D.S.C.C. ADVICE & TUNING TIPS

Purpose

- The intent of this document is to give advice to newcomers to the Dunton Slot Car Club (DSCC) on preparation and tuning of their cars for best performance and reliability. Having a well-prepared car will allow you to beat 90% of your opponents before you even get on the track!

  This document describes the things I do to my own cars (well, most of the things -- I don't want to give everything away!!), so it is very much a personal view. The document is very comprehensive, there are things you can leave out if you can't be bothered, and there may be alternative or additional tweaks that the other club members do to their cars.

- If you are unsure whether something you want to do to your cars is legal, please check first with the Scrutineer of your club for his view.

1. Ideal Handling

- I prefer a car that is stable going into a corner, and has just the right amount of grip to slide the rear end a little when powering out of a corner. I believe this to be the quickest way round a corner. If a car has too much grip at the rear it tends to dig-in and tip out of the slot without warning. If the car doesn't have enough grip at the rear, it will slide too much, it can't put as much power down and it will be slower down the next straight. The quickest, smoothest and most consistent way is to just have the rear end slide a little, so that the driver can see that the car is on the limit of adhesion.

- For the best race times it is far better to have a quick car that is easy-to-drive, rather than the out-and-out fastest car that is difficult to control.

- The factors that influence the handling of a car are (in no particular order): your driving style; the model of car being used (its height, width, weight, weight distribution, centre of gravity, motor layout, length from guide to rear axle, rear end overhang); controller resistance; whether the chassis is flat and free of distortion; friction in the guide system; type of braids; motor characteristics; gear ratio; friction in the motor/gears/rear axle; how true the rear axle/hubs/tyres run; rear tyre size & rubber compound; how 'floppy' the front axle is; fit of the body to the chassis; additional weight ballast. I will try to cover most of these in this document.

2. *Driving Technique*

- Slot car racing is all about what I call "controlled aggression" – running as close to your car's limit as you possibly can, for as long as you possibly can, without actually going over that limit and falling off. Watch a driver who has just been taken off by someone else – sometimes he gets the "red mist" and is able to drive more aggressively and faster in his efforts to catch up again. The ideal is to harness this and be able to drive like this throughout a race!

- The most important points to emphasise are smoothness, consistency and staying on! There is absolutely no point in being super-quick, but only being able to stay in the slot for a couple of laps at a time. Every time I fall off in a race, I lose up to half a lap before a marshall puts me back on and I can get going again. It is very difficult to recover the lost time without falling off again, so I find it better to calm down, stay in the slot, run my own race and stay out of other people's incidents.

- I've found that the best race technique for me is "slow in, fast out", meaning fast-ish into the corners, and totally on-the-limit out of the corners. This is the least risk, most consistent performance (from my driving point of view); it keeps the car smooth, stable, balanced and predictable, and gives the fastest race times.

- When a car is going into a corner, the ideal is for the car to still be braking so that the weight transfer presses the guide down into the slot and stops the car de-slotting. If I start braking too early, I will slow down too soon and actually have to apply power to enter the corner. This is totally the wrong thing to do! When applying the power again, the weight transfers to the rear, making the front of the car go light – so it can more easily de-slot, exactly what I don't need when entering the corner!

  Alternatively, if I brake too late and I'm going too fast into the corner, at best the rear end will swing round and 'hang' for a split second; at worst the car will fall off.

  The skill is in lifting off at just the right time to be still braking when entering the corner, but not going too fast and losing time. During practice I go a little faster into corners, just to find where the limit is. In a race I prefer to minimise risk by being a little below the limit into the corners -- unless I'm behind and I'm trying to catch up!

- It is easy to be slow in the middle of a corner by being on the brakes for too long. Just as it is important to start braking at the right time, it is also important to stop braking at the right time. By coming off the brakes at just the right time and applying the power again, I can 'carry' the speed through the corner.

- To be on-the-limit coming out of corners, the power is being applied to just make the rear end slide progressively in a single smooth arc, then 'snap' into line at the very exit of the corner. The weight transfer is now to the rear, giving extra grip to the rear tyres but making the nose light.

  If the car has too much grip, it can dig-in and tip out of the slot without warning, so it has to be driven below its limit just to make sure it doesn't fall out. If the car slides too much, so that the rear is noticeably sideways or even fish-tailing, the power cannot be put down effectively – the car will be slow down the next straight.

  Some people apply the power too harshly in my view, causing the rear to step out quite noticeably. This isn't the fastest way; it is better to *squeeze* the throttle for optimum traction and 'drive' into the next straight, rather than 'banging' it down. It may seem less dramatic, but the lap times tell a different story!

- Over a race distance, there are some things a driver can do to stay out of trouble and achieve a faster race time:

  - Put the lane colour sticker on the front of the car, so that it is not covered by the marshall's hand when he picks the car up. Place the sticker at an angle to other features on the car, so that it is clearly and quickly visible.

  - Try to run your own race at your own pace. Don't try to match someone else who is slightly quicker than you, you'll end up "over-driving" and falling off. If a car is coming up to lap you, let it past - I have seen (and experienced!) many times that the driver about to be lapped tries to see if he can go as quickly as the approaching car, he falls off and takes the other car with him (which is pretty frustrating for the faster driver!).

- Don't try to overtake someone on the outside of a corner, unless you trust that person not to nerf you off!

- Try to build up an awareness (almost like a sixth sense) of what else is going on round the track, especially incidents where you may have to slow down.

- If a car is off across your lane, don't run straight into it as you could be knocked off yourself -- wait for the marshall to remove the other car.

