

**Some Roads are Safer than Others, and Here's Why**  
***AusRAP: A Cooperative Initiative Between Automobile Clubs and Road Agencies***

KW Ogden & PS Daly  
Royal Automobile Club of Victoria (RACV), Australia  
kenogden@bigpond.net.au, [peter\\_daly@racv.com.au](mailto:peter_daly@racv.com.au)

## **1. INTRODUCTION**

The Australian Automobile clubs, most of which have existed for over 100 years, have a long history of representing their members' interests. With a combined membership of over 6 million people, the clubs can be influential and have an important role to play in public policy and member advocacy.

Inevitably, many issues of interest to the automobile clubs fall into one or other areas of responsibility of road agencies, particularly (in Australia) at the state level but also at the national or local government levels. One such area is road safety, and in particular the design and management of the road system.

However, the automobile clubs and the road agencies have distinct roles. It is not the job of the automobile clubs to manage the road system, nor to determine priorities for the expenditure of scarce resources. On the other hand however, the automobile clubs may play a role in the community, media and political environments in which, as government agencies, the road agencies are more constrained. In the area of road safety in particular, the Australian automobile clubs see that they have an important role in raising community awareness of the contribution which road infrastructure can make to road safety. This has the overt aim of generating public support for a political commitment to direct greater financial and technical resources to this area, and thus, to the extent that this is successful, allow the road agencies to continue or expand their important work in managing and upgrading the safety of the road network.

A recent specific example of this complementary role has been the development of the Australian Road Assessment Program (AusRAP). This program was developed to raise community awareness of the importance of road and road environment in the broader context of road safety. While AusRAP was an initiative of the automobile clubs, nevertheless it was developed in cooperation with the various Australian state road agencies. This cooperation included access to road agency data, and a commitment from the automobile clubs to keep the agencies informed about both the evolution of the AusRAP model, and consultation on the results of the modeling prior to public release.

This paper outlines the development and application of the Australian Road Assessment Program (AusRAP) in the context of the "safer systems" approach to road safety. The paper focuses in particular on the development and application of the model in the state of Victoria by the Royal Automobile Club of Victoria (RACV), and RACV's use of AusRAP to raise community awareness of road and road

environment safety. Particular attention is also paid to the development and maintenance of appropriate relationships with the road agencies, recognizing the distinct though complementary roles which each have to play.

## **2. SAFER SYSTEMS**

Road safety philosophies have gone through a number of phases over the decades, each phase bringing new insights, new ways of approaching the problem, and new solutions. We are entering a new way of thinking about road safety, one that has been described as “safer systems”. In essence, the safer systems philosophy recognises that humans are not perfect decision makers and often make mistakes (it has been estimated that between one in one hundred and one in five hundred driving decisions can be wrong, involving a mistake, an error of judgement, a missed signal, or the like). The safer systems approach therefore moves beyond relying solely on the actions and behaviour of the driver to avoid a collision, but aims to both help the driver to make a correct decision, and provide protection when they do not. This notion is well understood in the aviation and rail transport sectors, and in workplace safety, but it is not yet well entrenched in road safety.

However, the philosophy, and its consequences, are implicitly reflected in the projections underpinning the current Australian National Road Safety Strategy. The target of the Strategy is to reduce the annual road fatality rate per 100,000 population by 40 per cent between 2001 and 2010. It shows that this can be achieved via four key strategies - improving the safety of the roads (47 per cent of the target), improving the safety of vehicles (25 per cent), improving driver behaviour (23 per cent), and adopting smarter safety technology (5 per cent). Thus, nearly half of the targeted improvement in road trauma can be achieved by upgrading Australia's roads.

However, the resources required to undertake such a task would be considerable, and would require a high level of political and community commitment over many years. One of the roles of the automobile clubs is to attempt to generate such commitment by demonstrating the significant road safety benefits achievable through road upgrade programs. Over recent years, the State based motoring clubs and their national association, the Australian Automobile Association (AAA) have developed the Australian Road Assessment Program (AusRAP) as one of the tools to pursue this objective. The program is closely aligned with the European equivalent, EuroRAP, which has been operating for a number of years.

