



Rubber for Runners

adidas shoes, Continental grip

A world record in 35,000 steps

When professional tire designers join forces with sports shoe experts, the outcome is a shoe that has paved the way to several sensational world records.

In the 2011 Berlin Marathon, Patrick Makau tore 21 seconds off the previous world record. Two years later, his fellow Kenyan, Wilson Kipsang, went one better, being cheered through the Brandenburg Gate and across the finish line in a fabulous time of 2:03:23. By finishing 15 seconds faster than Makau, he assured himself of a firm place in the marathon runners' hall of fame.

For a long time the 40th Berlin Marathon had been an open race. In contrast to previous years, a breakaway group had initially shared the lead. It wasn't until km 31 that a trio including Kipsang sprinted ahead. 31-year-old Kipsang waited until km 35 before launching his decisive push for victory, drawing on his final reserves of energy. The television commentators could sense that there was a world record for the history books in the making and yelled themselves hoarse. The crowds lining the streets urged the Kenyan on as he flew towards the finish line on lightning fast feet - a picture of concentration.

When it came to his equipment, the new world record holder had chosen to rely on technology and expertise from Continental: like Patrick Makau before him in his world record run and the legendary Haile Gebrselassie from Ethiopia, Kipsang runs in adidas shoes with rubber soles engineered in the development labs of the tire maker from Hanover. And these top runners know what they are doing: the Continental material gives their shoes up to 30 percent more grip than other soles. More grip means better contact with the road surface, better



A new world record on Continental Traction Compound soles: On September 29, 2013 Wilson Kipsang won the Berlin Marathon by a wide margin.

power transmission and thus faster times. Many international marathon runners make use of this technological advantage - as illustrated by not only the new world record in Berlin but also a number of course records, including London in 2012 and Hanover and Tokyo in 2013.

Fast, faster, Berlin

Berlin is one of the fastest marathon courses in the world. This is where the sporting history books get rewritten - by people with the willpower to draw on every last drop of energy over a punishing 42.195 kilometers.

What else does it take? The self-discipline to train regularly and a dose of natural talent. You have to be cut out to be a marathon runner. It's a discipline in which it all depends on you - unlike, say, motorsport where even the best driver has no

chance in a car that's not competitive. For a marathon runner, by contrast, shoes are the only item of equipment through which they can draw on technological progress to optimize their performance. The shoes, and above all the soles, are the only point of contact with the asphalt, the decisive link to the course.

Exactly how many steps Wilson Kipsang took on his way to the world record is not recorded. The average marathon runner pushes off the ground roughly 35,000 times between start and finish. And unlike in a rolling tire, every step is a separate acceleration process, no matter how smooth and regular your style of running may be. So it's the grip that counts and propels the runners forward.

High-tech for the ideal grip

Kipsang's colleague Patrick Makau, who couldn't take part this year because of injury, always runs in "adizero adios 2" shoes and is convinced of the benefits of their Continental Traction Compound soles. "I could really feel the grip that allowed me to accelerate through the corners," reported a delighted Makau after his world record run two years ago.

Europe's leading tire specialist Continental and sports equipment manufacturer adidas have pooled their expertise to manufacture this shoe. The development engineers in Continental's labs set themselves the task of coming up with the ideal natural and synthetic rubber compounds to make a significant difference to the athletes' performance - regardless of weather conditions, temperature, or the surface they are running on. The outcome of their efforts is a shoe that offers 15-30 percent more traction, a reduction in slip and thus more efficient running than ever before.

Continental first started developing rubber compounds for adidas in 2009. Since then the technology cooperation between the two companies has been progressively expanded and their joint developments in the shoe segment are being driven forward. That includes the outdoor sector, where with the Terrex line the two brands have brought shoes to market that make reliable companions for hikers and mountaineers in all kinds of terrain - the off-road tires of the shoe market, so to speak.



Wilson Kipsang signs his favorite shoe in which he claimed his first world record.



Lusapho April crossed the finish line in the 2013 Hanover Marathon in 2:08:32, setting a new course record.

