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RTA

Development of a Motorcycle Helmet Evaluation Program

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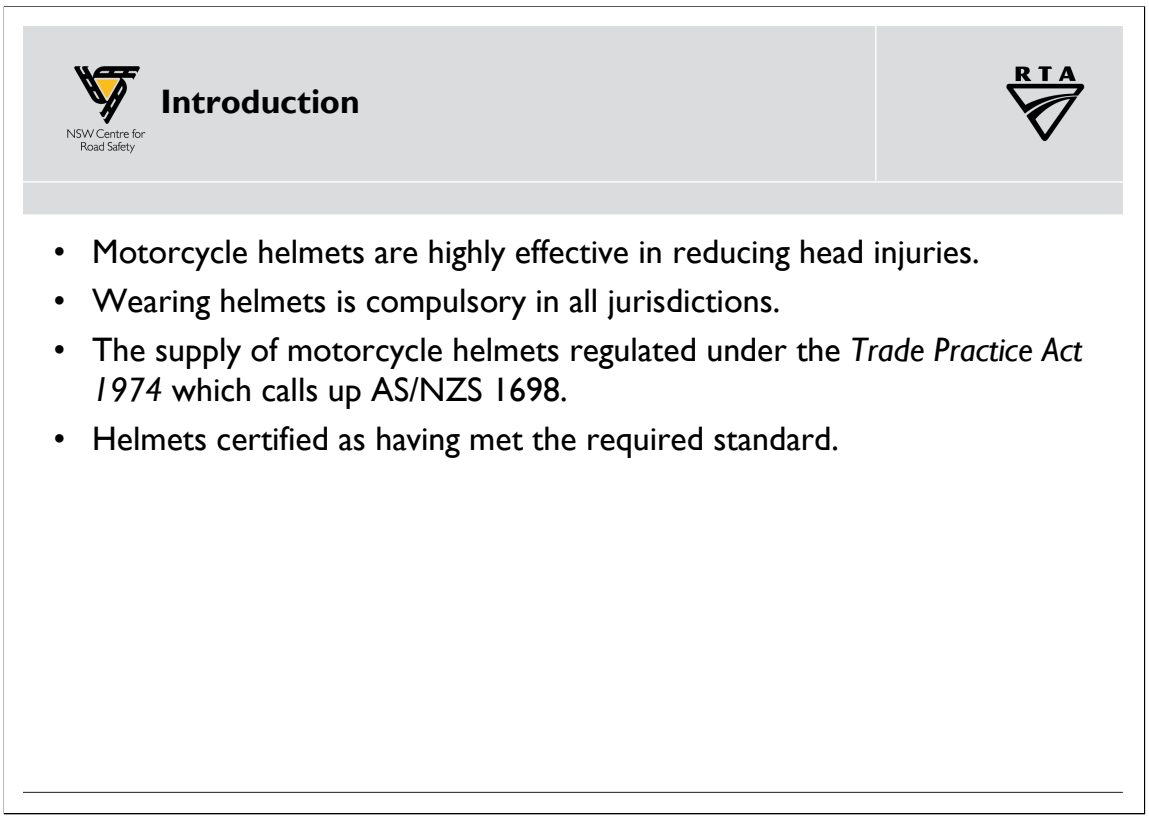
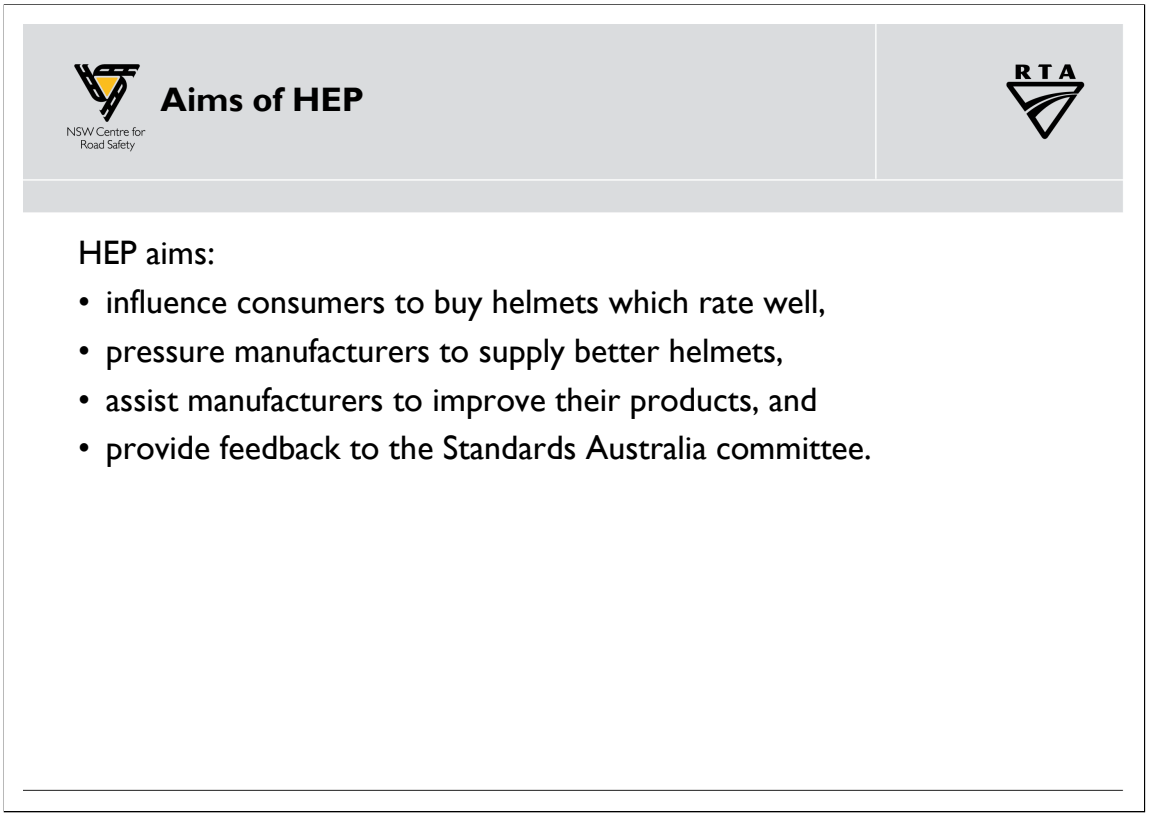
Dr Basuki Suratno, Dr R. F. Soames Job, Keith Simmons
NSW Centre for Road Safety



