A TECHNICAL REVIEW by Headkayse Ltd.

Making Sense of Cycle Helmets

Since the first 'purpose built' cycle helmet – The Bell Biker – was launched in 1975, the basic technology has changed very little. On some measures, helmets are less protective now than they were 40 years ago. ***Is it time we had more real innovation in cycle helmets?***

In the same period, since 1975, the motoring industry has given us compulsory seat belts, crumple zones, padded interiors, ABS brakes, Airbags, Side Impact Protection System, Electronic Stability Control… We could go on. But perhaps their most pivotal innovation has been the Euro NCAP Testing, rating cars on a clear 5-star system. Manufacturers who'd previously complained customers won't pay for safety, discovered that people do want safer cars – if they understand what they're buying.

Meanwhile, in the cycling world, we're still making helmets from the cheap and cheerful Expanded Polystyrene (EPS) pioneered by the 1975 Bell Biker. There have been improvements, such as moulding the fragile EPS into polycarbonate outer shells and more secure harnesses. But these gains have been offset by the trend for lower profile shapes with larger, complex vent holes, leaving less effective material to protect you, forcing manufacturers to use harder, less forgiving foams.

Can cycle helmets be safer? Yes, and we'd like to show you how. But first we need to clear up some of the dangerous confusion about how helmets work and their limitations. To help you cut through the nonsense, we need to start with the fundamentals of brain injury and prevention, and the physics of how helmets can prevent this.

PART 1 – Current Helmets and How We Got Here

Basics of Brain Injury

Did you know that the cycle helmet you wear today has its roots in the death of Laurence of Arabia in 1935? He became one of the most infamous victims of head injury 7 days after he crashed his Brough Superior motorcycle on a Dorset lane. Subsequently his young neurosurgeon Dr Hugh Cairns was driven to research the link between motorcycling and head injury. His stark findings persuaded the British Army to order all dispatch riders to wear protective helmets. This opportunity allowed Dr Cairns to prove that the Army riders experienced a dramatically lower incidence of head injury than the helmetless civilians. Further government research meant that by the early 1950's we'd already begun to understand the fundamental causes and effect of brain injury.

Even now lots of people think that 'cracking your skull' is the major danger of head impact. But when a fast moving head hits an immovable object, it's not usually skull fracture that kills, it's the extremely high deceleration of your head. Your hard skull suddenly stops, causing the jelly-like brain to slump forward against the inside, compressing brain tissue at the front and tearing it away at the rear. In a straight-on hit, the worst damage is often on the opposite side to the impact.

We've known since the 1950's that head rotations can be even nastier, shearing brain material all around the outside of the head. Imagine a bowl of jelly - if you suddenly spin the bowl hard enough, the jelly gets shredded around the outside of the bowl. Not good.

The result can be two very dangerous types of damage – internal bleeding from ruptured blood vessels and 'diffuse axonal injury' (DAI), where large numbers of brain cell axons (the connections between neurons) are damaged or torn. DAI is what causes unconsciousness and or amnesia.

This kind of internal injury can be very hard to detect. It may show up hours or even days later as a result of secondary damage, caused by internal bleeding or brain swelling restricting blood flow, starving large areas of brain cells of oxygen and glucose. This is more often what proves fatal[1].

Whilst one serious impact is clearly bad news, ***multiple-impacts*** have become far more of a concern recently. We know from research in high-impact sports such as rugby, that a medium 100g - 150g impact may cause undetectable concussion damage, but a second similar impact before the brain has fully recovered can dangerously exacerbate the damage.

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[1] ***Case Study:*** *The actress Natasha Richardson, who tragically died in 2009, is a classic victim of secondary brain damage. Whilst learning to ski at a resort in Canada (not wearing a helmet), Ms Richardson lost her balance and fell near the bottom of a beginner's slope. Although she laughed off what seemed like an innocuous fall, she was taken to the medical centre for checks. Refusing further medical attention she returned to her hotel room. As a precaution 2 ski patrollers stayed with her and called in the paramedics to check. But they were turned away. An hour later she began complaining of a headache. Two hours after her fall a second ambulance was called - by then she was disoriented, confused and vomiting. On examination the local hospital immediately transferred her to Montreal, where she arrived seven hours after banging her head. By then it was too late.*

Brain scanning shows even lower impacts in the 50g – 100g 'Sub-Concussion' range can cause permanent axonal scarring. And the latest research has found that cumulative sub-concussive damage from repetitive head injury (RHI) decreases neurocognitive function. More worryingly there is strong evidence linking RHI to the early onset of degenerative brain diseases such as dementia.

