ROAD SAFETY COMMITTEE

Inquiry into pedestrian safety at carparks

Melbourne—27 July 2009

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Witnesses

Dr B. Corben, Senior Research Fellow, Monash University Accident Research Centre.
The CHAIR—Thank you for being here today to assist the Road Safety Committee inquiry into pedestrian safety in carparks. As you can see the proceedings today are being recorded by Hansard and you are protected under parliamentary privilege but anything you say outside of this room is obviously not protected by parliamentary privilege. You will get a transcript of the recording and you can make amendments accordingly. If you could proceed with your presentation and we may ask questions as we go.

Dr CORBEN—I am Dr Bruce Corben, I am a senior research fellow at Monash University Accident Research Centre. One of the things that is important to say at the outset is that I—and I do not think my colleagues either—have conducted any research into this particular topic, but we have done quite a lot of work in the area of pedestrian safety over a long period, at least in my experience, dating back to the mid-1990s. In addition to that work we have also worked in areas of pedestrian safety in industrial and workplace settings, large industries where pedestrians are interacting with vehicular traffic. In my personal situation too I completed a PhD a couple of years ago in the area of creating safe traffic environments for pedestrians. What I have tried to do is to put a few thoughts together in the form of a PowerPoint to take people through what I think are important issues in the case of pedestrian safety in carparks.

You would already have received a written submission from one of my colleagues Erin Cassell who I think looked through the hospital injury database, as I say, provided a written submission but I thought it would be good to start by looking at the scale and nature of the problem of injury in carparks in Victoria. I will quickly move through some of the key points here.

Overheads shown.

Dr CORBEN—115 hospitalisations over the last six years were found in the database involving pedestrians that were struck by vehicles in carparks. There seems to be a high proportion, around 45 per cent of those cases, involving people aged 65 years or older. Two-thirds involved female pedestrians which is not necessarily an indication of them being at greater risk but perhaps an indication of exposure, a higher exposure of females. More than half of the injuries that were recorded in that database involved fractures, and most commonly it was the lower limbs in about 50 per cent of cases, and the head, face and neck in almost a quarter of cases. In addition there was a further 74 cases during that time period that were treated in emergency departments only, rather than only involving hospital admission. That gives some sense of the scale and the nature of the problem.

In terms of non-vehicular injury in carparks there is a number of other significant types of events: over 840 hospitalisations in that same six-year period due to other causes than pedestrian vehicular crashes. 55 per cent involves slips, trips and falls; 16 per cent involve vehicular crashes where the pedestrian was not involved, so between two or more vehicles; 11 per cent assaults; nine per cent self-harm, and then nine per cent other causes which were not defined at any level that was worth specific mention. In addition, 825 similar cases were treated at emergency departments only for the less severe injuries. Overall it could be summarised as saying over 1,800 cases of injury required medical attention during that six-year period from 2002 to 2007. The point is made here—and I think it is in the report as well—that this is likely to be an underestimate of the true size of the problem because of the way in which injuries are reported or in many cases not reported.

The CHAIR—in terms of trying to put a monetary value on those injuries in terms of treatment and so forth, would it be fair to say that it would be in the millions?

Dr CORBEN—I think it would certainly be in the millions for that time period. We are talking there about something like three or four hundred cases per year on average and to convert them into the dollar values you would need to look at them, and there are different values for different levels of injury severity, of course. I cannot, off the top of my head, remember what it is for the lower ranges of injuries but it would be very significant and I think it would run into the millions.

Moving now from the data that was provided by Erin Cassell and Nicholas Reid, I am now putting my views about what I think are the important crash risk factors in carparks based on, as I said earlier, quite a long period of experience in investigating these pedestrian problems, but more on the road system than in workplace settings. One of the most obvious things is pedestrians and vehicles are both sharing the same
space in carparks, generally speaking. Though there are some more advanced designs where separation is provided. There is also the concern about the attention-sharing and distraction that is experienced by drivers while they are searching for a carparking space. Often in carparks it is a very elusive carpark that remains and people are very distracted and often quite competitive in looking for those car spaces. That is not particularly helpful in terms of the safety consequences for pedestrians who might be in the vicinity. The setting too, in the busy carparks, is often quite a complex setting with lots of vehicles circulating and quite a lot of manoeuvring of vehicles both in and out of carparking spaces and down aisle ways and so on. That also makes for some added challenges for drivers being aware of pedestrians in the surrounding space and being able to respond to any risks that arise.

