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Motorcycle protective clothing: Are stars better than standards?

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Abstract

Little information is available to Australian riders regarding the likely level of protection provided by different brands and types of protective clothing. Australian manufacturers and importers are not subject to any mandatory standards in relation to protective clothing except for helmets. This paper presents the results of the first stage of investigating the possibility of developing a model for a safety 'star rating' system for protective clothing. Later stages are proposed to include a market research study and a research study into the feasibility of implementing a 'star rating' system for protective clothing. It is considered that mandatory standards such as those in Europe are unlikely to bring about a marked improvement in motorcycle protective clothing without substantial allocation of resources to enforcement of the standard which has not occurred in Europe and is unlikely to occur in Australia. Therefore two models for a star rating system are proposed: a voluntary star rating system and a system in which the accrediting body purchases and tests garments and publishes the safety ratings (analogous to the Australian New Car Assessment Program (ANCAP)). It is proposed that a star rating would be based on safety performance, weather protection and ergonomic performance. One of the issues to be addressed in the next stage of this research is whether the star rating should be presented as an overall score, or whether riders should be provided with the star ratings for the individual criteria. If an overall star rating was chosen, then how the results from the different tests were combined would need to be considered.

Introduction

Motorcyclists are among the most vulnerable road users, in Australia and internationally. Motorcycle riding is much more likely to result in injury than car travel, and the resulting injuries are likely to be more severe for motorcyclists than for vehicle occupants. The aim of protective clothing is to reduce the vulnerability of motorcyclists to injury, particularly in crashes at lower speeds. A large number of studies since 1976 have confirmed that protective clothing can reduce the frequency and extent of abrasions and lacerations of the skin and soft tissue in motorcycle crashes (reviewed in de Rome & Stanford, 2005). These findings have led road safety agencies to encourage riders to wear full protective clothing (gloves, boots, and jacket and pants, or suit). Yet little information is available to Australian riders regarding the likely level of protection provided by different brands and types of protective clothing (de Rome & Stanford, 2003). Australian manufacturers and importers are not subject to any mandatory standards in relation to protective clothing except for helmets. Standards Australia published its 'Motorcycle protective clothing: Guidelines for manufacturing' in December 2000, but these guidelines apply only to clothing (not gloves, impact protectors and boots).

For these reasons, VicRoads is funding a project to investigate the possibility of a system in Australia whereby consumers have access to information about some of the key safety characteristics of protective clothing, which they may then use in making purchasing decisions. This paper is taken from the report of the first component of the project, the literature review and development of a model for a safety 'star rating' system for protective clothing. Later stages are proposed to include a market research study and a research study into the feasibility of implementing the system.

Purposes of protective clothing

Any discussion of motorcyclist clothing should first distinguish between the different protective purposes for which it may be worn. Our focus is on protection from injury, although protection from the elements and conspicuity are also safety issues for motorcyclists.

Protection from the elements can contribute to rider safety by reducing the effects of dehydration and physiological stress which can increase crash risk. The symptoms of physiological stress include distraction, loss of sensation and thereby operational control, dulled responses and reaction times, impaired motor responses and fatigue (Woods, 1986, EEVC, 1993).

Clothing has the potential to increase riders' visibility to other motorists. Failure to see the motorcyclists was the primary contributing factor in 37% of all motorcycle crashes

investigated in the Motorcycle Accident In-Depth Study - MAIDS (ACEM, 2004). Although the researchers found no apparent contribution of garments to the conspicuity of the rider in 65% of crashes, they did report that dull or dark clothing may have decreased conspicuity in 13% of cases.

The European Standards for Motorcycle Protective Clothing

Under the European Directive on Personal Protective Equipment (CEC, 1989), any clothing claiming to provide protection from injury must be tested and labelled as complying with the relevant standard. This applies to all safety equipment not just for motorcycle apparel. Under the directive, a product can only be described as “protective” if it provides protection from injury, the term cannot be applied to products that provide protection from the weather.

The first standard to be issued for motorcycle gear was for impact protectors, which was released in 1997 (EN 1621-1). Standards have since been issued for gloves (EN 13594), boots (EN 13634), jackets and pants (EN 13595 Parts 1 – 4) in 2002 and lastly for back protectors (EN 1621-2) in 2003. Each has a different number and clothing that complies must have been tested and labelled with the CE mark and the appropriate standards number.

