

Date: 22nd August 2020

Paper for IFZ Conference

The Development of a 5 Star Motorcycle Clothing Assessment Program

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Abstract

The Motorcycle Clothing Assessment Program, known as MotoCAP, is an independent rating scheme for motorcycle protective clothing.

The aim of MotoCAP is to provide an independent process for testing and publicising the protective and thermal management performance of motorcycle clothing, to encourage usage of motorcycle protective gear and thereby reduce injury rates. The objectives are to:

- Enable riders to make informed decisions when buying protective garments
- Increase demand for better performing protective garments
- Allow riders to compare products on independently tested measures;
- Encourage industry participants to compare their products with those of their competitors;
- Providing incentives for industry to compete on safety and thermal comfort; and
- Improve overall safety for the riding community;

Motorcyclists wear protective clothing and helmets to both reduce the risk and severity of injuries in a crash and provide a degree of climate control. Evidence from crash studies indicates that the protective performance of motorcycle clothing was variable, with neither cost nor brand name reliably predicting protection. In addition, many motorcyclists choose to ride unprotected in hot conditions. This raised the question as to whether good crash protection was compatible with thermal comfort for motorcyclists in hot conditions and whether thermal discomfort could compromise safe riding, increasing crash risk. MotoCAP provides separate ratings for protection and thermal comfort so riders can make an informed choice on how they balance protection against thermal comfort to best suit their particular needs.

MotoCAP is the outcome of almost 20 years research and consultations, led by Dr Liz de Rome, with the support of the Australian Motorcycle Council.

Since the launch in September 2018 there have been over 22,000 unique users to the MotoCAP website, with over 1,300 subscribed to receive updates when more garments are added to the site. 78% of visitors originate from the target countries of Australia and New Zealand, with the remainder visiting from other countries. Almost 8% of visitors originate from Europe.

During the first year of operation 150 garments representing 10% of jackets, pants and gloves available across Australia and New Zealand were tested.

Introduction

Motorcyclists' clothing must serve a number of functions. On a day to day basis, it has to protect the rider from the weather, be suitable for use at their destination, in addition to protecting them from injuries in the relatively rare event of a crash. Evidence from laboratory tests and motorcycle crash studies indicates that the protective performance of motorcycle clothing is variable, with neither price nor brand name reliably predicting protection (Hoare 2005a, b, 2009, de Rome *et al* 2011a). Whilst international standards exist for motorcycle clothing, surveys of retail outlets conducted by the AMC found few products certified to any standard. Information to riders on protection was in short supply apart from advertising claims by manufactures. Particularly in Australia, it was found that many motorcyclists chose to ride unprotected in hot weather (Wishart *et al* 2009, de Rome *et al* 2011b).

This raised the question as to whether crash protection was compatible with thermal comfort for motorcyclists in hot conditions and whether thermal discomfort could compromise safe riding, increasing crash risk. This paper talks about the introduction of a motorcycle clothing 5 star rating scheme that was developed to inform riders of the protection and thermal comfort levels of clothing they buy.

The Australian rating scheme for motorcycle protective clothing, called MotoCAP, is the outcome of almost 20 years research and consultations, led by Dr Liz de Rome, with the support of the Australian Motorcycle Council and its member organisations. It's key aim is to provide independent information on the protection and thermal comfort of motorcycle clothing so riders can make an informed choice in what they buy.

MotoCAP won the 2019 *Fédération Internationale de Motocyclisme (FIM)* Road Safety Award.

The Australian rider

Riding in Australia is not that dissimilar to other places in the world. All styles of motorcycle and scooters are represented. The population of motorcyclist average 7 hours riding per week (de Rome *et al* 2016a). The majority ride for recreation (70%) but over half (53%) commute to work some (37%) riding larger distances on freeway networks to get to work. Scooters are not as common as would be found in a typical Italian city like Milan, representing just 12% of the fleet. They are most popular with young people living in inner-city areas and in warmer climate coastal environments.

