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## The Australasian Society for Motorsports Medicine and Rescue

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### Race control

Welcome to the May edition of the ASMMR newsletter. The various racing categories are moving on a pace and there is plenty to talk about in the world of motorsport medicine and rescue. This issue takes a look at some track safety devices; namely the run-off areas and gravel traps – the pros, the cons and the downright scary. There is a review of recent race events and a few highlights from other aspects of motorsporting news. If you have ever wanted to know what a tank slapper, a lambda reading or reactive suspension was, then skip to the Wikipedia motorsports terminology link.

Good luck.

Matthew Mac Partlin



### Technical review

#### Track safety devices – Run-offs and gravel traps

Competitors and race vehicles can be fully prepared with safety equipment, but at some point or other a vehicle will unintentionally veer off the track. Sometimes the driver will be able to gather it up and rejoin the race, if there is sufficient space to do so. However, there is often a conflict between race track safety, spectator friendliness and geography. The safest track would probably be a straight road, with a wide run-off to either side and at either end and have no more

than a couple of cars competing on it at any one time. But it wouldn't be terribly interesting to compete in or to watch.

As soon as turns are introduced, there is the likelihood that vehicles will shunt each other off or simply misjudge a corner and leave the race line. As the sport needs to cater for its fans, spectator points are placed close enough to the track to get a good view of the event. In the past, this led to competitive vehicles flying off the track into trees, down into gorges or into crowds lining the edge of the road. Clearly this was not a sustainable state and moves were taken during the 1970s and early 80s to redress these problems. As a result, motorsports saw the introduction of run-off spaces, debris fences, a variety of crash barriers, deceleration surfaces and track design regulations.

The following is a review of run-offs and gravel traps (colloquially known as "the kitty litter") and their relative merits and limitations for various categories of motorsporting events.

### Run-off and deceleration surfaces

Run-offs were introduced when motorsporting events had begun to establish themselves as spectator sports beyond a bunch of speed junkies throwing unprotected vehicles around a rough track as fast as possible. It was realised that the fans provided a reasonable source of revenue, between attendance and sponsor advertising. So mowing them down with errant vehicles was a bad tactic. The FIA now regulates track design, under Appendix O. For permanent tracks, a minimum 10cm, non-slip paint, continuous white line is required at both edges of the track, with a 1 to 5 metre wide verge outside those lines. The verge can be any type of surface, but is usually grass, synthetic grass, asphalt or concrete. The verge may also incorporate the distinctive red and white ripple strip, variably used to try and slow competitors, or give them a little extra leeway through corners.



The continuous white line, red and yellow ripple strip and grass verge at Oran Park

Where the trajectory of a vehicle leaving the track is likely to require greater space to avoid an impact, or if the impact is likely to be high angle and therefore expose the competitor to sudden deceleration, a run-off is required. A properly restrained competitor in a safe race car is expected to be able to survive a 50G impact; though not necessarily without injury. Run-offs provide space and time to reduce velocity and bring any impact force to less than 50G. The exact dimensions are not tightly defined, but obviously engineering, physics (The kinetic energy of a car is proportional to its weight and to the square of its velocity) and common sense play a role in determining the depth and width of the run-off. The obvious conflict is limiting the spectator restrictions.

The obvious limitation is that the regulations only account for “permanent race tracks”. Rallies, hillclimbs and street circuits, amongst others, are more difficult to cater for, in terms of providing adequate run-off. One need only look at the Monaco Grand Prix or Surfer’s Paradise circuits or almost any rally to see why. The roads are often public streets or private roads which were not originally designed as race circuits. On street circuits, crash barriers and debris fences are often much closer to the racing line than on permanent tracks. As a result, there is often greater spectator restriction with tighter viewing access. Competitors are forced to tone down their racing style as a compromise. This does not automatically mean a less exciting event, but clearing a crashed vehicle and accessing an injured competitor become significantly more challenging, even with yellow flag and safety car procedures.



The track margins at Bathurst, a public road converted to a race track several times a year

Clearly for rallies, it is impractical to try to fence off the entire competitive portion. Different events have taken different approaches to this safety aspect over the years. Some pulled spectators right back from the track edge, severely limiting the viewing experience, while others, like the notorious Catalunya Rally, allowed spectators almost total free reign, with disastrous consequences. More recently, rally events are getting better at incorporating specific viewing points, often set around a particular feature such as a jump or a water splash. Rally Australia, while based around Perth, had a good reputation for balancing spectator safety and access.