## **3. THE AUSTRALIAN ROAD ASSESSMENT PROGRAM (AusRAP)**

AusRAP is based on the premise that safer roads will save lives, but that in order to develop the political will to improve the roads, there must be community understanding of the benefits of doing so. Currently, reasonably objective and accepted measures exist of what constitutes a safe road user (essentially someone who is responsible and obeys the law) and a safe vehicle (one which rates well under programs such as the Australian New Car Assessment Program). However, there is much less community awareness of the role of infrastructure improvements (such as the provision of dual carriageways, design of safer intersections, provision of sealed shoulders or installation of safety barriers) in reducing risk.

AAA and the Australian automobile clubs (including the RACV) have been monitoring the attitudes and priorities of motorists for many years through both qualitative and quantitative market research. Recent surveys consistently show that although road safety is recognized as being an issue of concern in the community, the true extent of the problem is not well recognized. Most people attribute the causes of road crashes almost exclusively to way people drive. A telling finding of the latest RACV research was that respondents spontaneously mentioned one or other aspect of driver behaviour as one of the three biggest causes of road crashes almost exclusively. Accordingly, the most popular strategies for reducing road crash deaths and injuries involve more driver education and training, and focussing on aggressive and irresponsible drivers.

However, the research also shows that motorists are becoming increasingly well informed about the safety of new cars, and many can readily expound on the features that assist in preventing crashes - better brakes and handling, roadworthy tires and stability control - and features that help to protect occupants when a crash does occur - airbags, seatbelts and crumple zones.

But by comparison with behaviour and vehicle safety, motorists' concept of a *safe road* is barely developed. Motorists tend to think in terms of road condition and maintenance, and certainly not in terms of forgiving roads. Blackspots (i.e. sites where there is a concentration of crashes) are recognised and accepted as dangerous, but they are thought to be remote and reasonably scarce.

By giving roads across Australia a safety rating, AusRAP aims to make the risk of death and injury on different roads more meaningful and stimulate public discussion and action. It aims to help road users understand how risk can vary according to changes in the road environment. Risk-aware road-users may be more likely to adapt their driving to reduce their risk of a crash. The ratings will also provide road planners and engineers with vital benchmarking information to show them how well, or badly, their roads are performing compared with others.

In short, AusRAP represents the completion of "safe system" approach to road safety by providing an objective measure of the safety performance of roads. In doing so, AusRAP aims to increase public and community awareness of the safety benefits of safer roads, as a necessary prerequisite to stimulating political will to provide the resources to upgrade the safety of the road system.

Like EuroRAP, AusRAP uses two methods or protocols for assessing the safety of roads. The first protocol, risk mapping, is based on a road's history of crashes and traffic flow. The second protocol, star ratings, provides a measure of the inherent safety of a road.