How Does a Helmet Help?

It's pretty clear then, ***IF*** you're going to hit your head, you really do want a way of reducing the decelerations[2]. This is the main purpose of a cycle helmet – to act as a cushioning layer that slows your head down over a greater distance.

If we grab a handy equation from physics, we can show you the difference that distance can make…

Acceleration $a = (v_i^2) / (2s)$ [where v_i = initial velocity, s = distance]

So let's say your head is going at 20kph on impact and then:

1. ***Without a helmet*** we assume it stops in 1mm (the squashable thickness of your scalp)

   $a = 15456.8\ m/s^2$ or **1576 g**

2. ***With a helmet*** it stops in 15mm (about ½ thickness of the foam)

   $a = 1030.5\ m/s^2$ or **105 g**

In case you were wondering - '**g**' stands for the acceleration due to the force of gravity that we experience at the Earth's surface, equal to 9. 81m/s^2. This is an arbitrary measure that makes sense to us, in the similar way that people agreed a length of 3 barley corns would be called an 'inch'.

The UK Department for Transport's 2002 review of cycle helmet effectiveness states: *"Research has shown that decelerations of about 250 - 300g are the maximum that can be tolerated by the adult head without leading to irreversible injury".*

So 105g sounds great right? Well no, it's not quite as simple as that.

Firstly, the deceleration isn't constant. Helmet foam is like a spring, the more it's compressed, the harder it is to squash any further. Plus the round shape of a helmet means that as the material crushes, the contact area widens to push on lots more material. So over the few milliseconds of an impact, deceleration will start off low and quickly rise

[2] ***NOTE*** *to any engineers and physicists – we know the correct term is 'acceleration', but we're going to use 'deceleration' throughout this article as it's easier for everyone else to visualise.*

to a peak before dropping off. Drop tests of a typical cycle helmet at 20kph shows the peak acceleration is likely to be around 200g.

Secondly there is a big trade-off between speed of impact, the thickness of the foam and its hardness. Like a spring, there's only so far you can crush a foam before it 'bottoms out', basically becoming a solid. If the speed of impact is fast enough to bottom out the foam, the accelerations jump up dramatically – it's effectively almost as bad as no helmet.

You can solve this in two ways. Either make the EPS foam harder to crush, so the head sinks less far into it – but this hardness increases the accelerations at lower speed impacts. Or you make the helmet thicker. But cyclists don't seem to want thicker helmets.

So here's the truth that the helmet industry doesn't really like to talk about – helmets definitely will reduce decelerations on impact… but they can only realistically help up to impacts of about 20kph. And seeing as deceleration is related to (impact speed)^2 – after 20kph things ***rapidly*** get a little ugly.

Having said that, if you hit something at 30kph, you're still better off with some crushable cushion in between. But don't be under the illusion that you're wearing any guarantee of walking away.

The Standards and the Free Market

How did we get to the current bicycle helmet standards and what effect have these had?

After WW2 the UK Road Research Laboratory's (now TRL) investigation of materials and tests, led to the first British Standards. These pioneered testing performance, rather than prescribing materials and construction methods. BSI published the first cycle helmet standard BS4544 in 1970.

In the USA the birth of helmet standards was triggered by another tragedy. In 1956 the amateur racing driver William Snell died during a road race in California (wearing an inadequate helmet it turns out).

His good friend (and the track Doctor), George Snively, was persuaded to test the racing helmets being sold on the market, and a year later Dr Snively incorporated the Snell Foundation to provide independent safety standard testing.

The Snell foundation devised their first cycle helmet standard in 1970, but it was really just a minor modification of the motorcycle helmet standard, and was pretty much ignored. Understandably, cyclists need lighter, more aerodynamic and better ventilated options than a motorcycle helmet - the tension between safety and function that bedevils cycle helmet design.

