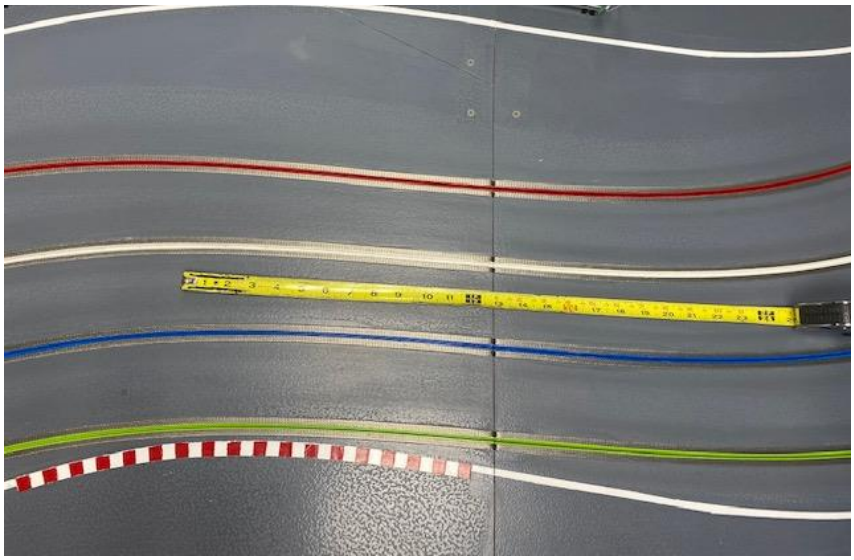
Track Design Background

When I was a Dodge/SRT Motorsports Engineer, I did some traveling for work, had kids, and other hobbies too. I couldn't commit the time necessary to build a routed layout. Plastic Carrera track meet my needs for enjoying slot car racing on budgeted time. After the 2015 Challenger Drag Pak project was launched, I left SRT Motorsports and took a job in Advanced Powertrain at FCA. This gave me more time at home to build my "dream" CNC routed slot car track. What a great experience it has been, and I hope to share my learnings and collaborate with you to build your "dream" CNC layout.

The first step in this process is to understand what makes for a great slot car layout. For some people it may be fantastic scenery, for others it is to re-create racing in miniature. However, what makes slot car racing enjoyable to me is side-by-side racing action. It doesn't matter near as much if the cars are fast or slow, as long as they are evenly paired so the racing is close. You could say this is what makes NASCAR racing so great, as you often don't know who will win until the last lap, or sometimes even the last few feet before the finish line! Great side-by-side racing starts with certain physical track attributes, the design of the layout, delivering power to the motors, and finally the cars themselves. I will step you through things I've learned to make slot car racing more enjoyable, with a few real racing examples imbedded as well.

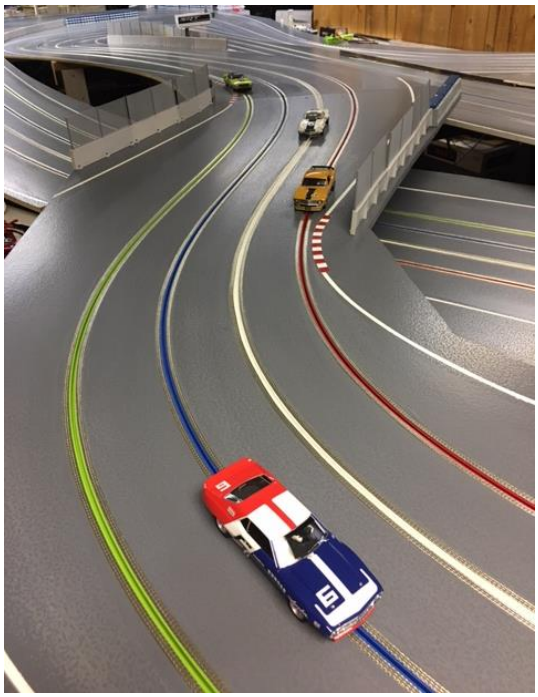
I am going to start with discussing the best plastic slot car track. Why???

- It is easier to understand and relate to.
    - Especially when it comes to "counting" turns of a specific radius.
- It is easier to show you how to "design" increasing/decreasing radius turns.
    - You can easily see the segments of each radius, and where straight sections start and end.
- It is easier to show you a variety of tracks, that you can duplicate in plastic first before committing to a CNC design.
- I can reference performance data from Model Car Racing magazine that relates to plastic track attributes.
- If you decide after reviewing all of the material on the CNC Track Design website, that you just can't commit to a fixed layout, then the following information on plastic slot car track may be helpful to you.



A CNC Track Design layout will have little "straight" track section, (unless there is an extremely long run). However, because the transitions from "turns" to "straights" are so gentle, even though this looks like less than a 2' straight section, you will be able to give your car a WOT blip through here and not de-slot. My 94' lap length CNC routed track has almost no "straight" sections, but has a very high WOT duty cycle. Meaning once you learn the rhythm of the track, you will be at WOT about 75% of the time.

The ”Racing Line” means cars will move from one side of the track to the other in preparation of “setting up” for the largest possible arc thru a corner, or the path of least momentum loss. A CNC Track Design layout will have very smooth lines, with less apparent distinction between “turn” and “straight” sections. We will design a track for you with large (6” wide) aprons so that you can pin stripe the edge of the track to add to the illusion that the cars are maneuvering across the full width of the track, setting up for turns and apexing the corners.



You can accentuate the “Racing Line” appearance of your circuit when you pin stripe the edge of the track and add kerbs. A 4 lane CNC Track Design with 4” lane spacing and 6” aprons will be 24” wide. The track image above was edged at 18”. Note the edging pin stripe was allowed to “fall off the edge”, left side of image. This is where a Driver’s station is located, and the track is slightly cut away to improve Marshalling access.

