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May 12, 2005

An open letter
From: The Snell Memorial Foundation
To: The motorcycling public.

I've been several months waiting for the helmet comparison write up that has finally come out as the "Blowing the Lid Off" article in the June issue of Motorcyclist. This same comparison has been done before. During my second year with the Foundation, 1991, some of the same people involved in the current article participated in an effort titled "Breaking Some Eggs." This earlier article also created a stir. They told any number of people that their good helmets were bad. Fortunately, hardly any of them panicked and a sober assessment of the facts indicated that the egg breakers were mistaken. Now, they've done it again. When I hear someone yell "Fire!" in a crowded theater, like most sensible people, I won't stampede for the exits but I'm apt to sniff the air before I start to wonder about who did the yelling. This time, after a little sniffing, I've got to tell you, I'm not smelling smoke. I'm happy to say that the worst is they may have broken the wrong egg again or lifted the wrong lid. In any case, the smell will dissipate quickly so we all can get back to the feature.

The most important item in the article is the helmet comparison itself. They based their comparison on flat impact performance and looked for the lowest peak acceleration. The authors maintain that flat surface impacts are the most common and "Fewer Gs = Less chance of brain injury." Flat impact performance is important, there's no doubt about it but looking at flat impact performance only is like judging a beauty pageant looking through a keyhole. The article holds that more than 75% of impacts will be against a flat surface but this implies that a substantial number of impacts may still be against some other, more threatening surface. The COST 327 report, the same European study mentioned in the article, goes further. It suggests that this number will be much larger than 25% and the resulting hazard much greater than mere flat impact imposes. Their crash study indicated impact surfaces as follows:

> "A round object was the most frequently struck, 79%, and the severity of injury was fairly evenly distributed. An edge object, for example a kerbstone was the least likely to be struck, 4%, but the most likely to cause a severe, AIS 5, injury. A flat object was struck in 9% of cases but was the least likely to cause an injury."

The immediate conclusion is: the asphalt slab testing is, at best, incomplete. Impacts against flat surfaces will not tell anyone all they need to know about protective performance. Flat impacts

are not the whole story and, if the European data is good, and I've got no reason to doubt it, flat impacts may be the least important crash consideration.

But there's still another weakness, the "fewer Gs = less chance" statement is, at the very least, misleading. All the standards, Snell M2000 and M2005 included, presume a threshold model of injury. That is: so long as a threshold G limit is not exceeded, there will not be a serious injury. A corollary conclusion is that any G exposure not exceeding this G limit is no better or worse than any other G exposure not exceeding this limit. If a G exposure below this limit is safe, another exposure 40 G's lower cannot be any safer.

The difficulty about this threshold is that no one is certain just where it is but there is some confidence about where it isn't. In the 1950's, BSI helmet testing relied on force measurements and used a test criteria that equated to about 450 G in current terms. The first Snell standard in 1959 set a criterion of 400 G but, because the headform was heavier, today's equivalent work out to 435 G. During the 1960's, the Foundation began to lower this G criterion. Snell certified helmets were no longer just for young, tough auto racers. The American public was taking up motorcycling and while many were as tough as anybody on four wheels, many others needed an additional margin of protection. The motorcycling environment itself raised some qualms. Snell standards and helmets were first developed for use in well ordered competition. No one thought the mean streets would require any less than that. If the helmet hadn't already been all the protection the industry could manage, I'm sure Snell would have asked for more. By 1998, the Foundation's criterion settled on 300 G. It was down some 33% from the levels set in England in the 1950's. Why was it down? Likely because the 50's estimates were based on the needs of soldiers and young, healthy males while today's helmets are intended for almost everyone.

What about the Wayne State Curve and all the other advances in the science of head injury during the last fifty years? Much of it was good work by gifted and dedicated scientists but, to this day, no one is quite certain what hammer blows to cadaver skulls and air blasts to the exposed brains of test animals have to say about the risks of helmeted impact. We're all still waiting for the breakthrough that will relate helmet parameters to head injury hazards. Right now, the most directly useful information developed for helmeted impacts has come from crash studies. Those findings suggest that current test criteria are working. If they weren't, COST 327 would not have considered flat impact "the least likely to cause an injury."