Australia's climate is governed mostly by its size and by the hot, subtropical high-pressure belt. The climate is variable, with a wide variety of climates due to its large geographical size. The largest part of Australia is desert or semi-arid. Only the south-east and south-west corners have a temperate climate. The northern part of the country has a tropical climate, varying between grasslands and desert.

Depending on the location in Australia riders can be subjected to a wide range in temperatures. Tasmania has a very low latitude and has a colder climate than most of Australia. The majority of Queensland and the Northern Territory have very mild winters with lows rarely dropping below 20°C. Compared to Europe, Melbourne is 450 kilometres closer to the equator than Rome, so just about all of Australia is closer to the equator than Europe. In New Zealand, the latitude of Wellington, its capital, is almost the same as Rome.

The clothing available in stores represents this wide temperature range. It is quite hard to locate a leather jacket in a store in far North Queensland, where the majority of garments are vented

textiles. Similarly, the range of wet weather pants available in store is less in Western Australia due to the drier climate.

Riders look for versatility and adaptability in garments. Controllable venting can be very important for a rider in Victoria who may experience 12°C on their morning ride which increases to 33°C as the day proceeds. Afternoon storms in coastal New South Wales are not uncommon in summer requiring breathable rain protection for a Sydney commuter

In Australia, all motorcyclists are required by law to wear a helmet. All motorcycle helmets sold in Australia, must pass Australian/New Zealand Standard AS/NZS 1698 or the international regulation United Nations Economic Commission for Europe Regulation No 22 (UNECE22.05). Motorcyclists are most likely to also wear motorcycle PPE jackets (82%) and gloves (73%) with over half also wearing PPE pants and boots.(de Rome *et al* 2016a)

Thermal discomfort can cause severe physiological strain which may affect rider safety by causing distraction, slowed reaction times and fatigue (de Rome *et al* 2015, de Rome 2019). The potential risks of thermal discomfort made the introduction of a performance rating scheme that evaluates both protection and breathability important.

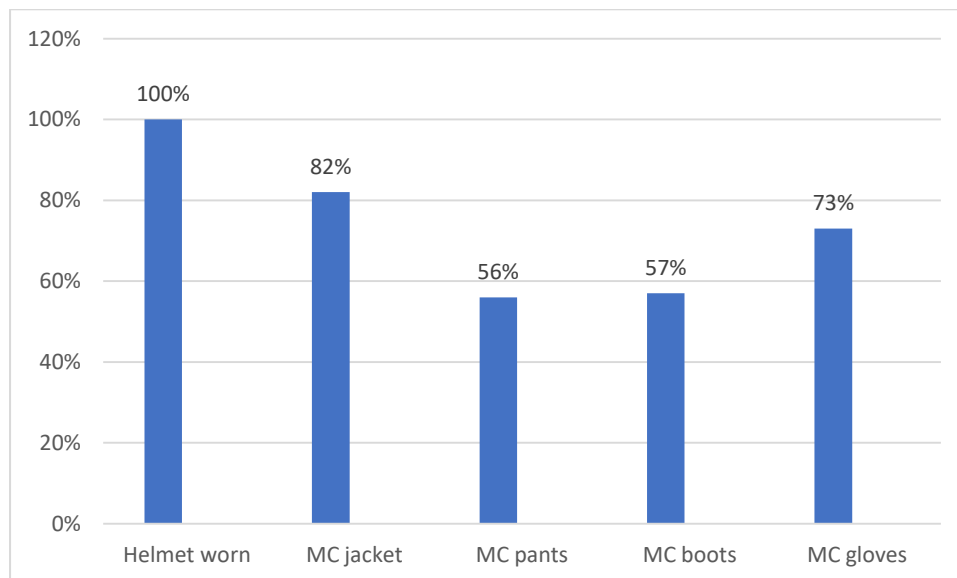


Figure 1. Levels of protection of clothing usually worn by riders and passengers (de Rome *et al* 2016a)

How MotoCAP works

MotoCAP tests the same garments as a rider would buy for general use. One of each item is bought from a retail store and the second is bought online. The garments are tested separately and their results are compared. No manufacturer, importer or retailer knows what products will be selected for testing, nor when or where their products might be purchased for testing.