We also know that in carparks, again depending on the design of the carparks, that there can be restricted sight lines for a number of reasons. One obvious case is that large vehicles parked, in particular four-wheel drives—which are now very common in the vehicle fleet—often obscure even an average-sized person, not to mention children or people of smaller stature. That tends to be a risk. If people are moving out from between parked vehicles and obscured then there is often, because of the constrained environment, not a lot of opportunity for drivers to get early warning that there may be a conflict. Added to that I think in some types of carparks, indoor carparks, you have structural columns which add to the difficulty in being able to see and be seen and, of course, the difficulty for a driver who is reversing out of a carparking space I think is quite well known as well and made even worse for larger vehicles and vans and so on.

The CHAIR—On that is there any evidence to suggest that reversing into carparks is safer than reversing out of carparks?

Dr CORBEN—I am not aware of any evidence about that. I have thought about that a lot. I know it is common practice in New South Wales, for example, for people to reverse into carparks. At some stage you have to reverse, so there is a reversing manoeuvre. Whether it works out better, I do not know. Also another issue about the visibility within carparks, for indoor carparks, moving from bright light into artificial lighting can also be a bit of a challenge. Some people take longer for their eyes to adjust to the changing light from the glare, either going into or coming out of the glared surroundings. I know that in some of the industrial settings that is a problem where large vehicles are moving into buildings and out of buildings and efforts are made particularly to try and have some graduated lighting as well to lessen the effect of quite strong changes in light intensity.

I have mentioned already the low conspicuity of children because of their smaller stature represents a problem in carparks as well, exacerbated by the presence of larger vehicles and other structural elements of the carpark. We also know—and I mentioned earlier in one of the slides—that older people, 65 and over, are involved in something like 45 per cent of all the injuries. Older people have limited agility for obvious reasons, they cannot move as quickly to avoid situations that might result in a collision, and also their perceptual function progressively declines as they age: their ability to hear approaching vehicles; sometimes their ability to see in their peripheral vision that a vehicle is approaching or is reversing towards them. Those kinds of issues can add to risk, the likelihood of a crash happening. I think, very importantly, it is the excessive travel speeds that can occur that also adds to the risk. I will make a distinction in a moment about how that might differ between parking that occurs in an aisle which only provides access to and from carparking bays, versus the roads that often circulate the larger carparks that can also present problems as well.

Mr TILLEY—You mentioned distraction by drivers looking for parking bays. In my experience recently, I was looking for a parking bay at the Westfield Shopping Centre at Doncaster. They have a system whereby there is a red light above the parking bay when the bay is full, and turns green when the vehicle exits. Do you think that affords the opportunity for drivers to minimise the distraction or once they see a green light they start heading for that bay to ensure that the other drivers coming from the opposite direction or other lanes do not get the parking bay?

Dr CORBEN—I have to say I have not heard of that system before. I have not obviously been to the carpark that you are referring to. But it could be both positive and negative. How it might resolve itself in the net effect, I do not know. It could create competition for people to rush around and try and get that space when it is vacant, but it can lessen the distraction, and the net effect I think would be unclear.
Mr KOCH—Do your statistics identify speed by percentage across accident and injury or is it an assumption that it is speed?

Dr CORBEN—in carparks or generally?

Mr KOCH—No, in carparks.

Dr CORBEN—No, as I said earlier, we have not done any research on speed in carparks but the heading I have tried to convey there is what I think would be the risk factors for pedestrians in carparks.

Mr KOCH—I take the last dot point you have there. That is an assumption, there are no statistics around it. I have assumed that someone in their later years could be hurt quite severely, even if they were touched and fell off balance, versus being knocked with some impact.

