GAM
Guildford Advanced Motorists

Newsletter

Summer 2020

IN THIS ISSUE

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Editorial matters

We still need a new GAM Newsletter Editor. *The GAM Newsletter is published Quarterly (4 e-versions, 2 of them include hard copy). There is an established format and template (Editor is free to refresh this). The main tasks are editing input from members and IAM-RS, soliciting articles and researching subjects of interest. Please contact if you are interested or have questions.*

Editor@guildford-IAM.org.uk .

Welcome to the latest edition of our GAM Newsletter. In this edition we have GAM reports and association information, articles of interest and guidance generated by IAM RoadSmart. This edition has been sent to members as a pdf e-Newsletter and hard-copy. When you receive the e-version, please try printing it if you want to. In your pdf print dialogue box, you should see options to print it as an A5 booklet, or A4 double/single sided.

Remember that we want to hear from you….. Letters, comments and articles should be sent to editor@guildford-iam.org.uk .

How about a better driving course as a Christmas or birthday present for a partner or family member?

If so, please put them in contact with us, membership@guildford-iam.org.uk .

Editor's small print

Please note that the views and comments herein are published without prejudice, being those of the writers and not necessarily those of the Guildford and District Group of Advanced Motorists or IAM RoadSmart.

Disclaimer: Driving is never a black and white activity, but full of grey areas, therefore neither GAM or IAM RoadSmart are liable for any consequences you may experience as a result of reading our advice. You are the driver. You should be in control of your vehicle at all times.

Data Protection Act. Members and Associates are reminded that names, addresses, telephone numbers and membership details are stored on computer files to assist with the management of the group and the distribution of Guildford Group correspondence. We do not pass your details on to anyone else.

Chairman's message May 2020

I need to start with a bit of sad information by letting you know that our President Victor Olisa has decided to stand down from the role. We have really appreciated Victor's input and perspective from the standpoint of being a retired police officer as well as a parent who has encouraged both his children to embark on the IAM RoadSmart Advanced Driver course. GAM is very appreciative of his input and is delighted that he will continue to be a supporting member of our fantastic observer team.

So what a strange year this has turned turned out to be! In our last Newsletter we were just entering the beginning of the uncertainty around COVID-19, and as I write this time we are in the thick of the heaviest restrictions on our lives that most of us will remember. Two months ago we were deluged with messages from IAM-RS

headquarters progressively restricting what we could do from an advanced driving coaching perspective. It looked as though GAM would totally shut down until mentored driving could start again. Little did I know that our fantastic committee and observer team would get behind a unique GAM initiative which has become known as "Virtual-Runs". At the time of writing we have delivered on a weekly basis half a dozen sessions to our associates and observers. We have also provided our members with the similar online material for them to use as a personal refresher or in preparation for Fellowship or Masters. In any event we hope our members will keep in touch and take the opportunity of refresher runs at the very least.

The feedback from our "Virtual-Runs" has been fantastic, and clearly a large number of our associates see a great advantage in receiving some classroom style training in addition to the traditional mentored runs. It has become very apparent that there is a great benefit from receiving training sessions and material in addition to that dispensed by the observers from the passenger seat. It has given many of our associates an opportunity and stimulus to read the advanced driver course book in a slightly different and more rigorous way. The virtual runs have been configured to follow through the sequence of *key competencies* that are clearly identified in the course and have been supplemented with reference to available material such as Reg Local videos and GAM produced coaching material. The sessions are recorded and have been loaded onto our GAM YouTube channel [see https://www.youtube.com/playlist?list=PLAEIlOdg_iR8PTrcQGJhXdB_RyZ3dXhKL]. We would really appreciate any feedback on what we have achieved and if we could do better.

And now for something completely different! On a completely different subject, I thought I would share some recent experience of things going wrong with complicated motor vehicles. I think there are some lessons to be learnt from these experiences.

Just before COVID-19 struck, my wife and I spent 5 hours in a lay-by in the middle of nowhere on the A30 waiting for a breakdown recovery to home. Thankfully we had some food and could stream a Netflix video to the car. Our BMW M135i went into 'limp' mode without warning. In spite of the warning message informing us that we could drive gently to the dealer, the car clearly didn't agree, disgorging unburnt fuel through the exhaust and running on 3 or 4 cylinders. The RAC appeared after an hour, plugged in their diagnostics, talked to BMW and concluded a low loader was required. Four hours later the low loader arrived. Fortunately we were able to start the car, this is necessary to get the double clutch transmission (DCT) into neutral for winching. Apparently if you can't start the car, you really need to be on ramps to access the manual override which is buried underneath. Not many people know this *[Suggest it is a good idea to know how to move, tow, or handle a severely disabled car, it may be trickier than you think!]*. Now came the challenge of winching

the car onto the truck. The M-Sport BMW has lowered suspension which means the front spoiler and belly of the car ground during loading. Use of wedges and bits of scavenged timber got over this problem. We arrived home safely, 7 hours late and somewhat exhausted by the driving style of our recovery driver. His life story was interesting to say the least, we're just happy he didn't have a recurrence of the heart attack from a few years ago! He was 70+.

Next day the car goes into Vines for diagnosis and repair. £1800 later with 2 new fuel injectors, 4 new plugs and coils and resetting the engine management system I go for a test drive to check all is well. Initially it seemed OK if a bit flat on throttle response. I decided to try some firm acceleration in *sport mode* and immediately got the 'limp to your dealer' message. I turned round and dropped it back to Vines. £500 later they diagnosed and corrected a turbo vacuum sensor fault. They weren't able to explain the root cause of the problem.

A couple of weeks later, just into the start of the COVID lock-down measures, our other cars develop faults. The rear folding passenger seat mechanism on our Honda Civic jammed and the Sat-Nav screen on the i3 developed big black blobs hiding part of the display. Honda wanted £300 for the Civic seat repair, and my friends at Vines around £450 to replace the screen. My Scots blood surfaced, and with time on my hands, it was DIY time. Amazingly I found a YouTube clip showing you how to use a bent coat hanger to release the CIVIC seat. Thirty minutes fishing did the job, the bent mechanism was straightened and all was well. Cost £0.

Encouraged by this success, it was time to take on the Sat-Nav screen. This is easily removed from the car, and I quickly found the Chinese manufacturer's details. However, the BMW replacement part isn't available in the UK for direct sale. So ebay came to my rescue. I found a part for a BMW X6 with almost the same part number for £104. I took a punt and *white van man* arrived 2 days later and left the part whilst maintaining the distancing rules. I opened the package to discover that the slight part number difference was due to a different die cast case and mounting. It was quickly apparent that I could swap the LCD screen and electronics from the X6 case to the i3 case. A 20 minute job done, all works perfectly and I celebrated a £340 saving.

Stay safe, keep alert,

Gordon Gordon Farquharso, GAM Chairman

Letters to the editor

Dear Sir,

Thank you for the Spring 2020 GAM Newsletter: it is always an enjoyable read.

