CORONERS ACT, 1975 AS AMENDED

SOUTH *AUSTRALIA*

FINDING OF INQUEST

An Inquest taken on behalf of our Sovereign Lady the Queen at Adelaide in the State of South Australia, on the 28th, 29th and 30th of June 2004, the 1st and 29th of July 2004 and the 1st of October 2004, before Wayne Cromwell Chivell, a Coroner for the said State, concerning the death of Liam Magee.

I, the said Coroner, find that Liam Magee, aged 19 years, late of L139 Preston Hill Road, Haddon via Ballarat, Victoria, died at Mallala Raceway, Mallala, South Australia on the 27th day of April 2002 as a result of bilateral haemothoraces complicating traumatic rupture of the thoracic aorta. I find that the circumstances of death were as follows:

1. Introduction

1.1. On Saturday 27 April 2002 Liam Magee was riding a Suzuki GSXR1000 motorcycle in the second qualifying session of the Australian Superbike Championship at the Mallala Motor Sport Park near the town of Mallala, South Australia.

1.2. At about 3:56pm, Liam was negotiating turn 4, which is a slight right-hand bend in the 'back straight' of the circuit, when he lost control of the motorcycle and fell to the track surface. He then slid across the track and across a dirt area before colliding with a concrete wall in front of the grandstand on the western side of the track.

1.3. As a result of his collision with the wall, Liam sustained fatal injuries.

2. Cause of death

2.1. A post-mortem examination of the body of the deceased was performed by Dr R A James, then Chief Forensic Pathologist, on 30 April 2002 at the Royal Adelaide Hospital.

2.2. Dr James noted abrasions to the lower right neck, which he thought might have been a helmet injury, and to the left forearm and wrist, as well as closed fractures of the left wrist, right femur (thigh), first rib, and a fracture/dislocation of the right sterno-clavicular joint.

2.3. Internally, Liam had suffered a massive injury to the lower lobe of the right lung, and complete traumatic disruption of the descending aorta, with separation of the segments by 5 centimetres. Dr James also noted massive bilateral haemothoraces (bleeding into the thoracic cavities). There were also several subcapsular tears in the right lobe of the liver.

2.4. Dr James commented:

> 'The cause of death was a complete traumatic rupture of the thoracic aorta. This injury is fatal and untreatable. It is unusual in the high speed accident described to find no head or neck injury presumably the helmet provided some degree of protection. The aortic injury is lethal but even without this injury the ruptured right lung almost certainly would have proven lethal by itself.'
>
> (Exhibit C13, p5)

2.5. A toxicological analysis of Liam's blood revealed that it contained 0.014% alcohol (Exhibit C3a).

2.6. Dr James explained that there are two possible explanations for that:

- Liam consumed alcohol at some time prior to his death, perhaps even the night before, and it had not been completely eliminated from his system;
- The alcohol may have been endogenous, ie. the product of fermentation of sugars in the blood (which also contains various yeasts and water).

Dr James said that the three day interval between death and the post-mortem examination gave sufficient time for such fermentation to have occurred (T149).

2.7. Peter Brooks, a friend of Liam's and a member of his pit crew, said that he had been with Liam the whole time since they had been in South Australia, they had shared accommodation, and he was adamant that Liam had not consumed alcohol at all that weekend (T16). I accept his evidence about that.

2.8. In those circumstances, I find that the alcohol in Liam's blood at post-mortem was endogenous.

3. Liam Magee's background

3.1. Liam Magee was born on 7 November 1982. His father, Mr Peter Magee, provided the following background information about his son's motorcycle riding career:

> 'Liam was a very accomplished rider winning many, many races and championships. Liam raced nearly every weekend and trained/practiced 2-3 times a week.
>
> Liam started riding motorbikes around the 40 acre family property at about 4 years of age. He then started racing officially when he was ten. Liam raced motor cross and at the age of 12 won the Victorian A grade in both 80cc and 60cc class and was 3rd in the Australian Junior Championships at Mannum in SA at 14 years of age.
>
> The year before Liam's' death (2001) he won the first and last round of the 250cc Australian production championship. Liam was the only rider to win two rounds of the 5 round championship. Later than year Liam won the 250cc production support race at the Qantas 2001 Australian Grand Prix which was a round of the World Grand Prix championship. That Sunday Liam was the only Australian rider to share first place on the winners podium with 3 other International Grand Prix riders. This is the most important race in Australia for the year for 250cc production bikes.
>
> In fact Liam qualified in pole position 3 sec clear of his nearest rival and these were all the best of the 250cc production riders in Australia.'
>
> (Exhibit C1b, pp4-5)

3.2. 2002 was the year in which Liam moved up to the 1000cc 'Superbike' class. He had no corporate funding, and was riding a borrowed motorcycle. In the first round of the National Superbike Championships, he was second overall. In the second round, he finished second again. Mr Magee commented:

> 'In the short time before Liam's tragic death, Liam had beaten every Superbike rider in Australia on his borrowed bike including those international riders who rode overseas as well as in Australia.'
>
> (Exhibit C1b, p5)

4. Circumstances of the accident

4.1. Mr Brooks said that there had been two practice sessions on 26 April 2002, lasting about 30 minutes each. He said that the motorcycle was running well, and Liam recorded second fastest time in both sessions, only 0.5 seconds behind Shaun Giles (Exhibit C9, p1). Mr Peter Magee said that Liam was 'very happy and excited' to be in that position (Exhibit C1b, p1).