Dr CORBEN—Yes. I think maybe the next slide might in some way address that. Come back to me if that does not answer the question there.

Mr KOCH—Sure.

Dr CORBEN—This slide addresses injury risk factors as distinct from crash risk factors. Given a crash, what are the sorts of things that might add to the severity of injuries. I have made two points here: one is the instability and the frailty of older pedestrians. I think perhaps the point you are making, David, is if an older pedestrian is bumped, even very gently, enough to unbalance them that a fall then can result in severe injuries. We all know the stereotypical fractured pelvis or hip or something that results commonly for older people who have a fall, be it in their own homes or out in the public areas. This diagram—and you may be familiar with this from other work—the blue line on the right which is labelled 'all pedestrians' is based on the search that has been done, both in Australia by our colleagues at the University of Adelaide, and also in other studies internationally which generally coincided and presents a risk relationship. On the horizontal axis you can see the impact speed for pedestrians who have been involved in crashes. On the vertical axis you can see the risk of death for a pedestrian as a function of the impact speed. You can see also pretty clearly that somewhere around 35 plus kilometres per hour, the risk of death rises very rapidly up to around 55 kilometres per hour and it is approaching virtual certain death on average for these sample of crashes.

Mr KOCH—Where are these carparks where these sorts of speeds are being attained?

Dr CORBEN—No, this is not from carpark data, it is more general data.

Mr KOCH—It says 'in carparks' up the top. That is the general data?

Dr CORBEN—This is the general data about pedestrians who have been struck.

Mr KOCH—Yes, I just picked up on the title.

Dr CORBEN—Yes, sorry if that is misleading, but this is general data for people out on public roads who have been involved in pedestrian crashes.

The CHAIR—Whether you are on a normal road or carpark, I do not that would alter anyway, whether you did that same study in a carpark.

Dr CORBEN—No. That reflects the biomechanical limits that humans have in crashes, given the design of vehicles that characterise our roads. The very strong message out of this is that when you get to speeds about 30, 35, pedestrians are starting to get into a very high risk range for severe outcomes in the event of a crash. The yellow line that has also been drawn on there is not from research itself but rather to indicate that for an older pedestrian that curve would shift to the left. For much lower speeds we would get much higher risk of severe outcomes for older pedestrians. The point about all of this here is that we have issues about instability and frailty of older people and when the impact speeds in the event of a crash get above a certain level then we start to get into a quite high risk area.
The CHAIR—Before you go off that, in relation to speed limits in carparks, what would you say would be a reasonable speed limit?

Dr CORBEN—I come to that in the next line as well.

The CHAIR—Yes.

Dr CORBEN—Again it will be pretty much my view based on what I have seen and experienced rather than having done the work. In fact this is the last line and it captures a number of points that are important here. I have tried to summarise what I think would be good elements of good design practice for carparks. Firstly, the desirability of physical separation, that once pedestrians exit their vehicle or come to their vehicle they can do it via a separate path. In some cases it might be possible to provide vertical separation which means some elevated walkways. In some of the big carparks in the big shopping centres, for example, that people can get to and from with very minimal need to walk on the roadways. Another aspect is having clearly defined vehicle and pedestrian paths. That can be done with line marking and pavement colour and texture et cetera.

Also I think there are opportunities for innovative designs as well. One possibility is the one down in the bottom right-hand corner, I put that as an example where you may be able to have vehicles driving along in that area between the two yellow markings and make it one way. But if two vehicles are coming towards each other then if the speeds are low it is easy for each vehicle to move across to the left a little bit and move past each other. By having people move down there you can create a buffer space or a strip there so when people do walk out from between parked vehicles there is a separation between them and the passing vehicles. Whether that is the right design or not, I am not sure, but it is designs of that nature that can get some separation there.

The second main point on this slide is ensuring that there are only low travel speeds in carparks for the sake of pedestrians, to do a number of things: firstly, it will reduce the conflicts because drivers will have greater time in which to perceive there is a conflict ahead and to be able to respond; it also means that their stopping distances will be reduced considerably. It is quite a powerful relationship between the initial speed and the distance to stop; then the third point about low travel speeds is that the risk of severe injury can also be substantially reduced. As a reminder, the curve I showed on the previous slide, the fatalities, there is a corresponding curve for severe injuries which also is moved to the left. It takes a lot lower impact speeds to produce a severe injury.