I was, however, surprised by the article regarding left foot braking. The anonymous article quoted from The Daily Telegraph's Honest John column, from Wikipedia and from "Car Throttle". Much of the latter's contribution covered the rally style of driving, most of which would not be applicable to Associates taking the Advanced Driving Test. I found it disappointing that the article did not refer to the Advanced Driver Course Logbook, where the subject is mentioned, albeit briefly, on page 54, under the "Manoeuvring/Speed" heading. This is the only advice that counts for Observers coaching Associates through the course to take the Advanced Driving Test and should have been mentioned in the article.

One paragraph in the article mentions the increased thinking distance caused by the delay when the driver's right foot is moved leftwards from the throttle to the brake pedal. An Advanced Driver should not need this extra half-second if they have been applying the system of car control correctly.

My first five cars all had a manual gearbox. My sixth car had an automatic gearbox (because of price rather than choice) and now I would never choose a manual gearbox car again. I brake with my right foot even under slow manoeuvring because (i) it is a long-ingrained habit; and (ii) a car with an automatic gearbox has "creep" which is invariably sufficient not to need to use the throttle.

Yours faithfully,

Clive Heavens

GAM and IAM-RS member, NSR Manager, GAM

Thanks to Clive for his attention to this important detail.

IAM RoadSmart Advanced Driving best practice reminder:

- Left foot braking on the open road isn't considered acceptable Advanced Driving practice in any vehicle. The only exception might be an automatic vehicle configured with a special pedal arrangement to accommodate a physical impairment.
- Page 54 of the Advanced Drivers Course book says *"Braking with your left foot in anautomatic may help when conducting a manoeuvre".*

Following one of the GAM "Virtual-Run" coaching session the other day, one of our members was moved to write in.

Dear Editor,

Setting headlights to auto is very dangerous in my view. At the motorway tunnel near my house you get cars 'flashing' their lights as they go through the tunnel and they confuse van drivers who are turning across them into a yard, thinking they have been 'flashed to go'. Also, setting wipers can be tricky if the control device has several options on speed of response and you have to set for light - heavy rain with several intermediate points. They may not work as quickly as you expect them to in sudden showers.

Examiners have frequently commented on the cleanliness of cars being presented at test, saying a clean and tidy vehicle 'speaks volumes about the driver'.

Regards
Paul Whitehead – GAM member and Secretary
Let's hear your views! Editor@Guildford-IAM.co.uk

Chief Observer's message (aka Ranshaw's rant!)

First, I hope that you, your relatives and friends are all safe and well as the impact of Covid-19 permeates through our lives. I have never seen such an effect on our World.

So, here we are. At the end of a 2 month period of madness, where I have never driven less in my entire driving career! I filled up my X-Trail last week, the first time since mid-March. I am driving out today to meet a chum for the first time in 2 months - we just have to prove (if stopped!), that we are maintaining social distance and that we are walking longer than it took to drive there. Life is strange!

GAM has not been sitting idly on its hands however and a comment made to Gordon (our Chairman) back in March as the lockdown started, has grown to be quite a phenomenon – *Virtual-Runs* or as I sometimes refer to them as *Lockdown-Lectures*. I felt guilty that we had just walked away from our current Associates and that we could see no date for re-commencement of any sort of sit-alongside-driving again. Whilst there are many online videos out there that you can view (eg, the Reg Local ones), there does not appear to be much that an IAM RoadSmart Associate can grab hold of to help them improve their technical skills and take them through the Advanced Drivers Course. We decided to break the IAM RoadSmart course book syllabus down into bite-sized chunks and have been delivering sessions to our GAM associates and Observers since mid-April. From the emails we have received, they are going down very well. We still have another 4 – 6 sessions to go from mid May, and I am looking forward to each of them! We deliver them via a well known application called ZOOM™, which has provided us an excellent platform to speak simultaneously with between 25-30 people every week. We also have time for chat and questions – all in all a good experience, I hope. We are now asking our Observers to deliver some of the modules – this has the positive effect of focusing each of our minds on a specific subject.

We are (video) recording all of sessions and these will become available on the new YouTube Channel that Gordon has created – these will be made available to all Associates and packaged to GAM Members as refresher coaching. It is likely that we will adopt this technology for the foreseeable future to enhance our traditional mentored run coaching, as we want to help current associates as much as members who want to renew their skills.

In the meantime, as we progressively get back into our cars and do longer journeys than home to supermarket, I would advise caution. I am seeing some 'rusty' driving out there now – we all have the muscle memory skills required to drive, but without regular usage, they fade – at quite an alarming rate. So please take care and really focus on applying the skills you have learned – also watch out for others who may not be adopting that pattern!

Stay safe, keep alert and I really look forward to seeing you all again,

Graham Ranshaw GAM Chief Observer – May 2020

Become an IAM RoadSmart qualified Observer! Yes really. Want more information, then email training@guildford-iam.org.uk

From IAM RoadSmart

Check out the IAM RoadSmart YouTube channel

Have you had a look at the IAM RoadSmart YouTube channel? Our videos cover lots of driving and riding topics including advice from our ambassadors, technical tips and clips from events and skills days. Feel free to share these videos with your group members through your social media channels. To browse through these videos follow this link: https://www.youtube.com/user/RoadSkillsUK/featured .

Flat battery? IAM RoadSmart's guide to jump starting your vehicle safely

As more people start to need their vehicles for driving to work or to take exercise - in England at least – it's likely that some will be frustrated to find their battery has lost its charge during an extended period of inactivity. Breakdown organisations report that this is one of the most common causes for call outs at the moment.

If the worst happens and you do emerge from lockdown to find your vehicle battery is flat, jump starting the car with jump leads can cause damage. For some modern cars it is even not possible or requires specialist equipment. So, you should always consult your manufacturer's manual at the first stage to understand their recommendation on what to do in the event of a flat battery. If jump starting is not

possible, contact a garage or breakdown service who may be able to provide support.

If your car does allow jump starting, Tim Shallcross, IAM RoadSmart's head of technical policy and advice, has these tips on how to do it safely:

- Before you start, check the handbrake is on, the gears are in neutral and the lights and all other electrics are switched off.
- Make sure the engines and ignition are off in both cars – put the keys in your pocket as modern cars can lock themselves when leads are connected to a flat battery.
- Next, connect the red lead to the positive terminals on each car battery.
- Now connect one clip of the black lead to the negative terminal on the donor car, the one with the charged battery. If someone is helping you, unless they're from your own household, remember the two metre social distancing rules are still in effect.
- Connect the other black clip to a metal part of the engine of your car, well away from the battery. This is important because there may be a small spark when you complete the circuit and batteries can give off hydrogen. Keeping the spark away from the battery prevents any possibility of igniting the hydrogen. Some cars have a recommended point for doing this, so check the manual to ensure you are following manufacturer's guidance where it is available.
- Start the donor car and leave it running for about 15 minutes to charge your battery. Leave your ignition off.
- Switch off the donor car, disconnect the black lead from the engine on your car, and then from the battery of the donor car. Disconnect the red lead. Do not be tempted to try turning on your ignition until after you are sure that all the leads are disconnected, as any power drain may damage your donor's battery.
- If, when you attempt to start your car it still doesn't work, try the process again leaving a little more time for the charge to have an effect. If you still can't start the engine, you will need to seek advice from a garage or breakdown service.