Garments are tested for three protection elements; impact abrasion, seam burst strength and armour energy attenuation. The test methods followed are from the existing European Standard EN13595-1:2002 with some modifications made to allow for sampling from actual garments. These test methods were selected because they were well developed and had scientific evidence relating their performance to real world crashes. The testing of gloves follows a similar direction using the tests outlined in EN13594:2003.

Jackets and pants have additional testing for thermal comfort (breathability). The result is presented separately to the protection rating. This test is drawn from the sports clothing industry and evaluates the ability for clothing to expel body moisture in a hot environment. This measurement is important to introduce garments with both good protection and thermal comfort to suit Australia's diverse climate.

At present MotoCAP is testing approximately 10% of the Australian and New Zealand market which is 152 garments per year. Over 200 garments have been tested, rated and published for riders to view worldwide.

The tested gear includes some of the best sellers on the market as well as lesser-known brands. The objectives of MotoCAP are detailed below:

- Enable riders to make informed decisions when buying gear;
- Increase demand for better performing gear;
- Allow riders to compare products on independently tested measures;
- Encourage industry to compare their products with those of their competitors;
- Providing incentives for industry to compete on safety and thermal comfort; and
- Improve overall safety for the riding community;

The program is administered by Transport for NSW with all results published on the MotoCAP website (www.motocap.com.au and www.motocap.co.nz). A large number of parties are involved in the funding and direction of MotoCAP.

Partners

The MotoCAP working group is chaired and administered by Transport for NSW, who manage the development of the program.

Other members include:

- Government Agencies

- Department of State Growth (Tasmania)
- Department of Transport and Main Roads (Queensland)
- Transport for NSW
- VicRoads
- Road Safety Commission (Western Australia)

- Compulsory Third Party Injury Insurance Agencies

- Accident Compensation Corporation (New Zealand)
- Lifetime Support Authority (South Australia)
- Motor Accident Insurance Commission (Queensland)
- State Insurance Regulatory Authority (NSW)
- Transport Accident Commission (Victoria)

Insurance Companies

- Insurance Australia Group
- Royal Automobile Club of Victoria

Independent Bodies

- Australian Motorcycle Council

Consultants

- Dr Chris Hurren and Dr Liz de Rome from Deakin University for Frontier Materials are contracted as consultants for the MotoCAP program and were instrumental in its development.

How the 5 star rating scheme was developed (key milestones)

The following details the development timeline of the inception and development of a motorcycle clothing rating scheme.

- 2003 – The Motorcycle Council of NSW (MCC) obtained a grant from the Motor Accidents Authority of NSW (MAA) to commission the investigation of the features of effective motorcycle personal protective equipment (PPE). The outcome was a report and the establishment of websites for the MCC and the Accident Compensation Commission (NZ) to provide information about protective clothing and other motorcycle safety issues to riders in Australia and New Zealand (de Rome 2002, 2004b, a).
- 2005 – A national PPE industry seminar was held by the MCC with the support and funding of the MAA to consider the implications of the European Standards for PPE. A proposal to establish an Australian star rating scheme for PPE was canvassed and supported by the participants (de Rome *et al* 2005)
- 2007 – The National Roads and Motorists Association (NRMA) funded a survey of novice riders to establish their knowledge, information sources and usage of PPE (de Rome *et al* 2010, de Rome *et al* 2011b).
- 2008 – Swann Motorcycle Insurance funded a study of the injury reduction benefits of the clothing worn by injured and un-injured riders involved serious crashes. The study confirmed the potential for PPE to reduce the risk and severity of injuries, but also identified high rates of garment failure under crash conditions. The study also validated the impact risk zones framework of the European standards against clothing damage and rider injuries in real world crashes (de Rome *et al* 2011a, de Rome *et al* 2011b, de Rome *et al* 2012b, de Rome *et al* 2014, Meredith *et al* 2014).
- 2008 – PPE researcher invited to give a presentation on protective clothing research to members at the AMC Annual Conference
- 2009 – AMC successfully lobbied Federal Government for funding to publish and distribute a guide to riders on the features of effective motorcycle protective clothing ‘The Good Gear Guide’ (de Rome, 2009).
- 2011– The Australian and New Zealand Government Injury Insurance agencies commissioned industry consultations and research into the development of a model for providing riders with reliable information when buying motorcycle protective gear (de Rome *et al* 2012a).

