● ONE CALIFORNIA MOTORCYCLIST recently made an important contribution to science when he fell off, whacked his noggin on a guard rail post and came within a capillary's breadth of suffering serious brain injury. He couldn't have known a bunch of people were waiting for someone to do just what he did, wanting a closer fix on the impact level a helmeted head can take without having its contents scrambled. Our man didn't disappoint them: he bashed squarely against the flat side of the post hard enough to leave a tell-tale pattern of damage on his helmet; hard enough to knock his eyeballs thoroughly but not permanently ungimballed. His experience is important, because researchers will be able to impact identical helmets on an instrumented head-form until they get the same kind of damage, at which point their gauges will have told them how much whack was almost too hard for the gray matter in one human head to survive intact. And the numbers they get eventually will be reflected in the design of future helmets.

You might be thinking that our anonymous rider's helmet couldn't have been much good if his crash damaged it enough to create a record of the forces involved, yet did not do him lasting harm. But it is precisely because the helmet absorbed the impact and suffered the damage that its wearer still functions normally, as comes clear if you examine the situation closely. A human head of average size and density weighs about ten pounds, and if it gets thudded against an unyielding surface at only ten miles per hour that works out to be an 8800 foot-pounds/second chunk of energy, which is more than enough to send shards of skull flying all over the road. Helmets protect by absorbing impact energy, and the available evidence suggests that today's first-rate helmets can handle up to around 17,000 ft-lb/sec jolts.

Until just this past decade helmets weren't much good. Their shells might be made of anything from aluminum to pasteboard, and there commonly was nothing between the wearer's head and the shell but a bit of soft sponge rubber and a fabric sling, which meant that a few nanoseconds after the shell hit a post your head hit the inside of the shell—and almost as hard. Today's helmets also use a hard shell as their outer surface, but cover much more of the head and are more rigid.

Modern helmet shells are made almost exclusively of fiberglass or polycarbonate thermoplastics. The latter is made by squirting molten plastic into a mold cavity, which is an extremely inexpensive process. Unfortunately, the process also hides a few opportunities for catastrophic error. Good polycarbonate shells are *very* good but if a dab too much pigment is added when mixing the plastic, if there's too much moisture in tha air, if the material is contaminated, or if workers handle the shell roughly in removing it from the mold, then all bets are off. Polycarbonate shells also are sensitive to some chemicals used in paints and cleaners, and may be seriously weakened by the drilling of the small holes needed for installing extra face-shield snaps. These shells can be extraordinarily tough, especially in their resistance to penetration, if made to high standards of quality and not mistreated (i.e. painted or cleaned with the wrong stuff) by the purchaser.

Fiberglass shells are, in varying degree, more expensive than those of molded thermoplastic. Fiberglass can be blown into molds as chopped fiber and uncured resin, which is very cheap but susceptible to manufacturing error and acquires adequate strength only if made fairly thick. Rough-cut fiberglass mats can be soaked in resin and stuffed into molds to cure, with slightly better results. Fiberglass cloth is most commonly used, and the best strength/weight result is had by using light, close-woven cloth pieces laid by hand in multiple, overlapping layers; fewer layers and coarser cloth are cheaper but not as good. Again, though not to the extreme of the polycarbonates, quality-control has much to do with the performance of a fiberglass helmet shell. If yours has a thin spot in it, and that's where you happen to come down, knowing its *average* thickness was adequate won't be a whole lot of comfort.

Fiberglass was around some time before helmets got to be good, as was the now familiar three-quarter-bubble shell configuration. The big difference, the reason for the vastly-improved protection provided by today's helmets, is found in the material used in the space between the shell and your head. This material is a stiffish plastic foam, either polystyrene or polyurethane, and it absorbs impact energy by crushing. Five years ago many helmets had crushable liners only a half-inch thick, and these were molded of a very dense, stiff foam because liners that thin had to be stiff to provide enough resistance to bottoming. Now, manufacturers use inch-thick liners of a somewhat softer plastic foam and these give markedly better protection than those of the recent past. Indeed, the improvement is so great that if your present helmet is more than two years old and fitted with one of the old liners, you should throw it away and get a new one. Replacement is expensive, but you should think of it as a matter of "your money or your life."

Helmets aren't much good unless they are on your head, which is why manufacturers are required to provide them with chin straps and fasteners strong enough to take a 300-pound pull. Nobody has discovered a way to convince everyone they should fasten their chin strap; we've seen plenty of people riding along with the strap's loose ends flapping in the breeze. Neither has anyone been able to convince all motorcyclists that the wearing of helmets is a life-saver—and we're not going to try. Anyone who rides without a helmet is a mental midget, without much brain to protect, and we're not going to worry about him. We do worry about the anti-helmet lobby's propaganda about how this indespensible safety item is supposed to obstruct vision and hearing and cause broken necks. It isn't so.

The helmet's innermost layer of padding is what makes it comfortable, which is important because people won't wear something that gives them a headache. Helmets' inner padding could be arranged to protect one's hearing, but that isn't being done just yet. Wind-noise at 60 mph is a bit over 100 decibels, high enough to cause a hearing loss after prolonged exposure. On the other hand, the wind rushing past your bare ear is even noisier.

No discussion of helmets is complete unless it mentions the Department of Transportation's attempts to highway-fund blackmail the states into making motorcyclists wear helmets under penalty of law. Government's actions in this matter have infuriated even those who are convinced that wearing helmets makes the best kind of sense. You should be more furious knowing that the DOT's tender concern for our well-being did not translate into a federal standard for helmet performance until 1974—eight years after all the noise about mandatory helmet laws began. And even now the standard is incomplete, due to bureaucratic dithering. The new federal standard covers only helmets in the "medium" size category; those smaller or larger have been ignored.

You'll find the interiors of many new helmets plastered with stickers, and these can be a useful indication of quality. The DOT sticker can only be used on medium-size helmets, by law, even if a manufacturer's smalls and larges perform at the level specified in the DOT's FMVSS 218 standard. A Snell Foundation sticker is an indicator of high performance, and some racing organizations recognize nothing else. Also on the list of acronymic sticker-names is the AAMVA, (American Association of Motor Vehicle Administrators) which has persuaded most states to adopt an updated ANSI Z90.1 standard for the smaller and larger helmets ignored in the DOT's paperwork. And, oddly enough, the helmet industry's own association, the Safety Helmet Council of American, is doing a worthwhile job: the SHCA program for members requires that they adopt and maintain strict quality-control standards, keep careful records, and submit to regular inspections. Backsliders don't get to use the SHCA sticker.

The most important thing to know, and remember, about how helmets work is that they don't work at all unless you've got one on your head. You say helmets aren't stylish? Believe us, you wouldn't want to be caught dead not wearing one. ●

HOW THINGS WORK: HELMETS

Nobody wants to think about crashing, but it happens to most of us sooner or later, and that's when a helmet can be the difference between life and death.

by Gordon Jennings

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