Tim Shallcross said: "Keeping your car healthy during the lockdown, or any extended period of inactivity is important. Your tyres and handbrake should also be checked regularly. And when you are ready to get going again and government advice allows, remember to check the whole vehicle and yourself in good time before you set off by completing POWDERY checks of petrol (or fuel), oil, water, damage, electrics, rubber and last but by no means least, you.

"That way, you can be as confident as possible that you and your vehicle are fit for the road and you can continue to play your part in managing demand on the NHS and other emergency services."

You can read more tips on lockdown vehicle health care here

From GAM

Check out the GAM YouTube Channel

On the GAM YouTube Channel you'll finds recordings of the GAM Virtual-Run training sessions.
https://www.youtube.com/playlist?list=PLAEIlOdg_iR8PTrcQGJhXdB_RyZ3dXhKL

Time for some more maths. John Holcroft looks at engine braking for hill descent

It has long been recommended practice to adopt a low gear on descent of steep hills, a process known as engine braking. In classic cars fitted with drum brakes this is deemed essential otherwise the brakes may overheat, greatly reducing their effectiveness. But to what extent is this still true for a modern car fitted with disc brakes with more effective heat dissipation? In this article I attempt an approximate order of magnitude answer to this question.

Conventional brakes operate by converting energy into heat (through friction). Stopping a car from speed converts kinetic energy, the energy of motion, to heat, while descending a hill converts potential energy to heat. (Electric cars use regenerative braking where much of the energy is converted back into electrical energy that is stored in the battery - a much more 21st century approach - but that topic is beyond the scope of this article. We are just concerned with so called friction brakes.)

Kinetic and potential energy are different manifestation of the same thing and they are interchangeable. An excellent example of this is a pendulum where the energy is all potential at the ends of the swing, all kinetic in the middle, and a varying mix at all points in between. The total energy, potential plus kinetic, is constant.

As mentioned earlier the main limitation of friction brakes is that they can get too hot! The discs and pads have a maximum temperature beyond which their effectiveness diminishes. Engine braking helps by diverting some of the heat away from the brakes to the engine which is equipped with a radiator and fans to dissipate excess heat.

Is there a simple way of putting some numbers on the capacity of friction brakes without resorting to materials science? Well, I think there is based on practical experience on IAM skills days and track days. (IAM skills days have been described in previous articles in this newsletter. Briefly they are an opportunity to explore the handling characteristics of your car in a safe environment - Thruxton circuit.)

First let's introduce the simple equations that allow us to calculate the potential energy (PE) and kinetic energy (KE) of a vehicle.

$PE = mgh$ 1) $KE = 0.5mv^2$ 2) where

m is the mass of the vehicle in kilogram (kg) - I'll assume 1,500 kg
g is the acceleration due to gravity, generally taken to be 9.81 m/s/s
v is velocity in metres per second (m/s)
h is the height of the descent in metres (m)
KE and PE are in units of Joules (energy)

It might be helpful to remind you that a Joule per second is one Watt, or putting it another way one Watt for a duration of one second is a Joule.

Using equation 1) above we can easily calculate the energy released during a hill descent, initially without distinguishing between friction and engine braking. From how high a hill are we going to descend? Let me suggest three examples that we should consider.

- Leith Hill (294m)
- Ben Nevis (1345m)
- Sierra Nevada (3353m)

Leith Hill is the highest point in Surrey, Ben Nevis the highest point in the UK and the Sierra Nevada has the highest road in Europe. (I've been up the Sierra Nevada and recommend it if you're ever in southern Spain near Granada. You can't get to the actual peak because it's a nature reserve, but the public can drive to more than 3050m (10,000 ft.)

For simplicity I assume that you descend from the peak down to sea level on a constant downward slope of 10 degrees, which is pretty steep. Starting with Leith Hill equation 1) tells us that the energy to be dissipated is 4.3 MJ (4.3 million Joules). Over what period is this energy dissipated? On a 10 degree slope the distance travelled along the road will be 1693 m. At a speed of say 30 mph this will take 126 seconds. It follows that the average power is 34 kW, an enormously high value! For comparison a domestic electric fire will be no more than 3 kW. It should be stressed that the 4.3 MJ of energy is unavoidable (due to the laws of physics) and the only way of reducing the 34 kW is by slowing down.

Doing the same sums for Ben Nevis and Sierra Nevada produce the following results.

Hill ->	**Leith Hill**	**Ben Nevis**	**Sierra Nevada**
Height m	294	1345	3353
PE MJoules	4.3	20	49
Power kW (no engine braking)	34	34	34

Most striking is the fact that the power dissipation required is the same in all cases. The reason is simply that for the assumed fixed slope of 10 degrees, the time to descend the hill is directly proportional to its height - you have proportionately longer time to dissipate the heat produced. Similarly reducing the speed of decent reduces the power dissipation required. For example, reducing speed from 30 to 25 mph reduces the power from 34 kW to 29 kW.

At this point we can return to the question of how much of this power is dissipated in the friction brakes and how much by engine braking. Before proceeding

further let me first explain, for those who may not be aware, how engine braking works. Internal combustion engines these days are so called four-stroke, because there are four strokes of each piston in a cycle, namely induction, compression, power and exhaust.

- induction - open the inlet valve(s) and suck in the fuel air mixture
- compression - close all the valves and compress the mixture at the top of the cylinder
- power - ignite the mixture and force the piston down the cylinder
- exhaust - open the exhaust valve(s) and let the piston push out the burnt mixture

In a petrol engine the majority of engine braking is produced due to the vacuum produced in the inlet manifold when the throttle is closed (i.e. when your foot is off the accelerator). There's no air available to be sucked in and so during the induction stroke the piston has to work against a near vacuum above it. The compression stroke has little effect as not much air gets into the engine to be compressed and in any case any compressed air pushes back during the following downward stroke. Engine braking in a diesel engine is very different. There is no throttle hence no inlet vacuum. As in a petrol engine, energy stored in the compression stroke is returned during the "power" stroke, so in its standard form a diesel engine produces very little engine braking. As a result of this what follows only applies to petrol engines. (Many HGVs have special mechanism called a compression release brake which alters exhaust valve operation so that the engine acts as power absorbing air compressor.)

In Appendix 1 it is shown how you can "calibrate" the engine braking levels of your car. In summary, for a given steepness of hill there will be one gear ratio at which the engine braking holds the car at a steady speed, neither slowing nor speeding up. With discrete gear ratios as in a conventional manual gearbox (as distinct from continuously variable gearbox) it may be necessary to estimate the gear ratio which matches a particular hill.

I happen to live close by a hill of approximately 10 degrees and I know that I can descend at a constant speed if I select 2nd gear - no friction braking at all, braking done entirely with the engine. A simple sum, shown in Appendix 1, indicates that the engine is producing a retarding force of 2,555 Newtons.