Accident research has found motorcycle helmets to be highly effective in reducing head injuries. In all Australian jurisdictions, the compulsory wearing of helmets is mandated though their respective Road Rules. And, the supply of motorcycle helmets is regulated under the *Trade Practice Act 1974* which calls up AS/NZS standard 1698 as the product safety standard.

Currently, helmet testing is reported as meeting or failing to meet the required standard. Generally, international standards either require a helmet meet a minimum performance criterion, for example the relatively simple DOT, or they attempt to encourage the helmet to provide maximum protection, for example Snell with its higher performance levels or ECE 22.05 with its significantly larger set of test requirements which include oblique impact and chinbar testing. Field research and test studies however have failed to distinguish crash protection levels between helmets qualified to one standard against another.



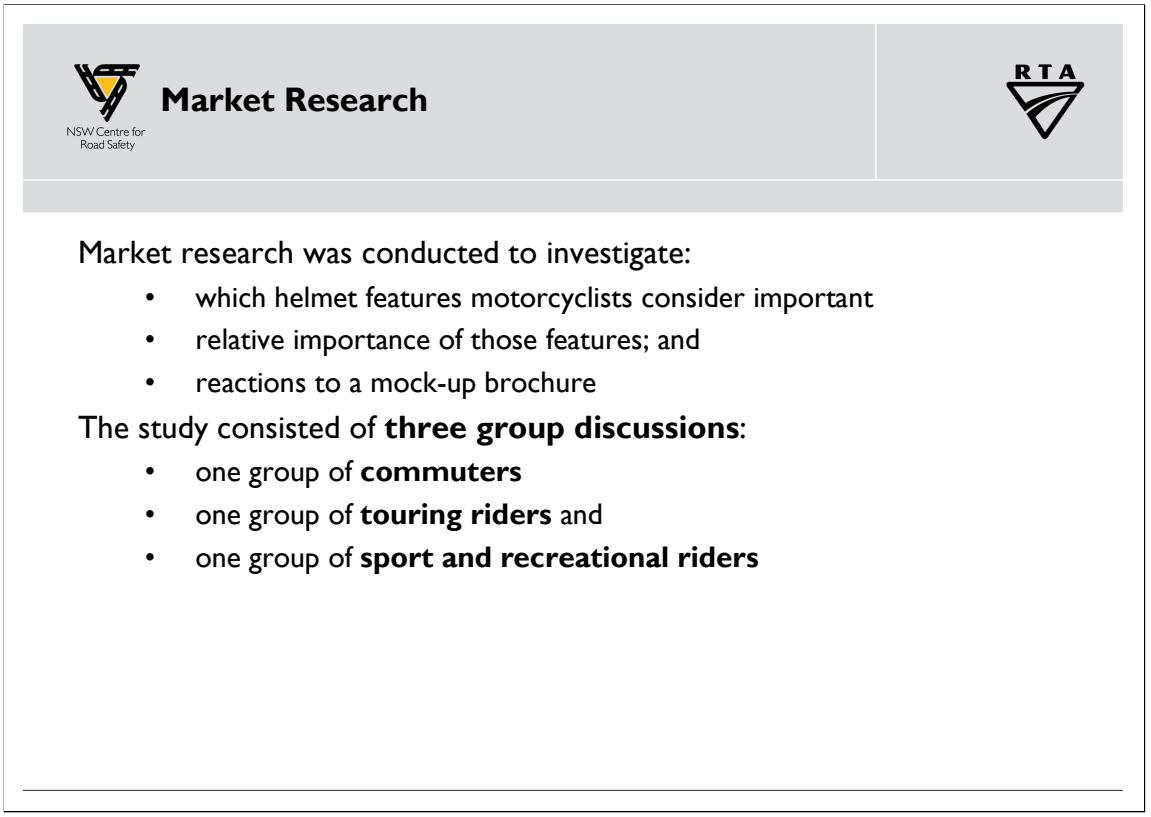
The Helmet Evaluation Program (HEP) was developed, as a parallel to the Australasian New Car Assessment Program, or ANCAP, to promote safety and drive market demand through informed consumer action. This paper describes the development of HEP and the specially designed assessment methodologies it uses. HEP rates helmets on crash protection and rider comfort performance assessments. Like all consumers information programs such as ANCAP and CREP, the underlying philosophy of HEP is to:

•influence helmet buyers in making an informed decision to buy helmets which rate well, and avoid those which do not.

•apply commercial and public consumer pressure on helmet manufacturers to develop and market products that are at least equal to the best currently available.

•assist manufacturers with detail of where their products rate well and where they do not,

•provide feedback to the Standards Australia drafting committee to be used in updating the Standard.

