

# M.A.G. Ireland: Leg Protectors, Airbags and Total Rider Safety

*by David French*

The relevance of leg protectors (especially in the USA) is that litigious customers may eventually force motorcycle manufacturers to include leg protectors on motorcycles. Research has shown that the disadvantages of these so-called "leg-protectors" outweigh the advantages but the very name of the item causes quick-fix politicians to seize on them as a panacea to motorcyclist injuries. Leg protectors have been proposed by the English government (and defeated) but the item is now on the European agenda.

[This paper was prepared] in response to the European Commission proposal for an Action Programme on Road Safety which recommends the speedy introduction of compulsory leg protectors for motorcycles over 400cc.

## History

Research has been conducted into leg protectors since 1969, mainly by Japan, the USA and Britain. Early research used rigid tubular steel construction which caused detrimental effects to the chest and head.

The UK Transport and Road Research Laboratory (TRRL) has been responsible for the most of the work on leg protectors since 1982. As a result of increased head and chest injury potential found in early research, early tests by the TRRL incorporated a chest pad to offset the problems. More recently the use of airbags has been investigated also.

In 1985 Bryan Chinn presented his PhD thesis "Injuries To Motorcyclists' Legs: Testing Procedures and Protection" to a conference on experimental safety vehicles held in Oxford.

Following on from this work, TRRL devised a draft specification for leg protectors in 1987. This became the basis of a UK proposal for legislation in 1988. The draft specification required leg protectors to have several characteristics; a primary impact element, a rigid support element, a knee protector element, leg lateral retention, smooth

outer contour and a detachment of the rigid support at high impact energies.

In 1989 the International Motorcycle Manufacturers' Association (IMMA) undertook a programme of crash tests using leg protectors constructed to the TRRL draft specification. The results were entirely different from those reached by TRRL and suggested that the entire concept of leg protection was inherently flawed. Results showed that in 25% of accidents leg protectors increased rider safety, in 25% they made no difference and in 50% actually caused increased injuries.

In addition two independent reports commissioned by the industry into TRRL research were critical of the research methods used. It should be noted that TRRL research has always supported the use of leg protectors with no negative results.

This led to a member of TRRL alleging scientific fraud in TRRL and by the head of leg protector research Dr. Bryan Chinn. There followed an independent investigation by Glaister and Cesari which cleared the TRRL of any deliberate deception, but was highly critical of the methodology used. Following the independent reports the TRRL produced a working paper in 1991 which was critical of the IMMA research and questioned the fact that the industry had not then tested the prototypes provided by the TRRL. Since then the industry has performed these tests and again found leg protectors to be inherently flawed.

In the meantime Dr. Chinn has continued his research into leg protectors and airbags and has heavily promoted them in Europe. Further tests and simulations have found no overall benefit in the use of these devices.

## Current Situation

In April 1992 the Gerondeau report compiled by high level government experts contained the following paragraph.

“The Committee also hope that research on protection for motorcyclists’ legs should speedily be put into effect by the makers and that protective devices should speedily be made compulsory, starting with motorcycles above 400cc. (Recommendation No. 59). Research into the use of airbags for motorcycles and into any other device able to improve the safety of users, should be pursued actively.”

This has been echoed in the Commission proposal “An Action Programme for Road Safety” COM(93)246/final, published in June 1993. Pressure by the UK government forced the Commission to include leg-protectors in this new proposal.

As vulnerable road users, motorcyclists naturally welcome efforts to reduce accident rates and severity. Unfortunately, implementation of the research done so far on can do neither and is likely to achieve the opposite of the desired effect. That the work is surrounded by controversial and contradictory evidence, by claims and by counter-claims, is indicative of the fact that the field of study is at a fledgling stage.

Only one person in one research body is seen to publicly recommend leg protectors. As this person’s doctorate, reputation and employment are linked to the success of leg protectors then we feel that corroborating research from independent bodies in other countries is vital if an objective and impartial judgement capable of standing up to public scrutiny in Europe is to be found. So far this research is notably lacking.

Any legislation based on the current state of research would be at best both premature and unjustifiable, at worst murderous and maiming.

The Gerondeau report which contains the recommendation for compulsory leg protectors also contained the ill-fated power limit proposal. With the power limit proposal a complete lack of supporting evidence led to its eventual defeat in Parliament. With such a discredited stablemate recommendations for leg protectors should be viewed critically and carefully analysed.

The problem with leg protectors is partly one of context. In certain cases a combination of leg protectors and airbags are likely to be of benefit. In other cases it is not clear and in more cases they

are a hazard. With the exception of the TRRL the consensus is that leg protectors reduce total rider safety.

## Insurance Concerns

Given the current litigious climate the lesser road of legislating for optional leg protectors is not acceptable to motorcyclists. Aggressive use of certain facets of leg protector research in court could be used to win a contributory negligence settlement in cases where the protectors could have made a difference. This would be a back-door introduction of leg protectors. Leg protectors as currently defined by research are a danger in themselves and for this reason should not be used.

