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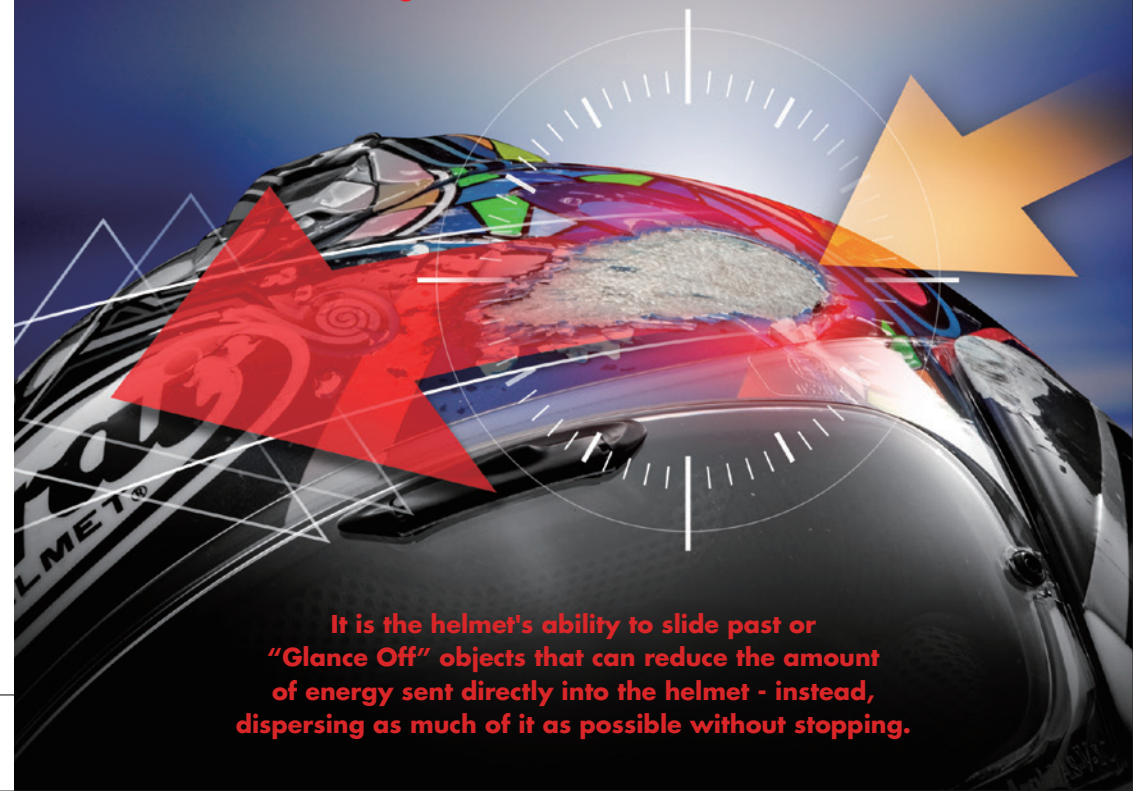


GLANCING



OFF

IMPACT ENERGY
Enhancing Performance Wherever Possible



It is the helmet's ability to slide past or "Glance Off" objects that can reduce the amount of energy sent directly into the helmet - instead, dispersing as much of it as possible without stopping.

In the event of an impact, energy is created, and the role of a helmet is to 'appropriately manage the impact energy' to protect the rider's head. That energy management is generally achieved by 'absorption' of the impact energy around the head, thus protecting it. The outer shell deforms and the cells of the inner EPS liner crush, and that destruction manages impact energy by converting it into work. However, the truth is even the best helmet has limits to how much energy it can manage. On the other hand, the helmet isn't only absorbing energy, but rather in a large crash when the rider's head is repeatedly protected by the helmet, we understand that it's working to manage impact energy in another important way.