By the early 1980’s a range of EPS helmets had hit the market, and it became obvious that not all were created equal. ‘The Washington Area Bicyclist Association’ (WABA) took things into their own hands and started working with Dr Snively to start testing them. The results, published in a landmark article in 1983, were clear - some of these helmets were as useful as chocolate donuts. Within 2 years the ANSI and Snell had introduced new standards, sweeping the junk off the market.

This time Snell, with ‘B85’, set the bar at a more achievable level, aiming to periodically review the standard upwards as manufacturers managed to improve technology. This worked rather well. By 1995 most cycle helmets were Snell ‘B95‘ certified.

But then the US and Europe changed the game. Due to lobbying, the US Senate ordered the Consumer Products Safety Commission (CPSC) to create a mandatory standard, that came into force in 1999.

In the EU, laws require helmets to be CE marked, meaning they comply with the safety directive for personal protective equipment. The simplest way to prove your product complies is to pass one of the agreed European Normalised (EN) standards. Stupidly, Snell B95 couldn't be recognised under this system, so Europe began creating their own standard, setting up a committee which included representatives from test houses and manufacturers.

Apparently the British members were keen to include improvements like a rotational test that BSI carried out on other helmets. But the other European standards bodies (who didn't have the same equipment) and the helmet manufacturers successfully argued that the existing standards were already pushing costs too high. EN1078 : 1997 was the result - a weaker standard than Snell B95, easier for the helmet manufacturers to achieve.

By 1999 virtually no helmets sold in the EU complied with Snell B95, and the helmet you've bought today is certainly less protective than the one you would have bought in 1995.

You may well look at your helmet and wonder what the difference really is. All current standards testing includes four key things:

- **Visibility** – Whether any part of the helmet impinges on your field of view
- **Security** – Testing strap strength and effectiveness with a "roll off test" that tries to yank the helmet off a fixed head with a falling weight attached to the helmet.
- **Coverage** – Measuring that the helmet extends past defined areas of the head.
- **Energy Absorption** – *The most important bit.* This is proven with a Drop Test Rig, dropping the helmet, with a standard (5kg) 'headform' inside, onto differently shaped anvils. 3-Axis accelerometers are fitted inside the headform, allowing the deceleration during impact to be recorded. Anvils used include a flat, a 'round' hemisphere and an angled kerbstone shape.

Where the standards differ is in:

- The required impact velocity - usually larger (from a higher drop) for a hit on the flat anvil
- The allowable peak g reading
- Most importantly, the number of times one helmet must be hit and survive.

The drop heights and velocities don't appear to be that different, until you realise the kinetic energy (which relates more accurately to the deceleration) in EN1078 is only 65% of Snell – although the allowable acceleration is also less. The table below summarizes the differences, where you can see that CPSC (the US standard) and Snell are the most similar.

[***Image: EN1078 drop test rig.*** *NOTE: What's not apparent from this picture is how heavy the thud is when this hits the Anvil, which generally turns viewers into strong helmet advocates.]*

Requirement		CPSC	Snell B95	EN1078
Flat Anvil	Drop Height	2.0 m	2.2 m	1.5m
	Impact Speed	6.2 m.s^{-1}	6.5 m.s^{-1}	5,42 m.s^{-1}
	Energy	**98 J**	**110 J**	**72 J**
Hemispherical Anvil	Drop Height	1.2 m	1.5 m	-
	Impact Speed	4.8 m.s^{-1}	5.42 m.s^{-1}	-
	Energy	**59 J**	**72 J**	**-**
Kerbstone Anvil	Drop height	1.2 m	1.5 m	1.07m
	Impact Speed	4.8 m.s^{-1}	5.42 m.s^{-1}	4,57 m.s^{-1}
	Energy	**59 J**	**72 J**	**53 J**
Helmet Samples Required & Conditioning		2 x Ambient 2 x Cold (-15°C) 2 x Hot (+50°C) 2 x Wet (immerse) *For 24hrs prior to tests*	1 x Ambient 1 x Cold (-20°C) 1 x Hot (+50°C) 1 x Wet (immerse) 1 x C or H or Wet *For 4+hrs*	1 x Cold (-20°C) 1 x Hot (+50°C) 1 x Aged: Wet (spray) Xenon Lamp x 48hrs *For 8hrs*
Hits on samples		1st conditioned set hit on Flat & Hemisph Anvil. 2nd Set hit on Curbstone	Each helmet must be hit 3 – 4 times, at least once on ***each anvil***	Each helmet is hit twice, Hot – Kerb + Flat Cold – Flat + Kerb Aged – Flat + Kerb (Hits >150mm apart)
Failure threshold		300 g	**300 g** Helmet structure must remain intact	**250 g** Helmet structure is allowed to break
Coverage vs. CPSC			Lower at rear	Less: high at rear

Perhaps the biggest difference is in the number of hits that a helmet must survive. A helmet that passes Snell will have survived between 3 and four hits intact. Whereas a helmet can shatter (at impact site) after the first hit and still pass EN1078.