## Research inadequacies

Given the complex dynamics of a travelling motorcycle any worthwhile investigation into the behaviour of rider and motorcycle in an accident situation is extremely difficult to undertake. Simple collision tests such as those used in the TRRL research are not sufficient to justify leg protector recommendation. All aspects should be addressed in any research which supports legislation. Among the many aspects not addressed are:

- Increased risk to pedestrians from bikes which tumble further in accident situations due to leg protectors. (This was noted in the JARI report.)
- Effects of the devices when a pillion passenger is on the motorcycle.
- Effects on so-called “one-vehicle collisions.”
- Effects on motorcycle stability during cornering, in high winds and at motorway speeds.
- Effects on the wide variety of motorcyclist seating positions.
- Effects due to variance in rider size.
- Effects on motorcycle appearance and fuel economy.
- Effects on manufacturing cost and on potential bike sales.
- Effects on imports from outside the EU.

## Airbags

Airbags can be seen as an unfortunate attempt to solve the problems associated with the flawed leg protectors. That the TRRL recognised a need for airbags in conjunction with leg protectors is an admission of the device's shortcomings even in the limited tests to which they were subjected.

Motorcycles are not cars and this has to be borne in mind when a transfer of technology is considered. To pick an obvious example, seat belts have no use on a motorcycle. In their current state of development neither do airbags.

Airbags present a number of serious and fundamental problems. Erratic ejection from the machine increases the rider's disorientation during an accident and decreases his/her chances of taking evasive action. Complete loss of control of the machine is unavoidable when the airbag inflates.

Due to suspension differences the motorcycle environment is harsh in comparison to other motor vehicles and the risk posed by unnecessary inflation of an airbag has to be taken into account. Because a motorcycle needs to be balanced by the rider unnecessary inflation poses a much greater threat to the vehicle's stability.

By using corpses French research has shown that the actual airbag inflation can cause a serious risk to motorcyclists by hitting the rider under the chin and consequently breaking the neck. Ironically Dr. Bryan Chinn of the TRRL warned that tests using corpses can provide results that do not reflect what would happen were a live person involved. It has to be borne in mind that Dr. Chinn promotes leg protectors and airbags based on limited and mostly unpublished research using an obsolete dummy.

## Statement of Position

MAG Ireland's position is that leg protectors and airbags represent the wrong approach in the search for safer roads. Without a consensus that leg protectors increase total rider safety, legislation enforcing their use is dangerous to the motorcyclist.

In the strongest possible terms we oppose the introduction, or recommendation as to use, of both leg protectors and airbags as currently specified.

## Summary

1. Leg protectors designed to the UK draft specification can lead to:
  - a. increased leg injury potential
  - b. increased head injury potential
  - c. increased overall accident severity in various forms of realistic accident configurations.
2. The increases in head injuries and overall injury severity are directly related to a lower overall head trajectory with leg protectors caused by the restraining effect of the knee protection element.

In summary, it is concluded that leg protectors designed to the UK draft specification are not beneficial for rider protection.

## References

- "Injuries To Motorcyclists' Legs: Testing Procedures and Protection." Technical Session No. 8, Safety Design of Two-wheel Vehicles, BP Chinn, P Hopes. TRRL 1985
- "A Study Of Motorcycle Leg Protection." Japan Automobile Research Institute.
- "Draft Specification of Leg Protection for Riders of Motorcycles." TRRL June 1987 IMMA 1989 leg protector crash tests
- "A Review of TRRLs Research On Motorcycle Safety." Glaister and Cesari 1991 TRRL - Working paper
- Priority fields for action and guidelines for a Community Road Safety Programme
- Gerondeau Report April 1992
- "Communication from the Commission to the Council for an Action Programme On Road Safety." COM(93)246/final June 1993 Section 4.2.2

## Appendix:

Main Test Results from the 1989 series of Leg Protector crash tests by the International Motorcycle Manufacturers Association (taken from the test video): the tests consisted of sixteen crash tests, eight with leg protectors and eight without. The crash configurations were taken from accident databases and were chosen to be representative of real-life situations.

The number of leg injuries decreased with leg protectors in two of the eight test pairs, there was no difference in two cases and in four test configurations the number of leg injuries increased with leg protectors.

In five out of the eight test pairs there were knee injuries which resulted from contact with the knee protection element.

In a comparison of the effects of leg protectors on head injuries the trajectory of the dummy's head between the time of initial motorcycle impact and the time of primary head impact was lower with leg protectors in all eight test pairs.

In addition and for similar reasons the head velocity at primary impact was increased with leg protectors in seven out of eight cases. Maximum head acceleration was also increased with leg protectors in seven of the eight test pairs.

A lower head trajectory combined with greater head velocity and acceleration results in greater head injuries.

In looking at the effects of leg protectors on the injury severity in terms of total accident injury severity scores leg protectors were found to be beneficial in two out of eight cases and harmful in six.

A comparison of maximum accident injury severity showed leg protectors were beneficial in two of the eight test pairs, had no effect in two and were harmful in four.

For estimated injury cost leg protectors were beneficial in three test pairs and harmful in five

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I became involved with the Irish Motorcycle Action Group in 1988 when a law to restrict full motorcycle licence holders to sub-125cc machines for a period of two years after getting their licence was enacted. Since then I have taken over as general secretary, launched the organisation's newsletter, travelled to mainland Europe to lobby Members of the European Parliament on riders' issues and to attend meetings of the European MRO co-ordinating body, the Federation of European Motorcyclists. I work as a software engineer in Dublin, Ireland.

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