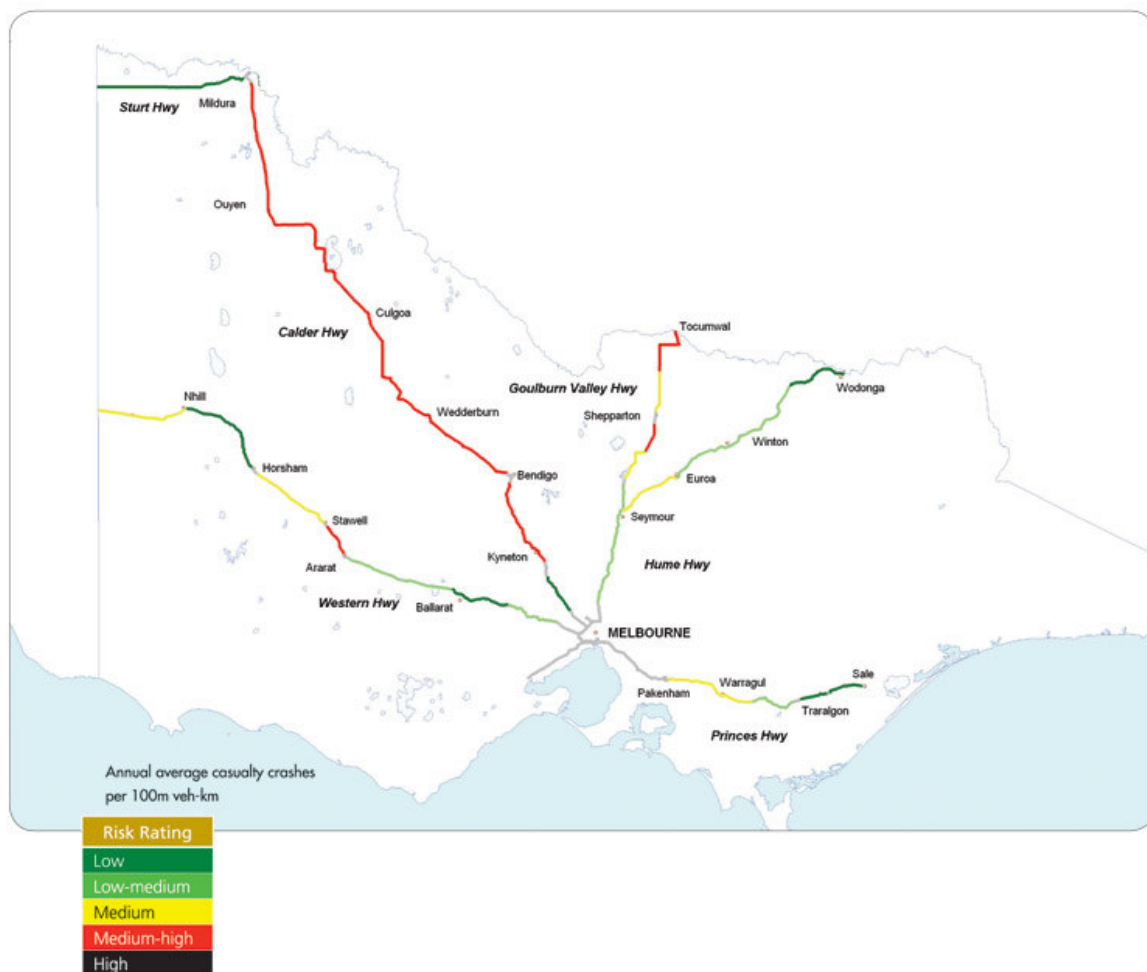
#### **4. RISK MAPPING**

In 2005, AAA published its report *How Safe Are Our Roads?* (1). This report used risk maps to provide a measure of the safety performance of the Australian national road network, referred to as AusLink (the name given to the road network funded in whole or in part by the Federal Government).

Two types of risk map were presented. The first type plotted the annual average number of casualty crashes per kilometer on highway links for the period 1999-03. This type of map is referred to as the 'collective' risk map and presents the 'crash density' on highways.

An alternative measure of risk is based on the number of crashes per vehicle kilometre traveled. This is referred to as the 'individual' risk map, since it essentially shows the risk for individual drivers, and is calculated by dividing the frequency of crashes per annum by the distance traveled on each road link per annum. Figure 1 presents the individual risk map for the State of Victoria for the period 1999-03.

Figure 1. Individual Risk Map, Victoria, 1999-2003



The collective and individual risk measures are most useful when used together to “tell a combined story.” Roads that score poorly on both measures - those having high collective and high individual risk - might be considered as candidates for investment. Further cost-benefit analysis will assist in determining the appropriate road treatment and priority.

However, risk cannot be eliminated from roads through infrastructure improvements alone. Nor should it be. The road user must always share responsibility for a safe road system. The AusRAP risk maps strengthen the connection between infrastructure and personal responsibility by highlighting sections of road where

improvements are warranted, but also where road users may need to take extra care to minimise their risk until road improvements are made.

### 5. STAR RATINGS

The second protocol uses star-ratings to communicate a measure of the inherent safety of a road. AAA (2) published star ratings for most of the AusLink network in 2006, and RACV (3) complemented this report with publications of star ratings for the Victorian State highway network.