- If a car comes into your lane, don't try to blast it out of your lane by applying full throttle – drive gently to bring the offending car to the next marshall, and let him remove it.

3. ***Cars***

- Most clubs run 'box-standard' classes for Sports/GT, Formula One and Saloon. The most popular cars in each class are:

  Sports/GT — The Ninco McLaren has the best combination of low height (& centre of gravity), maximum width and rear track, longest distance from guide to rear axle, minimum rear overhang, wide rear tyres, and even weight distribution (48/52), creating a very stable and easy-to-drive car. Other Ninco cars used successfully at DSCC are the Porsche GT1, Ferrari F50 and Mercedes CLK.

  Formula One — The SCX Indy Lola and Ferrari are very popular, though the Ferrari is no longer available. They are also very stable and easy-to-drive due to their light weight, low centre of gravity and wide rear tyres, and they lap marginally faster than the Sports/GTs.

  Saloon — The Ninco Calibra and Alfa are virtually identical, with any differences between individual cars being down to different motors (normal production tolerances). The Saloons are slower than the Sports/GTs as they are taller (higher centre of gravity) and narrower, they have narrower rear tyres and more rearward-biased weight distribution (38/62). Typically the Saloons tip over more easily, so they are slower into and out of the corners and are more difficult to drive.

- All of the above cars have relatively low-powered motors, which makes them very driveable and controllable coming out of the corners, but they are slow down the long straights. Scalextric/Hornby cars have faster motors than the Ninco or SCX cars, so they are quicker down the straights and they are becoming more popular at DSCC. They demand more concentration to get the braking right due to their higher speed, and they are slower round the corners as their tyres are not as soft, but on balance I believe they are quicker than the Ninco & SCX cars. The popular models are the Porsche GT1 for Sports/GT, the Jordan for Formula One, and the Subaru Impreza for Saloon.

- Fly cars are banned from the 'box-standard' classes but they are eligible for the Modified class.

- DSCC runs a class for Modified cars, which tend to be Sports/GT cars with a different faster motor and soft slick rear tyres. The more powerful motor makes the cars more difficult to control out of the corners and under braking, but they are much faster down the long straights. They need lots of concentration to keep on the track and achieve a fast race time!

- All the Ninco, SCX and virtually all of the Scalextric/Hornby cars have the traditional 'in-line' motor configuration, where the motor is at right-angles to the rear axle. Some Fly cars have the motor in a 'sidewinder' configuration, so that the motor is sideways across the car parallel to the rear axle. Sidewinder cars have a tendency for the front to jump out under hard acceleration. This can be improved by adding some weight to the front of the car, but this will then worsen the acceleration and brakes. Overall, the 'in-line' configuration appears to be the best compromise on a wooden track.

- Finally, we also run a Historic class for 'box-standard' cars primarily from Ninco. These Historic cars are narrow, tall and have a high centre of gravity. Combined with very soft, grippy tyres, the cars tend to tip out of the slot very easily. This makes the Historic class the slowest of all – but the old Jaguars, Ferraris & Porsches do look good as they go round the track!

4. Controllers

- The choice of finger-operated or thumb-operated controller is really a matter of personal preference, with no performance advantage one way or the other. All controllers have brakes (which puts an electrical short across the motor to make it slow down more quickly, rather than just letting it coast). I run Parma Plus controllers that have a very smooth action and therefore a psychological (if not a real) advantage!

- The electrical resistance of the controller is very important as it affects the speed of the car through the corners and the acceleration coming out of the corners. A low resistance gives higher speed in the middle of the corner when applying the power again after braking, and it gives faster acceleration and more "punch" out of the corners. It feels more "instant" and like a switch. A higher resistance means that the car doesn't accelerate as quickly for the same throttle movement, so it is slightly slower mid-corner and under acceleration.

  Sometimes you can see a car blip-blip-blipping round a corner, the driver has to keep lifting off because the car picks up speed too quickly and would tip out before the exit of the corner. This typically happens with Saloon or Historic cars run with a 25Ω controller. Here, a higher controller resistance is needed to give more control, slow the car down mid-corner, and allow the driver to apply the power in one smooth action going round the corner. Another case is when a car jumps and judders when accelerating out of a corner – a higher controller resistance can give slightly less brutal acceleration, calm the car down and give faster lap times.

  I tend to run 25Ω for the better handling Sports/GT and Formula One cars, 35Ω for the more tricky Saloons, and 45Ω for the very tricky Historic cars!

5. Tools & Equipment

- To maintain and tune my cars I use the following tools & equipment:

  Small cross-head screwdriver
  Small scissors
  Thin oil (preferably a modeller's pin-point oil pen)
  Soldering iron, solder & flux
  Set-up block, see below
  Adhesives
  Vaseline
  Sandpaper
  Long-nose pliers
  Brush
  Modelling knife or scalpel
  Power supply >1A -- preferably with variable voltage

- The set-up block is basically a flat acrylic block with a slot cut into it, so that a car can sit on it with all wheels touching the surface and the guide in the slot. I bought mine from SCD (01274-682120 £4.50). I have glued copper tape on each side of the slot to replicate the DSCC track when checking ground clearance and chassis flatness. I also connect my variable voltage power supply to the copper tapes via crocodile clips, and use the block for truing the rear tyres (see 6.9).

6. Car Set-Up and Tuning

I do the following things roughly in the order written:

6.1 Chassis

- The first thing to do is to check that the chassis is flat. An uneven chassis can cause inconsistent handling between right- and left-hand corners, and cause the car to slew sideways under braking.

