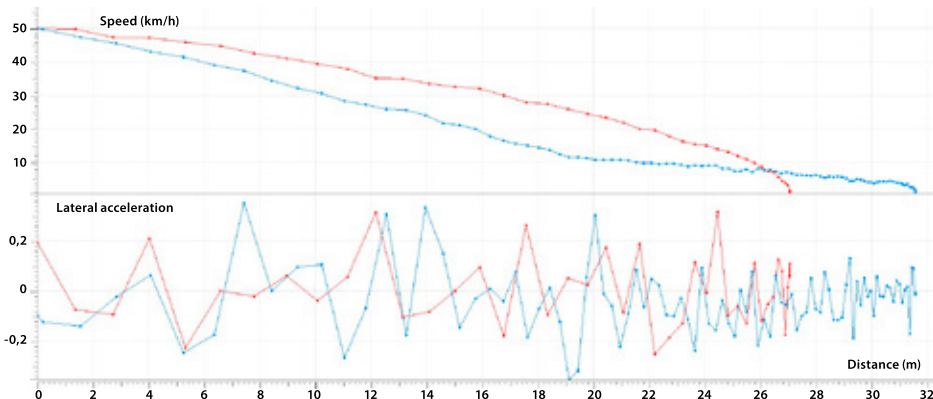


### Off-road tires vs road tires Off-road ABS

The difference between road tires and gravel tires on gravel roads. The braking distance differs by about three meters, which in this case also means that the motorcycle with road tires lasts about 25 kilometres per hour when the motorcycle with gravel tires has already stopped. Again, we see here how much smoother braking becomes with road tires at the expense of stopping distance.







**Maria evasive manoeuvre Off-road-ABS vs No-ABS**

An inexperienced driver on a gravel road where the red curve is with ABS and the blue is without. The prickly graph is Lateral acceleration, ie the motorcycle throws sideways (instability). In this case, the driver dares to brake harder in the beginning without ABS, but the throwing and throwing causes the fear to enter and the driver almost stops braking. The difference in braking distance is over four meters. A good illustration of how important it is that the driver does not stop braking even if the motorcycle feels unstable. A clear visualization of fear.



The point of this test was to simply scientifically test whether the systems have improved on gravel since 2011, and also how much the different settings affect braking force, braking distance, stability and evasive manoeuvres.

The result was both expected and unexpected. The expectation was that the systems have improved with higher braking force, higher G-value, and shorter braking distance. We could also consistently brake better with the system set for gravel than for the street and we could brake better with gravel tires than with road tires. No surprise there then.

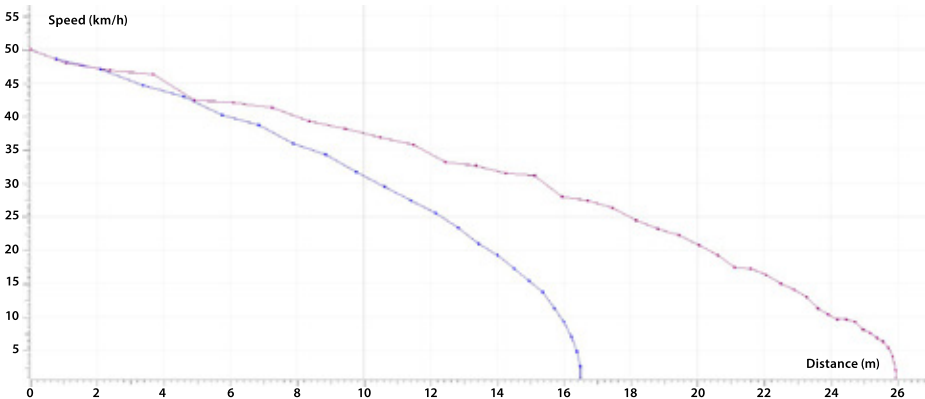
What was unexpected, however, were the small margins, how much the surface affects the outcome and how much it differs between an experienced and an inexperienced driver on loose surfaces.