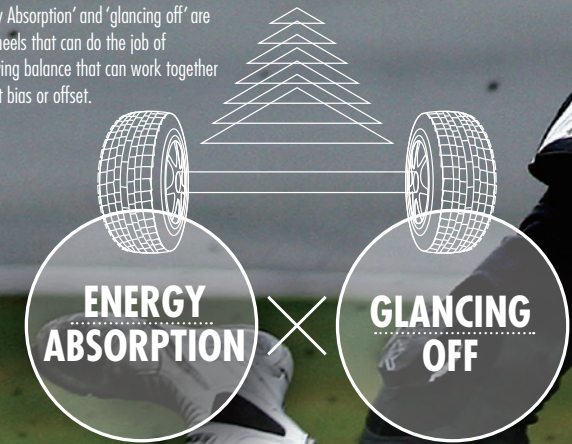
That is 'glancing off'. Many people probably don't even realize this, but at the moment a helmet is impacted, if struck off center it can slide on the crash surface, minimizing the impact energy that might otherwise be transferred to the rider's head. Therefore, if not directed toward the center of the helmet, the head inside can be protected, even with high energy levels and the liner's limited energy absorption ability. Even in extreme crashes we've witnessed 'glancing off' and 'energy absorption' as two halves of energy management that work together to increase the chances of head protection. This holds true for any kind of helmet.



All helmets protect the rider's head through both glancing off and energy absorption.

MOVING FORWARD

'Energy Absorption' and 'glancing off' are two wheels that can do the job of preserving balance that can work together without bias or offset.



How does a helmet protect your head?

Head protection can be called managing impact energy. Except managing that energy is not just absorbing it.

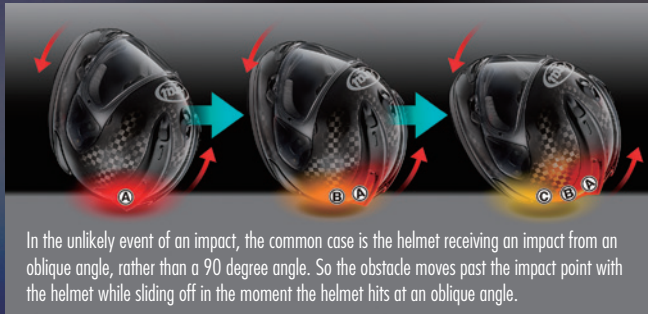


Here is the moment of impact. The rider tenses up, and the helmet contacts the ground. You can imagine what the helmet has to do next.

'Energy absorption' can be called when an obstacle collides with a helmet and the energy from the impact enters the helmet. We call this 'impact energy'.

Glancing Off Works Together with Energy Absorption Invisible to Your Eyes

When we talk about 'Impact absorption ability' there will be a limit regardless of any manufacturing technique employed, because of the limited amount of space between the shell and rider's head necessary to manage impact energy (see below "The Limit of Absorption Ability"). And on a motorcycle, we have to prepare for impacts that far exceed our imagination. So it follows that glancing off is critical for supporting that. Arai's helmet exhibits results due to its strong shell combined with its round smooth surface and achieves the important goal of not letting energy into the helmet. However, helmet standards place their emphasis on impact absorption and do not show