The aim of the star-ratings protocol is to examine and evaluate the safety that is built in to the road through its design, in combination with the way traffic is managed on it. The star-ratings do not take into account a road’s crash history.

The safer a road (i.e. the more *self explaining* and *forgiving* it is) the more stars it will be awarded. Self-explaining roads reduce human error through their simple and intuitive design. Forgiving roads have design elements that minimise the risk of a crash, and in the event that a crash does occur, reduce the energy of the crash to levels that are tolerable for the human body. Thus, roads with a higher star rating are likely to be straight or gently curved with dual carriageways, have good line-marking, full-width lanes, sealed shoulders and forgiving roadsides, and all or most intersections will be grade separated. At the other extreme, roads with fewer stars are likely to be single lane carriageways with sharper curves, have narrow lanes and unsealed shoulders, poor line marking and severe roadside conditions. The star ratings are described in more detail below.

As with the risk maps, star ratings have been presented pictorially. An example is shown in Figure 2, showing the application of star ratings to the Victorian Highway network.

Figure 2: Star Ratings for the Victorian State Highway Network, 2006



One benefit of star ratings in communicating results is that it comprises a single measure, which can be broken down into components of run-off-road, head-on and intersection scores as desired (see below). Although there remain significant communication challenges in explaining the underpinnings of the ratings, this is aided by the use of examples drawn from sensitivity testing of the model. For instance, it is straightforward to use the model to explain how the results would change for the better if the road was improved (e.g. duplication, sealing of shoulders, safer roadsides). In contrast to risk maps, where the measures are not tangible to the travelling public, star ratings form a common language for dialogue on the role of road infrastructure safety.

### 5.1 *How the data were collected*

AusRAP star-ratings are based on a detailed inspection of a road's design elements. AusRAP used an innovative approach to undertake these inspections by obtaining State and Territory road agencies' "video" data of road networks, which are usually collected for asset management purposes.

These data were collected using specially equipped vehicles which record digital photographs, or images, of a road (generally at 20m to 100m intervals) using an array of cameras aligned to pick up various views of the road (forward, rear, side left and side right). The vehicles are able to drive along the road at almost normal speed while collecting this information (see Figure 3).

Figure 3: Star-ratings data are collected by specially equipped vehicles



The digital images are streamed together to form a "video" of the road network. Analysts then undertake inspections by taking a virtual drive through of the road network, at highway speed or on a frame-by-frame basis depending on the complexity of the road. The software used by the analysts enables accurate measurements to be made of elements like lane widths and shoulder widths.

The analysis of the images then becomes a desk-top study with the ability to travel forward and backwards along the section frame by frame to define homogeneous sections and undertake the rating process. This method provides the ability to

quality-assure the rating process, rate over an extended period of time, undertake more detailed analysis of individual frames (especially important at intersections), and return to sections of road after the rating has been completed.

The data enable a number attributes to be assigned (see Table 1), which are in turn are used to calculate a star-rating for the road section.

Table 1: Rated attributes

Mid-blocks (road sections)	Intersections
Road section type	Intersection type
Lane width	Risk adjustment (volume of side road)
Sealed shoulder	Alignment of legs
Horizontal alignment	Sight distance
Terrain	Right turn provision
Delineation	Left turn provision
Overtaking requirements	Speed environment (of through road)
Speed environment	
Offset to roadside hazards	
Severity of roadside hazards	

A road’s star-rating is based on an inspection of design elements which influence the *likelihood* of crashes occurring and the *severity* of those crashes if they do occur.

The focus of the star-ratings is on the three most common and severe types of crash on rural highways: run-off road crashes, head-on crashes and crashes at intersections. Together, these crashes account for around 75 per cent of all crashes on Australia’s rural highways.

The design elements AusRAP considers for each type of crash are as follows:

for run-off road crashes: how well opposing traffic lanes are separated (for example, whether the road is divided or undivided), lane widths, sealed shoulder widths, number and sharpness of curves and hills, line marking, proximity and size of fixed objects (like trees and poles) to the side of the road, presence of safety barriers, and traffic speed.

for head-on crashes: how well opposing traffic lanes are separated (for example, whether the road is divided or undivided), lane widths, sealed shoulder widths, number and sharpness of curves and hills, line marking, overtaking requirements and traffic speed.

for intersection crashes: type of intersection (for example, overpass or underpass, tee, cross roads or railway), number of vehicles using intersecting roads (or trains), alignment of intersecting roads, sight distances and right and left turn provision.