The fact is, all the major crash helmet standards call out G figures greater than those in the article. It's 300 G for Snell, BSI 6658, and FIA 8860, the Advanced Helmet Specification set out by FIA in 2004. It's 275 G for ECE 22-05. It's all of 400 G for DOT. Yes, yes, I know they said 250, they said a lot of things. Their rationale is that DOT's "time duration criteria" effectively set a new G limit of 250 rather than the 400 G limit in the standard. This may even be true for flat impact but DOT also calls out impacts against the hemispherical anvil. They even said so in the article. But they did not tell you that the "effective" G limit for the hemi is still 400 G. And, drawing on COST 327, it's there against the shaped hazard anvils like the hemi, the edge or the kerbstone that serious helmets will prove themselves.

The upshot is they seemed to have based their comparison on incomplete tests and drawn their conclusions from inconsequential differences. Anyone who was happy with his helmet before reading this article has been given no real reason to feel any differently now.

Now, ordinarily, at this point we'd fill in the grave, sing a few hymns and go home. But I've got a few more stakes here and the certain feeling we're dealing with the undead. So keep your garlic at the ready because I'm going in again.

The article also takes Snell to task for impact severity. The complaint is that by the time a rider takes that kind of hit, he's dead anyhow. The article proposed to trade that impact management away for softer liners. Yes, it's a trade. We cannot have both. For a given liner thickness, the softer the liner, the lower the energy management. We've been at just about at the limit of acceptable liner thickness for some time. However, there's no real assurance that softer liners would yield any benefit in reduced incidences of fatality or serious injury while, contrary to the article, the COST 327 report concludes that there would be a substantial benefit from increased energy management:

> "Head impact energy is proportional to head impact speed, which, in turn, indicates to what extent helmets need to be improved to give a corresponding reduction in injury severity. This was calculated and it was estimated that an increase in helmet energy absorbing characteristics of some 30% would reduce 50% of the AIS 5/6 casualties to AIS 2-4."

There are others who agree. When TRL, one of the companies participating in the COST 327 project, made helmet recommendations to FIA, the controlling body for Formula 1, their advice culminated in FIA 8860, the Advanced Helmet Specification. This specification demands considerably more impact management than the most severe Snell standard. A study of Snell test results has shown that the double impact test against the hemispherical anvil equates, on average, to a single impact of about 185 Joules. FIA 8860 tests helmets against this same hemi anvil and applies a single impact of 225 Joules.

It doesn't take too much imagination to see why this additional impact management might be valuable. When a rider goes off a bike at speed, even if he's got the good fortune to hit smooth pavement with an 8 foot drop or less, his body will still be sliding along the roadway at his initial cruising speed. Since leathers, denim and human skin aren't nearly as effective at braking as a good set of tires, this rider is likely to slide for some considerable distance and every obstacle he encounters offers a considerable head impact hazard. His helmet may have to do considerably more than see him through the first thump. A famous movie star some years ago crashed and received his most serious head injury smacking into a curb after sliding some distance from his bike.

It could be even worse. Frequently, when a rider spills onto the pavement, he will not be able to maintain a controlled slide while his cruising velocity gets scrubbed off. If he gets even a little out of shape he'll start to tumble and sustain multiple strikes to all his extremities. His helmet may need to manage a succession of impacts. And there's also no doubt that if he goes off his bike and strikes something less friendly than flat pavement, for example: a vehicle turning left across his right of way, even that first impact by itself may be considerably more serious than any eight foot drop could ever be.

The article also takes Snell to task for two hits. Snell calls for the helmet to be tested in 150 Joule impact (about 7.75 meters/second) followed by a 110 Joule impact (about 6.6 meters/second) at the same point on the helmet. Snell standards have always been two hits against the flat and hemi anvils and so have DOT and BSI 6658. I've already described how a helmet might sustain more than one hit in a crash and I've seen a number of helmets with signs of several severe impacts and at least a few where those signs overlapped. But there's at least one other justification for the two hit protocol. Back in 1959, when Dr. George Snively was developing the first Snell standard, the favored test device was the "swing-away" rig. This device was an improvement on anything that came before it but it demanded a high ceiling even for a very moderate shot. The only reasonable way for Snively to stress the helmet properly was to hit it twice. By the mid '60's, Snively switched over to the guided fall rig, the same type Snell, BSI 6658 and DOT use today but, by that time he'd also bumped up the test severities. He still needed the double hit.