The tests in the EU standards are largely based on the work of Roderick I. Woods who published a specification for motorcycle protective clothing in which he defined the injury risk and protection requirements for each part of the body (see Figure 1). This was based on the analysis of 100 crash damaged motorcycle suits, and the resulting specifications tested on a dummy in simulated crash incidents (Woods, 1996a & 1996b).

- Zone 1 High risk - needs impact protectors & high abrasion resistance
- Zone 2. High risk - needs high abrasion resistance
- Zone 3. Moderate risk - moderate abrasion resistance
- Zone 4 Relatively low risk.

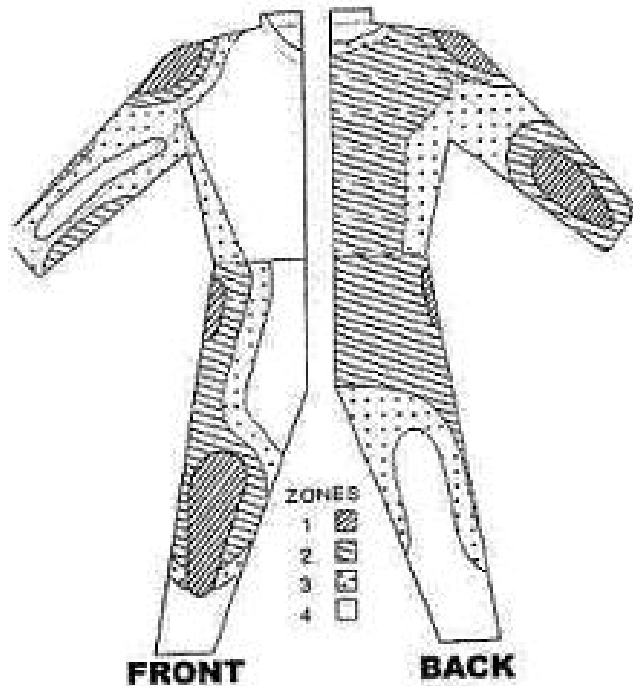


Figure 1 Injury risk zones (Woods, 1996a)

The Standards specify the test process and equipment upon which they must be performed. Two levels of performance are specified for clothing providing protection against road impacts:

- Level 1: Clothing designed to give some protection whilst having the lowest possible weight and ergonomic penalties associated with its use.
- Level 2 clothing providing a moderate level of protection, higher than that provided by level 1. There are however, weight and restriction penalties in providing this level of protection.

Shortcomings of the EU standards approach

Lack of cooperation from manufacturers compounded by the suspicions of the rider community resulted in it taking 14 years from when the Personal Protective Equipment (PPE) Directive was issued until the final standard for motorcycle protective clothing (EN 1621-2 for back protectors) in 2003. Many riders in Europe were concerned that the standards would be used by authorities and insurance companies to set requirements for all riders. This is also a concern that has been expressed in Australia. In Europe rider groups only agreed to support the standards if leisure riders' clothing was specifically excluded, to prevent the standards from being used as the basis of further legislation to support compulsion. As a result the EU standards are expressed as being for "Professional riders". However, a separate item of European consumer safety legislation – the General Product Safety Directive 2001/95/EC

(GPSD) states that “products which are designed exclusively for professional use but have subsequently migrated to the consumer market should be subject to the requirements of this Directive because they can pose risks to consumer health and safety when used under reasonably foreseeable conditions” (Section 9, L 11/5).

Relatively few of the European manufacturers have submitted their products for independent testing against the EU Standards. Many manufacturers are in direct violation of the Standards because they claim their equipment is protective but have not had the items tested and they are not marked with the CE mark to identify their compliance with the Personal Protective Equipment Directive. Other manufacturers carefully word their claims to imply that there is a likely reduction in injury to riders wearing their equipment but refrain from using the word “protective” and have not had the items tested against the relevant Standard. However, this situation is changing as more riders are demanding quality control and verification that the protective clothing they buy is fit for the purpose. The substantial increase in the number of products that include CE marked impact protectors observed in the market is evidence of this trend.

Standards Australia Guidelines

The Standards Australia (2002) document ‘Motorcycle protective clothing: Guidelines for manufacturing’ applies only to clothing, it is not compulsory for manufacturers to follow and there is no requirement for marking the garments that comply with the Standard. The levels of protection are defined in terms of four “end use categories”:

- A Strong enough for racing
- B Strong enough for sports road riding
- C Strong enough for commuting
- D Not strong enough to offer crash protection

The Guidelines drew on the Cambridge Standard (Woods, 1999) which provided the basis for EN 13595 Parts 1-4. The Guidelines include tests of the suitability of the clothing for various weather conditions and discuss issues related to testing for thermal comfort which are not specifically included in the European or Cambridge Standards. The Guidelines also include tests of durability which are quality rather than safety issues, but the durability of zip fasteners is also a safety issue (Reference AS 2332 specifications for slide fasteners).