- 2011 – The Victorian Transport Accident Commission (TAC) organised a series of state-wide seminars – entitled “What’s Safe?” – which covered the testing and other assessments of motorcyclists’ clothing, of which riders, retailers and clothing suppliers were amongst the interested parties who attended.
- 2014 – The AMC formed a Protective Clothing Sub-Committee which developed a Position Statement on Protective Clothing from a rider’s perspective.
- 2014 2015, 2016 – AMC Annual Conferences invited PPE researchers to provide updates on research progress on protective clothing.
- 2015 – The AMC collated and listed CE approved gear available in Australia on its website to assist riders in choosing suitable gear. The AMC joined the Australian and New Zealand Working Group tasked to develop a 5 Star Rating scheme.
- 2015 – The Motorcycle Protective Clothing working group formed, consisting of 10 members from government agencies and motoring clubs, led by the TAC.
- 2016 - The science program ‘Catalyst’ produced a segment on motorcycle protective clothing, this was broadcast by the national broadcaster, the Australian Broadcasting Commission (ABC) <https://www.abc.net.au/catalyst/motorcycle-clothing/11016386>
- 2016 – The Transport for NSW, assumed the lead role for the Motorcycle Protective Clothing working group and commissioned the development of test protocols for a PPE star rating scheme in consultation with industry (de Rome *et al* 2016b). Transport for NSW actively sought interested parties, and the consortium grew to 20 members including the AMC.
- 2016 - Dr Liz de Rome and Dr Chris Hurren from Deakin University Institute for Frontier Materials were contracted to the consortium to develop test and rating protocols for motorcycle protective clothing.
- 2016 – The test protocols were distributed for comment to the motorcycle accessories industry in Australia and New Zealand including local manufacturers and importers.
- 2018 - Dr Liz de Rome and Dr Chris Hurren were contracted to the consortium to conduct testing of motorcycle protective clothing for publication under the MotoCAP program.
- 2018 – The Motorcycle Clothing Assessment Program, and the accompanying website, www.motocap.com.au, were launched in September by the MotoCAP working group,. At launch, there were twenty products rated on the website. At the time of this paper, there were 128 products on the website, with the site continuously updated.

Why stars and not a standard

Australian riders are hesitant for the introduction of a protective clothing standard. The introduction of a standard poses two main problems. The first is that a standard does not delineate how well a product performs. It produces product that is either a pass or fail. This leaves the rider still not knowing performance levels of a product. The second reason is the mandatory helmet laws in

Australia requiring a helmet to be worn that meets a standard. Riders are concerned the introduction of a standard may be followed by the introduction of a mandatory clothing law.

Significant work done by New Zealand with their Ride Forever program has shown that empowering the rider with the appropriate skills and knowledge often leads to a lower risk position for a rider. This is seen in their statistic showing that a rider is 27% less likely to be involved in a crash if they have done Ride Forever training (McMillan 2018).

1. **Need a consumer/rider centric test** – The ratings system uses the same test methods as the European standard EN 13595 for jackets, pants and one piece suits, but rather than using a simple pass/fail score, this allow products to be ranked and rated on their relative performance. A 5 star rating scheme enables riders to make informed decisions when buying protective garments based not only on protection but also breathability, allowing riders to choose the most appropriate gear for their riding conditions.
2. **Inappropriate for Australia's diverse climate** – Whilst protection is the main aim of motorcycle gear, comfort is an important factor for riders. If motorcyclists are comfortable, they will more likely wear motorcycle gear and perhaps, choose more protective gear for better safety on the bike.
3. **Does not provide a market incentive for manufacturers to improve the quality of their gear** – it has been found where testing is left to manufacturers, some companies avoid any reference to safety when marketing their motorcycle clothing products. The objective of the 5 star ratings scheme is to fully fund and manage the introduction of the scheme to allow local industry to improve their products where necessary.
4. **Helps riders make informed decisions about what is best for them** - The weight, flexibility, temperature control and fit of clothing can all contribute to motorcyclists' comfort levels and keep riders alert to minimise rider error. Riders can choose to buy based on level of protection, as well as comfort, taking into consideration the type of riding they do.