Top successes on Continental soles:

- In the 2013 Hanover Marathon, which Continental helped to sponsor, Lusapho April from South Africa running in the new adizero adios boost shoes set a course record in a time of 2:08:32.
- Olena Burkovska from Ukraine in adizero adios boost shoes broke the women's course record in the 2013 Hanover Marathon in a time of 2:27:07.
- Also in adizero adios boost shoes, Kenya's Dennis Kimetto set a new course record in the 2013 Tokyo Marathon, coming home in 2:06:50.
- Wilson Kipsang of Kenya won the 2012 London Marathon in adizero adios 2 shoes.
- Kenya's Mary Keitany won the women's 2012 event in London in a time of 2:18:37, also on Continental soles.
- In 2011 Patrick Makau from Kenya crossed the line in 02:03:38 at the 38th Berlin Marathon, notching up the first marathon world record on Continental Traction Compound soles.
- In the 40th Berlin Marathon in 2013, Wilson Kipsang from Kenya beat the previous world record held by his compatriot Patrick Makau by 15 seconds, completing the course in 2:03:23 and setting the second consecutive marathon world record on Continental soles.



Man versus machine - in the Conti Run 2 Stop Challenge 2012, a charity project in South Africa, cars and racing bikes on Continental tires and runners in shoes with Conti soles set out to beat one another. While the runners ran straight from Cape Town to Johannesburg, the cars had to visit 28 Conti dealers across the country en route.

ContiRunningWeek takes place once every four years. In 2012 18,000 Continental employees at over 90 locations across the globe lined up to take part - all for a good cause, because the number of participants determines the amount that the Corporation donates to the charity „Welthungerhilfe“. In 2012 that meant 100,000 euros.



Today there are more than 80 different adidas running and trekking shoes for men and women on the shelves, all with Continental soles that offer exceptional grip. Between 2012 and 2013, sales of these models almost doubled to around three million pairs. Sales of outdoor shoes increased sixfold over the same period, providing impressive confirmation of the success of this high-tech cooperation.

A long-term commitment to running

Continental is also an active sponsor of running events including, since 2011, the Hanover Marathon. “We’re aiming to use the main running event of the year to fly the sporting flag on behalf of the more than 7,000 people who work at our head office in Hanover,” says the Executive Board Member responsible for Human Resources, Elke Strathmann. The Continental logo lines the entire course through Hanover, the capital of the federal state of Lower Saxony.

In 2012, more than 400 Continental employees registered for the Hannover marathon. And by way of added motivation, the company reimbursed the entry fee for everyone who completed the course. Also, since March 2011, Continental has been supporting competitive sports in the Hanover region through the ProSportHannover initiative, as well as funding a tour of South Africa for the charity project Run 2 Stop Challenge. “We are delighted that adidas shoes with rubber compound technology from Continental are helping many professional athletes to achieve personal bests and course records. This just goes to show that, in the long run, it can be well worthwhile looking at technologies and solutions from outside your own industry,” says David O’Donnell, who is responsible for global R&D for passenger car tires at Continental.



Interview

A success story is born

Tires and shoe soles have one thing in common: they are both responsible for ensuring safe contact with the ground. Continental and adidas complement one another to perfection in their joint efforts in the field of running shoes and outdoor footwear. In the following interview, the developers at Continental and adidas report on how it all came about and on the long, hard road to production-readiness.



Fabian Dettmer, Head of Mixing & Process Development at Continental



Gerd Manz, Senior Innovation Director at adidas

Gerd Manz, Fabian Dettmer, how did this cooperation between adidas and Continental come about?

Dettmer: It all began early in 2007 when we met with our counterparts from adidas at a workshop. At the time, adidas were working on a project designed to improve the grip of their shoes. With this aim in mind, Gerd Manz and his colleagues were on the lookout for an expert partner from the rubber industry. So we made a good match.