  Remove the body and the guide, and put the car on a set-up block. The chassis should have a small gap to the track and should not be twisted, with one side lower than the other or one rear wheel up in the air! The front tyres should be resting on the surface of the block, and it should not be possible to lift either front wheel off the surface without lifting the chassis. This shows that the front axle is hard against both chassis "up-stops" at the same time, so the front & rear axles are parallel.

  Another check is to press one front corner of the chassis downwards, watch the opposite rear wheel, then repeat for the other side – if both rear wheels lift by the same amount for the same downward pressure, and you cannot see any slack being taken up between the front axle and the chassis "up-stop" on the side you are pressing on, then the chassis is holding the axles parallel and the car should corner the same in both left-hand and right-hand corners.

  The above checks can't be done on a Formula One car, as they have a separate front axle unit independent of the chassis.

  Next, remove the front & rear axles and rest the chassis on the set-up block. The chassis should be flat front-to-rear and side-to-side, with no big air gap. Sometimes the lettering on the underside of the chassis stands proud, but this doesn't count!

- If the axles aren't parallel or the chassis isn't flat, it is possible to repair it by heating it and twisting it back into shape. My preferred method is to strip the car down to just the chassis, clamp the chassis down hard onto the flat set-up block with a couple of small modeller's G-clamps, and use a hair drier on it's lowest heat setting to gently heat the chassis until it is plastic-deformed into the right shape. It involves lots of trial and error, but it works!

6.2 Magnet

- On a Scalextric-type plexi-track with steel contacts, the strength of the magnet and its location in the chassis are dominant factors in the handling of the car. The magnet provides an additional down force, similar to the aerodynamic down force provided by the front & rear wings on real Formula One cars. Just to give you an idea, in some cars the magnet is so strong that it is possible to hold a piece of track upside down without the car falling off!

  The effect of the magnet is to clamp the car down on the track, giving higher cornering speeds and better braking. It is more difficult to find the limit of the car, as there is no progressive break-away to warn you when you are getting close – one moment you're on, the next you have flown off at high speed! I find that driving with a magnet on Scalextric - type plexi-track requires a quite different driving technique to driving on a wooden track.

- As the DSCC track has non-magnetic copper tape, the magnet in the chassis is redundant. I usually remove it to reduce weight, though I keep the magnet in case we run a challenge event against a club with Scalextric-type plexi-track, when it can be re-fitted.

6.3 Guide

- Make sure that the guide can turn freely in the chassis through its full travel. If it cannot, check for any moulding flash and remove it if necessary, and apply a drop of oil lubrication. If the guide is too stiff it can cause handling difficulties. For example the rear end no longer slides progressively and predictably, and it suddenly steps out when the cornering force is sufficient to overcome the friction. A stiff guide will also not self-centre but will stay skewed to one side when the car comes out of the slot, making it more difficult for a marshall to put the car back on again.

- Scalextric cars have a unique problem in that they have sprung sliding contacts to the braids, which provide no self-centring to the guide. At DSCC it is permissible to hard wire the guide for self-centring, provided that neither the chassis nor the body are cut away. This is possible with the Porsche GT1 and the Subaru Impreza, but I haven't found a way to do it on the Jordan Formula One yet!

  Remove the old guide and throw it away, remove the metal strips and fit a conventional guide (I have found the SCX guides to work best). You will need to replace the lead wires with something longer and more flexible, such as the wire supplied by Oz-Race. Don't forget that you will need a couple of the small eyelets to push into the new guide (see next section).

6.4 Braids

- All cars come with hard braids as standard. They last a long time but they are stiff and tend to lift the front of the car high above the track, raising the centre of gravity. I replace them with soft braids that help to keep the front of the car lower. My current favourite is the ultra-thin braid from Slot It, but sometimes I have to use the slightly thicker Pink Kar soft braid to stay above the new ground clearance limit.

- I put a 90° bend at the very end of the braid with a pair of pliers, then I feed the braid into the guide so that the bend is at the top of the guide and helps to prevent the braid being pushed through. I then use the pliers to bend the braid against the lower part of the guide with the sharpest, cleanest bend I can achieve. This helps to keep the guide as low as possible in the slot.

- The lead wires from the motor have a small metal eyelet with exposed strands from the lead wire poking through it. When pushing the eyelet into the guide, trap the exposed strands between the eyelet and the new braid, to give the best electrical contact.

  When pushing the eyelet into the guide, press the guide and braids hard down against the set-up block. I usually remove the front axle when I'm doing this, so that all the pressure is only on the guide. This will ensure that the braids are not pushed down out of the guide as the eyelet is pushed in, the bend in the braids is kept sharp and doesn't bunch up, and the guide is as low as possible in the slot.

- With Scalextric cars which cannot be hard-wired, I replace the supplied steel braids with softer braid. As supplied, the Scalextric braid comes up from the track surface into the guide, along the top of the guide against the spring contact, then dives down into the guide again and returns out onto the underside of the guide. This return tends to hold the main part of the braid away from the guide, lifting the whole front of the car. When fitting the softer braid, I end the braid on the top of the guide and hold it there with a touch of glue. So the braid no longer lifts the guide out of the slot, and the front of the car sits lower.

- Trim the braids to be the same length as the guide. Splay the braids apart to form a 'V', and slightly turn down the very ends to give best contact with the copper tape on the track. Good braid contact is important for a smooth-driving car. On Blue lane on the flyover section, the groove width varies quite a bit and the track height varies on each side of the groove. It is common to see cars stuttering because of poor braid contact, so give the braids an extra tweak before running on Blue!