It's obvious that manufacturers under tight competitive conditions will design down to the standard as much as possible. This is accepted by us 'The Market' because very few people understand the technical difference between Snell B95 and EN1078, other than a Snell certified helmet is likely to be more expensive.

For anyone who understands helmet safety, the most frustrating outcome of the European system (albeit unintended) is not only that it's killed the Snell standard, but it's also killed the progress in helmet safety that Snell encouraged. This combined with market forces, is what's reduced innovation in the last 20 years, in the most part to a marketing exercise rather than any serious attempt at improving head safety.

We don't believe that this is acceptable. In the next part we'll look at what needs improving, technology that has or could produce better helmets, and how changing the standard could unlock their use.

PART 2 – The Future of Helmets (is already here)

The Problems to Solve

Expanded Polystyrene (EPS) has been the main choice for helmets as it does a good job of absorbing high impacts, is cheap, light and easy to mould into complex shapes.

But EPS helmets come with some problems:

1. **EPS is a rigid, fragile foam that is permanently damaged on impact. This means:**
   a. It often disintegrates on large impacts. This isn't a sign it's doing a great job. It's just fragile and potentially useless if you hit a branch and then the ground.
   b. It won't provide adequate protection on a second hit. Results from testing market leading helmets at the UK's official test centre proves deceleration from second impacts are well beyond the maximum 250g.
   c. Even gentle hits significantly reduce an EPS helmet's shock absorbing capability. This is why the product manual states that you must replace your helmet if you have any kind of bump in it, or even just drop it on the floor. This is a problem, as it's very hard to avoid this or detect this kind of real life damage.

2. **Hardness**: Modern helmets contain less material, due to the fashion for lightness, slimmer profiles and much more venting. But nothing comes for free; the EPS has to be made denser to compensate. The problem is this harder material doesn't provide much cushioning at lower speed impacts. Try wearing a helmet and banging your hand on the top – actually we don't advise this, as most of the impact just goes straight through to your head. What's worrying about this is recent evidence from high impact sports, such as rugby, is showing a link between minor brain injuries and later brain diseases like dementia.

3. **Rotation Absorption**: Being rigid, EPS helmets don't absorb any rotational accelerations – for example, if some of the protruding 'aero' fins on the rear catch on the ground when sliding, it will just force the head inside to rotate with it.

4. **Comfort:** also, being rigid, it is difficult to make them snugly fit varying head shapes comfortably. The modern easy to adjust 'suspended' plastic strap arrangements have improved comfort and fit for a wider range, but this means the interior space of the helmet needs to be larger, either looking like a plastic pie on top of your head or sacrificing foam thickness.

5. **Styling:** Talking of looks, some of the argument levelled against wearing helmets is that they put people off from cycling. Style is obviously a personal judgement, but it's fair to say that the style of cycling helmets are somewhat alien to people outside the sport, which doesn't help encourage them to take up cycling. Skiing helmets on the other hand, are relatively flattering and make most people look pretty cool.

And of course the big one we've already highlighted – helmets can only protect you up to the speed of impact set by the standards, where all the competition pitch their helmets. Any more protection than that requires thicker foam, which is unattractive to consumers.

Improved or Alternative Impact Protection

Even though many of these problems are well known, almost nothing other than EPS has been used to make safety helmets. That is until recently, when a few notable exceptions have appeared.

Air Bag Helmet - Hövding

Probably the most radical new technology is the Hövding air-bag scarf for cyclists. Whilst the rider enjoys the wind through their hair, the Hövding electronics are constantly monitoring accelerations, ready to deploy the airbag on detecting a crash.

