TRANSCRIPT

ROAD SAFETY COMMITTEE

Inquiry into serious injury

Melbourne — 11 September 2013

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Dr P. Cairney, principal behavioural scientist, ARRB Group Ltd.

The CHAIR — Good afternoon, and welcome to the last session for Wednesday of the Victorian Parliament's Road Safety Committee inquiry into serious injury. I would like to welcome Dr Peter Cairney. Thank you for coming here this afternoon. I will just explain that the evidence you will be giving to us today has the benefit of parliamentary privilege, but any comments made outside the hearing are not afforded such privilege. The transcript of our dialogue today will become a matter of public record. You will receive a copy of the transcript in a few weeks, and you will be given the opportunity to correct any typographical or factual errors in it. We would welcome the return of that document to us. I invite you to speak to your submission, following which we will put some questions to you. You are also welcome to ask us questions at that stage.

Overheads shown.

Dr CAIRNEY — Thank you very much, Mr Thompson. You will recall that this picks up from the session you had at ARRB, when my colleagues spoke to you. This presentation follows on from Chris Jurewicz's and Van Hoang's presentation. If you remember, they talked about risk on roads and how we can develop objective measures of risk and move to a much more risk management oriented approach to managing road infrastructure. I was interested to hear some of Mr Elsbury's questions because I think some of what I have to say bears directly on some of the issues he raised with our TAC colleagues.

Today I am going to be talking about our rather poor understanding of the effectiveness of road safety treatments and some steps we can take to improve that understanding. Also I did add a little bit to this, because at the conclusion of the session at ARRB you were having a preliminary discussion with Stuart Newstead from MUARC about some of the issues relating to ITS and safety. I have done a little bit of research that is relevant to that, so I will conclude with some results and thoughts on that matter.

As I am sure you are all well aware from the work of this committee and past committees, improvements to roads and roadsides are a very important contribution to reducing deaths and injuries, and getting the best return for road safety treatments really depends on having a knowledge of where the risk is on the road, having a good idea about the sorts of treatments that work, understanding which treatments work in different situations and really being able to think in terms of the whole-of-life costs for these treatments. For example, some treatments are very expensive — like, for example, grade separations of railways and roads — but if you go to the examples of the UK, America or Europe, you find perfectly serviceable bridges that have been in service for 150 years or more. So although they may have seemed very expensive at the time, they probably turned out to be a very good investment.

The main point I want to raise with you is really how inadequate our knowledge of the effect of road safety treatments is. This is something that is pretty much acknowledged by leading authorities in the field. There is a gentleman called Ezra Hauer from Toronto, who has been particularly explicit about this point and quite critical of a lot of the work that has been done in the area.

We ourselves carried out a project for Austroads, which lasted over a seven-year period from 2000 to 2007, where we looked at engineering treatments, the sorts of risks they were designed to treat and the effectiveness of the treatments that we had. In the course of that we did a very thorough review of the available literature at the time, and we found an awful lot of gaps in knowledge. The reason for that is that very often studies of traffic safety improvements are pretty small-scale studies that come up with inconclusive results. For example, if you think about an organisation the size of VicRoads, half a dozen roundabouts in a year would be a lot. So that is not really a big enough study to draw conclusive results from. It is also compounded by poor study design, because people do not really understand what they are doing and as a result they draw quite the wrong conclusion sometimes. What makes it harder is that very often when there have been small-scale studies they are not documented very well, so it is very difficult to then try to draw these smaller studies together and put them into one big database and try to draw conclusions from that.

Of course, as you have been discussing this afternoon, we really have pretty limited knowledge of the accuracy of injury data. For example, if you are trying to compare the outcomes of different types of guard rails, you could perhaps know how many people get injured at different types of guard rails but you really have no way of credibly assessing whether the severities are really different or not. They are the sorts of reasons why it is so poor.

The remedies that we have would be first of all to combine the results of studies, and this would involve a collaboration between jurisdictions and sharing data. Presumably a roundabout in New South Wales has pretty much the same effect as a roundabout in Victoria, but it has been a long battle to get people to accept that. We can also improve the training of the practitioners so that they are aware of the sorts of mistakes they are likely to make and improve the awareness of the problem of the managers and administrators so that they are then prepared to put enough resources into evaluation to get good results and not just treat it as an afterthought.