6.5 Lead Wires

- Ninco cars come with a series inductor in the lead wire to absorb any electrical noise emitted from the motor. SCX and Scalextric/Hornby cars have a parallel ceramic disc capacitor across the motor terminals to do the same thing. Noel claims that they both affect braking performance, so I always remove them. Just break off the parallel capacitor, or remove the series inductor and attach the lead wire directly to the motor terminal using a small soldering iron.

- Bend the lead wires to: (i) make sure that they don't hold the body away from the chassis; (ii) centre the guide in the straight ahead position when the car comes out of the slot, making the marshall's job easier and quicker; (iii) still allow full side-to-side movement of the guide. If the wires are being stubborn, I sometimes use a piece of tape or some glue to hold them in the right place.

6.6 Motor

- Motor response plays a critical part towards the balance of the car when coming out of corners. The motor should be easily controllable; the power mustn't come in with too much of a 'bang' that will cause sliding, wheel spin, fish-tailing or judder. There needs to be a good balance between the motor response, controller resistance and rear end grip to give a smooth, progressive and easy to drive car.

- According to the DSCC rules the motor cannot be opened, so there is very little that can be done to it. As I have a number of cars, I have selected the best performing motors (by trial and error) and put them in the best handling cars. Beware that the fastest-revving motor when the rear wheels are lifted clear of the track will not necessarily be the fastest motor round a lap!

  Lubricate the motor bearings with a small drop of oil every now and then -- don't over-lubricate, as the copper commutator/brushes inside the motor could become contaminated!

- I like to glue the motor into the separate motor bracket or directly into the chassis. This has the benefit of preventing the motor rocking slightly and absorbing some power, or popping out in an accident. For the models without a separate motor bracket, a further benefit of gluing the motor to the chassis is to stiffen the chassis. Let me explain:

  With the body removed and the motor in the chassis, look at the chassis sideways on, put your thumbs under the centre and gently pull the front & rear of the chassis downwards. The chassis will flex, usually more so at the rear where it is narrow between the rear wheels. Formula Ones are bad because they are so narrow at the back, the SCX Formula Ones are worst of all because the chassis is made from particularly cheap, flexible plastic. This flexing can cause rear-end judder when accelerating hard out of corners or braking into them.

  As the chassis flexes, you will see the contrate gear moving relative to the pinion, and the front & rear mounting lugs splaying away from the motor. By gluing the motor at both ends into the chassis, I am effectively creating a structural member above the plane of the chassis, which will minimise any flexing. And sure enough, the motor lugs can no longer splay away from the motor, there is no movement between the pinion and the contrate, and the chassis feels much stiffer. The judder disappears.

  The other thing you can do when gluing the motor in is to check that the motor shaft lines up with the centre of the rear axle, to enable a good gear mesh. It is possible to buy an alignment tool to help you with this, the trouble is that the alignment tool works best if there is no pinion on the motor shaft – but once you've glued the motor in, it could be difficult to fit the pinion!

- Gluing the motor in is pretty drastic. If something goes wrong with the motor, then it is very difficult to remove it without damaging the motor bracket or the whole chassis. Because nominally identical motors have different performance (due to production tolerances & variations), I always try the car out before gluing the motor in, just to make sure that the motor isn't a duff one.

  To ensure a good joint, I roughen the surfaces on the chassis and motor. With Ninco, SCX & Fly models where the lugs wrap round both the motor can and the end bell, I run Superglue down the gap. Scalextric models have two legs to grip the sides of the end bell – I've found Superglue to be not quite "man" enough for this joint, so I use a viscous adhesive (e.g. Araldite) around the legs and across the rear of the end bell.

- When a motor is brand new, it will have tight bearings and poor brush contact. As the motor runs-in, the bearings will become a better fit to the motor shaft, the brushes will wear to the same curvature as the commutator and stop arcing, and any loose windings will settle and possibly improve the balance of the armature. A run-in motor is generally quieter, it has smoother acceleration, more top-end speed and better brakes.

So it is advantageous to run-in the motor before using it in anger. Some people run-in just the bare motor on a reduced voltage for ½-1 hour, until the brushes stop arcing. Others swear by running-in for 12 hours at 6V, a further 12 hours at 9V, and a final 12 hours at 12V (I'm told that this is of particular benefit to Ninco NC2 motors, after which they *fly*)! The choice is yours!

I prefer to run-in the motor in the car, so that I am also running-in the gears and the rear axle. Some running-in takes place during the tyre truing process (see 6.9). After tyre truing, I used to do further running-in with no load on the rear axle, but I've just acquired a Scalextric -based rolling road to experiment with. Early indications are that the rolling road demonstrates very clearly whether the rear axle is running true (see 6.9); a surprising number of my cars were jumping around which I could only cure with a quick re-true. I've also found that weight needs to be added on the rear of the car to load the drive-train whilst running-in. Watch this space for further observations!

- In the Modified class, choice of motor is open. Having tried the Oz-Race, Slot It and ProSlot alternatives, I have settled on the Ninco 'CLK' NC2 as the best compromise for the DSCC track. The 'CLK' NC2 has more torque than the standard Ninco NC2, and is ideal for punching hard out of the slow corners and braking late for the next one. With a 10t pinion (see below) it is still competitive for top speed, and I find I can gain on most cars down each long straight!

6.7 Gears

- Check first of all that the contrate runs true, by removing the motor and slowly rotating the rear axle. You should be able to see any 'wobble' quite clearly. If there is contrate 'wobble', you're going to have a noisy, power-robbing gear mesh. So throw the contrate away and find a good one.