How MotoCAP is influencing the market

- What do Australian motorcycle consumers think?

The author, a motorcyclist for over 50 years - When I retired, I was given a leather jacket. I had been told that when leather is treated to make it soft, it can destroy its abrasion resistance. I was reluctant to wear the jacket not knowing how good it was. It hung in my wardrobe for 2 years until it came up on MotoCAP and it rated fairly well. I'm now quite happy to wear it.

- What do manufacturers think? Have manufacturers changed their product development?

1. Australian company Draggin Jeans, designers and manufacturers of the world's first pair of protective motorcycle jeans were about to discontinue their range of Next Gen Seamless jeans when they noticed an increase in international sales. The reason for the rise in sales was the jeans had performed well in the MotoCAP rating system. The protective jeans were awarded a 4 star safety rating and a 3 star comfort rating.

2. Manufacturers are recognising the standard and consumer confidence in the measurability of MotoCAP 5 star rating scheme. Two small Australian start-up companies have purchased laboratory testing time to develop their protective motorcycle gear. These products will have a go-to-market of more than 12 months.
3. A state government protective agency in Australia have used the MotoCAP testing facilities on a variety of protective motorcycle gear before issuing to their motorcycle riders. The test results influenced their decision on which garments they will purchase.
4. Some motorcycle gear manufacturers, such as Hood Jeans in the UK, have identified a short-coming with the Darmstadt Abrasion machine currently used with the introduction of the new PPE standards (EN 17092). The results of the Darmstadt Abrasion cannot be used in research and development to compare the performance of different materials because it replicates a slide and tests whether perforation of the construction is smaller than half a centimetre. This machine then only provides a 'pass' or 'fail' result, whereas the Cambridge machine used in the MotoCAP test provides a detailed performance value. From the results of the Cambridge machine test, manufacturers can use the MotoCAP published results to compare with the result of their competitors garments.
5. General Manager of major importer Cassons, Geoff Wood, told AMCN (AMCN 2019) he absolutely approves of the testing regime.
"We are passionate as a team about motorcycle safety," he said, "(and) consumers need a reference point, as we don't have the standards on riding apparel that exists in Europe."
That general view is backed up by Joel Ryan, business development manager at accessories distributor Ficeda.
"I believe it's (MotoCAP) a great initiative. For us as a company, it helps support the message we have been telling our customers for years. It highlights the differences between products and makes customers think about their purchase and, hopefully, ask the question: How safe is this product?"

The future of MotoCAP

More publicity

Since the launch of MotoCAP in September 2018 there have been over 22,000 unique users to the MotoCAP website, with over 1,300 subscribed to receive updates when more garments are added to the site. 78% of visitors originate from the target countries of Australia and New Zealand, with the remainder visiting from other countries. Almost 8% of visitors originate from Europe.

More products

In the future, we would like manufacturers and importers to see the value of the 5 star ratings scheme and fund research of the protective and comfort ratings of their motorcycle gear.

Worldwide 5 star scheme

Other countries could adopt the MotoCAP test protocols and ratings methodology, which are published and available on application. The protocols are based on tests from current European standards, using commonly available test equipment. The tests used in the MotoCAP test protocols

have been modified only to account for the need for test samples to be harvested from completed garments, whereas common practice is to test representative samples in flat sheets of the materials and construction methods.

The current MotoCap website, where the results are published, is available to riders and industry globally, although currently only in English.

Conclusion

The introduction of a 5 star Scheme was supported by riders right from the start. MotoCAP allows riders to have options on what they buy depending on their needs and likes. MotoCAP educates riders and manufacturers on what features of a garment make it protective.

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