This provides an impressive level of protection with a claimed 65g deceleration recorded in comparative tests carried out by the Swedish Insurance Company Folksam.

The downside is this is expensive technology that's only good for one use. It also needs regular recharging to work and it's not a 'fail safe' system if the electronics are malfunctioning.

Corrugated Cardboard Helmet - Kranium

Believe it or not corrugated material such as cardboard is an excellent impact protector. An example of this was developed by a student at the RCA, who went on to launch Kranium Helmets.

Whether this is corrugated cardboard or aluminium honeycomb, it works best oriented ‘end on’ to the direction of impact, where the airspaces between columns allows them to progressively collapse like mini accordions, providing good even levels of energy absorption.

The problem with this technology is it is difficult to manufacture, and is of course is still permanently damaged by any impact.

Progressive Impact Absorbers

One way to protect against sub-concussion is to have softer cushioning inside, which works at slower speed, with harder material outside to handle heavier hits.

The simplest of this is a basic two-layer laminate. But this has been improved lately by including cone shapes moulded between each layer, meaning once just the soft layer is crushed, then you reach the cones, and further deformation starts to crush the harder cones, increasing the resistance. This is still EPS though, so is still easily damaged and only good for one hit.

A final variant is a ‘rate-sensitive’ material such a D3O, which is a rubbery material that stiffens up when it’s deformed quickly. This is a bit like corn flour if you’ve ever mixed that with water. Their original rubber material is too heavy for helmets, though we believe they are working on a lighter foam variant.

Reducing Rotational Acceleration – MIPS etc.

The most highly trumpeted new technology is MIPS (Multi-directional Impact Protection System), originally invented around 2001 in Sweden. This is basically a low friction layer between the head and the EPS liner, or sometimes the liner and the shell, that allows some slippage between them when the helmet impacts the ground at an oblique angle and tries to rotate.

It took a long time to catch on. One of the more innovative helmet makers POC were the first to introduce this into a mountain bike helmet in 2011, but 2016 is probably the year of MIPS, with most of the leading helmet brands introducing MIPS helmets.

An interesting alternative to this is **6D’s “Omni-Directional Suspension™”**, which achieves something similar by “suspending the liner from the rigid outer shell via a number of squashy, flexible shock absorbers.

Both of these are good solutions to improve the rotational energy absorption of rigid EPS helmets, but don't solve EPS's other problems.

Other Foams

There are other more elastic foam solutions such as Expanded Polypropylene (EPP) and Nitrile foams, which can cope better with multiple impacts. But they can be expensive and all struggle with the extreme temperature requirements of the standards, meaning helmet liners made from just these materials are very hard to certify without additional thickness and weight.

The Headkayse Approach

Create A New Helmet

3 years ago we started with a simple brief to make a folding helmet. But this led us to uncover the safety issues and blocks to innovation that you've been reading about here. It was obvious we were going to have to start with a blank sheet of paper and properly rethink how cycle helmets work.

Early on we asked one, deceptively simple, but crucial question - ***what if helmets were made of a softer flexible material that we could just squash flat?*** Initially we dismissed this as counter intuitive, but difficulties with other ideas kept circling us back around to this simple idea.

We started testing rough prototypes and were surprised to find it worked. We discovered that a rigid shell wasn't necessarily a good thing and a more compliant helmet could absorb shock better across a range of impacts. Over a 6-month period we tested hundreds of different flexible materials and started getting some really good results. "Interesting", we thought "this might just work".

But then we hit "***the problem***". The standards require helmets to be tested at temperatures of -20°C and +50°C, which suits EPS, but killed all the elastic foams we tried. They turned into balsa wood in the cold and marshmallow in the heat. We now know that this problem has prevented the industry from using potentially better solutions for years.

What we'd learnt did give us a hunch to go back and work on another material, one that everyone else said doesn't work. We partnered with a local materials specialist to create our own version and within weeks we had a solution that passed the extreme hot and cold drop tests. Had we cracked it?

To cut a long story short, turning this material into a working helmet caused us a lot of headaches, forcing us through multiple design and material improvement iterations, until finally we were happy we'd got far enough to prove without doubt that this worked.

We were encouraged both by the enthusiasm of Inspec UK (one of the UK's leading helmet testing organisations), and because we knew we were so close to achieving "The Ideal Helmet" described on the WABA's www.helmets.org website. In summary this reads:

The Ideal Helmet should...