- Then check that the contrate sits centrally on the axle by seeing whether the rear wheels are equidistant from the rear axle bearings and/or the chassis. Quite often they aren't! If this is the case, remove the rear axle from the chassis. Then grip the axle *on a non-bearing surface* with a pair of long-nose pliers and gently rotate the contrate relative to the axle to centre it. Hold the contrate in place with a drop of Superglue. Make sure that an axle bearing doesn't slide against the contrate at this point, because the glue will run into the bearing by capillary action and ruin it – I use an elastic band wrapped tightly around the axle to prevent the bearing from slipping down.

- Nincos and SCXs have a brass pinion that is a press-fit onto a smooth motor shaft; Scalextric/Hornby and Fly have a plastic pinion on a serrated motor shaft. With in-line motors, check that the pinion is in the right place on the motor shaft. It needs to fully mesh with the contrate teeth but not rub against the hub of the contrate.

- To move, fit or remove a pinion, it is far better to use a specialist gear puller like the one supplied by Ninco. This avoids the risk of damaging other parts of the motor with the forces involved.

- Pinions can move along the motor shaft and out of mesh with the contrate gear. When this happens, exchange the pinion for the same make but with a tighter fit (normal production tolerances). Alternatively hold the original pinion in place with a small amount of solder (brass pinions only!) or glue, making sure that none gets into the teeth.

- It is very important to achieve a good, smooth, quiet gear mesh. A noisy gear mesh is robbing power, it can give uneven acceleration and braking, and it is a psychological disadvantage to have a car sounding like a bag of nails! With the motor and rear axle in place but the body removed, turn the rear axle very slowly and lightly by hand in the direction of normal wheel rotation. A good gear mesh gives a consistent feel for the complete rotation of the rear axle. A bad gear mesh will have one or more 'sticking' points, where there is an irregular resistance to rotation (don't confuse this with the normal cogging effect of the motor). Sometimes it is even possible to see the effect of these 'sticking' points, by looking closely at where the motor shaft engages into the hub of the contrate -- a 'sticking' point will make the contrate jump sideways relative to the motor shaft, then back again.

  A 'sticking' point is caused when a tooth on the contrate binds against the pinion as it tries to come into mesh. To eliminate the 'sticking' point, you first need to determine which tooth on the contrate is at fault. At a sticking' point, mark with white Tippex correction fluid the contrate tooth that is just about to mesh with the pinion. Carry on rotating the rear axle, it is possible that there will be more than one 'sticking' point, and mark each one.

Then use a sharp scalpel to take off the *tiniest* sliver from the leading side of each marked tooth on the contrate. This is usually enough to remove the 'sticking' point, but check the gear mesh again and repeat as necessary until you have a smooth, consistent feel for the complete rotation of the rear axle.

- Gears benefit from running-in to exactly match the contours of the pinion and contrate in that particular car. Only run the rear axle in the right direction, never in the wrong direction. To speed things up, I gently press the contrate in towards the pinion, and out away from the pinion, with the motor running fairly fast. This usually results immediately in a quieter mesh and an increase in motor revs – good news! I then apply a small amount of Vaseline to the contrate teeth prior to further running-in (see the last part of section 6.6).

- The standard gear ratio is 27t (contrate) : 9t (pinion), i.e. 3:1. The gear ratio may be changed only in the Modified class. Ninco supplies a 24t contrate, which with the standard 9t pinion changes the ratio to 2.67:1 and can help to calm down a fast-accelerating, powerful motor. It is also possible to buy 8t, 10t & 11t pinions to change the ratio. Generally, a lower numeric gear ratio will give worse acceleration & brakes but a higher top speed; conversely, a higher numeric gear ratio will give better acceleration & brakes, but a slower top speed. Beware of mixing pinions and contrates from different manufacturers, as they won't always mesh together very well.

  In my Modified cars with Ninco 'CLK' motors, I have changed the pinion to 10t to calm down the acceleration a little, and give me a little more top-end speed on the long straights. I've found this to be the best compromise so far!

6.8 Front Axle/Hubs/Tyres

- Make sure that the front tyres are sitting properly on the hubs, so that they are relatively true when spinning the front axle. Don't forget that the front tyres support the front of the car when cornering and prevent it from tipping too easily. If there is a bulge in the tyre because it is not sitting properly on the hub, it could cause the front of the car to jump out of the slot!

- Also check that the front axle rotates easily, with no snagging or snatching against the body or chassis.

- For a good handling car, it is important that the front of the car is supported on the guide, not on the front wheels. Each front wheel should lift by only ½-¾mm off the track before the movement is restricted by the front axle 'stop' on the chassis (thus resisting the tendency to tip). Check that there is the same lift around the entire circumference of each front tyre.

  The type of braids you are using will set up the height of the front of the car above the track surface. The lift of the front wheels can be tuned by truing the front tyres down to a smaller diameter. This involves putting the front tyres onto a rear axle (of course!) and a bit of trial-and-error to true them down to the right diameter. It is even possible to compensate for a slightly twisted chassis (see 6.1) by making one front tyre a different size to the other.

  In the Modified class, you can mix different front hub sizes (e.g. Fly hubs and Ninco CLK hubs are larger than the standard Ninco front hub), or different front tyres (e.g. Pink Kar supply an ultra-low profile version) to get the front wheel lift just right.

- If you are running a Ninco chassis in the Modified class, you can experiment to increase the front axle "stiffness". A "stiff" front axle seems to give better entry into a corner, but slightly less grip coming out; a "floppy" front axle is the opposite, with slightly more rear-end grip but slightly worse turn-in.