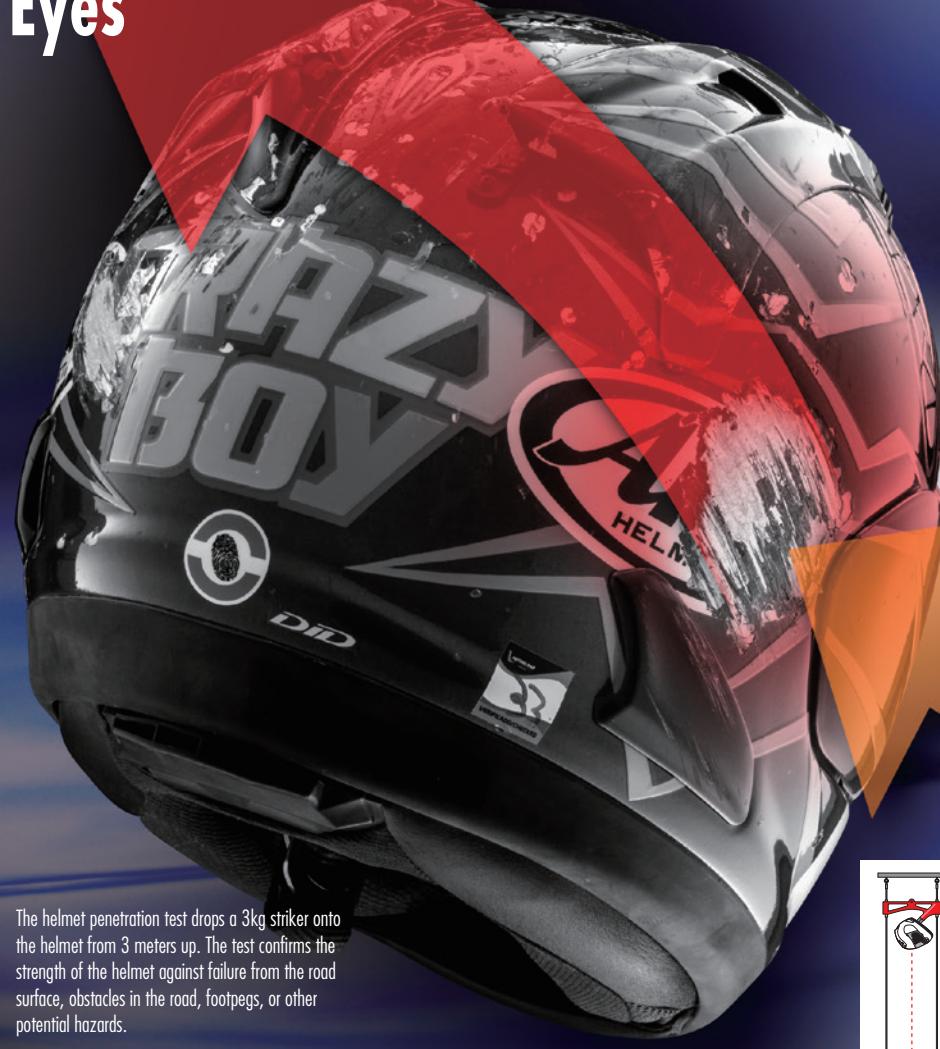
In the unlikely event of an impact, the common case is the helmet receiving an impact from an oblique angle, rather than a 90 degree angle. So the obstacle moves past the impact point with the helmet while sliding off in the moment the helmet hits at an oblique angle.

anything about glancing off. Glancing off is the synergy of various elements working together, and there is no set way to impact a helmet to test for it. There is a test for shell strength to resist penetration, though because it's difficult to put numbers to the the shell form and such for glancing off, there remains no definition. Any helmet makes use of glancing off, but due to the difficulty in numerically capturing each helmet's difference in ability, there are many cases

where safety standards simply don't define glancing off. In addition to passing standards, Arai makes continual efforts to improve our helmets' glancing off ability and pursue gains in head protection.



The helmet penetration test drops a 3kg striker onto the helmet from 3 meters up. The test confirms the strength of the helmet against failure from the road surface, obstacles in the road, footpegs, or other potential hazards.



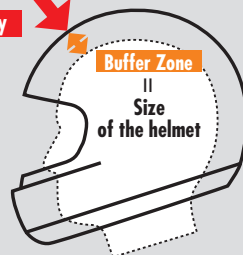
GLANCING OFF

The Limit of Absorption Ability

ENERGY OF IMPACT

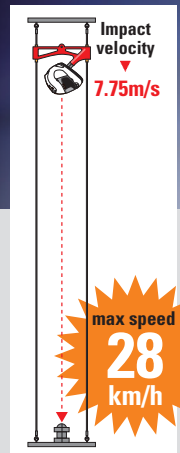
The amount of energy in a crash can be expressed as distance and force, where distance is the physical space between the helmet shell surface and the rider's head, or in other words the helmet size. If you make the helmet user-friendly, there will be a limit to its size. Regardless of construction or material employed, there's still a limit to the space available in a helmet.

Impact Energy



Illustration

As for the force involved, if you convert the force from the helmet drop test of the strictest helmet standard in the world, it amounts to merely 27.9km/h (or 7.75 m/s).