Manz: That's right. In the course of the workshop we got to know the team from Continental and we got talking about the similarities between car tires and running soles. That gave rise to the idea. We stayed in touch and started experimenting, initially with a rubber compound for motorcycle tires specifically for use in the wet. But the shoe turned out to have so much grip that you could walk up walls in it – far too much for a shoe, where you also need what's called "rotational freedom" to prevent injuries.

Dettmer: We were sure that we had the materials to help adidas, after all, here at Continental grip stands for short stopping distances and perfect handling, making it one of the top priorities as we develop materials for our tires. Initial samples that we produced confirmed our view that we could come up with something better than the existing soles. There was a tangible difference.

But why go and develop a whole new shoe when surely everything has already been tried before?

Manz: Expectations of products are forever rising, particularly in the leisure sector. People attach great importance to their leisure time. Everyone's keen to make the best possible use of it. And in sports that means automatically setting the bar high in terms of your own performance. People are less and less willing to compromise – not even in training, let alone in actual events. And when we turn to the outdoor segment, at times the quality of the



adidas Supernova Glide



adidas Supernova



adidas adizero Adios 2



adidas adizero adios Boost

equipment can be a matter of life or death. In running, the grip that a shoe provides can mean better performance; on demanding mountain hikes it's a safety factor.

Dettmer: The exciting thing for us was being able to apply our experience to the field of running shoes. And of course there was the matter of being able to present the Continental brand in a new environment, where we could boost brand awareness in different markets and demonstrate our expertise.

What are the main challenges when you're developing a running shoe?

Manz: We keep the focus firmly on the customer. It's often the case that the customer can't say exactly what makes the decisive difference for them. So we analyze precisely which features make that difference and what the customer likes and doesn't like. With running shoes, obviously they need to be fast, light and comfortable. Improving these traits is a complex and ongoing process. There are many different expectations to meet. We need to look at the energy management of the shoe as a whole – support, stability, grip... The sole has a key part to play here. Much like the tires in a car, it has to cope with very high loads, perform well at temperatures between minus 20 and plus 40 °C and much more besides.

And what new challenges did the developers at Continental find themselves facing?

Dettmer: We found we were dealing with a whole new set of parameters, starting with the fact that, in contrast to tires, shoe soles are stuck to the uppers with adhesive. Then



Technology transfer: Continental's expertise makes for top performance in adidas running shoes.

to avoid placing restrictions on the shoe designers there must be no loss of color in direct contact with white or light-colored midsoles. Also in contrast to tires, indoor shoes must be non-marking, which means they must not leave any traces on the floor. But the fact is that many of these understandable requirements have a direct impact on the composition of the materials used, such as the proportion of black fillers in the compound. We had to work hard to meet the criteria for a constant level of grip in the rubber sole. A tire will normally run on asphalt, concrete or occasionally off-road, but with a shoe we're also talking about moving safely over tiles, linoleum, grass, moss and wood. That calls for a different set of properties than in a tire.

At what stage and how do you involve athletes in the development process?

Manz: Initially it's very limited, but as the technology matures we step up the involvement of top-class athletes in testing prototypes. We once provided the former marathon world record holder Haile Gebrselassie with a prototype for test purposes. Imagine our surprise when he decided to run the famous New Year's Eve race in Trier wearing these shoes. That was in 2009, it had been raining and part of the course was on cobbled streets. Not only that, but the crowds had thrown lots of confetti on the track. So Haile spontaneously decided to wear his test shoes based on material derived from wet-weather motorcycle tires. He won the race by a big margin!

How do you actually test shoes and where does a sole get its grip from?

Dettmer: Interestingly, the contact patch in a shoe is not much smaller than that of a car tire. To see where the grip comes from we have to look at the macroscopic level. How much energy is lost during traction – during the power transmission process? How much energy is converted into heat at this point? In comparative tests we were able to determine that with our compounds we can achieve a 15-30 percent improvement in grip. But it was also important to find out how the materials behave in the various processing steps that are used in shoe manufacturing. We took all of these things into account in our test labs in Hanover.