With the system set in gravel mode, Off-road Pro, we could get very short braking distances, but the rear wheel often threw so much that the driver became insecure and had to release the front brake and take over. The braking distances thus varied for each braking.

**EVASIVE MANOEUVRE**

With the system set for street, we got a little longer braking distance, but the motorcycle was then completely stable, which facilitated, for example, an evasive manoeuvre. The interesting thing was that the difference in braking distance between street setting and gravel setting was so small, it differed only about one meter from 50 kilometres per hour. This indicates that a modern system via the sensors can determine the ground much better and adapt the braking force, ie. a modern ABS system set for asphalt works very well even on loose surfaces and with the increased stability also increases the ability and ability to turn and make an evasive manoeuvre.

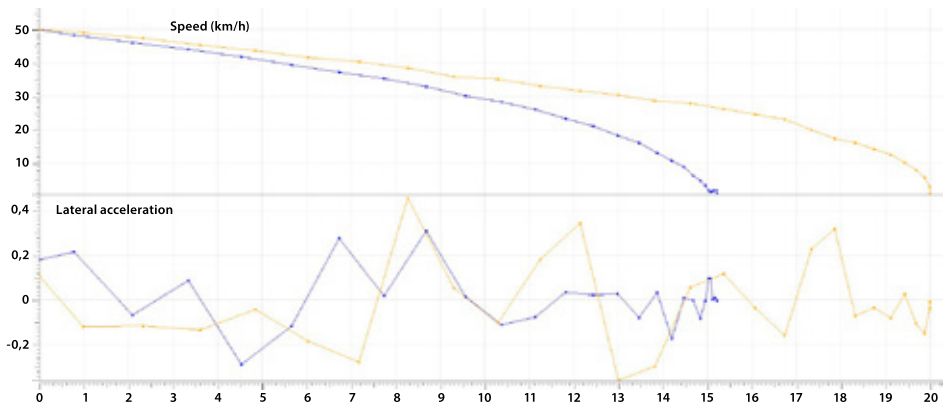
-I simply thought there would be a bigger difference, says Niklas.



**Maria vs Niklas evasive manoeuvre**

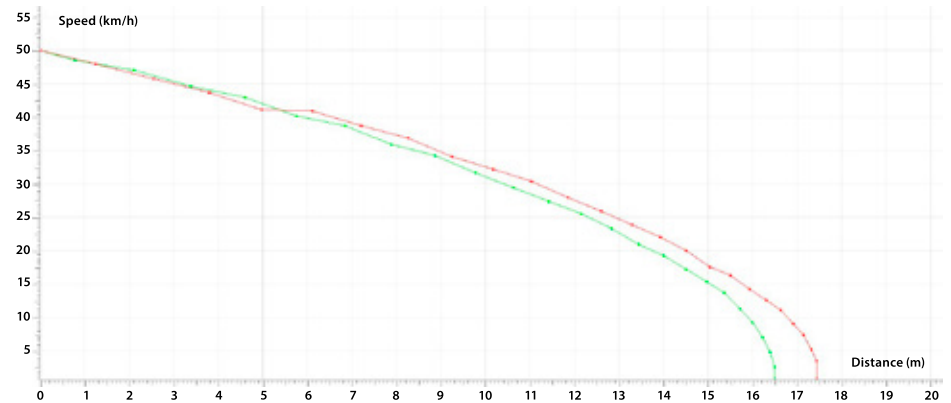
The difference between an experienced and an inexperienced driver on the same motorcycle, the same tires and the same ABS setting, in this case Off-road-ABS (Enduro Pro). Here you also see a clear difference in stability, which is a result of the experienced driver sitting more firmly and using his eyes so that the balance remains. From 50 kilometres per hour, the difference in the stopping distance will be about 9.5 meters. When the experienced driver stops, the inexperienced driver still keeps about 27 kilometres per hour. Measured in G-forces, the red graph corresponds to 0.31 and the blue to 0.72 G, which is a significant difference in braking force. ABS is a great help for both drivers, but it always pays to practice braking, you cannot replace experience with technical systems.