Aiming to be the Best in the World

When it comes to proficiency in head protection, Arai has the goal of making a helmet superior to all others and continues to make our helmets this way today. We have seen this confirmed in many of our rider crashes over several decades, and we pursue gains in protection even if just a little. Because we come from this background, we've come to notice the importance of the smoothness of the helmet as a component

above all others and continue to employ it in our approach. Head protection is the foundation of our belief in being the best in the world and we pursue the value of both 'glancing off' and 'impact absorption' equally. This is the difference of Arai.



Arai's desire is to pursue gains in protection wherever possible, and glancing off plays a major role in improving impact performance.



The harshness of reality can far exceed our expectations. And we have the regrettable thought of knowing there is a limit to our ability. But we don't want to tell ourselves it could have been different had it been another helmet. So with great pride in ourselves, we stick to our will to tackle protection better than any other helmet in the world.

GLANCING OFF

Helmet Scars from Impacts

ENERGY OF IMPACT

Impact absorption testing is representative in helmet standards testing. It numerically measures the impact when a helmet collides with an obstacle straight on. Diagonal scars are left on the helmet where it received a perpendicular impact. On the other hand, impacts can be received from different angles and the scars flow horizontally from the impact point. *See riding impact case examples.

Right: Impact scars from drop test (hemisphere anvil) ▶



The Never-Ending Evolution of Glancing Off.

Seeking various improvements every day: Introducing one part of the challenge.

Accumulating improvements that over time combine and advance glancing off.

+ EVOLUTION
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Glancing off cannot be adequately quantified as a basis of head protection. In actual crashes, an impact can come from any angle at any speed and cannot be prepared for. Also, the exact speed and angle of an impact cannot be replicated 100%. So as for the development of 'glancing off', there's nothing that can be done except to accumulate improvements that we think we should do through experimentation and small adjustments to combat every possibility.

Form

The Evolution of Form Continues as Time Goes By

From the scars left by actual rider impacts, we can gather that the helmet was able to slide past obstacles and not catch or snag because of its smooth surface. In other words, we surmise they exhibited 'glancing off' properties. So, the shape of Arai helmets will be round and smooth to the very end. We have kept the same basic shape since the beginning, and think it alleviates impact energy more so than a shell with an exaggerated shape with hard edges that may catch. Our helmets evolved from a cannonball shape when first introduced, into an egg shape today, to better blend the entire outer surface more smoothly. The current shape of an egg is a simple sphere evolved in nature for survival. Arai also evolved towards the egg shape with the notion to protect the rider's head as much as possible from impacts that might exceed expectations.



The whole helmet has evolved to receive impact energy with its round surface to address obstacles, and reduce flat facets in the shell.



FORM

The Never-Ending Evolution of Glancing Off

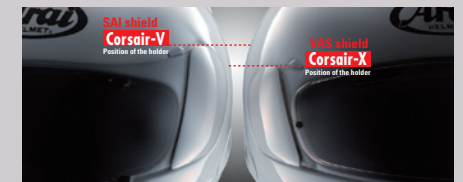
R75

The aero parts and vents that keep the rider comfortable break off in an impact by design. Our helmets are designed to avoid protrusions in the shell. They also have a continuous round and smooth spherical form maintaining a radius of no less than 75mm, which we call R75, in the specified head protection area of the helmet according to safety standards.



VAS SHIELD

Designed for improved function, but more importantly to increase the continuous smooth shape of the shell. VAS aims to increase the 'glancing off' ability of the helmet by maintaining the smooth shape of the helmet above all.



*The convex curved surface of the shell has a continuous radius of 75mm or more across its curvature.



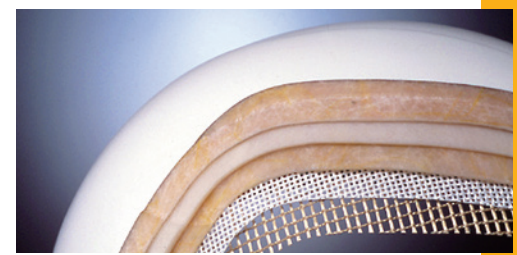
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Strength

The Never-Ending Evolution of Glancing Off.