Manz: The tests that Continental performed and the ones we ran in our own labs complemented one another. What we study here are metrics such as traction on wet and dry surfaces, as well as damping. How does the sole perform on rough, uneven and smooth surfaces? Then there are strict regulations in terms of harmful substances. After all, shoes are items of clothing. All rubber compounds that we use in our models are subjected to rigorous controls in line with our high quality standards.

How long does it take for a running shoe to make it from initial idea to production readiness? And how does that compare with a tire?

Dettmer: The length of the tire development process can vary strongly. It depends on whether we can meet the requirements in terms of dynamic handling and control with established technologies or if we need to apply whole new approaches to make a substantial improvement in properties such as stopping distance, rolling resistance and mileage. In this latter case, developing a new tire line can easily take two or three years. Along with the tread pattern, the design of the tire is also revised and the materials that go into the components improved and harmonized with one another. But by the time whole new technologies have found their way into a product, as much as three to five years can go by.

Manz: For a standard running shoe it normally takes roughly 18 months to get from idea to production readiness. In this special collaboration, though, we set aside three years from our first encounters to the finished product. In the meantime, collaboration has matured

to such an extent that we have no problem combining the materials from Continental with even the new Boost sole that we developed together with BASF.

It's not just running shoes with Conti soles that you're developing but outdoor shoes as well. What are the main differences between running and outdoor models?

Manz: Grip and traction are the key functions in both types of shoe, but while in running shoes the focus is on performance attributes like efficiency and acceleration, in the outdoor sector the spotlight is on protection and safety aspects.

In terms of tread design too we've been able to adopt quite a few things from tire technology to address the enormous demands on performance and robustness in dynamic outdoor sports such as trekking and hiking.

Dettmer: When it came to tread concepts our experience in the mountain bike sector came in useful. While you can't simply transfer an MTB tire tread 1:1, there are certain similarities in the way geometric structures behave in rough terrain and in how to use tread blocks for specific applications. But we also have to consider the visual appeal of the shoes, because runners and trekkers also have their own expectations of the way their shoes will look – and of course we need to meet those expectations.



*Design study:
The high-tech shoes equipped with Continental technology take shape in the development department at adidas.*



Experience makes perfect

Continental grip for the road and feet

For as long as they've been giving car tires the grip they need for the road, Continental experts have also been enabling safe passage along urban sidewalks and mountain trails with reliable, high-quality soles and heels. Now the Hanover-based engineers are taking their expertise to a new level by transferring their tire research endeavors to the world of extreme sport.

The "Huberbuam" expedition had to negotiate some extremely rough terrain on the trek to Mount Asgard. The best available shoe is an absolute necessity when faced with glaciers, scree, ice, and rock.

Whether you're scaling mountains or pounding the road, Continental has you covered. The company's products give runners all the grip they could wish for to make every mile count in training and competition. But they also meet the demands of mountaineers and outdoor enthusiasts, who need to know that their shoes will see them through any situation - no matter how tough the conditions.

Continental can boast a proud heritage when it comes to mountaineering boots, in particular. Its rugged Robusta, Contrec and Berghaken treads have been reliable performers off the beaten track for many decades now and also shown their mettle on the "Springerstiefel" boots used by the German military. These soles remain classic elements of heavy-duty mountaineering, hiking and work boots. But Continental has also made soles and heels for classic low-cut ladies' and gents' footwear ever since the company was founded in 1871, has been a supplier to renowned shoe-makers for more than 125 years, and remains the preferred choice of many cobblers.

Now Continental has decided to push its historical expertise in shoe-making to even greater heights - literally, in some cases. The company has developed unrivalled sole material not only for the high-tech marathon shoes that carry professional athletes to world records and amateurs to personal bests, but also for the outdoor sector. The focus here is very much on safety and robustness. In its work with cooperation partner adidas, the development team headed by Fabian Dettmer reached into the company's vast well of experience in tire development to create rubber compounds capable of meeting the challenge of the most extreme conditions. In order to ensure



Left: The happy conquerors: Alexander and Thomas Huber with Mario Walder (center) after scaling the South Peak of Mount Asgard.