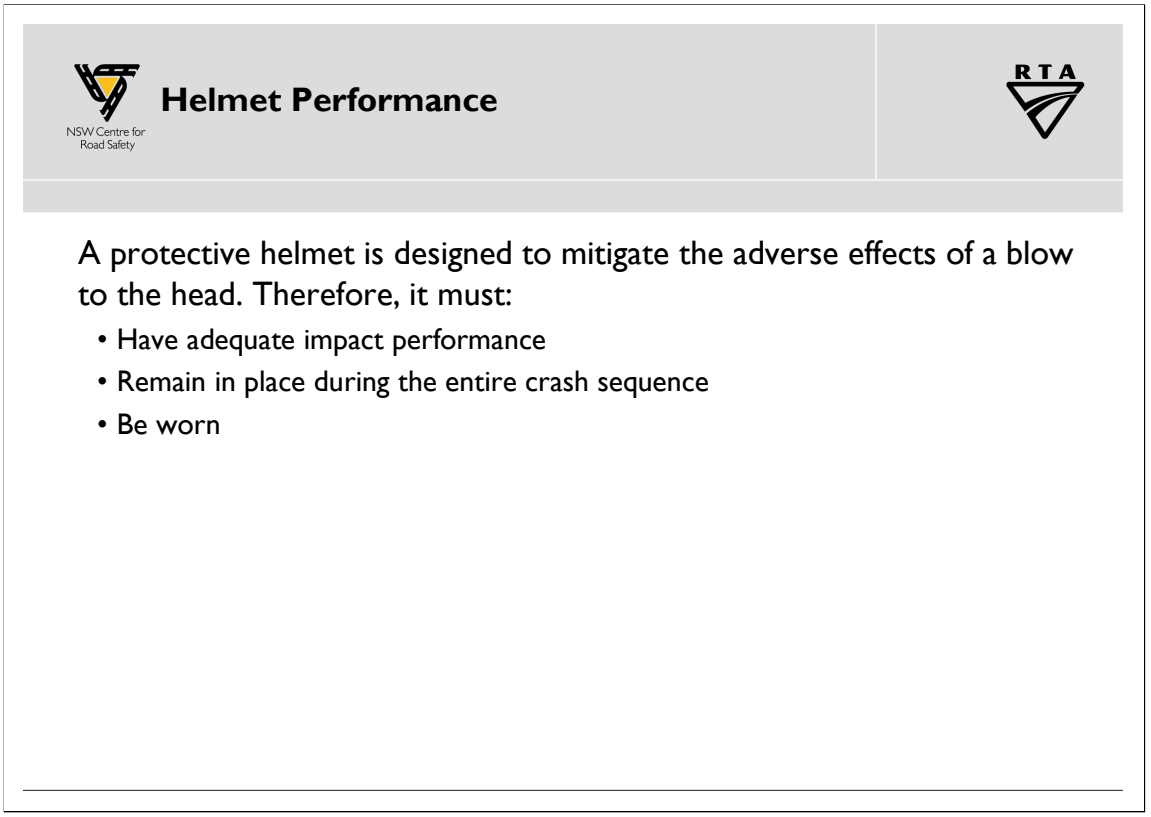


Before the assessment program was conducted, a research consultant was commissioned to conduct market research amongst motorcyclists in order to:

- investigate and understand which helmet characteristics motorcyclists consider important and the relative importance of those characteristics; and
- evaluate reactions to a mock-up brochure, particularly in terms of:
    - ease of understanding; perceptions of the usefulness and believability of the information in educating buyers;
    - extent to which it can contribute to improved purchase decision making;
    - how best to present the findings of the Helmet Evaluation Program.

This study was an initial 'toe in the water' exercise. It consisted of three (3) group discussions with male motorcyclists aged 25-55 years in the target group:

- one group of **commuters** – those who regularly use their motorcycle to get to and from work;
