Development of Ranking Equations for a Protection Level Star Rating System for Motorcycle Clothing

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Abstract

Motorcyclists are one of the most vulnerable road users on Australian roads. Motorcycle protective clothing may reduce the incidence and severity of injury in crashes, however a substantial proportion has been found to fail under crash conditions. The aim of this research was to develop an evidence-based system for rating protective motorcycle clothing to enable motorcyclists to make informed purchasing decisions. A set of equations and weighting systems were developed based on the results of 21 garments tested to the European Standard for protective motorcycle clothing (EN13595:2002). This work provides a first step towards consumer information for protective motorcycle garments.

Background

Usage of motorcycle protective clothing (PPE) may reduce the risk and severity of injury in crashes, however a substantial proportion of garments fail under crash conditions.(L. de Rome et al., 2011) The protection provided by the PPE available in Australia varies widely, is not predicted by cost or brand name nor are there any other indicators of likely protective performance or suitability(L de Rome & Stanford, 2006; Haworth, de Rome, Varnsverry, & Rowden, 2007; Hoare, 2009). Research commissioned by the Motor Accidents Authority of NSW recommended an independent scheme for testing and rating motorcycle protective clothing could reduce injuries and improve the quality of products in the market. (L de Rome et al., 2012)

For such a rating system to be effective it must encompass the different types of clothing damage sustained in crashes, specifically: abrasion, burst, tear, cut and impact and also fastenings failure.(Woods, 1996) The European Standard EN13595:2002 specifies tests to address garments' resistance to each form of damage.(CEN, 2002)

This paper focuses on the derivation of the calculations for impact abrasion resistance, which is the most commonly reported type of damage (L de Rome, Meredith, Ivers, & Brown, 2014). Other types of damage will be addressed in future work.

Methods

The impact abrasion resistance of 21 locally-purchased all-season motorcycle protective jackets and pants (leather=3, textile=18) were tested on a Cambridge impact abrasion tester (Mesdan LAB, Italy) as specified by EN13593-2:2002. Garments consisting of more than one fabric structure were tested in composite and separately for each layer's contribution to impact abrasion resistance.

Under EN13593-2:2002, injury risk is defined into four zones with risk levels highest in zones 1 and 2 and lower in zones 3 and 4. These zones were used to define the area coverage of protection for each garment and for each fabric type separately. A numerical value for the protective value of the garment was calculated using the abrasion resistance test results and percentage of protective coverage, weighted by zone to account for the associated increased injury risk. The resulting scores were validated by visual inspection based on the abrasion resistance test results and areas of coverage by an independent assessor with experience in testing protective clothing.

Results and discussion

There was a strong correlation (r^2=0.95) between the calculated protection factor and visual ratings, indicating that objective measures are available to provide a numerical basis for rating the abrasion damage resistance of motorcycle protective clothing.

The proportion coverage-base as an element of the protection factor is intended to discourage manufacturers from decreasing the coverage area in high risk zones. The protection factor calculations were designed to provide increased importance to protection levels and coverage of zones 1 and 2.

This work successfully demonstrates a means of using the test methods of the EU Standard to evaluate the protective abrasion resistance performance of motorcycle garments. For the star rating system, the protection factor will be based on test results for resistance to each damage type.

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