Then finally, as you have been discussing this afternoon, we need to improve the links between crash records and medical records, and that would be a big step forward. At the moment I will just talk about this, because we have been involved in a hands-on way in a couple of exercises. The first was as part of an Austroads project to prepare a guide for evaluating the effectiveness of road safety treatments. It is very much aimed to be a practical guide for practitioners. It sets out in reasonably simple steps what you would have to do to carry out a reasonable evaluation, and it is the sort of thing that we hope, for example, staff in a road authority regional office would pick up and apply to their evaluation. We have had it extensively peer reviewed, so we are pretty confident about what is in it.

The problem with evaluations is it is very difficult to get what we would call an unbiased estimate of the effects. Usually when you look at the effect of any sort of treatment it is never as straightforward as it might seem. One of the classics is this rather mysterious-sounding regression-to-the-mean effect. All that means is that it is sites that suddenly have high accident rates that get the treatments, and then the crash rates come down. If you had left them alone, in all probability the results would have come down anyway. Maybe not quite as much as they would have without the treatment, but they probably still would have come down a fair bit. There are quite a few studies that show this, and one study in particular measured the effect and found that the regression-to-the-mean effect was roughly the same as the actual effect of the treatments. So we get a very exaggerated effect of the effectiveness of the treatments if we do not take account of this. The other problem, of course, is confounding variables, so perhaps when treatments go in they are going in because there is a lot of development happening in the area, so when traffic goes up, crashes go up. The other thing that can happen is that people do not like treatments so they stop using that road and crashes go down, but that is because it is carrying less traffic.

It is all of these things that you really have to take care of, and there are a number of suitable study designs that we can use that eliminate that bias. They are more complex than just looking at the numbers before and after, but they are not that much more complex. They are quite manageable, but they do require more time, they do require a bit more budget and they do require a minimum level of skill and understanding, but we would argue that this is an investment that really seriously needs to be made.

The simple studies can still be useful because they provide a useful input to something that has become very common in the medical field. I do not know if you are familiar with the idea of the systematic review. The sort of review we are used to is what is called a narrative review, where you take all the literature, go through it and come up with a story of what has happened in the field.

The systematic review is a bit different because it sets out with a very specific question. It then usually sets some very strict criteria as to the methodological quality of the studies it will conclude and then adds up all the evidence and tries to come up with a yes or no answer. This has very much been the trend in current medical research. You can only do this, of course, if the documentation is adequate. If you do not know exactly what sorts of patients you have been dealing with or exactly what sort of other things they have been doing as well as being given the drug, then you cannot really come up with any conclusions. The same applies in the road safety sense.

There have actually been about five or six road safety reviews that have appeared in this medical database called the Cochrane Collaboration. We would be hopeful that even quite simple studies can be useful, provided you have adequate documentation of what they are about.

The second approach we have taken has been part of an international collaboration. I and two of my colleagues were part of a working group for the International Transport Forum, which looks specifically at how different countries can get together and share information about the effectiveness of countermeasures. There are a few obstacles to overcome, of course, in the way that crash data is treated and recorded, the way things are costed and the sort of information that is available. Again, if everybody is agreed about the basic information that is

recorded, then there really are quite good possibilities for a much better international collaboration. As a result instead of the 10 treatments we might have in Victoria or the 40 or 50 treatments we might have across Australia, we can then access the 200 or 300 treatments that have been installed in similar countries around the world. That is the big advantage from our point of view — accessing much bigger databases that allow far more robust studies.

The main conclusions of this report were that decision-making about safety interventions is actually a very complex business and we really need good information about it. We are increasingly dependent on good information about the effectiveness of interventions, because generally speaking we are spending more and more on this type of intervention as time goes on. In economies like ours, where we have a fairly mature road system that is being asked to do more and more, it is likely that this sort of investment will increase.

We have the fundamental importance of what we might call crash modification factors. That is just the proportion by which crashes change as a result of an intervention. If crashes are prevented by half, the crash modification factor would be 0.5; if they go up by 10 per cent, it would be 1.1 — that sort of thing. But we really need good information on these.