The Martindale test specified in the Australian Guidelines does not provide an appropriate basis for assessing abrasion resistance for motorcycle clothing (de Rome & Stanford, 2005). The apparatus does not replicate the effects of friction induced heat which may melt some fabrics or yarns and the abrading surface can become clogged, which would not occur in a

real world slide across a road surface. The EU test apparatus was not available in Australia when the Australian Guidelines were being developed but a testing facility in New South Wales has informed the authors that it is considering installation of this equipment.

Concerns about the usefulness of the Standards Australia Guidelines were discussed at an industry seminar funded by the Motor Accidents Authority in NSW and coordinated by the Motorcycle Council of NSW (de Rome & Stanford, 2005). While a working party of industry and rider community representatives undertook to establish an industry related system for ensuring motorcycle protective clothing sold in Australia is fit for purpose, little progress has been made.

Underlying concepts of consumer rating systems and standards

Current consumer rating systems provide guidance to consumers on the relative performance of competing products, all of which are legally allowed to be sold and used. Examples include energy efficiency ratings for whitegoods and water efficiency ratings for plumbing fixtures, star ratings for accommodation and restaurants, the Australian New Car Assessment Program (ANCAP), the Used Car Safety Ratings and the Safe Tractor Assessment Ratings (STAR) system (Day, Scott, Williams, Rechnitzer, Walsh & Boyle, 2005).

A rating system seeks to use consumer demand to promote sales of better-performing products. In contrast, a standards based approach identifies a minimum acceptable level of performance for a particular product, often on a number of dimensions, and provides a way of identifying whether or not that product reaches this minimum level of performance. In the opinion of the authors, the pass/fail outcome in standards does not provide manufacturers with incentives to produce goods that exceed the standard or allow the public to choose the best performing products.

The establishment of a consumer rating system may require less evidence than is required to implement a mandatory standard. In addition, the evidence to support the nature and the need for a mandatory standard may be considerable to prevent the standard being challenged on the grounds of restraint of trade.

Models for a star rating system

A star rating system for motorcycle protective clothing needs firstly to ensure that the clothing will be effective in protecting from injury and secondly, to provide a mechanism for communicating the extent of protection to the consumer. Three alternative approaches were considered: mandatory standards, and two types of star rating systems - a voluntary industry program and an independently administered system.

We do not recommend the introduction of mandatory standards for motorcycle protective clothing. Leaving aside the difficulty in introducing mandatory standards in Australia, it is considered that mandatory standards such as those in Europe are unlikely to bring about a marked improvement in motorcycle protective clothing without substantial allocation of resources to enforcement of the standard which has not occurred in Europe and is unlikely to occur in Australia.

The general characteristics of two proposed models star rating systems are outlined below. The criteria for awarding of stars are then discussed.

Model 1 – Voluntary industry star rating system

Model 1 is a voluntary star rating system where manufacturers or distributors can choose whether or not to participate. For participating manufacturers or distributors, the star rating would be displayed on a swing tag on the garment to provide the potential purchaser with information about specific items at the point of sale. It is assumed that manufacturers or distributors would send items for testing to local or international accredited testing facilities.

A system of random audits could be used to ensure the compliance of the items with the test procedures. A licensing fee associated with participation in the rating system could at least partly fund the compliance auditing. The options for auditors include an industry body, an independent auditing organisation or a consumer organisation.

The voluntary industry star rating system would require publicity to make motorcyclists aware of the system, explain how it works and encourage purchase of items with many stars (and discourage purchasing unrated items). The publicity would also encourage other manufacturers/distributors to participate in the scheme.

A similar model (based on the European Standards but without star ratings) has been proposed by an industry working group under the auspices of the FCAI and MCC of NSW (de Rome & Stanford, 2005). It is proposed that it be an industry managed process, and that products once assessed would be listed on a website (potentially hosted by industry or MCC). The website would keep manufacturers and distributors honest by preventing any fraudulent labelling of products. It would also serve as an information source for riders seeking to identify products they can trust.

Model 2 – Independent star rating system

The second model is a system in which an accrediting body purchases and tests garments and publishes the safety ratings on a website and in brochures etc. This would be modelled on the ANCAP. Like ANCAP, it could utilise European findings where the same item is sold there.