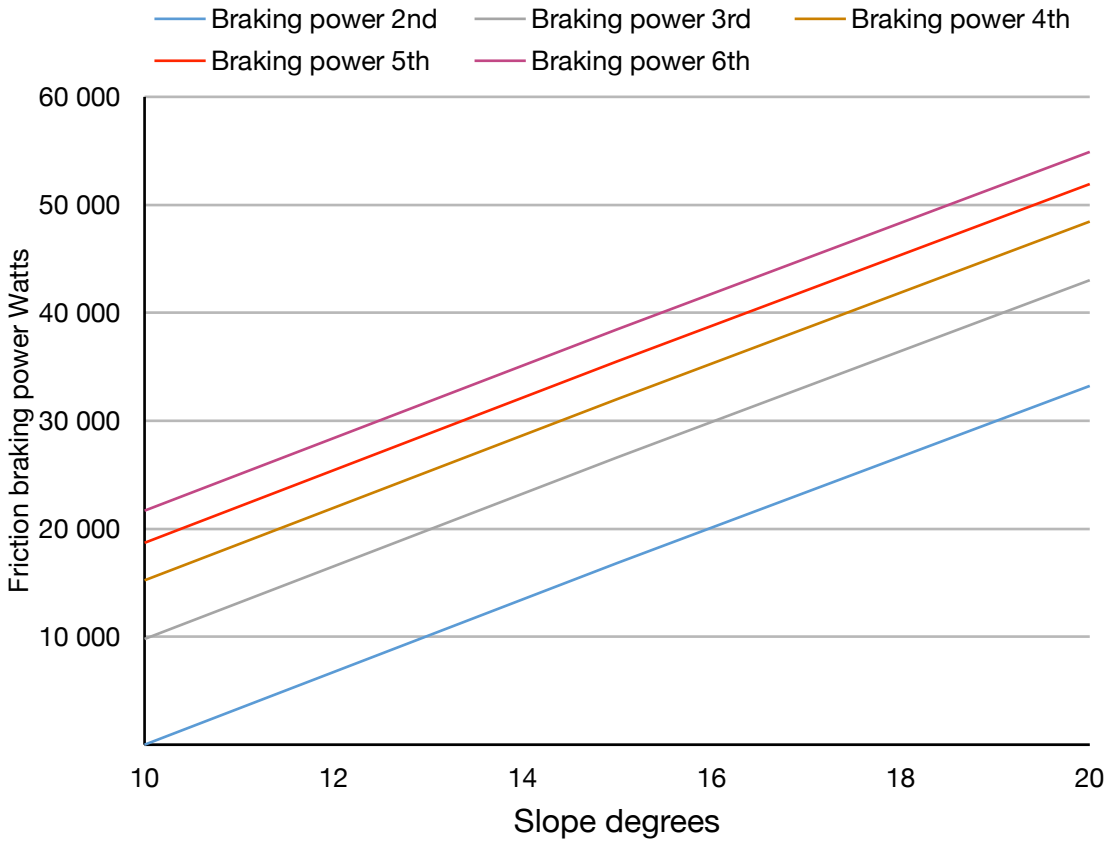
But what if I left it in a higher gear? From information in my car owners' manual I can see that the difference between 2nd and the other gears are as shown in the adjacent table, which also shows how the retarding force of the engine is reduced in higher gears. Using this information, it is possible to calculate the amount of friction braking required for a descent.

Generalising the specific examples given above to a range of slopes and available gears leads to the graph below which shows the friction braking power required for slopes between 10 and 20 degrees and gears 2 to 6. The graph applies for a speed of 30 mph but can be scaled linearly for other speeds - twice as fast, twice the power.

Gear	Gearing	Engine retarding Newtons
2nd	1.0000	2555
3rd	0.7143	1825
4th	0.5556	1420
5th	0.4545	1161
6th	0.3676	939

You can see that, as expected, for a 10 degree slope and 2nd gear no friction braking is required. At the other extreme in top gear on a 20 degree slope about 55kW needs to be dissipated.

Modern warning signs for steep hills indicate the approximate steepness as a percentage. The highest I recall seeing in the UK is 20% which equates to 11.5 degrees. The famous Stelvio Pass has an average slope of 7.5% with a local maximum of 13% (7.5 degrees). According to Mr Google the steepest road in Surrey is Barhatch Lane at up to 21%. All this is saying that in practice you're unlikely to move far from the left side of this graph. Slopes of around 20 degrees are extreme and likely to be short.



We now want to compare the rigours of downhill with on track braking. I regularly participate in track days at a local circuit. From many laps I know that my brakes are satisfactory (no noticeable reduction in braking effectiveness) under the following conditions

- two braking efforts per lap from 160 down to 40 mph
- 120 seconds lap time
- laps repeated for > 20 minutes

Using equation 2) for KE reveals that the heat energy generated per lap is 7.2 MJ (about seven million Joules). This energy will be absorbed by three mechanisms namely,

- friction braking,
- engine braking and
- air resistance

You might expect that air resistance would be significant at the speeds mentioned, but in Appendix 2 I show that in fact it is negligible. Braking is completed in 6th gear so we can use the 939 N engine braking force that was calculated in Appendix 1. The remaining braking effort must be due to the friction brake, the value we want to estimate. Appendix 3 shows the calculation which reveals that 93% of the energy is dissipated in the friction brake and hence only 7% is due to engine braking, as might be expected in top gear. This results in an average power dissipation over a lap of 56 kW in the brakes. Of course, the temperature of the brakes will peak at the end of each braking event and then cool during the remainder of the lap. From the fact that the brakes can sustain this performance for over 20 minutes without noticeable loss of performance it is reasonable to conclude that they can dissipate about 56 kW of heat (by radiation, conduction and convection.)

Comparison with the graph above shows that for all reasonable slopes and for a sensible descent speed there is ample capacity in the brakes irrespective of the gear selected. From this rough order of magnitude calculation, I deduce that there is no imperative to use engine braking during hill decent (at least with a petrol engine).

After all this effort let's summarise and draw some conclusions.

- Engine braking only operates on the driven wheels, usually two, whereas of course friction brakes operate these days on all four. That means, contrary to what you can read on the internet, that use of the friction brake is less likely to produce a skid: the braking force is spread over four contact patches not two.
- I've never owned a diesel car but, from what I've read and tried to explain above, they produce a lot less engine braking than does an equivalent capacity petrol engine. They seem to survive around the world without cooking their brakes. This tends to support the idea that engine braking isn't essential. If anyone knows more about engine braking in diesel cars I'd like to know! Are diesels in cars modified to produce additional engine braking?
- Recall that the above graph assumes the car travelling at 30 mph. Reducing speed will reduce the braking power required proportionately so if in doubt reduce your speed of descent.
- Some people like to use engine braking because it reduces wear on the pads and discs. Ok, but remember you are putting additional wear on the engine due to increased engine revolutions……think which is cheaper/easier to replace.
- Some people wish to differentiate holding a steady speed downhill, using engine breaking, without showing brake lights from slowing down and showing brake lights when friction brakes would be applied.
- At night engine braking will reduce the amount of brake light glare for following vehicles.

- You may wonder how the results presented above relate to your car. I expect that for a modern, manual gearbox, petrol engined saloon car the results will be reasonably representative.
- Remember that use of engine braking is a traditional IAM technique. On your test if there's a significant hill your examiner will expect you to demonstrate the technique. It is a process for maintaining a steady speed, not for slowing down.
- Perhaps the real question is not whether but how much engine braking should be applied, in other words which is the best gear for a particular hill. You might conclude from the above graph that slopes of around 10 degrees (~ 20%) hardly need any action. On the other hand, for very steep hills, especially around 20 degrees selection of a lower gear would be very wise.