Still under the heading of lower travel speeds, I think it is important that there are clear speed limits that can be enforced and are enforced, according to the scale of the problem. Avoiding even low impact speeds with older pedestrians, as we talked about a short time ago, even a light impact can cause an older person to fall and suffer severe injury. My suggestion might be that in areas, such as the one in the bottom right-hand corner there, where you have cars driving along aisle ways and coming in and out of carparking bays, I think walking pace is an appropriate speed in those circumstances. I do not see personally a justification for trying to save a few seconds for the added risk that that promotes. It depends on the nature and scale of the carpark but some of the larger carparks—and I would even look at Monash University; I do not know whether people are familiar with the Monash Clayton campus layout but there are huge expanses of carparking there and a ring road that circulates around and allows vehicles to access carparks around a circuit. Speeds of maybe 30 kilometres per hour on those roads, the likes of Chadstone or some of the regional shopping centres are reasonable because you do not have a high mix of pedestrians with vehicles. If I reverse that slide you can see again if we have travel speeds of around 30 kilometres we are on that relatively flat part of the curve and therefore the likelihood of a severe outcome is much reduced.

Mr WELLER—Is that impact speed or travel speed in the zone?

Dr CORBEN—That is impact speed.

Mr WELLER—If you were doing 15 K's and you saw someone, you might only be doing five K's when you hit them.
**Dr CORBEN**—That is right. We have done some work on the relationship between travel speed and the risk of a fatality which I have not brought to bear here, but we do have some figures that could inform that because there is a perception reaction time that people have to go through before they can start to slow the vehicle down. We know from other work, pedestrian fatality studies in Adelaide, that it is only in about half of the cases that the drivers have the chance to shed some speed before impact. In a lot of cases people are struck at the travel speed. It is a bit of a compromise but those sorts of speeds are probably quite reasonable.

**Mr KOCH**—Bruce, your diagram in the right-hand corner, please explain that a little bit more to me.

**Dr CORBEN**—I am sorry, I have not explained that very well. You can see the bays marked down in the black conceptually there.

**Mr KOCH**—Is your car travelling down the strips of yellow, is it?

**Dr CORBEN**—Yes, between the two yellow marked areas. This was an idea from a study we did at Monash looking at traffic safety. We thought that instead of allowing two-way traffic which means that both cars are displaced much closer towards the marked bays, that you have a single lane that would still allow two-way travel, but if two vehicles were coming towards each other then they would be able to move each to the left across the yellow marked areas where the pavement mark is.

**Mr KOCH**—Has [MUARC] looked at the opportunity as to how many parking spaces may be lost in the event with most carparks now you park to the rear of the car in front of you or what have you. If you had one parked here and the other one parked there and every time you get out of your car you walk forward, away from any travelling vehicles, has MUARC had a look at that from the point of how many parking spots may be lost at a shopping centre or—

**Dr CORBEN**—No, we have not.

**Mr KOCH**—To me, if you are looking for ultimate safety, if you want a grade separation or a clear separation between the travelling, therefore young children would end up being in those passive pedestrian corridors versus in traffic thoroughfares.

**Dr CORBEN**—That is right. There would be a consequence in terms of the number of parking spaces that would be available. That is one of the reasons why there has not been a strong incentive for developers to provide that—

**Mr KOCH**—No research has been done though?

**Dr CORBEN**—No, I do not believe so, not that I have become aware of. Reinforcing the issue about the low travel speeds is a very important point and then desirably providing traffic calming infrastructure that helps to ensure that low speeds will result as well. There are a couple of photographs in the top there that illustrate raised platform type speed humps that can serve both to regulate speed but also provide crossing opportunities for people where they would also have right of way. The final point is about ensuring the surfaces that people are driving on, particularly walking on, are smooth and even and as non-slip as is reasonable. High quality surfaces but also providing lighting as well. It looks as though I have not managed to show the last bit of that, indicating indoor carparks where you get change in light conditions.