- one group of **touring riders** – those who regularly take long rides (on-road) on weekends and days off; and
- one group of **sport and recreational riders** – those who regularly ride off-road (eg: trail riding, motocross, etc).



Motorcycle helmets have been found to be very effective in preventing contact injuries such as lacerations and skull fracture, but less effective in preventing inertial injuries to the brain.

For a helmet to have any effect during a crash it must:

•Have adequate impact performance

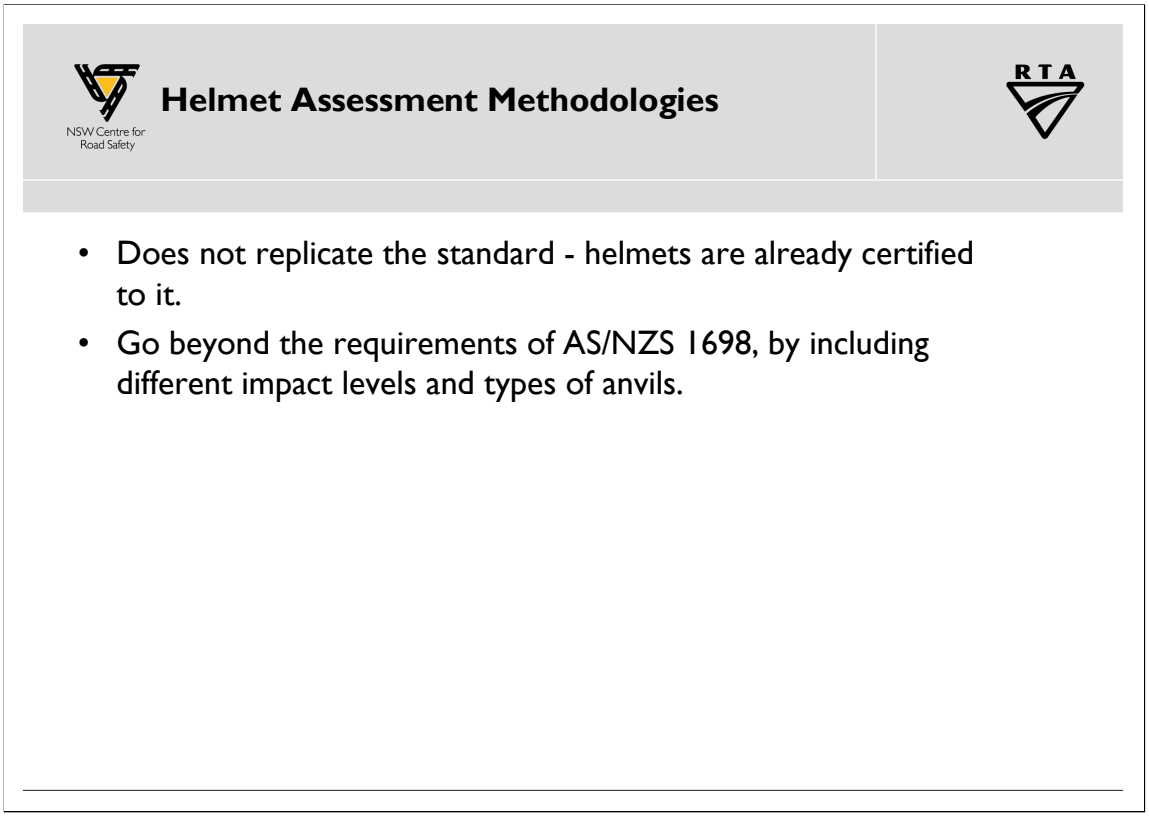
The helmet must attenuate the impact to minimise injury to the head resulting from impacts with different types of objects. To achieve this: the helmet must cover the appropriate areas of the head especially the frontal and temporal areas (test coverage); it must not disintegrate from the impact (helmet integrity); and, must be able to minimise injury to the head from impacts with different types of objects (energy attenuation and load distribution).