You may be wondering whether I use engine braking. I have to confess that I often do without really thinking about it, perhaps because my first car was an original Mini with not very good drum brakes. My final words though are that there is no real technical justification for use of the technique especially driving around Surrey, even if you live on Leith Hill.

John Holcroft

Appendix 1 - Engine braking

It has been explained why engine braking occurs, but how does gear selection and road speed affect the level of engine braking?

The retarding (braking) force produced by an engine is due to the torque required to rotate the engine against the vacuum in the cylinders (for a petrol engine). This torque will be approximately independent of engine revs as the vacuum level will be nearly constant (except at very low revs when air leakage past the throttle will overcome the pumping action in the cylinders.)

The retarding torque of the engine is transferred through the gearbox to the driving wheels. If the retarding torque of the engine is T and the gear ratio is G where this ratio is interpreted as the number of revolutions of the engine for one metre distance travelled, then the work W done in moving L metres is

W = TGL Newton-metres A1)

and the retarding force Fr is

Fr = TG Newtons A2)

The value of Fr for a particular vehicle can be determined experimentally by selecting a gear ratio and hill slope such that with that combination the vehicle descends the hill at approximately constant speed under engine braking alone. We can then equate the component of the vehicle weight in the plane of the hill with Fr. For a hill of slope S the component in the plane of the road is mg*sin(S).

Using some hills near me I found that a slope of about 10 degrees gave constant speed in 2nd gear. So in 2nd gear Fr = 1500 * 9.81 * sin(10) = 2,555 N.

In the adjacent table I show the retarding effect of selecting higher gears. This is based on gear ratio information in my car owner's manual. For simplicity I've normalised 2nd gear to a ratio of one. (We're only interested in relative ratios). The retarding force from equation A2) is proportional to the gear ratio leading to the retarding force results in the final column.

Gear	Gearing	Fr N
2nd	1.0000	2555
3rd	0.7143	1825
4th	0.5556	1420
5th	0.4545	1161
6th	0.3676	939

Appendix 2, Air Resistance (Drag)

The following is the well know equation for calculating the retarding force Fd due to air resistance

$$F_d = C_d \rho A v^2 / 2$$

where

C_d = drag coefficient, say 0.3

ρ = air density 1.255 kg/m^3 at sea level, A = cross sectional area, say 2.0 m^2, and v = velocity m/s

Substituting these values gives

$$F_d = -0.367 v^2$$

(negative because it slows the car)

On its own this force will decelerate the car according to Newton's second law

$$a = F_d / m = -0.367 v^2 / m$$

Evaluating this equation at a speed of 100 mph (44.7 m/s) reveals that the drag force is -733 N and the acceleration is -0.489 m/s/s. This acceleration is ~ - 0.05g *which is negligible compared with the declaration achievable by the brakes*, which can approach a maximum of 1g in a road car.

Substituting a = dv/dt gives

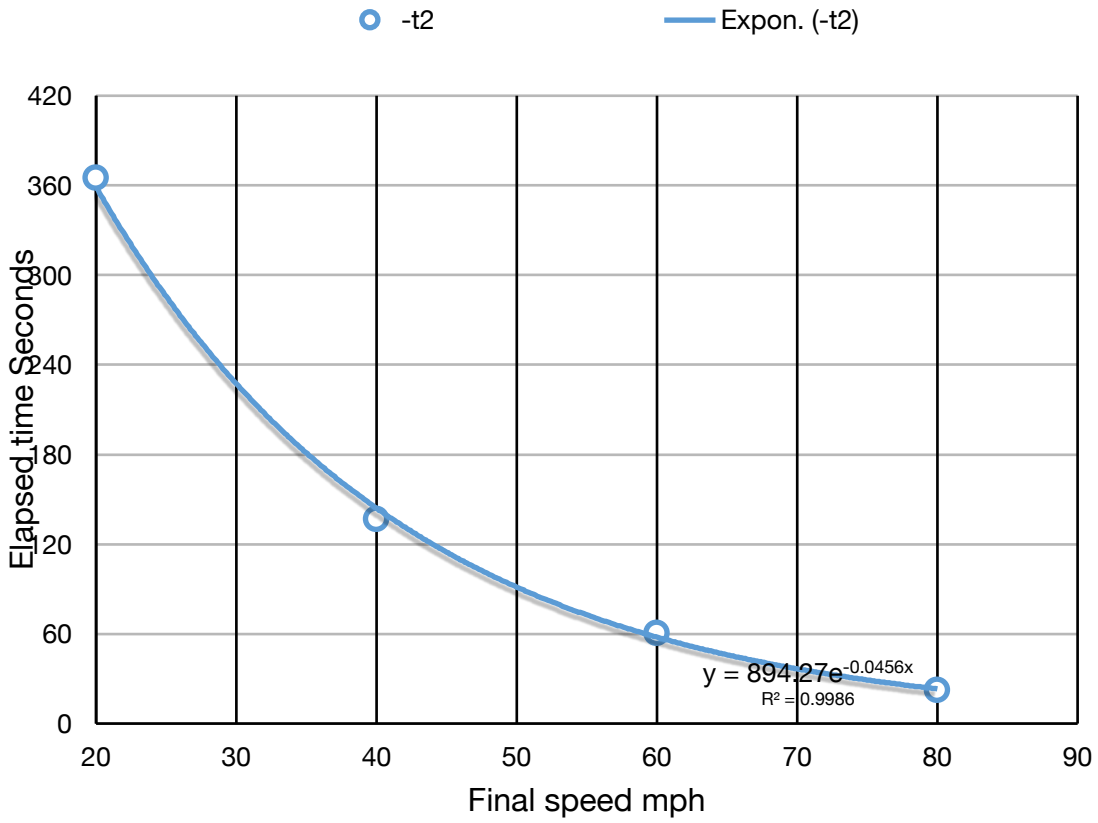
$$dv = -0.367 v^2 dt / m$$

which leads to,

$$-2.72m \int_{v1}^{v2} dv/v^2 = \int_0^t dt$$

Completing the integration gives,

$$2.72m\left[\frac{1}{v1}-\frac{1}{v2}\right]=t$$



Using this equation, the following chart shows the time taken to slow from 100 mph to the final speed shown on the axis *due to drag alone*. For example, time to slow from 100 to 60 mph is one minute! If like me you find this initially surprising, I believe that is because the off-throttle slowing normally experienced is largely due to the engine braking discussed in Appendix 1, even if you're in a high gear.

We can conclude that air resistance is not a significant factor in braking, even from high speed. It is even less significant in the context of hill descent where speeds are not generally high.

Appendix 3, Braking from Speed

We wish to calculate the friction braking power required to slow a car from 160 to 40 mph while in 6th gear twice per lap, with a lap time of 120 seconds. The car weighs 1500 kg.

We know that the engine braking force off-throttle in 6th gear is 939 N.

We will assume that deceleration observed is 0.9g, a hard brake, approaching the limit of what can be achieved.

From Newton's second law the force F required to produce this deceleration is

F = ma = 1500 * 0.9 * 9.81 = 13240 N

The force required of the friction brake is 13240 - 939 = 12300 N which is 93% of the total.