There is a need for more training and a regular practical use of all this. We need more extensive analysis for which treatments are effective and where they are less effective. We do not have a good understanding of this at the moment. We really need that understanding if we are to try to get any sort of transferability between jurisdictions.

That is all I really wanted to say about the infrastructure issues. Knowledge of road safety treatments is not as good as it could or should be. We really need to improve the quality of the individual studies and set up collaborative arrangements for our larger studies. We need to study the treatments under a wider range of circumstances to ensure that we have crash reductions that will apply generally and not just be confined to a limited type of site. This will ultimately lead to more accurate estimates of how we can reduce risk on the road and more effective investment in road safety.

Moving on from that, and following on from the discussion at the end of the session at the ARRB and your discussion with Stuart Newstead, I thought it was probably worth mentioning a bit of work that we have done on safety-related intelligent transport systems. This goes back to an Austroads project that was reported in 2010; I will provide the reference for it. We examined the potential for different types of roadside and in-vehicle ITS to reduce crashes under Australian conditions. We assembled an Australia-wide crash database so that we could find out how many rear-end crashes happened compared to cross-traffic compared to head-ons, because different types of ITS have affected different types of crashes.

We looked at the pattern of crashes across Australia. We looked at the available evidence on the different types of ITS and how effective they were in reducing different types of crashes. We applied that to the database and said, 'Well, how many fatal crashes and how many injury crashes is this particular ITS likely to reduce across Australia?', and then we worked out benefit-cost ratios based on the standard ways of valuing crashes and the information you had about the cost of the technologies, which, of course, became rapidly out of date because technology is changing so fast that the cost-benefit ratios did not really hold up for very long. However, the lasting value of this work is in identifying the number of different types of crashes and the numbers that might be prevented by different types of ITS.

I will just give a few examples of some of the standard ones that were really effective. The seatbelt reminder system was estimated to save around 100 to 180 fatalities nationally and a proportionate number of serious injuries. The value of that in economic terms would be somewhere between $380 million and $630 million. Then there is intelligent speed assist, which you have probably heard a lot about in this inquiry. In this case we only looked at the advisory version of intelligent speed assist — in other words, something that beeps when you are going too fast. On the information we had available, which I think was before the big New South Wales trial, the estimate was that it would save a very large number of injury crashes and be of quite considerable value. The New South Wales trial actually came up with a more favourable assessment than that.

The other one that does not get a lot of attention is the roadway departure warning. This is a system that is available in vehicles at the moment. It is based on a camera in the car that detects the contrast between the road surface and the line markings. It is connected to a processor that will tell you if you are heading towards the

lines or drifting across them and sounds a warning. A lot of people with this technology apparently switch it off in the city because it is a pain — it starts beeping every time you cross. In a way its safety value as a lane departure device is very limited, but where it really would pay off is as a roadway warning device. If instead of having to have a profile edge line down the edge of every road, you have something in the car, it is always there, and the sort of warning it gives would be about the same. We reckon that would save something between 100 and 300 fatal crashes and anything up to 2000 serious injuries at a value of up to $1.7 billion.

The CHAIR — Just one quick question. For what time frame are those savings?

Dr CAIRNEY — They are annual, so they are big numbers. But what you have to realise is that it does cost a lot of money to put these things in the vehicle. These are coming through with favourable benefit-cost ratios, not huge ones, but the cost of all this technology is actually coming down dramatically so the future of it all looks very good.

Collision avoidance warning is something that now is actually available in some quite low-cost cars, as you are probably aware. It again has tremendous potential to reduce fatalities and serious injuries.

What I think is really the game changer in all of this is that many of these functions are now available as nomadic devices, which was not quite true at the time of the study. For example, if you want ISA — intelligent speed advice — there is a free phone app. How good is that? Something for nothing that nearly always gives you the right advice about the speed you are going. If you have something you can just plug into a vehicle and go with it, then that really brings the cost down dramatically, and it also means it is not going to cost a lot to retrofit existing vehicles. If you can perhaps have a system where you can combine roadway departure and collision avoidance, that maybe makes a very attractive package.

Mr LANGUILLER — Is that available currently?