  In a car with a "floppy" axle, the front axle can lift upwards so it cannot initially resist any tendency of the chassis to tip. A "stiff" front axle has no lift, the front wheels are locked in place relative to the chassis, and this helps to prevent the car tipping when going into a corner.

  However for best grip coming out of a corner, the car needs to lean slightly, allowing the outside rear wheel to dig-in and provide maximum grip. Look at a well-used car on a set-up block. You will notice that the tread of the rear tyres is not sitting flat on the track surface. Instead the tread slopes upwards towards the outside of the wheel, indicating that the car is leaning in the corners. A "floppy" front axle allows a car to lean and generate rear-end grip, whereas a "stiff" front axle resists the lean, so the outside rear tyre cannot dig-in and instead slides over the track surface.

- This tweak stiffens the front axle but is easily reversible, so you can try it and see if it suits your driving style and your car. If you don't like it you can always revert back to the standard "floppy" front axle, with no harm done! Remember though that it is legal only in the Modified class.

  Remove the front axle, remove one front wheel, take a couple of rear axle bearings and slip them onto the front axle. If you are using the Scalextric/Hornby plastic bearing, you may have to open them out to fit onto the slightly larger diameter Ninco axle. Replace the wheel and refit the front axle to the chassis, ensuring that the bearings sit on top of the ridges moulded on the chassis right behind the guide. The bearings now restrict the downward movement of the axle, the lugs on the chassis restrict the upward lift, and the axle is effectively locked in height. You may have to tweak the braids a bit, as some of the weight of the front of the car may now be supported by the front wheels. To revert back to the standard "floppy" axle, just remove the bearings again.

- It is possible to take the approach further for even greater front axle stiffness, by opening out the chassis lugs locating the front axle and gluing the axle bearings directly into the lugs. You'll have to be careful though, as the DSCC rules require the front wheels to touch and roll on the track surface, but you still want the guide to support the front of the car – a difficult balancing act!

- Again only for the Modified class, I like to add small washers to centralise the front axle and stop it slopping around sideways in the chassis.

- A tweak only for Fly cars in the Modified class – most of them have stub front axles, which are not a good fit and they allow the front wheels to wobble all over the place. Grab the inside end of the stub axle with a pair of pliers and rotate the wheel until it comes off. Now throw the stub axles away, and fit a conventional front axle instead. A Scalextric one seems to fit nicely – it is a slightly loose fit in the chassis, the hubs fit OK, but the axle will need narrowing. Now you have a front axle set-up giving much more consistent support to the front of the chassis during cornering.

6.9 Rear Axle/Hubs/Tyres

- It is VITAL to achieve true-running rear wheels for a car to be smooth to drive, and not to jump or judder when powering out of a corner. This is the most common failing I see in other cars running on the track. I cannot over-emphasise the importance of having the rear axle/hubs/tyre assembly run true. It gives much better rear end grip, much better braking (because of the better grip), smoothness, traction, stability and balance, and makes the car easier and more predictable to drive. A true-running rear axle assembly even allows the motor to rev faster, as there are less out-of-balance forces to overcome.

- I have a long and quite elaborate process to achieve a true-running rear end, which works for me. You may choose to leave out some parts of the process.

- Firstly, check that the rear axle bearings are a good fit on the axle. They should not be so tight that they are causing friction, but not be so loose that the axle can move inside the bearing. If a bearing is not a good fit, replace it.

- Next remove the rear tyres, turn them inside out and remove any debris or flash from the tyres. Cut or file off any flash from the hubs.

- Then run the motor at the slowest speed and look closely at the rotating rear hubs to see whether there is any trace of 'wobble'.

  If you're lucky both hubs are running true, but usually one hub has a distinct 'wobble'. If a hub does 'wobble', pull it off and check the axle itself for 'wobble'. If the axle 'wobbles', it is bent and it should be replaced with a good one. If the axle is OK, then the hub is at fault. You then have to find a good replacement hub by trial and error. With some cars, the front hubs are the same size as the rear hubs, so you can try the front hubs to see whether you can find a better one. If you can't, raid your spare parts for equivalent hubs.

  I dislike removing a hub, as it is difficult to put it back true on the axle, or sometimes the hub can split. If the 'wobble' is minor, there are two things to try rather than remove the hub: (i) rotate the offending hub on the axle

slightly, this could misalign cumulative 'wobbles' in the hub and the axle, and result in less overall 'wobble'; (ii) run the motor and try to true the hub with a file.

- Now that both rear hubs are running true, the next step is to ensure that the hubs are secure on the rear axle. If it is possible to rotate one hub on the axle relatively easily, use a drop of Superglue to secure it to the axle. Again, I use an elastic band wrapped round the axle to prevent a bearing sliding down against the hub and the glue running into the bearing and jamming it up.

- Next, check that the rear axle bearings cannot move relative to the chassis. In some chassis, a bearing can move slightly inside its mountings – especially SCX Formula Ones. I don't like any looseness in the rear axle assembly, as I believe it is detrimental to achieving a rear end that slides progressively. So, as a matter of course I glue the rear bearings to the chassis using Evostick. Evostick holds the bearings securely enough during normal use, but allows the rear axle to be removed by applying gentle pressure without wrecking the chassis (unlike Superglue – thanks for the tip Ken!).

  Ken has another tweak for SCX Formula Ones, which have bearings that are particularly loose on the rear axle. He deliberately misaligns the bearings (e.g. makes them both slope downwards in a shallow 'V') when he's gluing them into the chassis. The axle is now a much tighter fit in the bearings, so the car's handling is better, and when the bearings wear they can always be removed, rotated and glued back in again!