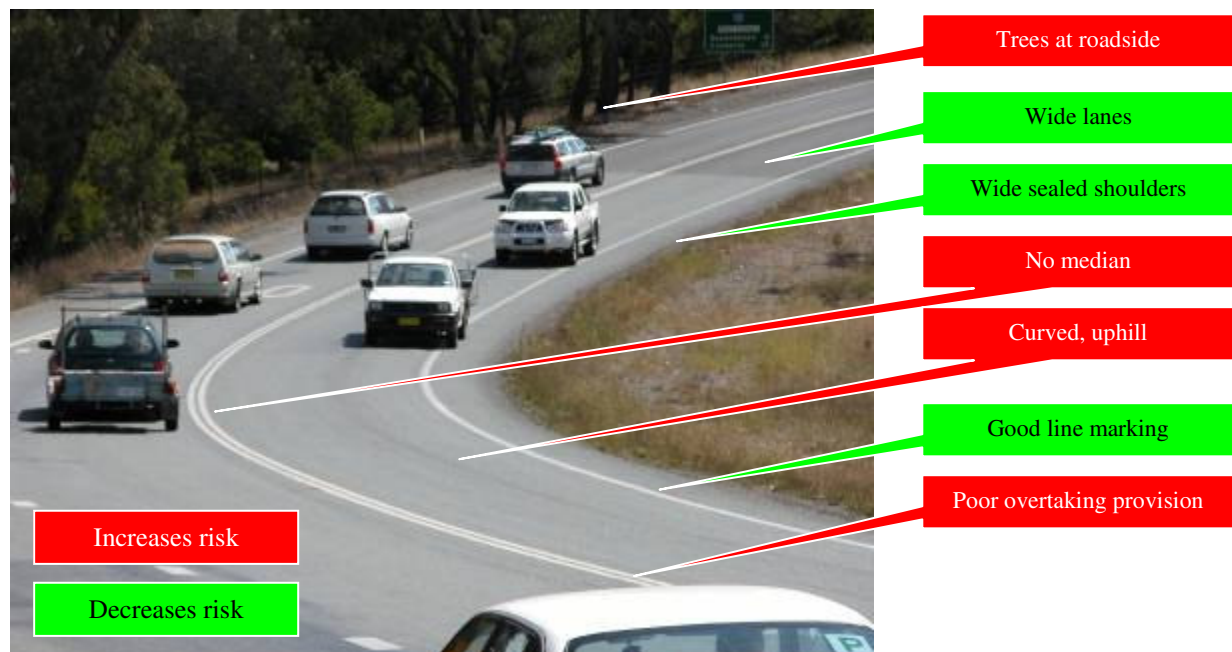
5.2 The Road Protection Score (RPS)

Central to the star rating is the Road Protection Score (RPS). The RPS approach to assessing a road was developed by ARRB Consulting and the Australian automobile clubs. It builds on work undertaken by the European Road Assessment Program

(EuroRAP) and draws extensively on research conducted over recent years by AustRoads and ARRB Consulting in the development of the Road Safety Risk Manager.

This research enables a relative risk score to be determined for each of a road's design elements (see Figure 4). As an example, the risk of being involved in a crash on a road with narrow lanes (less than 2.8m wide) is 50 per cent higher than on a road with wide lanes (greater than 3.6m wide). That is, other things being equal, a road with wide lanes is safer - and therefore receives a better score - than a road with narrow lanes.

Figure 4: Illustration of the Effect of Road Features on Risk



A RPS is developed for each of the three crash types: run-off road crashes, head-on crashes and intersection crashes. For each RPS, the individual risk scores associated with the relevant design elements are combined and weighted (according to their relative contribution to the road's inherent safety). The final RPS is determined by combining the run-off road RPS, head-on RPS and intersection RPS.