**The CHAIR**—Smoother surfaces.

**Dr CORBEN**—Yes. As I say, it is not based on research in carparks per se but it is attempting to bring together—

**Mr KOCH**—Is it likely some of this will have resources spent researching some of it or will it remain best guess?

**Dr CORBEN**—I think it will only become formal research if somebody asks us to do it and is willing
to pay to have it done. Unfortunately, we work in an environment where we are self-funding, unless somebody wants the work done and then we are able to do it. That is the end of what I wanted to say.

Mr TILLEY—Talking about technology earlier there was made mention of cameras and sensors on vehicles and drivers being reliant on those additional aids in their driving. Do you see that creating an additional problem or raising the likelihood or possibility of pedestrian versus motor vehicle incidents?

Dr CORBEN—I think there are two ways things can go. All the in-vehicle technology can be developed specifically to aid drivers, depending on what the technology is and how it is used and how it is designed and how it interfaces with the driver. Things like video cameras at the rear of vehicles which are now available can certainly help in the reversing manoeuvre to give greater safety. There are also detectors to pick up potential conflicts ahead. Pedestrians in the space ahead can be sensed and therefore give some warnings to drivers who might otherwise be distracted. There are other kinds of in-vehicle technology that is not about providing safety that could certainly become a distraction to drivers and perhaps accentuate the problems.

Mr KOCH—Bruce, do you think there is vulnerability within carparks, be it open or covered, from the point of view of some form of enforcement versus some physical management opportunity? I say that from the point of view that many of our larger shopping centres have a fee for parking. The tenants pay an increased rate of rentals for the opportunity of harnessing those people within the shopping centre, so there is quite some revenue generated by having on-site parking. But beyond the person at the collection point in the carpark, we do not see anyone wandering around those carparks. Would you see that physical management of somebody being visibly seen and assisting the parking traffic and the travelling pedestrian would have merit and would not erode the viability of these larger shopping centres?

Dr CORBEN—I think it is something that would have potential. It is something that really would take some careful thought.

Mr KOCH—The money collected is for jam at the minute. It is not offering any greater security or safety for those using the carpark.

Dr CORBEN—Yes. However it is done best by people walking about and guiding drivers or undertaking some other management effort, I am not sure, but—

Mr KOCH—I think it is a physical presence as much as anything.

Dr CORBEN—Yes. I think there is potential for something like that to help but it is something that would need a bit of thought to how that would actually happen. There is also potential for that revenue being used for enforcement purposes as well within carparks, to ensure that people do drive at appropriate speeds and it might also add a further security.

Mr KOCH—That would come back to that physical management arena.

Dr CORBEN—Yes.

Mr TILLEY—in your studies, the attitude of motor vehicle drivers and the attitudes of pedestrians, we have heard quite a substantial amount about the need for separation between pedestrians and motor vehicles. In your research have you found any attitude issues that might be able to address safety within carparks?

Dr CORBEN—we look a lot at the introduction of Swedish and Dutch approaches to road safety for a couple of reasons: one is that both of those countries are leading the way, as you probably well know, in terms of deaths per hundred thousand and so on, but also the second thing is that they do have advanced visions and principles for achieving safe operation. One of the things that the Dutch talk about is the notion of creating a forgiving road transport system. They talk about that in two senses: one is the physical environment, that when people inevitably make mistakes that they do it in a way that does not produce a severe outcome. Part of that thinking is built into what I have tried to present here. The second part about a
forgiving road transport system is what they refer to is a social forgivingness and that is about people with their attitudes towards each other, be it as drivers and pedestrians, or driver to driver et cetera. What they find—and I think the research is also found in Sweden—is that people, the lower the speed of travel the more socially respectful they are of the people that are around them and it does produce better behaviour. Higher speeds, less so; lower speeds, a better social behaviour.

The CHAIR—Thank you very much.

Witness withdrew.

Hearing suspended.