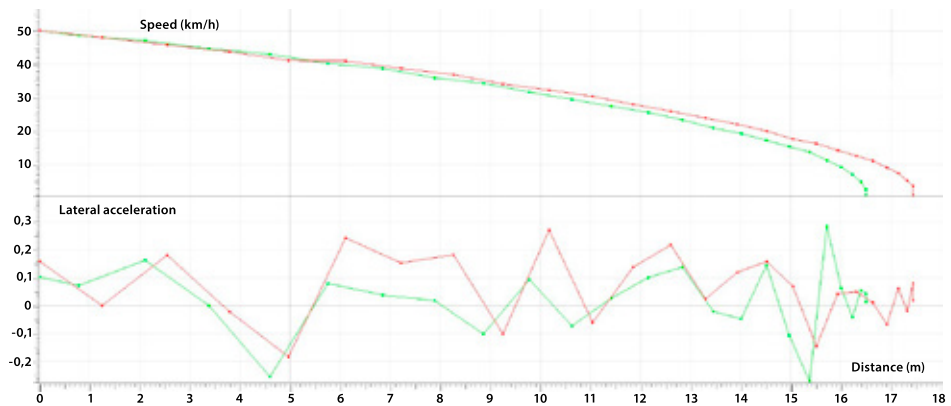
**Niklas with and without ABS**

Brake with Off-road-ABS (Yellow curve) and without ABS (Blue curve) and graph with lateral acceleration, ie instability. In a well-known place, with a well-known motorcycle and after many rounds of training, you can slow down an ABS system. The throw looks violent but the accelerometer is on the package holder so it throws more there than the driver experiences. In addition, the casting is 0.2 to 0.4 G, which is very little. The small final grunt on the blue line is when the front tire locks.



**Niklas evasive manoeuvre Street-ABS vs Off-road-ABS only speed**

Identical conditions with gravel tires on the motorcycle. The green braking distance is set with Off- road-ABS (Enduro Pro) and the red with Street-ABS. Clearly shows that Street-ABS has also come a long way and adapts to the surface in a very good way. There is only a difference of one meter between the ABS programs.



**Niklas evasive manoeuvre Street-ABS vs Off-road-ABS**

Same as previous picture but with instability inserted. It does not say much because it is something that the driver hardly notices, especially if it is an experienced driver. Purely subjectively, Street-ABS is perceived as significantly more stable and safer, which is clearly seen in the last four meters.



-In an imaginary situation where a motorcyclist buys his first adventure motorcycle to start riding on gravel, it comes with standard-fitted tires intended primarily for asphalt. In addition, this driver is told by his friend that "You must at least turn off the ABS on gravel" so in this case the inexperienced get a braking distance of upwards of 27 meters, from 50 kilometres per hour. The driver simply

does not dare to brake harder fearing to lock the wheels.

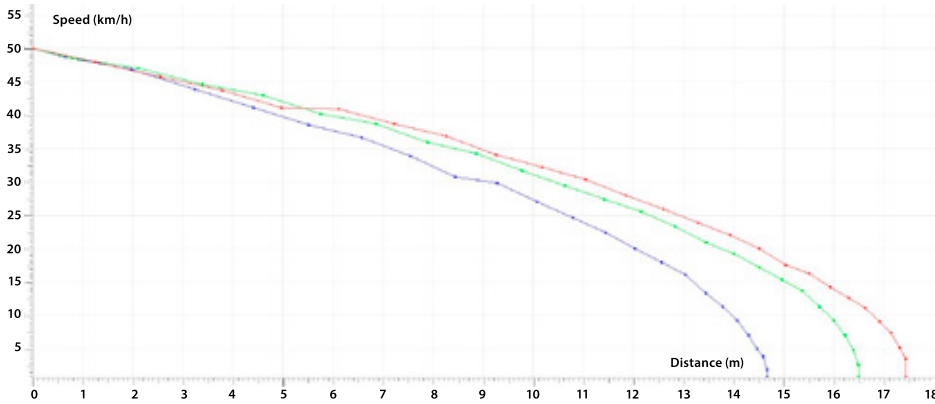
The same motorcycle with an experienced driver and ABS on stops at 15 meters, almost half the distance.