Strength

Shell strength is very important for enhancing 'glancing off'. In an actual crash, if the shell deforms or is completely destroyed it can no longer slide and will stop and catch on that point. A helmet that can't slide can't maintain its 'glancing off' ability and that impact energy can reach the rider's head. Since we've decided on being the number one helmet in the world for protection, we've pursued shell strength as well as weight reduction by accumulating improvements that embody the lifeblood of Arai. This evolved into the development of the cLc shell process (complex laminate construction) which encompasses both strength and lightness. Although the cost of the material utilized is 6 times higher than conventional fiberglass, Arai exploits its use for a stronger and lighter helmet. To prevent cracks from spreading to the helmet's edge, the critical edges of the shell have a Super Fiber Belt which reinforces these areas like the bands of a barrel. The resin blend as well is evolved through our obsession with strength and weight reduction as we continue to accumulate various improvements.



Between the high strength fibers, special lightweight elastic fibers are sandwiched between, which is the Complex Laminate Construction (cLc). It offers a 20% weight reduction compared to making it with just all the same fiber.



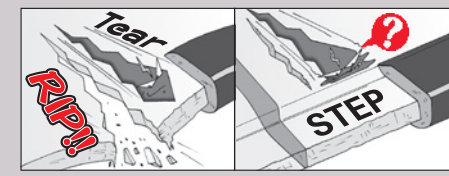
The bottom of the shell has a Super Fiber Belt which reinforces the helmet like the bands of a barrel for better protection. This special belt suppresses the spreading of cracks that form when the helmet receives a large impact and improves glancing off.



STRENGTH 2 Continually Seeking the Strongest Materials and Best Techniques at the Forefront of Technology

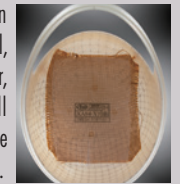
HYPER RIDGE

At the bottom of the shell there is a three-dimensional 'Hyper-Ridge'®, a step in the shell designed to stop the migration of cracks that form when the helmet receives an impact.



SPECIALIZED GLASS FIBER

Arai's top models utilize the same material found in a bulletproof vest in the crown part of the shell, which is expensive but strongest in function to maintain strength, reduce weight, and lower the helmet's center of gravity for reduced rider fatigue. Shell evolution involves more than improvements in construction, material, and manufacturing techniques. Rather, we pursue strength from the shell shape. All elements of shell shape are connected to the function of the helmet.



EPS Liner

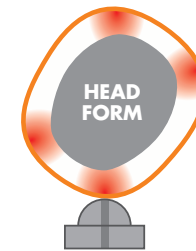
● The Never-Ending Evolution of Glancing Off.

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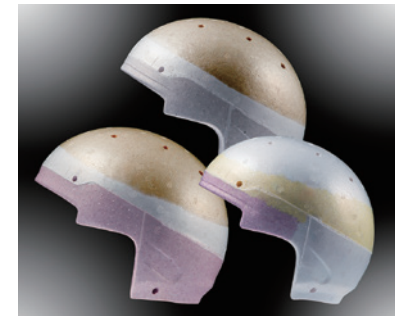
Absorption Liner

Even the best 'glancing off' ability alone won't protect the rider's head. 'Impact absorption ability' is necessary to pass even the strictest helmet standard in the world. In the impact absorption ability test, the shell surface deforms when it receives an impact with the helmet hitting obstacles of certain angles and shapes. If the impact surface is narrow, concentrating the impact energy, the EPS liner must naturally be thicker. However, while that makes it easier to pass helmet standards, making the EPS liner thicker only in the necessary places ends up distorting the helmet shape away from 'round and smooth'. It doesn't maintain a form ideal for making the most of 'glancing off'.

Arai's proprietary 1-piece multi-density EPS liner has finely-tuned sections with various densities. It can make the most of its 'glancing off' ability because the EPS density varies according to the corresponding shell surface, allowing the shell to remain 'round and smooth'. This 1-piece multi-density liner is indispensable for improved results in Arai's strength of the shell shape pursuing 'glancing off' performance.



The head form shape used in helmet testing is somewhat square, so the 'four corners' get tight inside the helmet, and we can see a tendency to make the shell square too.



Arai's proprietary 1PMDL (one piece multi-density liner) is the only one of its kind in the world and offers incredible protection by being fine-tuned to each shell size, in each model and in each head size, with varying EPS densities.