### 5.3 Star-ratings

The Road Protection Scores (RPS) are converted into easy-to-understand star-ratings. The star-ratings are also coloured, which enables colour-coded maps highlighting the various star-ratings to be produced (see Figure 2 above). Table 2 summarizes the types of road in each star-rating category.



Table 2: Typical Roads Within Each Star-rating Category

Rating Scale	Typical road	
	Divided Road	Undivided Road
* * * * *	Straight with good line-marking, wide lanes and sealed shoulders, forgiving roadside and overpass or underpass intersections.	No undivided roads can achieve a 5-star rating.
* * * *	Minor deficiencies in some road features such as lane width, shoulder width, curves or roadside.	Straight with good overtaking provision, good line-marking and forgiving roadside.
* * *	Major deficiencies in some road features such as poor median protection against head-on crashes, many minor deficiencies and/or poorly designed intersections at regular intervals.	Minor deficiencies in some road features such as bends and roadsides and/or poorly designed intersections at regular intervals.
* *	Many major deficiencies such as poor alignment, poor roadside and median protection and poorly designed intersections at regular intervals.	Major deficiencies in some road features such as poor roadside environment and/or many minor deficiencies such as insufficient overtaking provision and narrow lanes, and/or poorly designed intersections at regular intervals intersections.
*	Many curves, in mountainous terrain, narrow lanes and shoulders, severe roadside conditions and many major intersections.	Many curves, in mountainous terrain, narrow lanes and sealed shoulders, poor line marking and severe roadside conditions.

**6. COMMUNICATION**

As noted above, the ultimate objective of the AusRAP initiative is to reduce death and injury on our roads by improving road infrastructure safety. It aims to do this by raising community awareness of the role of safer roads and roadsides so that the community will support, and indeed insist upon, political action to direct financial and technical resources to upgrading the road system.

It follows therefore that communication of the AusRAP results, and increasing community awareness, is an intrinsic part of the overall program.

RACV’s activities in raising community awareness, using the AusRAP results and risk maps as a base, included the following:

a series of public launches involving the media, including a State-wide launch which coincided with the release of the national results by AAA; specifically targeted local

launches in regional centres, each of which involved local community leaders, local media, localised media releases, participation in talkback local radio, and local television.

the release of supporting collateral, including widespread distribution of the AusRAP reports; inclusion of the results on the AAA and RACV websites; preparation of a DVD on the safe systems philosophy and the role of AusRAP in that, and a series of fact sheets outlining the reasons why particular sections of the road achieved only (for example) a 2-star or 3-star rating.

stakeholder briefings, including presentations to professional associations such as the Institute of Transportation Engineers; informing and inviting support from other road safety agencies such as the Australian College of Road Safety; and ensuring that related stakeholders were not only aware of the AusRAP Program, but invited to make reference to it in their own advocacy activities.

The key community message in the program was a simple and succinct one: *Some roads are safer than others and here's why.*

By basing all communication, media, stakeholder contact, and peer briefings on this simple and succinct message, together with the technical credibility underpinning development of star ratings, the message had immediate and widespread community impact. This was measured, for example, by media interest, public feedback, and reference to the AusRAP material by political figures. The importance of having a clear objective, a succinct message, a detailed communication plan, excellent collateral, and political credibility cannot be overstated.

## **7. RELATIONSHIP WITH ROAD AGENCIES**

The automobile clubs have a role on behalf of their members in developing community and political awareness of the importance of safer roads via initiatives like AusRAP. This is quite distinct from the role of the road agencies (particularly at the State level, but also with Commonwealth and local government). However, RACV recognized the vital importance of clarifying these distinct roles with the road agencies, and emphasizing that RACV was not in any way attempting to do their job of prioritizing investments or determining what specific actions needed to be taken to improve the performance of any given link of the network. Rather, as noted above, RACV's role was to raise community awareness of the importance of road infrastructure in road safety, with the aim of generating grassroots support for a political commitment to direct greater financial and technical resources in this area.