Likely candidates for the accrediting body include independent auditing organisations, consumer organisations or a specialist body created by a consortium of organisations with an interest in reduction of injuries to motorcyclists. It is assumed that the accrediting body would send items for testing to local or international accredited testing facilities.

While Model 2 would require significant input of resources from the accrediting body, it has the potential to avoid the problems that have arisen in Europe where many of the largest manufacturers have simply refused to comply with the European Standards. With a funding base that is independent of industry, an independent star system may be more able than a voluntary industry standard to withstand pressure to water down the performance requirements for award of particular numbers of stars. Thus, the independent star system would potentially have greater safety benefits for motorcyclists.

Potential criteria to be used for measuring safety performance

An example of such a star rating system for jackets, pants and suits is provided in Table 1. This system would allow items that had been tested to European Standards to be rated without any further testing. The two star rating is broadly based on the requirements for EN 13595 Level 1 clothing, whereas the four star rating is broadly based on the Level 2 requirements. The five star rating is based on the requirements of Level 3 of the Cambridge Standard. The one star rating corresponds to the requirements for EN 13595 Level 1 clothing but for Zone 3 in that Standard. The three star rating is intermediate between EN 13595 Level 1 and Level 2. The example in Table 1 is simplified because it does not set out different requirements for different zones of the garment.

Table 3 An example of allocation of stars based on test performance of Zone 1 sections of garment – for jackets, pants and suits.

| Rating | Abrasion resistance of materials | Burst strength of seams and fastenings | Maximum knife penetration |
|--|----------------------------------|--|---------------------------|
| 0 Stars | <1.8 secs | < 500 kPa | > 30 mm |
| 1 Star <i>(CE Level 1, Zone 3)</i> | ≥ 1.8 secs | ≥ 500 kPa | ≤ 30 mm |
| 2 Stars <i>(CE Level 1, Zones 1 and 2)</i> | ≥ 4.0 secs | ≥ 700 | ≤ 25 mm |
| 3 Stars | ≥ 5.5 seconds | ≥ 750 | ≤ 20 mm |
| 4 Stars <i>(CE Level 2, Zones 1 and 2)</i> | ≥ 7.0 seconds | ≥ 800 | ≤ 15 mm |
| 5 Stars <i>(Cambridge Level 3, Zones 1 and 2)</i> | ≥ 12.0 seconds | ≥ 1000 | ≤ 10 mm |

Zone 1 High risk - needs impact protectors & high abrasion resistance ; Zone 2. High risk - needs high abrasion resistance; Zone 3. Moderate risk - moderate abrasion resistance; Zone 4 Relatively low risk.

A disregard of weather protection (thermal control and waterproofing) and ergonomic performance (whether the rider can actually ride while wearing the product) could quickly damage the credibility of the star rating system as a useful guide for consumers. Protective clothing can only convey a benefit if it is worn and it will be less likely to be worn if it is uncomfortable (de Rome, 2006). As such, it is proposed that the weather protection and thermal comfort tests included in the Australian Standards Guidelines be incorporated as part of the star rating system.

Further research is needed to address whether the star rating should be presented as an overall score, or whether riders should be provided with the star ratings for the individual criteria. The consumer ratings currently provided by the British Ride magazine present the scores on each criterion and a combined score which is the simple addition of all of the category scores (with the exception of dye fastness because this depends on the colour chosen).

If an overall star rating was chosen, then the way in which the results from the different tests would be combined would need to be considered. A stringent approach would be to base the star rating on the test with the lowest performance. Even if this stringent approach were not

taken, it would need to be considered whether a fail - “no stars” - on a particular criterion should be an overall fail. If, for instance, a garment gained no stars for burst resistance, then perhaps it should have no stars overall.

The way in which the weather protection and thermal comfort tests included in the Australian Standards Guidelines would be incorporated as part of the star rating system would depend on whether there was an overall star rating or stars were awarded for individual components. For an overall rating, one option would be to subtract a star if these tests were not passed.

Conclusions

Neither the mandatory EU standards for motorcycle protective clothing nor the voluntary Standards Australia manufacturing guidelines have been successfully implemented to provide Australian riders with an indication of the extent of protection from injury they can expect from an item of motorcycle clothing. A star rating system, whether a voluntary industry system or an independent system, has the potential to provide such information to consumers and contribute to reductions in the severity of injury to riders.

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