•Remain in place during the entire crash sequence

The retention system must keep the helmet in place during the events immediately before and during the crash. The helmet should also continue to remain in place on the head for subsequent impacts.

•Be worn

The helmet must be attractive, comfortable and easy to put on and remove to ensure that the user always wears it.

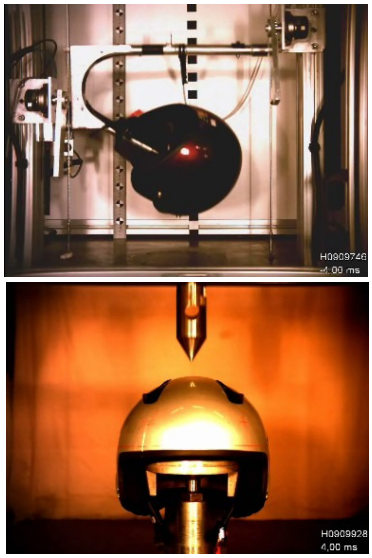


The evaluation testing to be performed is not intended to just replicate the tests already included in the AS/NZS 1698, as the helmets are already certified as passing these test requirements. Therefore the test protocols have been chosen to extend the requirements of AS/NZS 1698, by including different impact levels and test criteria for existing tests and proposing different test protocols designed to extend the protection given to the wearer. Our intention is the testing will allow a better understanding of the evidence based protective capabilities of the helmets on the market as well as leading to developments in AS/NZS 1698.

Impact Performance Assessment

Helmet ability to absorb impact energy assessed using the following tests

- Energy attenuation tests at higher and lower drop heights
- More stringent penetration tests
- Kerb anvil test using a modified ECE-22.05 (higher drop test height)
- Helmet Coverage



•Energy attenuation tests

There are currently debates on the stiffness of energy absorbing liners. If a liner is too stiff, it may be less able to prevent brain injury than a softer liner, however if it is too soft, it may be unable to protect the head in a more violent impact. To ensure helmets provide protection at both ends of the scale, two levels of impact tests (higher and lower than AS/NZS 1698) were used.

•A kerb anvil test using a modified ECE-22.05 (higher drop test height).

Currently, anvils representative of a kerb, roadside barrier or corner of a vehicle are used in three helmet test standards. The kerb anvil energy attenuation tests were performed according to ECE 22.05, however the same drop height/energy as the high level energy absorbing test (2.5m) was used. Preliminary testing showed the kerb anvil impacts to be the worst case for rebound of the helmet. The rebound of the helmet post impact was measured (this required a video of the test). The level of rebound provided an assessment as to the residual velocity in the system post impact, allowing a delta V criterion to be used to assess probability of injury. Also an assessment of the crushed area of the shell was made and compared with the results of the current AS/NZS 1698 penetration test. This comparison allows assessment of the use of the penetration test to check the quality of the shell in the standard.

•A More stringent penetration test than one in AS/NZS-1698.