1. Manage as much energy as possible in a very hard crash, keeping g levels in lab testing as low as possible, below 200 g for a two meter drop. ***In a lesser crash it should keep g's below 75. It should be able to handle multiple impacts***.
2. Have a strong strap that keeps it on your head after the first impact (car) for the second impact (street). Child and toddler helmets should also have a buckle that holds firm in a crash but releases after 5 seconds of steady pull to avoid strangling if the strap gets caught.
3. Be easy to adjust properly or be ***self-adjusting, and designed to encourage a good fit without excessive fiddling.*** Once adjusted, the adjustments should stay put.
4. ***Be comfortable to wear***: cool, light, unobtrusive to the user ***and fashionable in appearance***. The quality of the materials should be apparent.
5. Be as smooth and round as possible on the outside to prevent snagging in a crash. ***It should not have an "aero" tail*** that can shove it sideways in a crash and leave the rider's head unprotected. (Time trial helmets are an exception.)
6. Be highly visible to motorists and others both night and day.
7. Be durable, easily cleaned, ***and should not scuff or dent in normal use***.

Courtesy of WABA & www.helmets.org

Headkayse is a revolutionary flexible helmet, which can be folded, and adapts to the shape of your head for a very good close and comfortable fit.

But is it safe? Yes – Headkayse passes the current standard tests, with improved performance over many EPS helmets. But it really comes into its own outside these tests, where unlike an EPS helmet, the tough but flexible **Enkayse™** material will:

- Survive everyday punishment without losing ***any*** impact protection
- Absorb multiple heavy impacts without falling apart or serious loss of performance
- Provides softer cushioning at lower speed to reduce concussion.

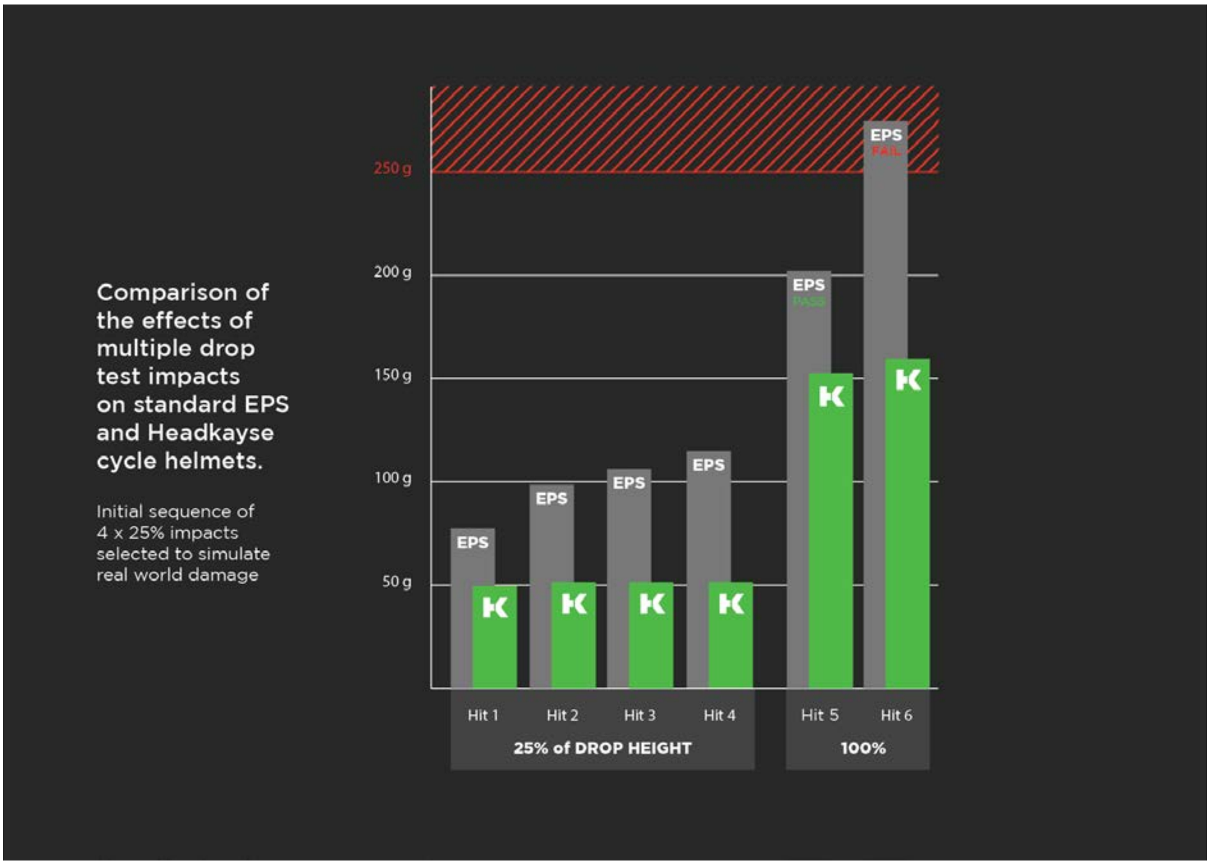
We recently asked Inspec UK to compare what happens to a Headkayse ONE and an EPS helmet, when subjected to multiple low level impacts. We were surprised by the results…