- In the 'box-standard' classes, any Ninco model may run any Ninco tyre provided it is the same size as originally supplied on that axle. So for example hard ribbed rear tyres can be replaced with new soft slicks, which will have much more grip. We've even found that recent batches of slicks are softer than older slicks, not only from Ninco but also SCX and Fly, so there is obviously some experimenting going on by the manufacturers.

- In the Modified class, any make or size of tyre may be used. My personal favourite is the ProSlot rear tyre, which is ultra-soft almost like the sponge tyres used on the more sophisticated BSCRA cars, but they don't grain on the DSCC track like the Ninco slicks do. The ProSlot tyres have a larger internal diameter, so they must be used with Fly or Ninco CLK large diameter rear hubs.

- Refit the rear tyres, making sure that they sit properly on the hubs with no odd bulges. In the Modified class, if you are using soft tyres and a fast motor, it is possible that the tyres will grow at high revs, shift on the hub and end up out of true. I recommend gluing the tyres onto the hubs with Evostick to prevent this happening, they can still be peeled off again when the tyres are worn.

- Now comes the truing process. I have spent many hours getting this right by trial and error. The results vary depending on tyre make (e.g. Ninco, SCX, Fly, Scalextric, ProSlot), tyre compound (e.g. standard, soft), and even tyre batch (nominally identical tyres bought at different times can be different!).

  I use:
  - My set-up block (described in section 5)
  - Coarse sandpaper
  - Variable-voltage power supply (running 12V with Ninco NC1 & SCX motors, 9V with faster motors)

  I prefer to have the body removed from the car, so that I can clearly see the rear tyres.

  Holding the sandpaper down on the set-up block (otherwise the sandpaper will flick backwards), and blocking the front of car (otherwise it will fly forwards!), I lift the rear end of the car up.

  With the power on and the motor running, I very gently lower the rear end until the tyres just start to touch the sandpaper. I'm supporting most of the rear end weight, and the motor speed should only drop very slightly.

  The objective is to very lightly skim off the peaks on the tyres. Ideally I should see small slivers of rubber appearing on the sandpaper; I know then that the combination of sandpaper coarseness, motor speed and downward pressure is cutting the rubber cleanly.

  As the tyres get more and more true, gradually increase the downward pressure. If the rear end starts to jump around, then too much downward pressure is being applied too soon. Be careful to apply the downward pressure evenly to both tyres, otherwise one tyre could end up smaller than the other! Check that roughly equal amounts of rubber slivers accumulate on the sandpaper behind each tyre. Swing the rear end slowly from side-to-side, to prevent localised peaks in the sandpaper cutting ridges in the tyre surface.

If the surface of the tyre develops tear marks, the sandpaper is too coarse and needs to be changed to a finer grade. If shiny black stripes develop around the tyre, the rubber has overheated and smeared over the tyre surface. Stop, clean the tyre surface with lighter fuel to remove the shiny stripe, select a lower motor speed, and start again. To prevent the rubber from overheating again, lower the tyres onto the sandpaper only for a few seconds at a time, lifting in between to allow the rubber to cool off.

You can tell out-of-roundness by: (i) the rear end vibrating when it is running on the sandpaper (though don't be fooled by slivers of rubber rolling between the sandpaper and the tyre surface); (ii) the motor speed oscillating when truing the tyres; (iii) the profile of the tyre tread being blurred when the motor is running. When looking at the stationary tyres, only some of the surface will have been skimmed away.

Keep going until the tyres feel true (there is no vibration when cutting), sound true (the motor runs evenly when cutting) and look true (the tyre tread doesn't 'wobble'). Check that there is no 'wobble' at the slowest motor speed. The tread of the rear tyres should end up flat on the track across the entire width of the tyre (though this will change with use, see section 6.8). The tyre surface should have no patches and should be a uniform appearance all round.

A word of warning: cars with the relatively slow Ninco NC1 motor are sensitive to the diameter of the rear tyres. If you take too much off the tyres during truing, the overall gearing is affected and the car will be noticeably slower down the longer straights. Take the minimum off, even if it means that the tyres are still slightly out of true, as this is the better compromise for the DSCC track.

- If you have a set of callipers or a micrometer, you can check that the rear tyres are the same diameter after truing. Different tyre sizes can cause the rear end to skew sideways under braking.

- If the edge between the tread and the sidewall is sharp, this could cause the tyre to dig in and tip the car out of the slot. With the motor running, use a piece of sandpaper or a file to gently cut a small radius on the outside and inside edges of each tyre. This should allow the rear end to slide much more progressively.

- When you're totally happy, use a brush to clean out all the rubber debris from the chassis, and lubricate the rear axle bearings with a drop of oil. Fit the body and do one last skim of the rear tyres using the full weight of the car complete with the body. Then with the power off, re-check on the set-up block that all wheels touch the track, and that each front wheel lifts by the same small amount.

- With this elaborate process I still find that it takes 15-20 laps on the track to finally bed the tyres in and allow them to perform at their best. I've even heard that some racers have a special circular track with a Sandtex surface, and they run the car round and round to put a final 'cut' on the tyres!

- A useful tweak: the tyres pick up dust and debris from the track surface, or they can grain and form little 'baubles' that stick to the tyre surface. The effect is to reduce rear end grip, increase braking distance, and even cause the car to judder. To clean the tyres between races, I now roll the rear tyres on the sticky side of some masking tape, and then double-check to make sure the 'baubles' have been removed (sometimes they need picking off). Try it, you'll be surprised at the improvement this makes!

