

# Science behind remarkable new Wall of Death motorcycle world record

April 1 2016, by Hugh Hunt

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The Wall of Death has been the most enigmatic dare-devil motorbike stunt for more than 100 years. Motorcyclists ride around the inside of a vertical wall, rather like a huge barrel, at speeds of around 30mph. Most Wall of Death "drums" are about 32 feet (10 metres) in diameter.

There is a Wall of Death near Cambridge, UK, run by [Ken Fox](#). He was approached by NorthOne Television to assist in a mad project to set the world speed record for a [motorcycle](#) ride around the wall. The stunt was performed live on [Channel 4](#) television this week – and I was lucky enough to be right there, as a consultant engineer for the show.

It was thought that no one has ever ridden the Wall of Death any faster than 45mph, but during the record attempt, experienced motorcyclist [Guy Martin](#) attempted to reach 80mph, a speed which would completely smash existing records. So how did he do? And how on Earth can a motorcycle ride around a vertical wall?

## The G-force awakens

The limiting factor for speed on the Wall of Death is human physiology. When riding the wall, you are subject to high acceleration – or [G-force](#). Under these conditions, blood drains away from your brain and eyes, much as water is flung out of clothes during the spin cycle of a washing machine. It leads to tunnel vision, temporary blindness, difficulty breathing and eventually unconsciousness.

When riding the wall, the Gs are generated by what most people call "[centrifugal force](#)", but in actual fact there is no such thing. Physicists prefer to say that there is a "[centripetal force](#)" acting on your body as it goes around in a circle, but I'm an engineer, not a physicist, so I'm quite happy to go with the majority and call it centrifugal force.

Either way, the highest G-force that most of us will ever experience is when riding a roller coaster, where the body (very briefly) can be subject to accelerations of up to 5G. This is the equivalent of carrying an extra five-times your own weight throughout your body. Imagine: heavier arms, heavier legs, heavier head.

When you're riding the Wall of Death the centrifugal force pushes you outwards and then friction holds you up. Imagine the wall was wet and slippery – you'd slide right down. That's why it was very important that the wall was kept dry and free from dust and drops of oil. Clearly, the wall has to be built indoors and we needed a very big hangar for that.

The training for a high-G environment involves flights in stunt aircraft. During those Guy found himself passing out at around 7G – and it doesn't bear thinking about would happen if consciousness was lost when riding a motorbike at 80mph on the wall. Guy had a [serious crash](#) in August 2015 at the Ulster Grand Prix. He was lucky to come out of it alive, but only six months later he was in full swing training for the Wall of Death.

### **So how fast can you go?**

Let's assume that Guy doesn't want to exceed 7G (remember that he'd be experiencing the extreme forces for far longer than someone on a rollercoaster – and having to control a motorbike, too) and that he wants to ride at 80mph. Well, there is a formula for calculating the G-force experienced when going around in a circle. It can be worked out using

Isaac Newton's famous laws, which is all very appropriate, because Newton came from Grantham in Lincolnshire and the record-breaking attempt took place in a WWII airforce hanger not far away, in the heart of Battle-of-Britain country.

Using Newton's ["differential calculus"](#), it turns out that the centrifugal G-force increases with the square of your speed and decreases in proportion to the Wall of Death's diameter.

This means, for example, that if you travel at 80mph on Ken Fox's 10-metre wall you'd experience 25G of centrifugal force – certain death. But on a bigger wall, say 40 metres in diameter, you'd experience 6.4G – just about within the physiological limit.

The bike also has limits. The often-used, iconic Wall of Death Indian Scout bike has to be specially reinforced with stronger tyres, stiffened suspension and a modified engine to cope with the high Gs. The wall itself also needs to be resistant to the centrifugal force of the bike and rider, which at 80mph will be in excess of two tonnes.

## **Breaking the record**

With the maths in mind, a huge Wall of Death was constructed especially for Guy's record attempt. It was 37.5 metres in diameter and quite a dramatic sight. It was constructed out of upturned shipping containers, welded together and lined with timber. A refuge for paramedics was constructed in the centre so if anything went wrong, medical help could be summoned in a matter of seconds.

The main hazards were related to the high G-forces, however. If Guy passed out, then the worst fear was that he'd fly out of the top of the arena and hit the roof truss. He would probably not survive such an event so a barrier was installed at the top edge of the wall. Even so, hitting this

barrier at 80mph would be exceedingly unpleasant. Guy was given a large red line to follow so that he would know how to keep clear of the barrier, even when his eyesight began to fail because of the high Gs.

[Guinness World Records](#) was present to officiate – and required a speed over 60mph in either one of two attempts. In his first attempt on the Indian Scout, Guy achieved 72mph and there was much celebration. But during his second attempt (on his own home-made bike), he reached 78mph, smashing his own record.

He wanted to ride again and go faster but he was already experiencing problems with his vision – the first sign of blackout. His main complaint, as he said afterwards, was that the G-force (estimated at 6.4G) was pressing on his bladder and he was busting for a pee the whole time!

## The Future?

If anyone is going to break Guy Martin's record of 78mph then they will have to build a wall at least as big as the Lincolnshire one. In training, Guy thinks he once reached a peak of 85mph but he backed off quickly as he was blacking out at this speed. Perhaps on a bigger wall a new record will be set, but building a bigger wall is quite an undertaking. I think the record is safe for a few years.

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