All helmet standard specifications are a compromise to balance impact absorption and penetration resistance with helmet weight. Resistance to penetration tests assess the helmet's ability to resist penetration by projectiles, by ensuring that the integrity of the helmet (shell and liner) is maintained. The tests were performed using a penetration test striker with a nominal mass of 3kg dropped onto the outer surface of a helmet from a height of 3m (current standard). Unlike in the standard, where the helmet passes the standard as long as the striker does not make a contact with the headform, in HEP the depths of penetrations were measured and the helmets were rated based on the measurements.

•Helmet Coverage

There are concerns that manufacturers put their efforts into meeting the standard resulting in other parts of the helmet offering less protection. To aid in distinguishing the level of protection offered between helmet models, the helmets were rated based on their actual coverage.

Helmet to Remain in Place in a Crash

Performance tests to assess helmets' ability to remain on the wearers' head:

- Dynamic Stability tests
- Static and Dynamic Retention tests

Another factor necessary for a helmet to have any effect during a crash is for it to remain in place during the entire crash sequence.

Dynamic stability tests are used to assess the helmet's ability to be retained on the wearer's head and minimise the rotation of the helmet such that it does not obscure the vision of the wearer during a crash.

Static and Dynamic Retention tests assess the strength of the helmet's retention system to ensure that the retention system remains intact and the elongation is limited such that the helmet remains on the wearer's head during an accident.

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Be worn

Rider Comfort Assessment

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- Must be attractive, comfortable and easy to put on and remove.
- On-road evaluation by experienced riders using the most extreme riding positions.
- Field-of-view, ability to seal out wind, water, dust and noise, as well as susceptibility to buffeting were rated.
- Helmet fit was assessed on the likelihood to fit a variety of head sizes.

For a helmet to have any effect during a crash it must be worn. To ensure that the user always wears it, a helmet must be attractive, comfortable and easy to put on and remove.

The user evaluation tests explored helmet performance in key areas of importance as defined by the focus group study of key attributes of importance when choosing a helmet. These areas included fit, weight, comfort, vision, noise, visor and instructions (ease of use).

The user evaluation tests were performed on two types of motor bikes, with the most extreme rider positions chosen:

1. The Suzuki Hyabusa – a fully faired sports bike, where the rider was in a full crouched riding position, and

2. The Kawasaki VN2000- an unfaired cruiser bike, where the rider was in a full upright, feet forward riding position.

Two riders were chosen to undertake the user (rider) evaluation tests:

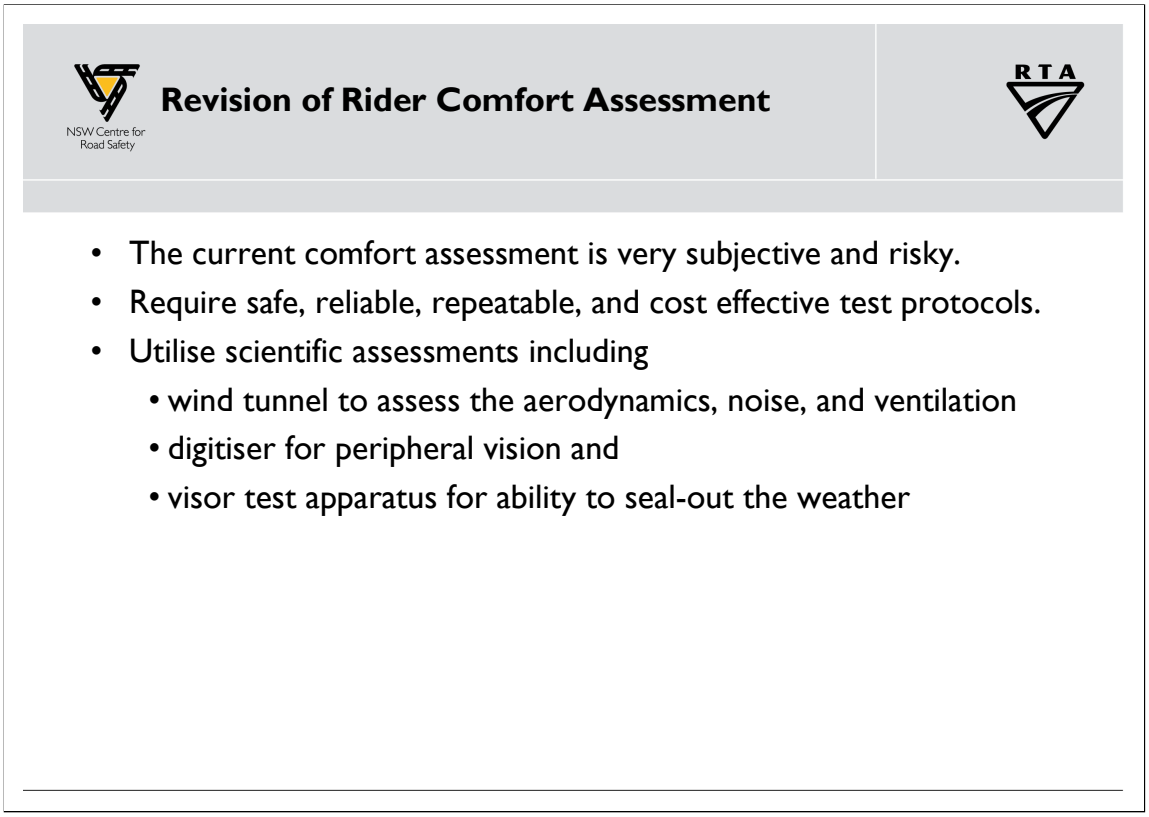
1. A mature aged rider with more than 20 years riding experience, and