We selected a brand new good mid-market EPS model from a brand that is reputed to offer the best performance. Then both helmets were subjected to four low (25%) impacts, to simulate some real life wear and tear, followed by two full height drop tests.

You can see from the results shown below that the initial 25% impacts were clearly damaging the EPS, resulting in the last impact being over twice the deceleration experienced in the Headkayse. This is clearly not good for those of us that tend to bash our helmets or drop them on the floor.

Following this, the two full drop tests (on the right side of the chart) show what a big difference there is between a damaged EPS helmet and the multi-hit Headkayse ONE. Remember this is one of the best EPS helmets, so typical thinner versions from their competitors are likely to fare worse.

And you might be interested to know that this is the same Headkayse helmet that's been beaten with a cricket bat, rammed into gates, thrown as hard as possible on the ground and even driven over by a large Mercedes… (something we thought was going to destroy it!). And still it's vastly outperformed one of the best EPS helmets straight out of its box.



This is just the start. There is plenty more room for improvement in the design and performance. But the dream outcome would be that Headkayse, by proving these performance aims are now realistic, is the catalyst for a new, better helmet standard that encourages the industry to focus on innovation in safety rather than fashion.

Set A New Standard

It's all very well saying: "we need a new standard!", but what would this be? Based on the additional causes of head injury not covered in the current test, it should be relatively simple to tests for:

- **Rotational tests:** These have been done since the 1950's in various formats, and is already part of some motorcycle helmet standard tests. Typically this involves either dropping a helmet onto a sloped (grippy) surface, or dropping a helmet onto a rolling road. The simplest measuring method is to mount the headform on a horizontal arm parallel to the impact surface, and measuring the torsional strain in the arm - but this is quite limited. It's better to have a free falling head form, but this requires more complex accelerometers inside the head + signal processing to resolve the angular accelerations.
- **Multiple impacts:** This is fairly simple to do – you just drop the helmets more than once and check they don't fail.
- **Low Impact (concussion) Test:** Again this is really very simple as it would use the existing test equipment, just drop it at a lower height.

For all of these tests, a challenging but achievable target needs to be set – with agreement on the number of impacts, impact location (same spot?), impact speeds and maximum allowable g readings. These levels could be fairly relaxed to begin with, to allow the industry time to adapt, and then get revised upwards over time.

This brings us to the second vital component of a new standard – it needs to keep developing alongside technology, to encourage the focus of innovation to be on safety. This could simply be achieved with a periodic review system, perhaps based on the collection and analysis of all test results.