-The scary thing about this scenario is that when the experienced rider stops his motorcycle just before the obstacle, the inexperienced person still has 34 kilometres per hour when he or she collides. And this from speeds as low as

50 kilometres per hour. 34 kilometres per hour right into a wall hurts, hurts a lot, says Niklas.

As for the myth that a trained and experienced driver can brake better with ABS off, the result was the same as 11 years ago. In a known situation, on the same surface and with a number of repeated attempts, the driver could brake a little better with the ABS off, but the result varied greatly between the attempts and the braking was swaying and unstable.





**Niklas evasive manoeuvre Street-ABS vs Off-road-ABS vs no ABS**

Same as before. Off-road-ABS (red curve), Street-ABS (green curve) and no ABS (Blue curve). Yet again just a proof that after a lot of training in the same place and with the same conditions you can shorten the braking distance. When the moose jumps up on the road, you have no opportunity to take fl your times, which is required to slow down a modern ABS system.

-When the moose then jumps forward, it is never a known situation, and you also get no opportunity to try again. ABS is always superior when an unexpected situation arises.

-My conclusion after the test is the same as I always thought. The human-motorcycle equation is so complex and has so many parameters that no technology in the world replaces training and experience, but an experienced and trained driver can also use the ABS systems much more efficiently and simply stops faster. I no longer drive one meter on either gravel or asphalt without having the ABS on, with the right setting for the surface I drive on, says Niklas.

**BEATING HEART**

For rookie Maria, it was a nervous start to the test.

-Gosh my heart was beating and I was wondering how I would manage to turn this bike on the gravel without falling over. Even worse brake with a little speed and get stopped.

-I rolled around a couple of laps in the area and felt that it was going, albeit very slowly. I went in for some instructions, but I am asked to ride a little more and feel the bike. Said and done, I wear around a bit in the area, try a little gently to brake in and then roll on. We are still talking very low speeds like 25-30 kilometres per hour maybe, says Maria.

After a while, Maria starts approaching 40-50 kilometres per hour and is stopped to drive more. She simply must not be too good.

Then it's time for sharp mode. Up to 50 kilometres per hour, brake and make evasive manoeuvres several times to secure the mea-

sured values. The last test is to brake to a stop completely without ABS.

-I can willingly admit that the adrenaline was pumping and I felt a little scared, but luckily I got a stop on the bike and everything went well.

To get an indication of whether education makes any difference, Maria must go to gravel instructor Maria Syrjälä for a very short and intensive education.

-I simply have to learn to accelerate a bit and then brake properly, straight ahead. The next step will be to actually look up from the hill, believe me, the gaze was constant on the hill and looked for what the gravel in front of the deck looked like. After a while, it was time to start breaking a little harder and crash on the gravel and then take me further and brake so I can use the crash to change direction. My body gets tired and I lose focus, despite breaks and water intake. But it's fun, and above all I feel how useful it is to get these instructions and start understanding how the bike will behave if I do this or that.

-Then it is time to brake again to get new measured values and it actually feels both safer and less stressed. Nice, even if I'm not immediately relaxed. We drive on and it actually turns out that when the day is over, the wear and tear and training have made me calmer, safer and I have cut a bit on the braking distance.