4.2. On 27 April 2002, there were two qualifying sessions. The first was in the morning when Liam ran even better than the day before.

4.3. The second qualifying session commenced at 2:45pm, and again Liam was running well. After about 30 minutes, they changed the rear tyre to a softer compound to provide more grip, so that he could ride even faster through the corners.

4.4. Mr Brooks said that the first lap after the tyre change was relatively slow at one minute and seventeen seconds (1:17), the next lap was 'quite fast' at 1:08, and that Liam was going even faster on the third lap when the accident happened (Exhibit C9, p2).

4.5. Mr Magee said:

> 'Liam would know his exact lap time as he had a timing device on his bike. The pit crew would put on the pit board the time of his nearest rival and his position. This was standard procedure for our team. Liam had instant information as to his lap time, his rival's lap time and his qualifying position.
>
> Liam would do a number of laps and when he decided he would pull in to the pits and discuss suspension/tyres/track conditions or other aspects with Glenn Willing, and Dale Topp. Qualifying time was also a test session used to gain the best 'set up' (suspension/balance) for the three races on Sunday. Suspension affects the steering of the bike, tyre grip, tyre wear corner speed and the general behaviour of the bike on the track, so it is very important to get the right 'set up'.
>
> I remember Dale Topp, Michelin tyre technician, saying to Liam midway through the final qualifying session, 'you're doing it right. They're throwing everything at you (meaning Suzuki had two bikes and about 6 tyre warmers on pit lane) and they still can't catch you'. Liam's team only had 1 bike and 1 tyre. That was the difference.
>
> Toward the end of the session Liam just completed a fast lap and was exiting turn three very quickly, it seemed a much quicker exit speed. I turned away and Andrew Brooks yelled out 'Liam's down'.
>
> I looked up and saw dust and what appeared to be a rider and bike sliding and then disappear in the dust. From the pits it was difficult to see with the dust and the track

slopes away over at turn four. I think the view was also obscured by a Flag Marshall's Station and signage, but I'm not sure.'

(Exhibit C1b, p2)

4.6. Mr Trevor Fitzgerald and his brother-in-law Mr Brian Fridmanis had the best view of the accident. They were sitting in the grandstand on the western side of the track. Mr Fitzgerald's description of what happened was as follows:

'I was watching the motorcycles as they raced around the bend in front of us and remember that we commented on how low and hard they were pushing it through the bend. I can't say that I saw what happened to cause Liam to fall to the ground but I must have only missed the first couple of feet of the crash. I would say that he would have been travelling at about 240 kph when he went down and it looked like the front end of the bike had lost traction by the way that it was sliding. In a corner like that, it would only take coming off the gas a fraction at that speed to unsettle the bike enough to cause that.

There were no other bikes within a hundred metres of Liam at the time that he went down. Liam had pushed the bike away from him as much as he could and he was trying to slow himself down. The bike was sliding on its side the whole way until it hit the wall. The bitumen section of the track extended up on a slight angle from inside to outside and then the dirt on the side of the track sloped down again away from the edge of the track. As the bike left the track it would have become airborne and wouldn't have touched the ground very much before it hit the wall.

I think there were two paths on the ground after the crash. One was from the bike and the other was from Liam as he had his feet and hands dug into the ground trying to slow himself down. As both Liam and the bike slid off the track, they both would have been about a foot apart. Liam was sitting on his bum with his feet out forward, sitting as upright as best he could with his hands to his sides. I doubt that he would have slowed down at all prior to hitting the wall. If he had been travelling at 240 km/h when he came off then he would have hit the wall at 240 km/h. He lost no velocity at all.

Liam hit the wall feet first and then the right hand side of his body would have been thrown in against the wall. The motorcycle hit the wall just before Liam did and had slid further along the wall, coming apart as it went. It slid about 60-70 metres to our left before it stopped and Liam about 55 metres. Liam did not hit anything else other than the wall. It would have been near impossible for the bike to collide with him after first colliding with the wall and prior to hitting the wall, Liam was well and truly alive. It is my opinion that the only thing that killed Liam was the wall. It was in the wrong place and way too close to the track.'

(Exhibit C10, pp2-3)

4.7. Mr Fridmanis gave a very similar description of these events, although he did not see the initial stages of the accident (Exhibit C5a, p2).

4.8. Another spectator, Mr Paul Kendrick, was the only other person in the grandstand, and he had a similar view to that of Mr Fridmanis (Exhibit C6a, p2).

4.9. Mr Fridmanis said that Liam did not move after the accident. He said than an ambulance attended within a minute.

4.10. Mr Peter Magee was on the scene soon afterwards. He said that emergency workers were performing cardio-pulmonary resuscitation on Liam until it became obvious that he had died (Exhibit C1b, p3).