Contact was therefore made very early in the process with the state road agencies, ensuring and they were thoroughly briefed not only on AusRAP and its technical aspects, by also on the respective roles of the clubs and the agencies.

In particular, it was made clear that the purpose of AusRAP was not to shame or embarrass road agencies for any perceived past under-performance, but rather to operate in the public and political realm, which as public servants they were much less able to do. Indeed, most of the Australian road agencies (and VicRoads in particular in the state of Victoria) have an excellent record for directing resources in a cost-effective manner to improved road safety, both through blackspot programs

which target sites where there has been a concentration of crashes, and also by building safety into new and existing roads via design and maintenance practices.

The role of the automobile clubs was to gain community and political support for these programs and thereby, ultimately, to ensure that additional resources flowed to enable the road agencies to continue or expand these worthwhile activities.

As noted above, AusRAP star ratings were calculated using video data of the road networks, and these data were obtained in most cases by the state road agencies and made available to AAA or RACV for the purpose of developing the star ratings. Thus, early involvement of the road agencies was an important factor in facilitating access to the data.

Particular care was taken to ensure that the road agencies were kept fully informed of the development of the overall AusRAP program, (including invitations to participate in relevant meetings of the technical working group of AusRAP) and they were also kept informed on progress of the program as it evolved.

A detailed briefing was given, prior to public launch of the results of the star ratings for each road, to the managers and engineers responsible for that section of the road network. Detailed explanations were available of the particular factors (e.g. road, roadside, or intersection factors) which, via the AusRAP modelling, produced a particular star rating. In very few cases were the AusRAP results a surprise to the road managers, because after all it is their responsibility to know their network and its strengths and weaknesses in great detail.

As a result of these detailed briefings, once the AusRAP results went public and there was the inevitable invitation from the media for the road agencies to respond, their response was generally to acknowledge that the results were a reasonable indication of the inherent safety of the road, and that AusRAP had indeed correctly identified those features which, if improved, would make the road safer for travelers. At the political and ministerial level, a number of favorable and supportive comments were elicited by the media, and only where a minister had not been briefed was there a knee jerk negative response to what was (incorrectly but probably inevitably) perceived as criticism.

In essence, AusRAP, developed by the Australian automobile clubs, has been successfully rolled out alongside the road administrations of Australia, and was aimed (with widespread success) at assisting them rather than being a threat to them.

## **8. CONCLUSION**

The AusRAP initiative has the ultimate aim of reducing death and injury on the road by improving the road and roadside environment in the context of the safer systems approach, which focuses on safer road users, safer vehicles, and safer roads. AusRAP aims to raise community awareness of the importance of the road as part of the overall road safety environment, particularly in the light of market research that indicates that the public generally does not appreciate how important the road is. The essential message of AusRAP is: *some roads are safer than others and here's why.*

A carefully crafted and multi-faceted communication plan is essential to raising community awareness. In AusRAP, a mix of stakeholder, media, political, and road authority briefings were used to distribute and promote the essential AusRAP message, using the outputs of the AusRAP program - in particular the AusRAP star ratings.

Care was taken to ensure that the role of the automobile clubs in raising community and political awareness of road environment safety was not seen as a threat to road agencies, much less that the clubs were attempting to do their job for them. Rather, the Clubs' role was to raise community and political awareness of the importance of what the road agencies are doing, and to help create an environment whereby there will be public and political support to expand these important road safety programs.

Combining the technical competence of the AusRAP program, the effectiveness of the communication activities to the public and political community, and the recognition of the value of the AusRAP program to the road agencies, we are confident that AusRAP star ratings will be increasingly recognized as a very useful measurement of a road's "fitness for purpose", with reduced road trauma as a result.

## **9. ACKNOWLEDGEMENT**

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## **10. REFERENCES**

1. Australian Automobile Association (AAA) (2005) How Safe Are Our Roads? (AAA, Canberra).
2. Australian Automobile Association (AAA) (2006) Star Ratings: Australia's National Network of Roads (AAA, Canberra).
3. Royal Automobile Club of Victoria (RACV) (2006) Safer Roads Save Lives: Star Ratings for Victoria's Country Highways (RACV, Melbourne)