3 ABSORPTION LINER

For Many Years We've Seen Our Liner's Performance Tested

The liners used by some other helmet manufacturers may have multiple densities, and have separate pieces with seams where they are assembled, or use a non EPS liner type. All address impact energy in a vertical drop from a set distance in helmet standard tests, where there is no



difference in absorption ability. However, it's difficult to manage an impact you cannot foresee on the road or track which could come from any direction. On the other hand, if the liner is 1 piece multi-density, it has unbroken bonds between all densities and can stop the spread of impact energy more efficiently. In an actual crash we can confirm the effective combination of the liner-shell system. Furthermore it exhibits ideal absorption performance in side impacts as well because it's designed with glancing off. The 1PMD liner is the ideal ingredient in impact energy management where it can manage impact energy from any direction and address actual impacts unknown to the rider.

[SUMMARY]

Glancing Off, together with Energy Absorption, is an Important Aspect of Rider Protection.

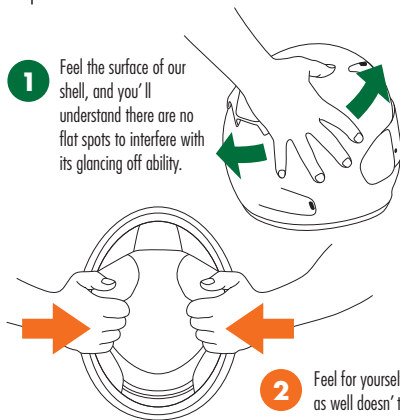
The Duty to Protect

Without energy absorption ability a helmet can be called meaningless. Though, in a crash any helmet will protect the rider's head by two roles: 'glancing off' and 'impact absorption'. While impact absorption can be measured, the shape that bears 'glancing off' cannot, but because of its relative ease of skipping past obstacles in a crash, the truth is it plays a large role in the helmet. And as mentioned above, in many cases we're riding above the speeds in a test environment. Actual crashes can exceed the absorption ability of the helmet and involve immeasurable impact energy, and even the best helmet would not be able to manage it. In the event of a crash, the number one goal is preventing impact energy from reaching the head. Before absorption, most energy can be avoided. This 'glancing off' shell shape plays the important role in going beyond just 'impact energy absorption' because actual crashes can exceed expectations.

Please see for yourself at your local dealer

Confirm Glancing Off

Arai continues its pursuit of 'glancing off' performance. However, 'glancing off' ability cannot be confirmed by seeing a certification label. You can probably say the 'glancing off' ability of our helmets is high when you feel the smooth shell with your own hand, improved with breakaway



1 Feel the surface of our shell, and you'll understand there are no flat spots to interfere with its glancing off ability.

2 Feel for yourself the lower part of the shell as well doesn't lose the round smooth shape.

vent covers. We invite you to feel and compare with your own hands. A form with few changes in its shape, consistently round, is difficult to deform in actual impacts, and can be said to have high glancing off ability.

Pursuing Gains in Protection

Emphasizing the Accumulation of Various Improvements, bearing in mind our mission to protect the Rider.

Riding motorcycles can be called a sport where you enjoy controlling risk. So naturally there is risk involved. Arai is the collection of people devoting themselves to the path of protecting the rider's head and the thought that the helmet has the noble duty, with the utmost meaning of potentially saving someone's life. To pursue advancing the ability of how a helmet should protect the rider from a crash, while we enjoy motorcycles, and continue to accumulate such gains in protection is our goal.

But the severity of actual crashes can far exceed our expectations, so even making the helmet with our goal in mind, we bear the regrettable thought of knowing there is a limit to the helmet's protective ability. Even when that happens, we can say to ourselves we did everything we could. We at Arai remain determined to pursue superior protection above all other helmets and to not lose pride in what we're doing.

What should we do to combat actual crash impacts? There's no simple answer or solution to this question. We've continued on a straightforward path of searching for every factor we can find, one-by-one, accumulating even small improvements for more than 60 years since our inception. So now, Arai believes we have fostered a brand that has received the recognition from many around the world that say 'Arai's protection is different'.