5. The event

5.1. The organisation of motorcycle sport in Australia is complex. Put briefly, the parties involved in the event on 27 April 2002 were as follows:

- The event was the third round of the Shell Advance Australia Superbike Championship;
- The over-arching governing body of motorcycle sport in Australia is Motorcycling Australia Ltd ('MA');
- MA issued a National Competition Permit to the Phoenix Motorcycle Club of SA Inc ('Phoenix') to operate the event (Exhibit C7l): It was Phoenix's role to provide track marshals, and other support staff, for the event;
- Phoenix accepted entries for the various competitors, including Liam Magee, by sending out a form (Exhibit C7k);
- The event was held at Mallala Motor Sport Park ('the circuit'). There was a venue licence for the circuit issued by MA to Clement Smith on 22 April 2002;
- In fact, the circuit is owned by Clem Smith Nominees Pty Ltd, which leases it to Mallala Sport Park Pty Ltd. The sole Director of that company is Mr Clement Smith. That company has a contract with Phoenix to promote and stage the event (see letter from Mr Smith's solicitors dated 8 June 2004);
- MA also issued a track licence in relation to the circuit, which was current from 8 February 2002 to 31 December 2002 (Exhibit C7f). The licence is signed by Ivan Golding, who was then the President of Motorcycling Australia (SA), and a Vice-President of MA.

- The rules of motorcycle sport are contained in the General Competition Rules published by MA (Exhibit C11a). There are also specific rules applying to the Superbike Championship (Exhibit C7m).

5.2. The track licensing process

Mr Clement Smith, through his companies, is effectively the proprietor of the circuit. He purchased the property in 1976. He said that motorcycle racing commenced in 1980, and car racing in 1982.

5.3. Mr Smith said that the circuit was inspected annually by MA for the purpose of issuing a licence. It was last inspected before the accident on 8 February 2002 by Mr Golding. He was aware that a concrete wall had been constructed at turn 4 about three years earlier. He found nothing wrong with the circuit on 8 February 2002 and issued the licence (Exhibit C11, p3).

5.4. Mr Smith said the concrete wall adjacent to the grandstand was constructed in January 1998, and was extended in a northerly direction in 2000. The concrete wall replaced an old wall made of tyres filled with earth which was 12 feet thick. It was removed to provide extra space for the grandstand. Mr Smith said:

> 'The concrete wall was put there in place of the tyre wall because tyre walls are only good for a limited time and nowhere near as successful as a concrete wall and it just formed part of my upgrading of the facilities at the track. The concrete wall was safer for car racing as cars don't dig into them. They can slide along the wall after impact. The tyre wall was constructed with areas that went in and out and a car could get caught on them and stop suddenly or be flung into other directions or even back out onto the track into the path of other vehicles. Since the wall was erected there have been no mishaps involving cars. I think a bike has hit the wall once before but there was a much slower speed involved compared to what Liam was doing and I don't think the rider even hit the wall. I had considered that this area of track was safe for motorcycle racing right up until the crash involving Liam but I guess accidents prove you wrong sometimes.'
>
> (Exhibit C12, p3)

5.5. The new wall had been inspected by Mr C T Hall, who was then a member of the National Safety Committee of MA, on 14 February 1998. This was a joint inspection with representatives of the Confederation of Australian Motor Sport ('CAMS') which is the governing body for car racing.

5.6. Mr Hall said that they were concerned at the time to ensure that the realignment of the barrier may have reduced the effective run-off length. However, after inspection, it

was found that the run-off available remained within acceptable limits. In a letter to the Chief Executive Officer of MA, Mr David White, dated 16 February 1998, Mr Hall said:

> 'New Concrete Wall Along Back Straight
>
> The radial length of the verge has been reduced significantly to a minimum of 9 metres (at the apex) adjacent to the bend in the back 'straight'. Visually the presence of the wall is disconcerting. However, while the new wall has reduced the radial run-off by 50%, the tangential run-off from the race line has generally been reduced by 10-15%. At one location, where the run-off has been reduced by as much as 20%, there is still 110 metres from race-line.
>
> Given that the change in direction along the curve has only reached 30º adjacent to the new wall, and that the bikes are either under light acceleration or steady state at that bend (already in top), the run-off remains adequate.
>
> Given that the barrier is new and visually prominent, it would be wise for the Steward at the first meeting to monitor the situation with riders, and if deemed necessary, place straw bales along the last 50-100 metres (northern end) of the new wall (straw bales to be placed approx 1 metre from wall, except at southern end, where the gap will be closed).'
>
> (Exhibit C15c, p1)

At the conclusion of the letter, Mr Hall said:

> 'I am concerned that MA was not informed of the impending changes by Mr Smith, and it is only by luck rather than design that the run-off conforms to our requirements. Should any further changes occur without consultation and not meet our requirements, I will not be prepared to recommend the circuit be licensed.'
>
> (Exhibit C15c, p2)

5.7. Guidelines for road racing circuits

These Guidelines were prepared by the National Safety Committee of MA in 1994. At the time, Mr Hall was the Chairman of the Committee. He explained that the Guidelines were a transfer of standards prepared by the Federation of International Motorcycling ('FIM') into the Australian national environment. He said that the plan was that, in relation to run-off length, new circuits should comply with the Guidelines (Exhibit C15b, p14, fig 4) by 1996, and that existing circuits would comply by 2000. He explained:

> 'By the year 2000 we would've expected that every racing circuit would have a speed profile and we would be able to get that from the race teams so we would have accurate data on the speed of the motorcycle around a particular circuit. So then we could say at every corner the speed of the motorcycle was 'X' and therefore the minimum run-off distance was to be 'Y' using that data. That could and probably would be very different

> to the run-off distance required under CAMS. If we are comparing, say, super bikes with super cars, the cornering speed of a V8 Holden is significantly higher than the cornering speed of a motorcycle. So, generally, what we were finding was that if CAMS - if we applied the cornering speed of the Holden super car it would give a longer run-off area than if we applied the motorcycle run-off speed. Because we didn't have access to the Holden data anyway, we were happy that if CAMS applied their principle they should come up with a longer run-off distance than we did.' (T259-260)

5.8. Mr Hall said that for the above reason, the CAMS Guidelines in relation to run-off distances were adopted by MA.

5.9. The Guidelines were adopted at a meeting of the Council of MA on 27 April 1995 (Exhibit C15). The entry reads:

> 'Road racing tracks, interim safety Guidelines moved. Queensland, seconded Queensland, but in principle the draft safety Guidelines for road racing circuits as recommended by the safety committee are adopted, however, they are referred back to the safety committee for consultation with the circuit owners and to submit a further report to the council by 30 June 1995.' (T254)

5.10. It would appear that even though the Guidelines have been modified from time to time since then, no doubt in consultation with the circuit owners, they have never been finally adopted by MA (see the evidence of Mr Golding at T75). No further report was submitted to MA by 30 June 1995 (T255).

5.11. It was submitted by Mr Milazzo, counsel for MA, that the Guidelines were not binding upon circuit owners. Clearly, MA had no power to do that, except in the sense that it had power to withhold a track licence. Guideline 4.7 is as follows:

> 'Time limit – No circuit in Australia will be licensed for motorcycle road racing after 1 January 2001 if the above procedure (ie. prior approval by MA of proposed alternatives to circuits to achieve compliance with Guidelines) has not been followed.'
>
> (Exhibit C15b)

5.12. Mr Milazzo submitted:

> 'Whilst draft regulations 4.7 suggest one approach to ensuring the cooperation of circuit owners was to simply advise them that their circuit would not be considered for licensing unless the procedures were followed, this threat has proven ineffective. Motorcycling is a minority sport and the enforcement of draft Guideline 4.7 is not in its best interests. Neither is it necessary in the interests of safety provided that MA's inspectors continue to enforce circuit Guidelines (as amended from time to time) in the manner evidenced by Exhibit C16.'

Exhibit C16 is an affidavit of Mr Derek Williams, who has been involved in an unsuccessful attempt to obtain a track licence for a Queensland circuit because it does not comply with the Guidelines.

5.13. On the basis of that evidence, it would appear that development of circuits for motorcycle racing in Australia will remain the subject of some creative tension between circuit owners and MA, in the sense that the owners will decide whether or not it is economically feasible to modify their tracks in accordance with MA's wishes, and MA will decide whether to continue to issue a track licence in light of the owner's decision.

5.14. Did the circuit comply with the Guidelines?

The relevant Guidelines for the purpose of this discussion are as follows:

'7.13 b) Existing circuits

i) The minimum run-off area dimensions must be in accordance with Table 3. (From FIM - Standards for Road Racing Circuits).

ii) Where the minimum run-off dimension ("L") specified in Table 3 cannot be achieved, an Airfence Safety Barrier System, (or barrier of proven superior or equivalent energy absorbing characteristics), must be installed in front of the first line of protection. **If that run-off dimension available ("L") is less than 50% of that specified in Table 3, the circuit cannot be licensed**.

iii) The join between the run-off area and the track-side verge must be flush (without any slope). If the run-off area is on sloping ground, the gradient must not be greater than 25% uphill or 3% downhill.

iv) Additional Protective Devices in accordance with GRRC – Section 9 must be installed in front of the first line of protection at the extremity of all run-off areas for all turns on the circuit that have run-off area dimensions less than that required by GRRC Section 7.13.c) for "new circuits".'

Table 3 - Minimum Run-off Dimensions for Existing Circuits						
V (kph)	250	220-250	190-220	160-190	130-160	120
L (m)	80	60	50	40	30	15
Where: V = Maximum attainable speed at the point of braking before the curve itself or along the curve. L = Minimum depth of run-off area, calculated from the edge of the track to the first obstacle, on the tangent of the point of calculation at the race line						

(Exhibit C15b, p13)

5.15. Mr Hall said that on 2 May 2002, after Liam's accident, he checked the run-off distance at turn 4 from about five points along the concrete wall to a point on the edge of the track on a line tangential to the curve of the race line, using a measuring wheel, and each distance was between 50 and 60 metres (T305). On his evidence, the circuit complied with the Guidelines, on the basis that the expected speed through the corner was about 200 kilometres per hour, and applying the above criteria, the minimum run-off was 50 metres.

5.16. Mr Hall was cross-examined about these measurements by Mr Caldicott, counsel for Mr Peter Magee, to demonstrate that the run-off area did not comply with the Guidelines if a rider falls earlier in the turn. Mr Hall said that the measurements depended upon his assessment of where the 'race line' was, and the tangential measurement was taken from that (T363). As I will presently outline, Mr Hall is very experienced in making such an assessment, subjective as it may be, and I accept his evidence on the topic.