But the Motorcyclist article went further. Not content with impugning Snell standards, the article slyly suggested fraud. They quoted one of their sources saying, "The Snell sticker has become a marketing gimmick." and implying that riders were being hustled for as much as $100 a hat. Nonsense, we live in the most market savvy country in history. I've grown up seeing and seeing through more slick ad campaigns and smears than my great grandparents would ever have dreamed possible. The half-life for a marketing gimmick these days is surely no more than a few months while Snell is coming up for its fiftieth anniversary. Certainly Abe Lincoln was right, nobody could have fooled all the people for this long. If I wasn't already insulted as a Snell guy, I'd be insulted as an American. We're no gimmick and neither are any of the helmets we certify.

Snell certified helmets come in a range of prices, the least expensive cost not much more than Harry Hurt's bargain basement items. Of course, the production costs are higher, Snell test fees and stickers may add a dollar or so but the bulk of the costs is likely to be the internal quality control measures necessary to succeed in the Snell programs. But, if I'm to wear their helmets, I don't want manufacturers going light in this department in any case.

And not everyone wants to shop the bargain basement and I'm not sure that everyone should. There's more to good helmets than protective performance. Riders demanding premiums of comfort, fit quality and good looks may have to move up to the higher shelves. But here again, they can get real value for their money. No one will stay with a helmet that's ugly or uncomfortable, at least, not for very long and a helmet that isn't worn is no bargain no matter how inexpensive.

Snell can't really help with comfort, fit quality or style issues. They're all matters in which riders can tell us much better than we could ever tell them. But I will try to offer a little advice in the matter of fit. The less expensive helmet lines use no more than two helmet configurations to cover the full range of head sizes and some offer just one. A size medium rider is apt to wind up wearing a size x-large helmet stuffed with thick comfort padding to bring it down to his head dimensions. But on the higher shelves, a helmet line might include as many as four or five distinct configurations and at least one manufacturer configures different lines for different head shapes. The result is that almost everyone can find a good fit. The catch is that more configurations imply shorter production runs and, in turn, more expensive production methods. The saving grace is that the value is there, in the helmet. The price reflects the production costs. No one is laying out an extra $30, $40, $60 or $100 dollars for just a Snell sticker. The competition among Snell certified manufacturers is too fierce for that. Riders are getting the protective performance called out in Snell standards and they're getting the comfort, fit and style they demand at the best price our economic system can deliver.

I've attempted, as the writer at Motorcyclist did, to inject some humor into this. But even as I've worked on it, I've been getting emails from concerned riders who want to know whether we've been misleading them and whether their helmets were ever any good. I hope all of you will look past anything you might find frivolous or inappropriate here and understand that Snell standards and Snell certified helmets represent the best solution to head impact protection that we here at the Snell Memorial Foundation can propose.

Snell and helmets have come a long way in fifty years. Back in the late 1950's when Dr. Snively was drafting the first Snell standard, he was working with a clean slate. Almost anything he might do would be an improvement. But in fact, he was startlingly deft in all his choices and policies. He did better than improve helmets, he worked a revolution. Thanks to his effort and genius, and to the support of Snell helmet manufacturers and all the riders and drivers who wear Snell certified helmets, Snively has gifted us all with a tremendous legacy. And with that legacy comes a tremendous burden. A poorly chosen policy or a mistaken technical judgement at this point could well destroy that legacy and endanger all those riders who depend on Snell certified helmets. We're part way up a mountain on a narrow trail and a wrong step will mean a long, long fall. The good news, though, is we're on the right trail and we're moving upward. If we suck it up, watch the signs and ignore the mosquitoes we will continue to make progress.

Sincerely,

SNELL