Dr CAIRNEY — Not that I am aware of, no, but the technologies are available. The roadway departure is well proven. I am not sure about camera-based collision avoidance. I think most of these are still radar based, but if you had stereo vision, then that would conceivably work or it may be cheaper just have the camera for the roadway departure and radar for the collision avoidance. The point is that it should be possible to get a fairly low-cost system together that is easily retrofitted — not even retrofitted, just plugged in to vehicles. If you consider how this gets linked into the vehicle-to-vehicle and vehicle-to-infrastructure-type communication, then the potential benefits are enormous.

There is one really critical issue in all this that I do not think has had a lot of attention, and that is that if you think about safe system principles — which I am sure have been well drilled in because this actually is the keystone of the national road safety strategy and of course the VicRoads strategy — for the foreseeable future anything approaching a safe system road is really only going to happen on the heavily trafficked parts of the network. It is just unaffordable to take it a lot further. Even if it were affordable, it is going to take a long time to string wire rope barriers along all the minor rural roads. But realistically it is probably never going to be an option.

So if we cannot build safe system roads, then in-vehicle ITS, combined of course with improving crash protection of the vehicles themselves, is probably going to give us our best hope of getting close to safe system conditions because it can really cut down on the run-off-the-road-type events and possibly combined with vehicle-to-vehicle communication it would really work to cut down the head-on collisions, both of which are really major problems on rural roads. This will apply to even the most minor rural road.

That actually resonates with a bit of work that we are undertaking at the moment, which is to look at the injury risk for disadvantaged communities. We are using census data to look at the socioeconomic profile of different postcodes and we are matching that to road traffic injuries from these postcodes. For every area we get a picture of the people and a picture of the road crash outcomes, and what we are finding is that disadvantaged communities have a considerably higher crash rate than non-disadvantaged communities. Even more outstanding than that is the fact that remote communities have a much higher crash rate than non-remote communities. Put disadvantaged and remote together and you end up with really what is shaping up to be a very high level of disadvantage. We are not quite ready to go with the actual figures on that yet, but that is the sort of outcome we are getting.

The conclusion for ITS is we have some market-ready and emerging ITS systems that appear to offer considerable crash reductions. If they are not already available as nomadic devices, it is possible they will be available soon. This may be the only way in which conditions that approximate the safe system can be made available on the less well travelled parts of the road network.

The CHAIR — Thank you very much for a very learned submission. It attests to a lot of experience. I will invite Mr Perera to open the batting.

Mr PERERA — Thank you for the submission. In ARRB's view, what is best practice for evaluation studies?

Dr CAIRNEY — Interesting. There are a number of competing methods; I have to think a bit here. There is a technique called Empirical Bayes, which is very popular in the US. An alternative to that is to use very comprehensive modelling of the situation or there are less complicated approaches that involve making adjustments to your expected numbers of crashes based on things like traffic and other things that go on without going through the full rigour of the Empirical Bayes. It is not clear whether there is any one right way or not. What we do not have are studies that really compare these three methods. In our view, it probably does not matter which one of these you use as long as you use one of them, because they all aim to do pretty much the same sort of thing.

I think different researchers argue for different approaches that they are associated with. It may be that some methods are better suited to some circumstances than others. I guess our view is that the really critical thing you must do is document what you do properly and document what the results were properly. Then there are these other methods of analysis that can all be used. So long as you use one of them, your results will be a lot more valuable than if you do not.

Mr PERERA — Stick to one. Do you think it would be advantageous to include key performance indicators at the initial, implementation and post-implementation phase of projects to track effectiveness?

Dr CAIRNEY — I am at a bit of a loss. I do not know what to make of that question.

Mr PERERA — Do you want to take it on notice?

Dr CAIRNEY — Sorry. When you say projects, are you meaning something like a new infrastructure initiative or a new enforcement initiative?

Mr PERERA — No. When you evaluate things I guess you use different practices, and then you employ key performance indicators to identify which is the best one.

Dr CAIRNEY — I see what you mean. I really cannot give you an answer on that one at this stage, sorry.

Mr PERERA — Do you want to take it on notice and communicate with the committee staff?

Dr CAIRNEY — Yes, I think that would be best.

Mr LANGUILLER — I thought I would not be able to talk by the end of the day, but I must tell you that your presentation made an interesting challenge and I am almost excited, if I may describe it that way.