Now we probably already dare to promise further ABS tests on gravel next season. Then we will take with us some other models of bikes as well. Why not a scrambler? We will see if any manufacturer dares to lend one. **IMC**

**HOW DID WE MEASURE?**

ABS technology has advanced and developed since the test in the motorcycle people in 2011, so test and measuring equipment has also been refined, become cheaper, smaller and delivers data with greater precision. As always, choosing the right tool for the purpose. Smartphones of the later model have a built-in 3-axis accelerometer that can register up to +/- 8G with 8 bit resolution, ie a precision of 0.01G. However, a mobile phone's GPS is not enough, it is limited to an update frequency of one measurement per second. Therefore, we supplemented with an external GPS device, Dual Skypro XGPS160 which provides update at 10Hz, ie 10 times per second. The app "RaceChrono Pro" is a very competent software for Android that contains everything you could possibly want to register and it can export measurement data to most database formats, including \*.csv and \*.vbo formats. These components together are a fully sufficient setup for the measurements we would carry out. To analyze collected measurement data, we use Racelogic's "VBOX Test Suite" which provides the opportunity to specify exactly what you want to measure and get compiled tables and graphs of completed tests.

Links for those interested in technology: Race Chrono for Android phone: <https://racechrono.com/> • VBOX Software (free): <https://racelogic.support> • External GPS device: <https://gps.dualav.com>



Above left: Dual Skypro XGPS160 and mobile with RaceChrono Pro mounted on one of the bikes. Above right: Measurement data is analyzed with great interest in the Racelogic VBOX Test Suite.

**MOTORCYCLES**



Hasse Näslund at Triumph Sweden lent two Tiger 900 Rally Pros for the test.



# MATTEO RIZZI NOT SURPRISED

Matteo Rizzi who took part in the previous ABS test that MC-Folket did is not surprised by the result. He believes that the biggest advantage of ABS is that the driver maintains stability.

■ TEXT MAGNUS KLYS ■ PHOTO JOACHIM SJÖSTRÖM

**M**atteo Rizzi is now a traffic safety analyst at the Swedish Transport Administration. When he took part in the previous ABS test on gravel that MC-Folket did in 2011, he was employed as a researcher at an insurance company, Folksam.

-I have written a doctoral dissertation which, among other things, is about ABS brakes. The sum total of the whole thing is that based on analysis of real accidents, I have come to the conclusion that ABS reduces injuries by permanent but by about 65 percent.

-It is due to two effects that work together. First and foremost, ABS prevents some accidents, about 40 percent. The rest of the accidents still happen, but at lower speeds and above all in an upright position, which provides better conditions in a collision.

Matteo Rizzi can also call himself a motorcycle doctor after having previously defended his dissertation on the subject of "Safe motorcycles".

-All motorcyclists know that it is common for the vehicle to start wobbling when you need to brake hard from high speed and the vehicle's brakes can lock. Wobbling often leads to the crew overturning, which in turn leads to serious injuries. With the help of ABS brakes, you can prevent the motorcycle from

coming down and slipping away with another type of damage as a result, Rizzi explains.

When MC-Folket carried out the previous ABS test on gravel, it was clearly proven that ABS also works on gravel.

-Regarding the new test in Lidköping, it generally did not offer any surprises, I would say. My interpretation of the result from braking and weighing is that the biggest benefit of ABS is that you maintain the stability during braking, which reduces the risk of the motorcyclist falling over. And falling over is not good, we know this from previous research.

-Even though an experienced driver like Niklas can brake just as short without ABS (under controlled conditions), it is important to point out that the bike was always more "controlled" with ABS, says Rizzi.

-In reality, it is likely that the differences in braking distance between ABS and non-ABS would be greater. My point is that in a test you are mentally well prepared for what will happen and what will need to be done. In our case, we have tried to compensate a bit for that by pointing at the last second in which direction to turn. However, you still know that you will need to brake and so on. I think that in reality the risk of panic braking and overturning without ABS would be clearly greater.

-Last but not least, it is gratifying to note that the manufacturers have developed different sensitivities in the ABS software that are optimized for different surfaces. After all, gravel is a bit special. However, I'm a little surprised that street mode was so good. I guess most people usually drive with a mode like that, so it's gratifying that it was so good. I guess the engineers tried to set the sensitivity so it is okay on most surfaces but not the best on something, Rizzi concludes.

He too is now looking forward to a new ABS test on gravel where we also check bikes that are not directly connected to gravel driving. **[MC]**