*adidas
Terrex Fast R
med GTX*



adidas Terrex Fast R



The adidas Terrex Fast R and adidas Terrex Fast R med GTX use Continental soles to deliver 30 percent more grip than comparable outdoor shoes - even on challenging surfaces.

outstanding grip in any weather and economy of effort on ascents and descents. Continental's development engineers have been hard at work refining innovative technologies that both hikers and extreme sports enthusiasts can rely on in everything from the Sierra Nevada to the Antarctic.

Grip for extreme outdoor conditions

Two prominent extreme sports fans are Thomas and Alexander Huber, better known as the "Huberbuam" (Huber boys). The brothers are passionate climbers and have what

might be called an obsession with challenges most people would never contemplate. They know what mountains are all about and they were involved in the development of the adidas Terrex range of outdoor shoes, which includes the Terrex Fast R Mid GTX fast-hiking shoe - one of 12 outdoor models equipped with sophisticated Conti technology.

The optimal rubber compound is a key ingredient in these shoes. Developed by Continental, this material generates up to 30 percent more grip in dry and wet conditions than the soles of comparable shoes. And that is an important safety consideration - especially given the

ever-changing conditions that await mountaineers. Plus, the special sole material opens up new avenues for the designers in terms of tread design. Creating the perfect outdoor sole is a meticulous exercise in adapting the form and arrangement of the individual studs in relation to one another. The extremely high friction generated by the new soles means that only a relatively small contact area is required to produce the required adhesion. This allows a particularly open tread that digs into loose and soft terrain to prevent the foot from slipping - all of which makes it ideal for cross-country runs and demanding hikes across rough ground.

Going Continental on the Baffin Islands

For the Huber brothers, putting the performance potential of the Terrex series to the test meant heading out into the wild. Together with fellow climber Mario Walder, they set off for the Baffin Islands aiming to become the first to free-climb the 1,000-meter South Peak of Mount Asgard. The physical and psychological challenges here in the Canadian Arctic Archipelago far north of the Arctic Circle stretch the boundaries of human endeavor. Just the trek to the show-stealing mountain represents a searching examination of man and materials, the team having to find their way through a rocky Arctic desert guarded by snow and glaciers. But not only did they complete the journey, they also became the first people to overcome this extraordinary challenge of Canada's far north.

The mission accepted by Richie Schley and Tim "Livewire" Shieff was similarly spectacular. The Canadian professional mountain biker and British freerunning world champion traveled to Whistler Mountain Bike Park in British Columbia to put Continental products through their paces. While Schley's wheels were fitted with Conti tires, Shieff wore adidas Terrex shoes with Continental soles. And with a handful of impressive stunts safely in the bag, the two athletes arrived at the same conclusion. The breathtaking leaps and high-speed cornering over trees and rocks would not have been possible without the extreme grip of the Conti products. "I had to get acclimatized to the new environment," said Shieff, who is more used to training on concrete than foliage. "But here I suddenly discovered totally unexpected possibilities." It would have been virtually impossible, for example, to run up a wet tree trunk in Shieff's huge strides in "normal" shoes.

Continental is stepping up its mountaineering activities with adidas for the upcoming winter season. In the future, not only mountaineers and hikers but snowboarders too will be able to count on Continental's expertise. Fresh on the market is the Blauvelt snowboard boot - an extremely high-quality product based on rock-solid technology. "The boot," explains Katie Becker, adidas Action Sports Design Director, "features our patented Adiprene foam material, as well as Aerotharm nanotechnology for the necessary warmth. And the Continental rubber provides top-class grip."



Professional mountain biker Richie Schley and freerunning world champion Tim "Livewire" Shieff pushed the Continental components to the limit in Whistler Mountain Bike Park, British Columbia.



„Here I suddenly discovered totally unexpected possibilities.“

Tim „Livewire“ Shieff, British freerunning world champion

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