6. Causation of Liam Magee's fatal injuries

6.1. Obviously, the severity of Liam Magee's injuries was a function of the velocity with which his body collided with the concrete wall, and the resultant deceleration forces which were applied to his internal organs.

6.2. Mr Hall is a consulting mechanical engineer who specialises in the field of accident reconstruction. He has given evidence in many court cases in South Australia and the other states, and his expert evidence in this field has been accepted repeatedly.

6.3. As a sub-specialty, Mr Hall has developed expertise in motor racing accident reconstruction. This has been aided by the fact that Mr Hall has been racing motorcycles from the 1960s to the present day and continuing (T249).

6.4. Since retiring from the National Safety Committee of MA, Mr Hall has been engaged by MA as a consultant to analyse serious and fatal motorcycle racing accidents as part of their risk management process. He has been analysed about six such cases in the last three years or so (T249).

6.5. Mr Hall is also an independent safety auditor for the Australian Grand Prix Corporation performing the same function in relation to Formula 1 racing in Australia.

6.6. It was in Mr Hall's role as consultant to MA that he first became involved in an investigation into the circumstances of Liam's death. He first attended the circuit on Thursday, 2 May 2002.

6.7. Mr Hall calculated the distance Liam slid by measuring from a black mark which was adjacent to the commencement of the curve in turn 4 (see Exhibit C7b, photograph 1). He used the photograph as a point of reference, since the black mark had been partly obliterated by the racing which took place on 28 April 2002.

6.8. Mr Hall said that the black mark indicated where the front wheel lost traction and was slipping away to the extent that rubber was being deposited on the track. At that point, Liam was also falling towards the track surface, although he may not have lost contact with it completely (T274).

6.9. The distance from the commencement of the black mark to the edge of the bitumen was 85 metres, and across the dirt from the edge of the bitumen to the point of impact with the wall was 54 metres (T271). This was a similar distance to those referred to in paragraph 5.15 above.

6.10. Mr Hall said it was not relevant to his calculation to know the precise point at which Liam contacted the bitumen. His calculations incorporate the entire distance of travel to the impact point (T275).

6.11. In order to calculate the speed at which Liam collided with the wall, Mr Hall then proceeded to ascertain his speed at the commencement of the black mark. He referred to a speed diagram prepared by the Suzuki Race Team on the basis of telemetrical monitoring of the performance of Mr Giles' motorcycle during the morning qualifying session, which indicated that he went through the apex of turn 4 at 202 kilometres per hour. Since Liam was slightly slower than Mr Giles (his previous lap time was 1:08:478, 0.157 seconds slower than Mr Giles' fastest from the first session), Mr Hall assumed a slightly slower speed of around 200 kilometres per hour (T275).

6.12. Having calculated the speed, Mr Hall then set about determining the relevant coefficient of friction between Liam's body and the track surface, and then the dirt area, to determine the extent to which the velocity of his body decreased as he slid.

6.13. Since Liam's tragic death, Mr Hall has been engaged in a research project for MA in the hope that better information can be gathered about run-off distances. The project has involved painstakingly examining incidents during Superbike and Moto-Grand Prix events at Phillip Island, and attempting to measure the precise point at which stability was lost, measuring the distance between that point and rest, and then determining an appropriate coefficient of friction.

6.14. Mr Hall said that much more data was required to produce a comprehensive design strategy (T278). However, based upon his research so far, he estimated that the appropriate deceleration rate was between 0.9 and 1.0g. Applying that information, he determined that Liam hit the concrete wall at approximately 100 kilometres per hour (95 kilometres per hour at 0.9g, and 105 kilometres per hour at 1.0g) (see his report, Exhibit C15d, p9).

6.15. The police investigation showed that there was a scrape mark left on the bitumen surface of the track by the motorcycle as it slid. Mr Hall said that if he took that as the commencement point for the measurement, that is a point 20 metres further on from the commencement of the black mark referred to above, then Liam slid across the bitumen for approximately 60 metres, and across the dirt for 54 metres. Measuring the deceleration over those distances, Mr Hall estimated that he would have hit the wall at 105 kilometres per hour (T280).

6.16. There was also a red mark on the bitumen, probably left by Liam's red leather motorcycle suit, about 20 metres further on from the scrape mark. If this is taken as the commencement point, then Liam was in actual contact with the track surface for about 40 metres, then slid across 54 metres of dirt. On that basis, Mr Hall calculated that he would have hit the wall at about 120 kilometres per hour (T280).

6.17. Mr Hall said that the red leather mark was not a particularly reliable indicator because Liam may have been sliding before the red mark commenced, because the leather only leaves a mark once the surface begins to 'grab' the material as it slides across (T281).

6.18. Mr Hall also referred to the criteria in Guideline 7.13 c), which is the Guideline applicable for new circuits. Unlike Guideline 7.13 b), which expresses the run-off distance from the edge of the track (see paragraph 5.14), Guideline 7.13 c) expresses the run-off distance from the tangential point to the race line, so that it includes the trajectory over the bitumen of the track as well as across the dirt area. According to that Guideline, a corner which is taken at 200 kilometres per hour should be provided with a minimum total run-off distance of 118 metres. In fact, Liam slid 137 metres before he struck the wall. Hence, the run-off area for turn 4 complied with that Guideline as well.