A water hazard, with a tree line on one side and a drop off

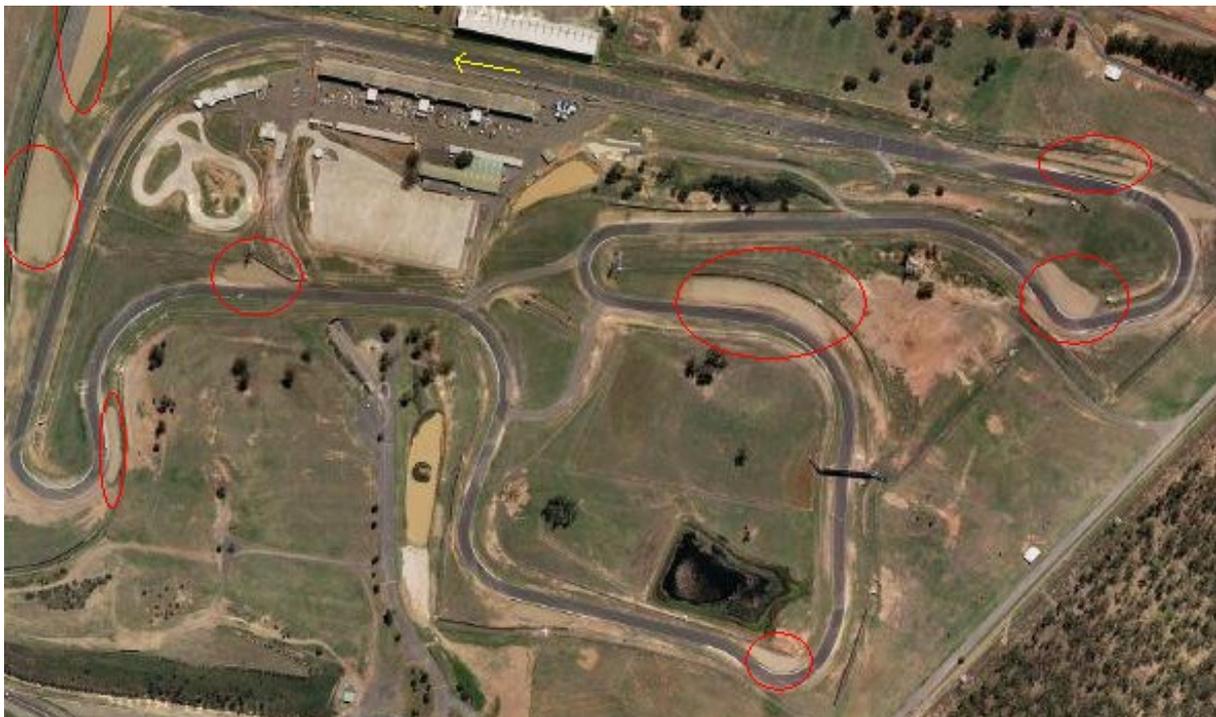
on the other, at the Carrick-on-Suir forest rally. Note the officials standing on the outside of a full speed wet gravel corner.

However, natural hazards, like rocks, trees and gullies are virtually impossible to account for and result in crashes such as those experienced by Petter Solberg in the 2004 Rally Deutschland and Jari-Matti Latvala last year in Portugal. In these situations, crash outcomes are in the hands of the drivers and the design engineers.



A nice clump of gum trees on the outside of an Australian WRC event. This is about as big as run-offs get in rallies.

Again, run-off areas can be composed of any surface, and on permanent circuits, often have some form of decelerating material incorporated into them. Most often this takes the form of a gravel trap, a volume of small pebbles designed to dampen the energy of the vehicle such that the force of any barrier impact is lessened. The gravel trap is often raked into waves, like mini speed bumps, again with the aim of draining energy off the vehicle. Conceptually, gravel traps make sense; however, there is controversy about their efficacy and their dangers.



The gravel traps at Eastern Creek raceway

Gravel traps work best when a car ploughs into one in a straight line with all four wheels on the ground. The wheels sink into the pebbles, resulting in friction and dissipation of the car's kinetic energy. Already, you can see some inherent problems. A car that enters the gravel trap sideways, will still sink its tyres into the pebbles, but the narrower width increases the chances of the entering side digging in deeper and flipping into a roll. This likelihood increases if the gravel is raked, or if the car has a higher centre of gravity. Touring car competitors are more vocal about gravel traps than the lower lying open cockpit car competitors for this reason. Furthermore, if you're riding a motorbike, you know that rather than a gentle slide off on the asphalt, protected by your leathers and pods, if you hit a gravel trap in any direction you are likely to get snapped off your bike, risking wrist and forearm fractures, and jerked into tumbles as you fly across the trap. In one well documented case, motorcycling world champion Wayne Rainey had his back broken tumbling across a raked gravel trap, resulting in a mid-thoracic spinal injury.