Dr CAIRNEY — Thank you.

Mr LANGUILLER — I thank you for your very good presentation. The ARRB submission refers to an Austroads report that ARRB contributed to which outlines the different types of evaluation study design, including cross-sectional studies, before and after studies and experimental studies. Can you briefly outline the key advantages and disadvantages of these evaluation designs? In your view, which evaluation design provides the most accurate and valid estimation of the effectiveness of a road safety intervention?

Dr CAIRNEY — As I was trying to explain before, I do not think it is possible to come up with the sort of one right answer. All methods have their advantages and disadvantages. The cross-sectional method is something that has quite often been used. Let us say you wanted to study the safety effects of roundabouts using existing roundabouts. You might just collect information on all the roundabouts in Victoria — for example,

look at the crash rates and then try to separate the roundabouts by the amount of traffic they cater for, the number of entrances and the diameter of the roundabouts and on that basis try to come up with some sort of conclusions as to the effectiveness of roundabouts of different size in relation to the amount of traffic they carry.

That sort of gives you an answer, but the problem with that is that you are dealing with only the existing situations and it probably does not take account of confounding variables very well. For example, the really big roundabouts are probably carrying different sorts of traffic from what the smaller roundabouts are carrying; the effect of roundabout size gets confused with the type of traffic. It is not a great method to try to pin down causes.

The experimental method is a very strong sort of method because if you are dealing with the same problem, imagine you had the luxury of going out and building roundabouts of different sizes in different circumstances. Sorry, that is not a good example. If you could go out and increase the diameter — if you think bigger roundabouts are safer, then you could go out and take existing roundabouts, make them bigger and then see whether the crashes are reduced as a result. It would probably never happen but think about it as a thought experiment. That would be the experimental method. That is in a sense a very strong method because you are taking the actual situation, you are changing it and you are looking at what happens. But of course it is very rare that you can actually do this. We do not live in a laboratory; we live with a road network that people need for their lives and their businesses and so on.

The other thing we could do is probably in the circumstances the most powerful approach, and that is to really model very carefully the effects of roundabout size, but it would be much more than a simple comparison. You would really need to take into account a lot of other variables and create a very complex statistical model. Once you have taken account of all the other possible confounding factors, then maybe you could come to some conclusion about the size of roundabout diameter.

Mr LANGUILLER — The ARRB indicates in its submission that internationally and in Australia the knowledge base around the effectiveness of road and roadside-based safety treatments is patchy. What are the challenges in transferring the results of strong evaluation studies to other countries and implementing countermeasures based on this knowledge?

Dr CAIRNEY — I guess the big challenge is always just how appropriate the solutions you have in one country are to another country in terms of the traffic mix, the sort of traffic habits and the whole enforcement regime and all the rest. I can think of one beautiful example. I have a picture from Thailand. It is of a fairly quiet little street that has a pedestrian crossing. There is only one car in the street and guess where it is parked? Right on the pedestrian crossing. I mean, it was probably a silly place to have a pedestrian crossing in the first place, but you always have that question about how appropriate the situation is. A lot depends on how people understand the treatment you are putting in and what sort of publicity and enforcement there is to get them to behave in the appropriate manner. There are all these issues again.

On YouTube a year or so ago there was remarkable footage of a new road in India, a dual carriageway with one carriageway unused and all the traffic going up and down the single carriageway because nobody had told the drivers that this was now a dual carriageway and if you are going in one direction, you go on one side of the road and you do not go on the other.

There are often these misunderstandings of just how things could work. This makes me feel ancient, but I do not know if you gentlemen are old enough to remember the fuss there used to be about roundabouts in Victoria — this strange treatment that came from England and nobody quite knew how to drive around. I think that is the big challenge, making sure that the treatments are appropriate and that the road user population knows what is expected of it.

The CHAIR — Dr Cairney, on behalf of my colleagues I would like to thank you very much again for your presentation and your answers to questions. You will get a copy of the Hansard transcript. There is an issue that you indicated you would be happy to follow up on as appropriate. If there are any questions on the depth and breadth of that, feel free to liaise with our executive staff so that the time spent is commensurate with the information being sought. It may be a simple exercise to round off.

Committee adjourned.