6.19. What is tragically apparent from Liam's death, however, is that even though the run-off area at turn 4 complied with MA's Guidelines, it was not sufficient to prevent him hitting the wall at extreme velocity, resulting in fatal injuries. It follows that the standards imposed by the Guidelines are inadequate.

6.20. Mr Hall said that the coefficient of friction used in the Guidelines was 1.33, which his subsequent research had shown was far too high (T337). Using a more appropriate coefficient of friction of between 0.85 and 1.0, the turn called for a total run-off area of between 157 and 185 metres (T335).

6.21. Indeed, based on data taken in 2004, in which motorcycles were taking turn 4 at approximately 220 kilometres per hour, Mr Hall said that the total run-off should be 210 metres (T349). So the challenge is either to provide ever-expanding run-off areas as speeds increase, or to provide other safe means of decelerating sliding riders which do not adversely affect safety.

6.22. Criticisms of Mr Hall's calculations

Mr Hall said that in calculating the speed at which Liam was travelling through the corner, he took into account that the data he received for Mr Giles' motorcycle (202 kilometres per hour) had already been adjusted for the lean of the motorcycle through the corner (T328). As the motorcycle leans, the diameter of the circle of rubber touching the track decreases, which means that although the wheel is rotating at the same speed, the speed of the motorcycle is lower. The telemetry is taken from the gearbox, so an adjustment is required to the indicated speed to allow for this (T339). He determined that the reduction factor on his own motorcycle was 13%, when the lean of the motorcycle was 45º (T329).

6.23. Mr Caldicott put forward some data, apparently from the Honda Racing Team, which suggested that the reduction factor was only between 5.3% and 8.4%. Their telemetry was showing 232 kilometres per hour as an approach speed to the corner, reducing to about 225 kilometres per hour through the corner. This should be reduced by 5%-8%, as discussed earlier, suggesting an actual speed of between 209 and 214 kilometres per hour through the corner (T376).

6.24. I heard a considerable amount of evidence from Dr Raphael Grzebieta, an expert retained by Mr Peter Magee. Dr Grzebieta is an Associate Professor at the Department of Civil Engineering, Monash University, and is President of the Australian College of Road Safety. He is an eminently qualified expert in accident reconstruction, including motorcycle crashes. However, he acknowledged that he had not previously analysed a motorcycle racing accident (T196).

6.25. Dr Grzebieta estimated that Liam was travelling at 233 kilometres per hour immediately before he fell (T160), much faster than Mr Hall's estimate of about 200 kilometres per hour.

6.26. On Dr Grzebieta's calculations, Liam was moving at between 146 and 196 kilometres per hour when he hit the wall (T172), compared with Mr Hall's 100 to 120 kilometres per hour. He said that because Liam hit the wall at an angle, the impact would have been the equivalent of hitting the wall head-on at between 82 and 105 kilometres per hour. This was clearly not survivable (T173).

6.27. However, in cross examination by Mr Milazzo, counsel for MA, Dr Grzebieta conceded that his calculations were based on some erroneous information. For example, Dr Grzebieta assumed that Shawn Giles' telemetry was taken during a qualifying lap (T194). Dr Grzebieta also had a lack of information, for example, about the difference between actual speed and indicated speed when the motorcycle was leaning over (T212).

6.28. What is clear is that, on 27 April 2002, Liam Magee and Shawn Giles were likely to have been negotiating the turn at about the same speed, since their lap times had been so similar. These factors led Dr Grzebieta to concede that Liam's speed was more likely to have been approximately 205 kilometres per hour (T214).

6.29. Dr Grzebieta also disagreed with some of Mr Hall's measurements, although he could only work from the plan prepared from the police investigation and the photographs. However, Dr Grzebieta was clearly inexperienced in interpreting the scrape marks (T220), and the leather marks on the track (T221, T227).

6.30. Further, Dr Grzebieta used figures for the coefficient of friction which were not based on data from motorcycle racing accidents, but rather more general data in the literature about motorcycle accidents. I think that Mr Hall's specific research into motorcycle racing incidents is more likely to be useful in this context.

6.31. At the end of the day Dr Grzebieta accepted (T238), and Mr Caldicott accepted on behalf of his client (Submissions, p7), that Liam's speed prior to losing control was likely to have been about 205 kilometres per hour. On the basis of that concession, and Mr Hall's specific qualifications, research and general experience, I have no reason to doubt the accuracy of Mr Hall's calculations, and will adopt them for the purpose of these findings.

7. Was Mr Magee's death preventable?

7.1. I have already found that the run-off area complied with the MA Guidelines in relation to the length of the run-off area where Liam left the track. That is not the end of the matter, however.