Let v = initial speed, u = final speed a = acceleration, and s = distance travelled during the braking.

The following well known equation applies.

$$v^2 - u^2 = 2as$$

Solving for s gives s = 272 m.

The energy absorbed by the friction brake is just force x distance = 12300 * 272 = 3.3 MJ

For two braking events and a duration of 120 seconds the average power required is

2 * 3.3 * 10^6 /120 = 56 kW.

GAM exposé

Alloy wheel damage and refurbishment

Typical damage

Scuffs from kerbing: This is probably the most frequent cause of damage, and it seems that alloy wheels are very much more susceptible than older steel wheels. This might be a combination of the wheel design and appearance as well as the prevalence of increasingly low profile, wide section tyres that leave the rim is very exposed.

Corrosion: This is surprisingly common, exacerbated by salt on the road and of course by prior damage. So-called diamond-cut finish alloy wheels are much more susceptible to salt corrosion because raw aluminium is only protected from the elements by a relatively thin lacquer finish. Powder epoxy painted wheels are much better protected and exhibit corrosion less often. In many northern hemisphere countries where harsher winters are experienced, it is common practice to swap between summer and winter tyres and in many cases this includes swapping wheels and using a less sensitive steel wheel in conjunction with the winter tires. Changing tyres on rims from summer to winter places additional stress on the tyres themselves and the rims of course.

Buckled wheel: Buckled wheels are surprisingly common and often hidden from view. Alloy wheels used with low profile wide section tires have a significant offset between the hub and the inside of the rim. This distance means that the inside of the room is relatively poorly supported and therefore more susceptible to mechanical damage and distortion of the relatively soft aluminium. Potholes are the most common cause of buckling distortion.

Repairs & refurbishment

POWDER COATING: Wheels are gently Chemically stripped to remove previous layers of lacquer and paint to obtain a smooth metal surface in preparation for coating. The wheels are then prepared, dressed and filled to deal with any damage to the rim edges and the face. Next the wheels are gently heat treated to remove any air from the alloy and a first stage powder coat finish is applied and then cured for a set time period . The wheels are also automatically subjected to a further thermal treatment. The lacquer coat is not only applied to enhance the finish but to protect the alloy wheel against environmental influences (UV radiation, salt, moisture, dirt, etc.) at all points. Many different finishes and colours are available.

DIAMOND CUT ALLOYS: The process of Diamond Cutting is very similar to that of powder coating with the addition of a machine cut finish to the front 'face' of the wheel. As with our Powder Coating process the wheel is refurbished, with the tyre off. The refurbishment of a diamond cut wheel is impossible to do as a touch up/ mobile as it requires the use of CNC Machine. Most wheels are gently blasted by hand to remove previous layers of lacquer and paint to obtain a smooth metal surface in preparation for coating. If the wheels are in a particularly poor condition they may be chemically stripped prior to blasting. The wheels are then prepared and dressed to deal with any damage to the rim edges and the face. Next the wheels are gently heat treated to remove any air from the alloy and a first stage powder coat finish is applied and then cured for a set time period. A second coating may be applied at this stage depending on what finish is chosen. Once cured the wheels are allowed to cool before being introduced to a state-of-the-art CNC lathe ready to be Diamond Cut.
It is important to note that there are many points to consider when having your diamond cut wheels refurbished, such as; have they been cut before (they can only be re-cut a finite amount of times)? The nature of the process require removal of metal from the front face subject to the level of damage or corrosion and if the wheel has embossed wording. Following their time on the lathe a clear coat lacquer is applied and then returned to the oven for further curing.

COSMETIC REPAIRS: Cosmetic repairs are applied to a small to medium section of the wheel. The damage would be minor, and the repair is blended into the undamaged area, leaving your wheel as original as possible.
The original finish is not removed as happens in the repair of powder coated wheels
Cosmetic repairs will last, but not as long as a wheel that has had a full refurbishment of the whole wheel.

ALLOY WHEEL STRAIGHTENING:

Although a buckled wheel may seem like a minor problem at first, it is not something you should ignore. If you fail to spot the defect and get it fixed in time, steering and suspension systems of your car are likely to be irreparably damaged and worsen your driving experience.

With dozens of potholes in the road surface today, even the best advanced driving observation cannot ensure you avoid every obstacle, hence there is no way to totally avoid bent rims and other defects. However, this doesn't mean you have to lash out on new wheels at the first sign of those damages. It's an affordable solution that makes sure your vehicle meets the MOT requirements.

In most cases, it's extremely challenging to spot a buckle with the naked eye, especially if you haven't hit any kerbs or manholes recently. However, there are some signs which may help you identify the defect before it's too late. Let's take a closer look at them:

- Steering wheel vibration
- Uneven tyre wear
- Poor steerability and car handling
- Bad brake performance
- Low tyre pressure

Examples of refurbished wheels:
Diamond cut Powder coated

If you notice any of these signs, it's time to get your car inspected.

The process of straightening largely depends on the type of your wheels and damage. To bring a factory-fresh appearance to alloys, techniques such as heating, tempering and hydraulic pressing are applied. Finally, if you have serious cracks or some missing parts in a rim, the only solution will be reshaping it with aluminium welding. It is deemed to be the most effective option for getting the original look of your wheels back.

Thanks to Graham Lindsey for help putting this article together. Graham runs local Send firm ***Revive! Auto Innovations (Guildford),*** Unit B, Rio Estate, Send, Surrey, GU23 6JX cell 07908 260 155

Val has a go at ICE driving

NOVEMBER 2019 ... there I am down in the depths of Devon working on a farm, loving the outdoor life, amidst beautiful scenery with my muscles aching all over and I receive this ... temptation! But seriously? Me? Drive on ice ... are you kidding? In Finland? Well, I guess that is as good a place as anywhere but ... *really*? If you must know the truth, I try avoid driving *anywhere* near ice but ... have always kind of liked tackling mud in a good ol' Landrover so ... I signed up! Eeeeekk ☺ and then, true to form, immediately begun doubting the whole idea!

So, call me foolhardy if you like, but it certainly gave me something to look forward to and of course the question then has to be ... was it worth it? Did it live up to my expectations? Hard to say what they were but, YES! Most definitely, YES!
Now, I wasn't the only one there from GAM... Paul Burn (actually it was Paul who had sent the original email that got me hooked!) was there too but then he is rather more accomplished than I am seeing as how he has been before and now instructs. Further to that we were part of a group organised by SDSA (Specialist Driving Skills Agency) with Phil as our leader.
So to describe it? Crazy, surreal, exciting, mind-blowing, ... just amazing ... and great fun ☺. It consisted of 5 days in all, 3 full days on the ice (oh, and I forgot to mention ... temperatures around -20°C!)

Where? Ruka in Finland (nearest airport Kuusamo) ... which if you look on the map is a land of lakes (if that is not a contradiction in terms!). The cars were all Audis, 4 wd (A3s, A4s and a Q3), winter tyres (of course!) with studs.
Well, in the winter those lakes are ice (good thing too else ... we wouldn't be driving there!) and yes, it was incredible to see such great expanses of ice ... and the scenery was superb ... a truly amazing 'winter wonderland'.
In the middle of all this was the Juha Kankkunen Driving Academy. He was there to meet us with his team and on the last day Juha even took each of us for a drive in his car ... now *that* was something else!!