2. A young rider with 5 years riding experience.

For each helmet model, the riders completed a 90 minute riding route on each motorcycle, including freeways with a speed limit of 100 or 110km/hr and local streets with a speed limit of 60km/hr during high traffic periods.

The assessments were undertaken with the assistance of a user evaluation (rider assessment) questionnaire form.

The fit of the helmets was assessed from the likelihood of the range of helmet sizes in the particular model to fit a wide range of wearer's heads. The shell size, liner size and consumer size ranges were considered and scores weighted at 50%, 30% and 20% respectively.



In moving from subjective volunteer helmet assessment methods of riding with the helmets and ranking them accordingly, there are several test methods available to assess certain aspects of helmet comfort due to aerodynamics, including

1. Drag of the helmet at speed; and
2. Effectiveness of the ventilation in terms of flow with the vents open and shut;
3. Generation of aerodynamic noise

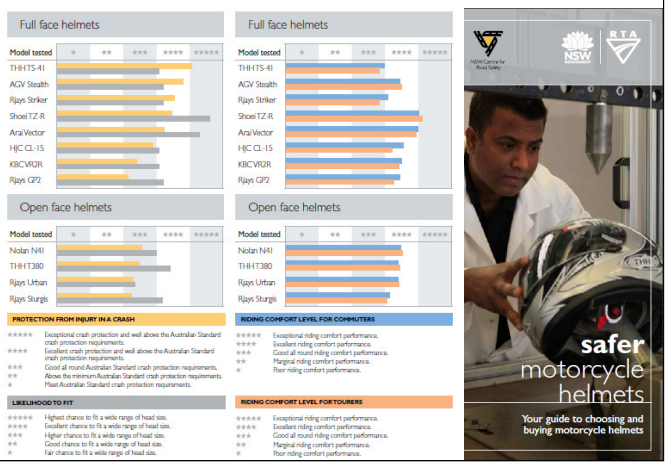
The most efficient way to perform these three aerodynamic tests is in a wind tunnel.

Another important aspect of helmet comfort is the amount of dust and moisture ingress, or ability of the helmet to seal out the weather. This would be assess using the Dust and splash resistance test protocols which are included in Australian standard AS 1337:1992.

In the current protocol, the vision was assessed based on the results of a questionnaire asking the wearer's opinion of the amount of vision available with the helmet in place. Central and peripheral vision was commented on. The assessment also looked at the visual interference endured during manoeuvring in heavy traffic. It's proposed that in the revised protocol, the vision will be assessed using a digitiser to measure the occultation in the field of view of the helmet around the visor opening.

Public Release of Helmet Ratings

- Consumers want complex scoring distilled into simple star rating systems for crash protection, comfort level and helmet fit.
- HEP launch supported by the brochure and a media release.