7.2. MA's Guideline 8.4 deals with concrete walls. It states:

> '8.4 Concrete walls.
>
> a) Due to their rigidity and lack of shock absorption, concrete walls on the outside of curves should in principle be avoided.
>
> b) On outside curves, concrete walls must be protected in accordance with the requirements of Section 9 herein.'
>
> (Exhibit C15b)

7.3. Guideline 9 is as follows:

> '9. Additional Protective Devices
>
> 9.1 General
>
> Any rigid obstacle not behind the first line of protection must be protected by means of additional protective devices, either permanent or temporary. These devices must consist of either straw bales, tyre barriers or Airfence Safety Barriers installed as described in the following:

9.2 Straw bales

a) Bales of peat or synthetic material may be used in lieu of straw bales.

b) When placed to arrest the progress of a fallen rider, straw bales must be placed in echelon (herring bone) fashion.

c) When protecting a solid obstacle or barrier, the bales must be erected such that there is a gap of at least half a metre (0.5m) between the bales and the rigid obstacle (or barrier).

d) The dimensions of the wall of straw bales must be higher than the obstacle it is protecting.

…

9.3 Barriers made of tyres

a) The use of protective barriers formed by car tyres placed in front of the guardrails is acceptable.

b) Car tyres of the same diameter will be attached to form a homogeneous barrier, of maximum three (3) rows deep (one (1) will suffice in most situations) and at least 750mm high, placed in front of and fixed to a permanent rigid barrier.

c) Tyre barriers must be restrained in such a manner as to preclude tyres causing nuisance to other riders if struck by a rider or motorcycle, but must be restrained in such a way as to enable the tyres to deform and shift.

d) Where the tyre barrier begins at the entry to a corner, its end may be protected behind the guardrail, on condition that this guardrail remains parallel to the straight preceding the corner and that the following guardrail is moved back to make room for the tyres.

…

9.4 Airfence Safety Barrier System

a) the ‘Airfence’ is a proprietary safety barrier system patented world wide and trademarked for the name ‘Airfence’.

b) The Airfence safety barrier is designed to absorb the kinetic energy of a fallen rider upon impact with the Airfence. The Airfence is a compressed air structure made from heavy duty PVC woven fabric. After impact, the rider can evacuate the module and the Airfence will self erect ready for operation.

c) The ‘Airfence’ safety system can be erected where the use of straw bales and/or tyres is considered inadequate since rider safety is paramount, ie. where the recommended run-off distance cannot be achieved.

d) Where Airfence safety barriers are used, they must be installed in accordance with the manufacturer’s recommendations.'

(Exhibit C15b)

7.4. I have already referred to the letter written by Mr Hall to Mr White on 16 February 1998 (Exhibit C15c) in which he suggested that straw bales be placed on turn 4 if, after monitoring the situation, it was 'deemed necessary'.

7.5. It could be argued that Mr Hall's advice was insufficiently direct in that, on my reading of Guideline 8.4.b), placement of some sort of protective device was mandatory. However, Mr Hall was a consultant, not an official, and was entitled to expect that MA, the stewards, and whoever else was responsible on the day, were equally aware of the requirements of the Guideline and would comply with it.

7.6. Dr Grzebieta argued that straw bales would have been unsatisfactory in that they are relatively stiff, and provide insufficient distance over which speed reduction could occur to be of much benefit. For example, he said that straw bales would only have reduced the perpendicular impact speed to 53 kilometres per hour, which is still too high. He said that, in most pedestrian studies, any impact speed above 50 kilometres per hour is not considered survivable (T175-177).

7.7. Mr Hall could not say that straw bales would have provided sufficient protection. He said:

> 'Certainly the application of a straw bale wall at least half a metre out from the concrete barrier would have reduced the velocity both in a longitudinal direction and in a perpendicular direction to the wall sufficiently to then have the final impact with the wall brought down to what perhaps could have been a survivable level. I can't say whether or not it would have made any difference to the outcome. It certainly would have reduced the impact force against the wall area, bearing in mind that the hay bale would have still been in front of the wall when they came into contact with the concrete structure. There would have been significant reduction in the forces applied to Liam in that circumstance. Whether or not that was survivable is really up to somebody else to comment on.' (T283-284)

7.8. <u>Sand traps</u>

Dr Grzebieta argued that in all situations where there is a solid wall on the outside of a corner, riders should be protected with a sand trap in addition to whatever other protective device is put in place. He pointed out that a sand or gravel trap would increase the coefficient of friction, and thus the effective deceleration, on dirt to 1.5 (T239). Mr Hall doubted the accuracy of this data (T288).

7.9. Mr Hall agreed that sand or gravel traps are useful, although he pointed out that a happy medium must be found between a trap which provides enough friction so that it

causes useful deceleration, but not so much friction that it will cause the rider to tumble, thereby causing head, spinal and severe limb injuries. Further, if a motorcycle is ridden into the trap upright, it should not be so soft that it will cause the front wheel to dig in, and throw the rider over the handlebars, again creating the risk of serious injury (T313).

7.10. Airfence

As described in the Guidelines, an Airfence is a structure made from PVC woven fabric, about a metre deep and 1.5 metres high, which is placed in front of a solid barrier. It is not filled with compressed air, as the Guideline implies, rather it comprises a series of cells at atmospheric pressure which have valves which restrict the escape of air when the structure is compressed. When something hits and compresses the fence, the force is progressively absorbed by the structure as the air escapes, rather like when a person stands on an air mattress when the plug has been taken out.

7.11. I note that since the accident, an Airfence has been installed for a distance of 160 metres along the concrete wall, covering the relevant section with which Liam collided (see the evidence of Mr Smith, T107).