So, onto the course; it starts slow (well, it did for me ☺) but despite the ice being flat (well, perhaps not as flat as one might expect) it is a steep learning curve ... and amazing fun at that but, also quite mentally challenging as all one's long learned theory comes to the fore and then gets sort of thrown up in the air & bounced sideways ... so it is true to say that one has to adapt pretty quickly to the conditions and then ... start *going* sideways!

Well of course, at this stage you are probably asking (and rightly so) whether I did indeed learn anything (and not only that -20°C is COLD!) or improve my driving in any way whatsoever and I can only say, I hope so.

There are still many words rushing through my mind about throttle control, on-grip, off-grip, oversteer, understeer, contra-steer, driving lines, and that all important weight transfer. Well, all that and eyes on full beam to look ahead at where one is driving as strangely enough, the car seems to go in the direction one is looking so it is advisable to look ahead or one is likely to land unceremoniously in the snow bank on the next corner! But a quick word on that ... should one do so, not all is lost as there is a tractor ready and waiting to pull one out and get one back on the road so to speak and however nice it was to have him there (well, for two reasons ... one to pull us out should we get stuck but also the knowledge that if the ice held his weight, it would surely hold ours!!) none of our group had to use his services so I fear it was a boring few days for him ... while an exciting few for us!

So is driving on ice just like driving on a huge open field of ice ... flat, featureless and unending? Well, not really for there are different areas set up ... the slalom, oval, circle or figure of eight were all great tracks to learn and practice on and then we graduated to the dynamic tracks (a mix of all the above) and finally the handling track ... longer and certainly more complex ... and boy does one realise how tiring it is to *really* concentrate 100% on one's driving ... the car, the conditions, the track, the lines, the approaching bends, the camber (yes, even on the ice circuits, there *is* camber!), consistent use of the throttle, the use of the brakes at just the right time and really feeling the ABS come into play as one brakes and turns at the same time ... feeling that weight go forward and the on the grip on the tyres as one enters the corner, ... oh my, I am now getting carried away as I remember the thrill of those circuits ... what fun it was and as Paul very right commented, it is a steep learning curve ... but one that is well worth tackling!

I did ask my fellow travellers for some possible quotes or thoughts and I hope I have done them justice as I have tried to incorporate their words and feelings in what I have written here but just to end, here are one or two more ...

"An added bonus was that we saw the Northern Lights, we were like children gazing up at a fantastic spectacle of nature."

"It's awesome fun, you learn a lot about car control beyond the limit of traction and it's all in a beautiful location"

"An amazing opportunity to share the emotions, achievements and excitement of such a unique experience, in encouraging, caring and confidence-giving surroundings, leaving us with lasting memories ... none less that the reindeer steaks at Stefan's Steakhouse!!"

"Oh, and of Audis & ice and drinking plenty of water!"

So finally ... if you are interested, do contact Paul Burn as he will be going again next February (& yes, I am sorely tempted and am saving the pennies!!) or feel free to ask me (but do beware, I am biased as definitely hooked ... mind you, I suspect Paul is too!).

Val Pascual GAM Member

GAM members, *News about ICE Driving in Finland in 2021*.

Paul Burn, a GAM member and Observer (mentioned above) is coordinating a GAM opportunity to have this amazing experience yourself. The outline details are as follows:

Travel out 28th February, return on the 4th March.
On the ICE 1st, 2nd & 3rd March.
If we had a lot of people, there could be another similar trip 4th to 8th March.
Cost 2020 was about £4,500 each plus an airfare of £350.

If you're looking for something nearer home, then Paul can help us arrange a driving experience on the Mercedes Benz World handling track at Brooklands. If you don't know what happens there, have a look at the following YouTube video! https://www.youtube.com/watch?v=OnjyuRSfvRY . The cost of a session is around £75.

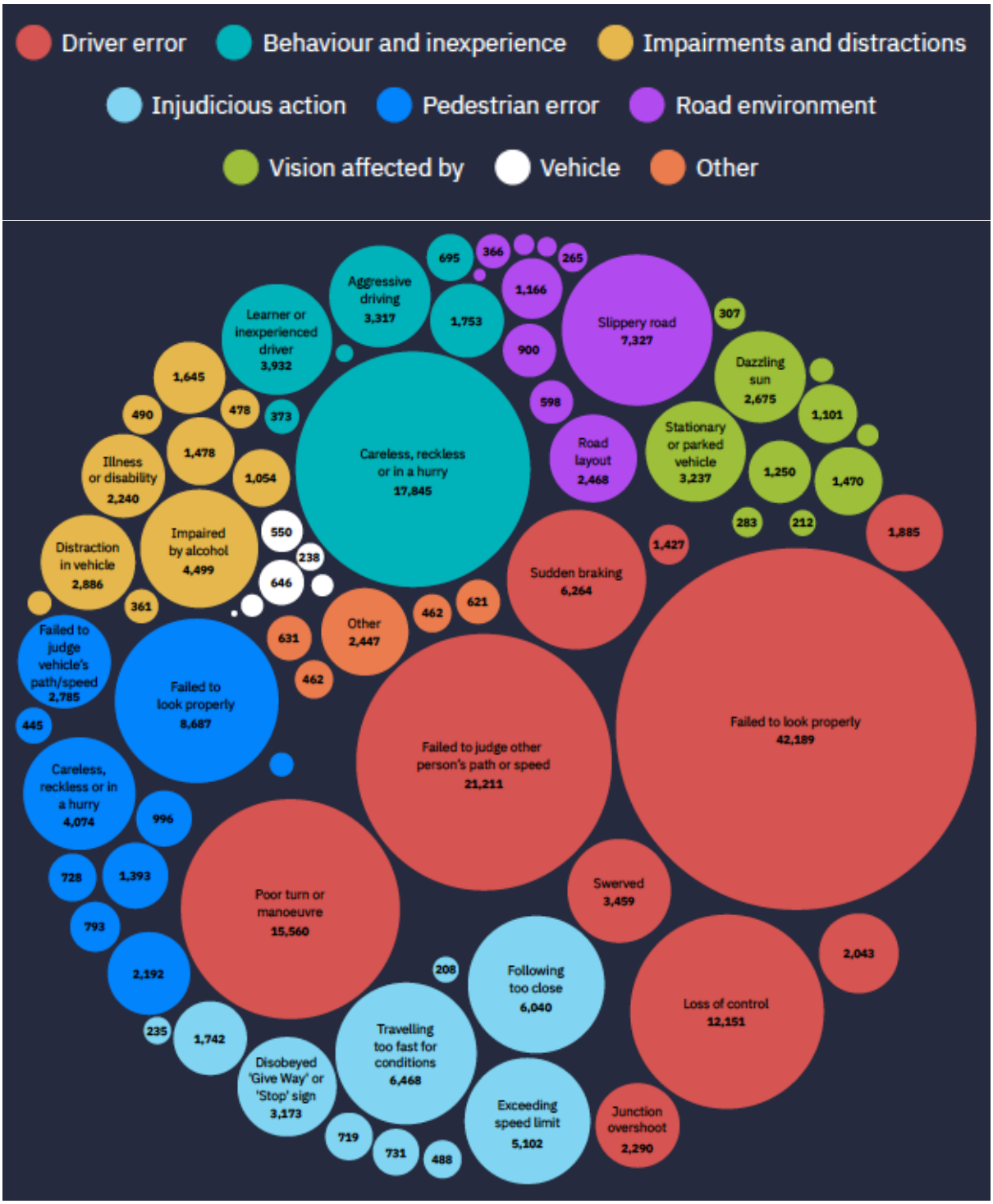
If you're interested in either of these opportunities, or need more information, please contact Paul Burn directly: paulburn181887@gmail.com .