MotoGP bikes in a gravel trap

The gravel trap's ability to dissipate a vehicle's momentum relies on the vehicle's tyres being in contact with the surface. When a car enters the trap on its roof, or without its wheels, it can simply skate across the surface with significantly less friction and therefore less deceleration before exiting at the other side and potentially impacting with a crash barrier at high G-forces. This was most recently demonstrated at Queensland Raceway, when Kain Magro's mini rolled off the track, straight across a gravel trap with enough residual energy to vault over a small spectator fence into the crowd. Luckily the injuries to the driver and two spectators was minor.



A gravel trap being foiled by an airborne F3 car

Gravel traps can also cause problems when competitors manage to get back on to the race track. The pebbles, often caught up in the vehicle's tyres, engine bay and air intakes, can get spread across the racing line, increasing the hazard for subsequent competitors.

Gravel traps can result in a hazard for safety officials as well. Vehicles that enter a gravel

trap frequently get beached in the pebbles and can't get free, necessitating the use of a towing vehicle or crane to remove what is now a crash hazard. This exposes officials to dangers on the track if other cars or bikes spear off the track at the same point. A car that comes to rest in a gravel trap on anything other than its wheels can present a danger to rescue crews, in that it can be more difficult to stabilise that vehicle while extracting the competitor than it otherwise might be on grass or asphalt.

There is little doubt that run-offs and gravel traps have contributed, along with other track safety devices, to the reduction in adverse outcomes for both competitors and spectators. It is also clear that there are further advances to be made to find the optimum dimensions, layouts, contents and contours of these two in particular, in order to cater for individual event and vehicle types. Run-off and gravel trap design may not be exciting engineering, but it is important and needs to engage competitors, track administrators, regulatory bodies, safety and rescue providers in their development.

## References

- FIA Appendix O - Procedures for the Recognition of Motor Racing Circuits: <http://www.fia.com/en-GB/sport/regulations/Pages/Circuits.aspx>
- Wikipedia – [http://en.wikipedia.org/wiki/Run-off\\_area](http://en.wikipedia.org/wiki/Run-off_area)
- What are the pros and cons of gravel traps, tyre walls, armco & walls? - <http://stason.org/TULARC/sports/motorsport/47-What-are-the-pros-and-cons-of-gravel-traps-tyre-walls.html>
- Course Safety and Emergency Response in Motor Sport, Ben Chapman, Melbourne, Australia. <http://www.benchapman.com/project/safety.html>
- Physics of the Gravel Traps - <http://www.atlasf1.com/99/ger/lindqvist.html>



## Recent race results

### Formula 1

1. Jenson Button - Vodafone McLaren Mercedes 60	6. Felipe Massa - Scuderia Ferrari Marlboro 41	11. Vitantonio Liuzzi - Force India F1 Team 8
2. Nico Rosberg - Mercedes GP Petronas 50	7. Robert Kubica - Renault F1 Team 40	12. Vitaly Petrov - Renault F1 Team 6
3. Lewis Hamilton - Vodafone McLaren Mercedes 49	8. Mark Webber - Red Bull Racing 28	13. Rubens Barrichello - AT&T Williams 5
=. Fernando Alonso - Scuderia Ferrari Marlboro 49	9. Michael Schumacher - Mercedes GP Petronas 10	14. Jaime Alguersuari - Scuderia Toro Rosso 2
5. Sebastian Vettel - Red Bull Racing 45	=. Adrian Sutil - Force India F1 Team 10	15. Nico Hulkenberg - AT&T Williams 1

Next race: Catalunya, Spain, this Sunday.

## World Rally Championship

After four rounds, Petter Solberg is really making a comeback to championship form, flying into second spot just ahead of Hirvonen. And as a privateer. Perhaps Subaru hadn't the legs after all as Petter has been in top form in his Citroen C4. Rally Turkey also saw former F1 champion Kimi Raikonen break into the top ten. Dani Sordo has had problems that see him beginning to fall behind, which has allowed the BP Ford team to stay in touch with Citroen in the manufacturer's standings. Ogier continues to challenge to top drivers (but does anyone else sense a tinge of strategy?).

<b>1. Sebastien Loeb 93</b> 2. Petter Solberg 53 3. Mikko Hirvonen 52 4. Jari-Matti Latvala 47	5. Sebastien Ogier 45 6. Dani Sordo 24 7. Matthew Wilson 22 8. Federico Villagra 20	9. Henning Solberg 18 10. Kimi Raikonen 14 11. Xevi Pons 5 12. Mads Ostberg 4
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Next event: Rally New Zealand – Happening right now!!