7.12. Mr Hall said that, in his opinion, had an Airfence been fitted, the average deceleration forces to Liam's body caused by hitting the wall would have been reduced to about 22g's, which is quite survivable (T291).

7.13. Of course, rider safety at these speeds cannot be guaranteed. Even if a rider hits the Airfence at quite a low speed, if he or she is in the wrong position, it is still possible to suffer cervical or internal injuries leading to serious disability or death.

7.14. Mr Hall said that this is an area which requires much more research and analysis before definite conclusions can be drawn about whether a particular track is as safe as it can be, even with Airfences fitted in appropriate areas. When asked whether he now considers the circuit safe, he said:

> ' … I mean, we're much wiser after the event. I'm much wiser, you know, over the last six years I've developed a lot more knowledge about all of this, the bikes are now much faster so for me to sit here and say that the airfence position is correct, that the circuit is safe I would have to go and do a pretty detailed analysis of it before I would be able to give you an answer on that.

> Q. The question I'm really asking is, is it safe for riders to travel around turn 4 at the speeds that we are talking about or does there have to be some additional information and material placed before you.
>
> A. Well, there certainly would have to be additional information, (is) there sufficient run off between the concrete wall and the race line where the wall is unprotected to enable the rider to come to an absolute zero after falling off. So the whole emphasis now has also shifted from riders running off the road upright to riders are going to fall and we must ensure they are either decelerated sufficiently or to zero by the run off area, or, place some absorbing barrier in front of the wall.' (T385)

7.15. I understand Mr Hall's position, and agree that further research and analysis is necessary and should be undertaken as a matter of urgency. Clearly, MA and all those who participate in motorcycle sport would wish that motorcycle racing should continue. However, motorcycle is an inherently dangerous sport. I am sure that is the reason why riders compete in it, and why spectators watch it. At the very high speeds involved, the risk of death or serious injury is high. For that reason, everything must be done to ensure that the maximum protection for riders and spectators is provided.

7.16. Unfortunately, that was not the case here. More could have been done to prevent the death of a young man with great potential. MA's Guidelines were clear that where a concrete wall is built on the outside of a corner, additional protection, in the form of straw bales, tyre walls, or an Airfence should have been provided. If this Guideline had been followed to the full extent, Liam Magee's chances of survival would have been greater. If an Airfence had been provided, there is a high probability that he would have survived the fall.

8. Conclusions

8.1. On the basis of the evidence discussed above, I have reached the following conclusions:

1. Liam Magee died on 27 April 2002 as a result of injuries he sustained when he collided with a concrete wall on the western side of the circuit at Mallala;

2. Liam had lost control of his motorcycle as he was negotiating turn 4. He fell from his motorcycle and slid 85 metres across the bitumen and 54 metres across the dirt area before colliding with the wall;

3. At the time he lost control of the motorcycle Liam was travelling at approximately 205 kilometres per hour. As he slid he decelerated, and he hit the wall at approximately 100 kilometres per hour;

4. MA's Guidelines, which were not binding upon the owner of the track, Mr Clement Smith, but which were used as a guide by MA when considering the issue of a track licence, required that for a corner such as turn 4, there should be a run-off distance of 118 metres. The run-off distance was 139 metres in this case. Hence, the run-off distance for turn 4 complied with the Guidelines;

5. Clearly, the run-off distance of 139 metres was insufficient to prevent Liam colliding with the wall, and sustaining fatal injuries. Subsequent research has shown that the coefficient of friction used to develop the Guidelines was far too high;

6. MA's Guidelines, the Guidelines also required that where a concrete wall has been built on the outside of a turn, an additional protective device should have been installed;

8. If straw bales had been installed, the chance that Liam could have survived the fall was significantly greater. If an Airfence had been installed, it is highly probable that he would have survived. The probability of survival would have been greater again if a suitable sand or gravel trap had been installed in front of the Airfence.

9. Recommendations

9.1. Section 25(2) of the Coroner's Act 1975 empowers me to make recommendations which might, in my opinion, 'prevent, or reduce the likelihood of, a recurrence of an event similar to the event that was the subject of the inquest.'

9.2. Pursuant to that section, I make the following recommendations:

1. That MA take steps to ensure that their Guidelines, whether draft or otherwise, are rigorously enforced when race meetings are being conducted, particularly in relation to protective devices;

2. That MA re-initiate the process of consultation with track owners, and then finalise and formally adopt a set of clear Guidelines for Road Racing Circuits.

The current state of uncertainty about the status of the Guidelines is unsatisfactory and should be removed;

3. That the research initiated by Mr Hall should be supported to continue so that the Guidelines referred to above can be developed with a clearer understanding of the scientific principles involved;

4. In the meantime, every effort should be made to prevent the fallen motorcycle rider colliding with solid objects around the circuit, and minimising the likelihood that injuries will be sustained as a result. In that regard, protective devices should be installed to the greatest extent possible;

5. If it cannot be established with reasonable scientific certainty that motorcycle racers can be protected by the provision of adequate run-off areas and/or the installation of protective devices, then solid objects such as concrete walls should be removed, or a track licence for the venue should not be granted.

Key Words: Motorcycle Racing; Protective Devices; Airfence

In witness whereof the said Coroner has hereunto set and subscribed his hand and Seal the 1st day of October, 2004.

Coroner