UK Accident statistics

We found this interesting presentation online concerning the statistics around UK road traffic accidents. The data comes from the Department of transport, and the graphic presentation is quite illuminating. We suggest that you look at this online following the link here as the interactive functionality is quite helpful. https://www.regtransfers.co.uk/info/road-accidents-britain

If you link through to the data for Surrey, you will see interesting percentages of accident by type and cause.

A rounded summary of the Surrey data set:- Road Environment 10%; Vehicle 1%; Injudicious driver action 10%; **Driver error 53%;** Impairment/distractions 11%; Behaviour/inexperience 10%; and Pedestrians error 5%.



GAM - IAM RoadSmart 'Fellows' Roll of Honour'

Craig Featherstone
Philip Sivelle
Val Pascual
Rosemary Henderson
Neil Fuller
James Sohl
Matthew Lawes
Ben Bridge
Celia Dunphy
Alan Powley
Paul Whitehead – F1RST
Brian Miller
Brian Mellor

GAM's Advanced Driving test successes in 2020 so far

(COVID-19 affected)

Graeme Blackmore	F1RST	Ian Cole	Pass
Ben Cheeseman	F1RST	Elaine Blackmore	F1RST
Shane Hackett	Pass	Paul Robinson	Pass

GAM - IAM RoadSmart 'Masters' Roll of Honour'

Peter Laub	2013	Mike Hughes	2017 Distinction
Howard Quinnell	2013	Gearoid Conneely	2018 Distinction
Dmitri Savin	2016	John Panting	2018
John Holcroft	2016 Distinction	Shaun Dymond	2019 Distinction
Phil Headen	2016 Distinction	David Nancekievill	2019 Distinction
Ben Bridge	2017 Distinction	Victor Olisa	2019
Graham Ranshaw	2017 Distinction	Peter Laub	2019 Distinction
David Clifton	2020 Distinction		

IMPORTANT GAM DIARY DATES

Look out for events in 2020 – See the the GAM Facebook page.

Observer Meetings 2020 Starting at 1930 hrs, venues to be advised. These meetings will provide an important opportunity to get information and guidance, and importantly share experience and best practice with GAM peers. Look out for venue and timing details! Apologies to Tim Lyon our training officer please.
Dates (to be confirmed nearer each event as details can change and are suject to COVID-19 restrictions): June 4th, August 6th, October 1st, December 3rd

Committee Meetings 2020 2nd July, 3rd September, 29th October. By ZOOM until further notice, 7.30pm – 9.30pm.

GAM Scorecard

We thought you might be interested to see what GAM has achieved recently. The table below is a summary of our scorecard is doing in comparison with other groups. We receive periodic scorecards like the one here from way back in March 2020:

Group Scorecard for Guildford Adv.Motorists (2062) (GAM)

Date: Thursday, 09 April 2020

New Joiners	Group	National Average
Last Month	1	1.3
Same period last year	7	2.0
Based on allocation date to group in DTE		

Enrolments	Group	National Average
Enrolled Last Month	0	1.3
Time to enrolment (Days)	0	6.5
Waiting enrolment	1	3.0
Based on enrolment date in DTE. Enrolment is the process by which a group acknowledges allocation of an associate via DTE, and which triggers payment to the group		

Members	Group	National Average
Full group members	515	183.1
Based on members linked to group (regardless of membership status)		

Associates	
Training in Progress	62
Last 12 months average days from enrolment to test ready	312
Associates with a course linked to the group - shown under OS Test ready lists in DTE	

Observers	
Local Observer Assessor	6
Trainee Observer	6
National Observer	16
Local Observer	11
Based on links to group and qualifications held in DTE	

Test Statistics	Last Month	National Average
First and Pass	2	0.8
Fail	0	0.1
Based on results submitted date and if course associated to group		

GAM Management Team – Officers and Committee Members

CHAIRMAN	**Gordon Farquharson**	chairman@guildford-iam.org.uk 07785 265 909
Secretary	Paul Whitehead	secretary@guildford-iam.org.uk 07860 600477
Treasurer	Michael Tilney	treasurer@guildford-iam.org.uk

Membership Secretary	Neil Fuller	memsec@guildford-iam.org.uk
Chief Observer	Graham Ranshaw	Chief.observer@guildford-iam.org.uk
Newsletter Editor	Gordon Farquharson	editor@guildford-iam.org.uk 07785 265 909
Lead Local Observer Assessor (LOA)	John Panting	assessor@guildford-iam.org.uk 07999 338616
Observer Training Officer	Tim Lyon	Training@guildford-iam.org.uk
Non-Sunday Run Manager	Clive Heavens	NSRManager@guildford-iam.org.uk

Observed Runs "Sunday-Runday" & Non-Sunday-Runs

SUNDAY Observed Runs (now called 'Sunday Runday'): (currently suspended) These are our main training runs. They will normally be conducted on the 3rd Sunday of each month between 9.15am and midday.
Observed Sunday Runs for 2020 –June 14th; July 19th; August 16th, September 20th; October 18th; November 15th; December 13th.

Location for SUNDAY Observed Runs:
Guildford Borough Council Woking Road Depot, Guildford, GU1 1QE (see map on back page).
Front desk manager - Telephone contact number 07706 930 315.

ALTERNATIVE Appointed Observer Runs (NSRs): (Currently suspended) We can also offer some alternative observed runs on any day subject to agreement with your appointed observers. These maybe helpful if you need additional support or are unable to attend a regular series of Sunday runs. Meeting arrangements will be handled by your nominated Observer(s). Make sure you have his/her contact details. Contact our Chief Observer or Non-Sunday Run Manager Clive Heavens NSRManager@guildford-iam.org.uk .

Appointments for Observed runs - contact the Associate Co-ordinator: e-mail associates@guildford-iam.org.uk .
Can't make your Observed run appointment? *We try to match the number of available Observers (all volunteers) with the number of booked Associates, but sometimes we realise things can go wrong. If you cannot attend your booked appointment please let us know. E-mail the Associate Co-ordinator as soon as possible.*

CONTACT GAM

Guildford Advanced Motorists

FOLLOW US ON twitter

@IAMgroup

Find us on Facebook

facebook.com/guildfordiam

GAM updated Website: www.guildford-iam.org.uk

(website devised and managed by Guildford Advanced Motorists (GAM).

GAM On-line coaching YouTube Channel

https://www.youtube.com/playlist?list=PLAEIlOdg_iR8PTrcQGJhXdB_RyZ3dXhKL

Location for our GAM Sunday runs:

Guildford Borough Council Woking Road Depot, Guildford, GU1 1QE