- Some clubs allow oil or other liquids to be applied to the surface of the rear tyres, to soften the rubber and give more grip. Another tweak is to apply varnish to the surface of the front tyres, to make a hard layer and reduce rolling resistance. Neither of these tweaks is allowed at DSCC.

6.10 Body

- With fully tightened fixing screws, check to make sure that the body is sitting properly on the chassis, and that it doesn’t catch on anything, trap the lead wires or tension the chassis.

- A performance tip is to loosen the front and rear fixing screws by about ¾-1 turn, allowing the body to run loose and float independently of the chassis. This seems to make the car more stable and allows it to be driven harder into the corners. If a screw feels very loose and about to fall out, cover it with a piece of tape to prevent any trouble on the track, or fit a longer fixing screw (supplied by Ninco).

If the body is *very* loose, it can vibrate against the chassis and make a very disconcerting noise, particularly under braking. I haven't found this to be detrimental to performance, though it is a little off-putting! The ideal seems to be to still have the body movement, but to have it damped a little by friction against the chassis – this gives the handling benefits without the noise!

- It is possible that the chassis will rub or catch somewhere against the body and restrict its movement, even with loose fixing screws. For example the Ninco Ferrari F50 and Mercedes CLK have the exhaust detail moulded on the chassis but poking through tight-fitting holes in the body, thus preventing the rear of the body from running loose. For the 'box-standard' classes at DSCC, we allow specific chassis detail to be cut away on specific cars, please check the latest rules. In the Modified class, the chassis can be cut away on any car to ensure unrestricted movement.

- Some of the Scalextric/Hornby models are fitted with working lights. Again, at DSCC it is permitted to remove them provided that the external lamp detail is retained.

- Some people like to repaint the body in their own personal colour scheme. If you're going to do this, (i) don't choose a colour which is the same as a lane colour, because the lane sticker won't be so easily visible to the marshals, and (ii) keep the paint as thin as possible, as you will be adding weight high up and raising the centre of gravity. It does make a difference!

- Another tweak for the Modified class is to replace the standard interior with a lightweight vacuum-formed alternative from Pendle Slot Racing. This has the effect of lowering the car's centre of gravity, and it makes a surprising improvement!

6.11 Weight

- A car's handling can be fine-tuned by adding weight and subtly altering the weight distribution. The added weight improves cornering, reduces sensitivity to bumps and makes the car more robust in clashes on the track, but it worsens acceleration and braking.

- As a rule-of-thumb if the front of the car shimmies down the straights or if the car tips too easily, add weight right behind the front wheels as far outboard as possible. If the rear end slides too much, add weight at the rear as far outboard as possible. Beware though of the pendulum effect (once all that weight at the back does break into a slide, it will be very difficult to stop!).

- Some people use plasticene when experimenting with the position of additional weight, as it is easy to move or reshape. Once you have found the ideal position, it is better to use small pieces of lead sheet to keep the centre of gravity as low as possible. I usually use Evostick to glue the lead to the chassis, so that I can remove the lead again if necessary.

6.12 Controller

- I do little tuning of the controller, other than to ensure that all electrical connections are clean and tight for minimum resistance. Adjust the pressure of the wiper button on the resistor to give a nice smooth action rather than a coarse one. With the Parma Plus controllers, also check that the brake stop and the full power stop are actually the end stops for the wiper movement. On one of my controllers a part of the casing prevented the wiper from getting to full power, until I removed the offending piece of plastic!

7. *Marshalling*

- Just a couple of points on marshalling:

  Marshalls:

  With the increasing competitiveness at DSCC, races are being won and lost on a single 'off', so it is critical to the race result that the marshall does his job quickly and fairly:

  - Marshalls should look only at their corner, and should not follow cars round the track. Have both hands ready, and don't chat with bystanders.

  - The first priority is to clear the track -- pick up car A that has fallen off, to allow approaching car B to get past.

  - If car A nerfs car B and both fall off, put 'innocent' car B on first.

  - If car B is knocked off in the process of marshalling car A, put 'innocent' car B on first.

  - Do not put car A back on where it could be hit by approaching car B (e.g. on the outside of a corner), either put car A back on in a safe place or wait until car B has got past safely.

  Drivers:

  - Do not shout or criticise the marshalls, whatever the rights or wrongs of the incident -- just remember that the marshall will do a faster job than you having to go and marshall yourself!

  - The onus is on you to stay out of trouble and to not fall off.

  - Poor marshalling will affect everyone at some point, so by the law of averages it will all even out over time.

  - If you shout at a marshall and make him nervous, he is more likely to fumble the next time!

  - And if you do get over-excited with a marshall, go and apologise to him after the race.

  - I have seen many times that a driver keeps the power on when he's fallen off. The marshall puts the car back in the slot, only for the car to speed off immediately, catch the marshall's hand and come out again. Or the marshall puts the car back into the slot extremely quickly whilst the driver is still mentally kicking himself for falling off, the car speeds off and falls off at the next corner, losing more time! It is far better to come off the power straight away, wait for the marshall to put the car back in the slot and get his hand out of the way, then start going and build up your rhythm again.

  - Finally, a nice sporting gesture I have seen a couple of times: if you fall off and take someone else off with you, and the marshall (incorrectly) puts you on first, wait for the other car to be put on before you get going again.

Well, I hope that you've stuck with this document this far and it has contained one or two useful points for you. I look forward to racing against some superbly well-prepared and well-driven cars at our regular Wednesday evening meetings! Best of Luck!

Mark Rampling