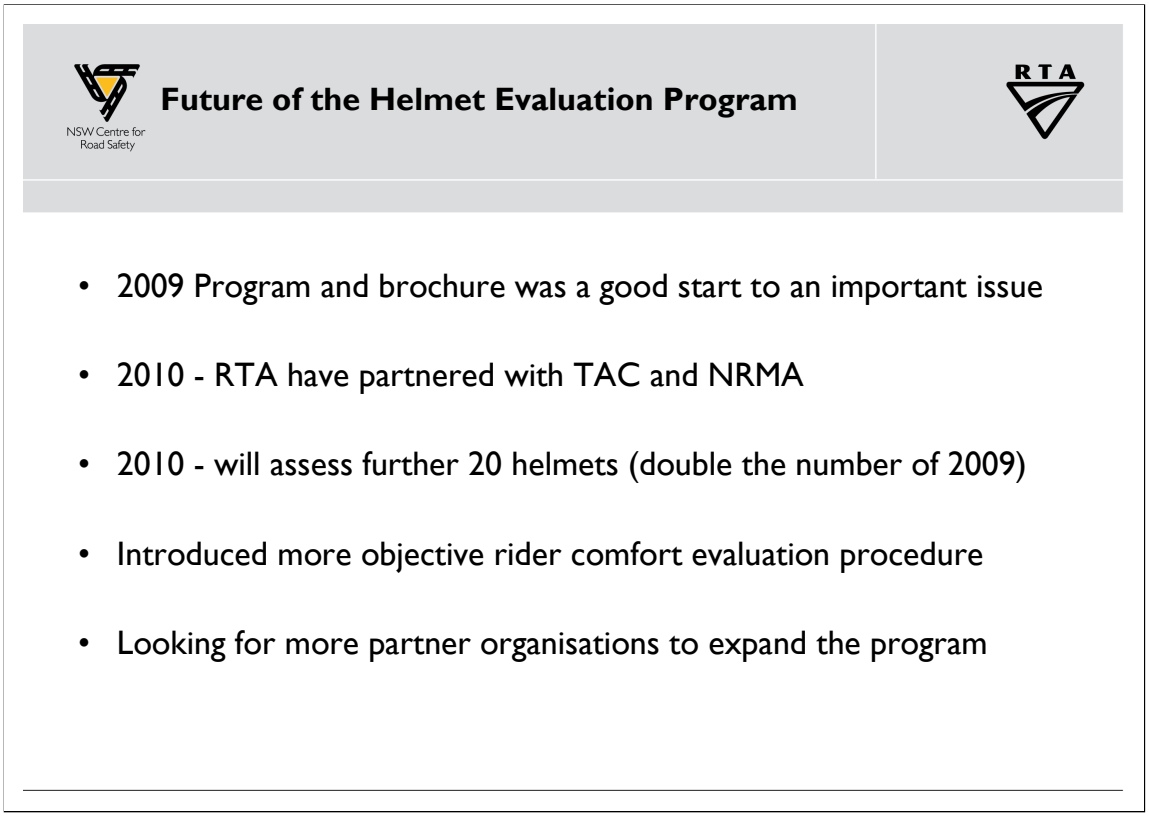


Experience from other vehicle safety advocacy programs, such as the Australian New Car Assessment Program, and the Child Restraint Evaluation Program shows that consumers want complex scoring information distilled into a simple form they can understand. Our Market Research told us the crash protection and rider comfort level scores were quite different and should be presented separately. This ensures good comfort performance does not mask poor safety performance and means a consumer must make a conscious decision to select a helmet based on its comfort rather than safety rating.

The release of the HEP results were supported by a brochure and a media release. The brochure lists the helmets in categories in order of performance, with the best performing at the top of each table. This information was also published on stakeholder websites as close as possible to the time and date the media release was circulated.

Media releases are agreed by all partners before release.

The media release is embargoed and, on the day of the release, stakeholder representatives make themselves available for interviews. The response normally includes television interviews, as there is good video from the crash test facility, with high rating morning TV shows being particularly interested in the subject.



The Helmet Evaluation Program has been well received in NSW. Motorcycle Riders are hungry for information about their safety equipment and HEP goes part of the way to satisfy this.

For 2010 and onward, the RTA have partnered with Victoria's Transport Accident Commission and the NRMA. This will significantly increase the coverage of the program, using the various outlets and media forms available to all the partners. This partnership will also allow us to increase the number of helmets we can test, in fact doubling the scope of the program.

Revised assessment procedures for the rider comfort evaluation have been implemented and these are now in use for this years assessments.

Of course, we are always looking for more partner organisations, to help fund this ongoing research and more importantly, to increase the number of motorcycle riders the results of the Helmet Evaluation Program will reach.