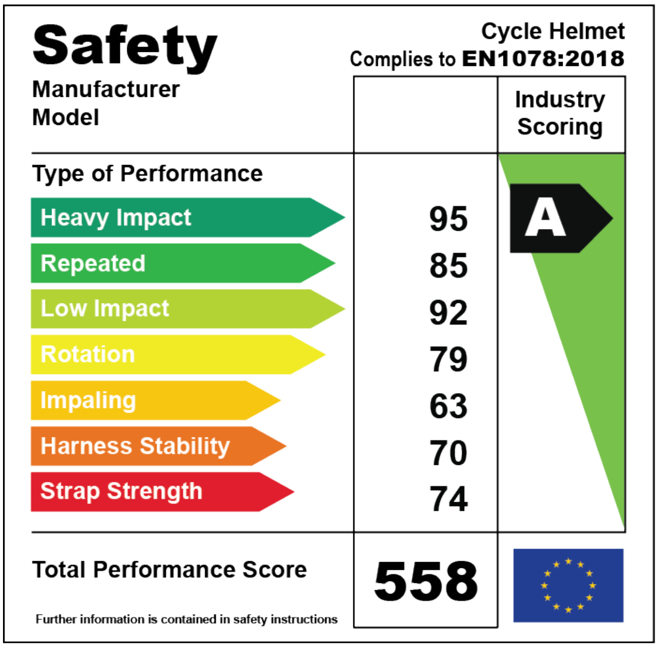
Finally the consumer needs to included in the solution. Ultimately the reason a better standard like Snell has dropped away is because the people choosing helmets don't understand and value why it's better. What normal cyclist has the time research this stuff?

One solution is to offer easy to find, good, clear, official information. This is what the Snell (www.smf.org) and the WABA (www.helmets.org) websites aim to achieve – although, much as we admire what they've done, we'd argue that an official GB / EU version, utilising better design could be more effective.

Secondly it's most important to give people a simple method of comparison at the point of purchase. The EU already has a system for rating environmental performance of consumer electrical goods – something that would be almost impossible to work out by yourself. Whatever you think of this system, it does provide a really quick way for the typical concerned but time poor consumer to compare two similar products in the shop.

Ideally this would highlight the different performance factors testing... (at least half of us in the cycling community do love to 'geek out' about technical specs!), but this should also be in a clear simple graphic form, with a nice big overall "safety score".

If we borrow heavily from the EU energy system, you can easily envisage there being a sticker on every helmet, as shown below. Please note this is just one suggested example of what could be done. The final solution would need a lot more thought and scientific testing before being launched on the public. That disclaimer out of the way, here's what a "Safety Rating" sticker might look like:



Of course, that brings us to the very last challenge. Assuming this is a good idea, how do we make it happen?

Headkayse has been approaching this from the ground up, starting with redesigning a helmet to prove it can be achieved.

We're also working closely with one of world's best medical experts in sports concussion, who is gathering evidence, from a range of sports, to make the case for change.

Hopefully from there, we'll be able to build enough of a consensus amongst standards professionals, to convince the EU standards committee to review the situation 20 years after EN1078 was set.

Conclusion

Despite all the heated debate and scary sounding information around safety… don't let this stop you enjoying the sense of freedom and health benefits that cycling provides. Cycling is still one of the safest ways of getting around. And when any of us do ride we should remember the best safety equipment we can deploy is our brains (ironically), and therefore cycle intelligently and defensively to avoid trouble in the first place.

But, if the worst did happen, then a helmet **will** work to reduce the decelerations on your brain- where '***reduce***' is the key word. A helmet won't make you invincible. Concussion is not a Boolean "yes or no" type of damage that you can eliminate. It progresses from mild to severe depending on the directions and level of acceleration.

The best we can do is try to reduce it, with better lower speed impact cushioning, ability to handle multiple impacts and the flexibility to help with rotational accelerations.

We believe our work in developing a new, tougher, more flexible material Enkayse is a solid step forwards in all these areas, producing a new construction of helmet that offers unique benefits, such as the ability to adapt to closely fit the shape of your head.

Our ultimate dream is that this project will help open the door to redesigning the current EU standard, to include new multiple impact, low-impact and rotational tests. Most importantly we want to get the standards bodies, the manufacturing and the market working together better to encourage more long term safety innovation.

Then we may well be on the way to a more sensible future for everyone – including those who may have otherwise been knocked senseless.

We think this is a worthy enough dream to have devoted three years of our lives to. If you agree, then support us by going to our **Indiegogo crowd funding page**, buy a Headkayse ONE, and help to launch the helmet revolution.

Author:

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Andrew runs a product design consultancy based in Bristol and is an expert in employing technical design innovation for start-ups and businesses. He's been working closely as part of the Headkayse team since its inception and has a huge belief in how well this small team works together.

He's a keen cyclist, and has been commuting by bike for the last 15 years. Andrew is passionate about cycling safety and has helped with the design of a cyclist detection system for buses and lorries.