## V8 Supercars

Six events completed.

<b>1. Jamie Whincup 3349</b> 2. Will Davison 3044 3. Garth Tander 2916 4. Craig Lowndes 2592 5. Mark Winterbottom 2414	6. Steven Johnson 2255 7. James Courtney 2192 8. Rick Kelly 2162 9. Russell Ingall 2048 10. Lee Holdsworth 2006	11. Michael Caruso 1977 12. Shane van Gisbergen 1970 13. Steve Richards 1780 14. Jason Richards 1756 15. Fabian Coulthard 1665
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Next round: Winton Motor Raceway, Victoria, 14<sup>th</sup> - 16<sup>th</sup> May

## MotoGP

After two rounds, Jorge Lorenzo is just nudging out his team mate, Valentino Rossi. A win in front of his home crowd and ahead of fellow Spaniard makes the lead all the more sweet.

<b>1. Jorge Lorenzo - Fiat Yamaha Team 45</b> 2. Valentino Rossi - Fiat Yamaha Team 41 3. Dani Pedrosa - Repsol Honda Team 29 4. Andrea Dovizioso - Repsol Honda Team 26 =. Nicky Hayden - Ducati Marlboro Team 26	6. Randy de Puniet - LCR Honda 17 7. Colin Edwards - Monster Yamaha Tech 3 12 8. Ben Spies - Monster Yamaha Tech 3 11 =. Casey Stoner - Ducati Marlboro Team 11 =. Marco Melandri - San Carlo Honda Gresini 11	11. Marco Simoncelli - San Carlo Honda Gresini 10 12. Mika Kallio - Pramac Racing Team 9 13. Hiroshi Aoyama - Interwetten Honda MotoGP 8 14. Hector Barbera - Aspar Racing Team 7 =. Loris Capirossi - Rizla Suzuki MotoGP 7
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Next round: Le Mans, France, May 21<sup>st</sup> - 23<sup>rd</sup>.

## Intercontinental Rally Challenge

After four rounds

<b>1. Juho Hanninen 32</b> 2. Jan Kopecky 25 3. Guy Wilks 25 4. Kris Meeke 15	5 Bruno Magalhaes 13 6 Mikko Hirvonen 10 7 Nicolas Vouilloz 6 8 Stéphane Sarrazin 5	9 Gabriel Pozzo 5 10 Federico Villagra 4 11 Alberto Hevia 3 12 Eduardo Scheer 3
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Next event: Rally d'Italia Sardegna, 4<sup>th</sup> - 6<sup>th</sup> June



## Worldwide motorsport update

- It looks like the A1 Grand Prix is on its last legs. Though it hasn't formally been terminated, its assets are being sold off, as a package or, if there is no sale, in parts. The cars, including the two safety cars, and the equipment are available for purchase and it is very unlikely that it will be rescued, despite its popularity in Europe. (CrashNet.com - Not dated). If you want to be the proud owner of your very own motorsport category, go to [http://www.godove.com/auctions/AuctionDetail.asp?auctionID=14131&utm\\_source=Motorsport%20Industry%20Association&utm\\_medium=email&utm\\_campaign=14131](http://www.godove.com/auctions/AuctionDetail.asp?auctionID=14131&utm_source=Motorsport%20Industry%20Association&utm_medium=email&utm_campaign=14131)
- For anyone who struggles with motorsports pit banter, here is a useful website: [http://en.wikipedia.org/wiki/List\\_of\\_motorsport\\_terminology](http://en.wikipedia.org/wiki/List_of_motorsport_terminology)
- Australia has been confirmed on the 2011 WRC calendar, with an event penciled in for around September 11<sup>th</sup>. (29<sup>th</sup> April, CAMS)
- The SFI Foundation, an American standards agency, has decertified racing suits made by Impact Racing, for failure to pass fire rating tests. The suits were certified by SFI previously, with the codes SFI 3.2A/15 and SFI 3.2A/20. These suits are available and in use in Australia. Impact Racing challenged the decertification, but subsequently withdrew the appeal. (SFI Foundation online, 22<sup>nd</sup> April 2010)



## Caught by the cameras



Spot the landing point! - Danni Pedrosa practicing his Russian dancing in zero gravity during the Spanish MotoGP in 2007

And if you think that is impressive flying, check out this video:

[http://www.redbull.com.au/cs/Satellite/en\\_AU/Sports/Aerial-Sports/001242760077671](http://www.redbull.com.au/cs/Satellite/en_AU/Sports/Aerial-Sports/001242760077671)