This segment addresses the track surface. The most important physical track attribute is mechanical grip, and then to a somewhat lesser degree, those that impact the design of the layout. If we make our own track surface from routing a groove in any number of different types of wood or composites, we can control the grip with surface finish, or add magnetic downforce attraction between the car and track with imbedded steel wire or magnetic braid. Note: All the modern 1/32 scale slot cars have chassis mounted magnets to improve traction and vehicle handling. If you can NOT commit space to a dedicated routed slot car layout, then you will be assembling a temporary plastic track layout from one of these current Manufactures:

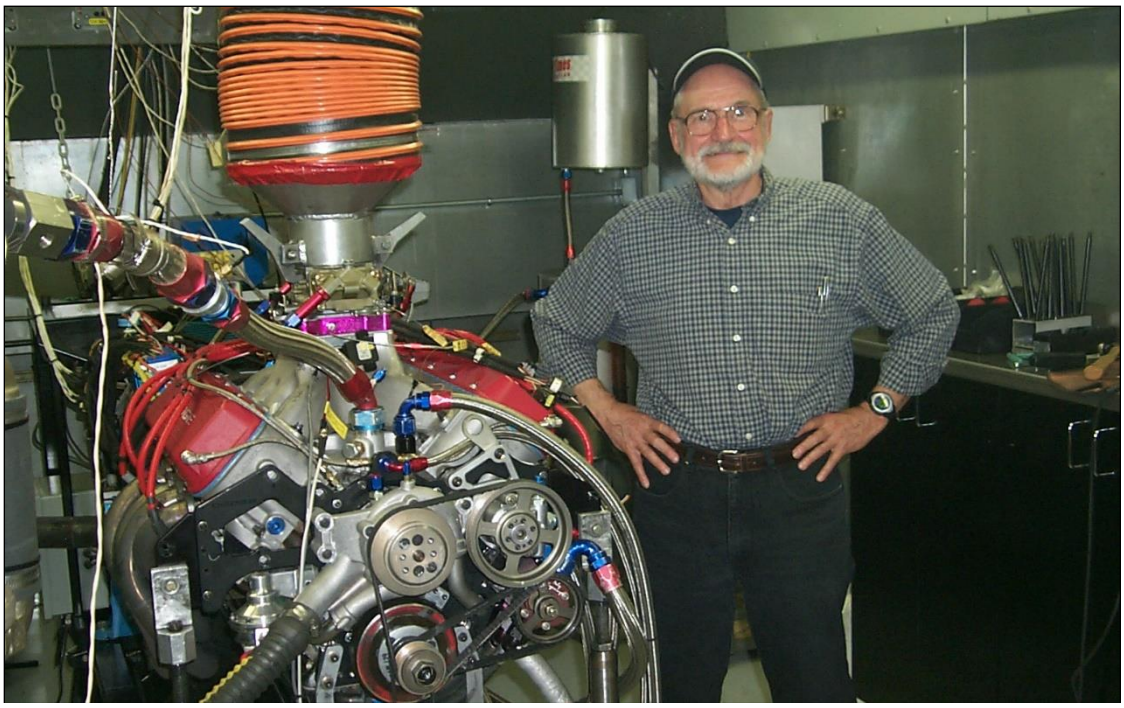
1. Carrera
2. Ninco
3. Artin
4. Sport/Scalextric/SCX

I have listed them in order of how I appraise them, with Carrera being the best and Sport/Scalextric/SCX being last. Even though I consider Artin track to be the most “toy like”, I rate it above Scalextric and SCX because they are so bad. Don’t confuse this ranking of track with track accessories or cars. Sport/Scalextric has excellent accessories, cars, and Engineers who are thinking outside of the box – evident by their digital control racing. An explanation of how I deemed the ranking of the track Manufactures follows, and why these features are important to your racing enjoyment:

Mechanical (Magnetic) Grip

What separates a good handling car and skilled driver is racing on a smooth track surface with less mechanical grip due to magnetic attraction. This is very noticeable on a routed track with non-magnetic braid. Traction becomes of paramount importance. Any run-out in the wheel/tire will become noticeable as the car will bounce or hop while accelerating. Thus, car preparation and skill become of greater importance. This is what "Racing" should be all about! Racing on a track that requires more skill keeps the racing from becoming boring.

Sport/Scalextric/SCX track sections are interchangeable and basically the same, very narrow and "grippy" from a track rail (magnetism) standpoint. The grippy or better termed "high downforce" track gives the cars greater parity in performance. Our goal is not parity, (unless you are NASCAR). Rather it is to, "Crush the Competition like BUGS!". That's an old Tom Hoover battle call, from when he was Manager of the Chrysler Corporation Race Group in the 1960's. Yea, I know I said I want parity in my cars and racing, but what I really meant is that I want the racing to be close, and *me* to have a small advantage due to car prep.



Tom Hoover, Manager of the Chrysler Race Group from the 1960's. His brain is always on the rev limiter. The success of the early Chrysler Race Group resulted in much thicker rule books from the sanctioning bodies. My FCA Management were once the young guys that Tom managed. Tom, Albert (Awesome Al) Nichols and Gary (The Racers' Edge) Congdon were retired 1960-70's era Racers who consult with me when I was in the Race Engine Group. On this particular day Tom was helping us with data analysis on a Dodge R5P7 NASCAR restrictor plate engine for Talladega. This photo was taken in one of our R & D dynamometer test cells so we can take accurate, repeatable measurements of engine performance.

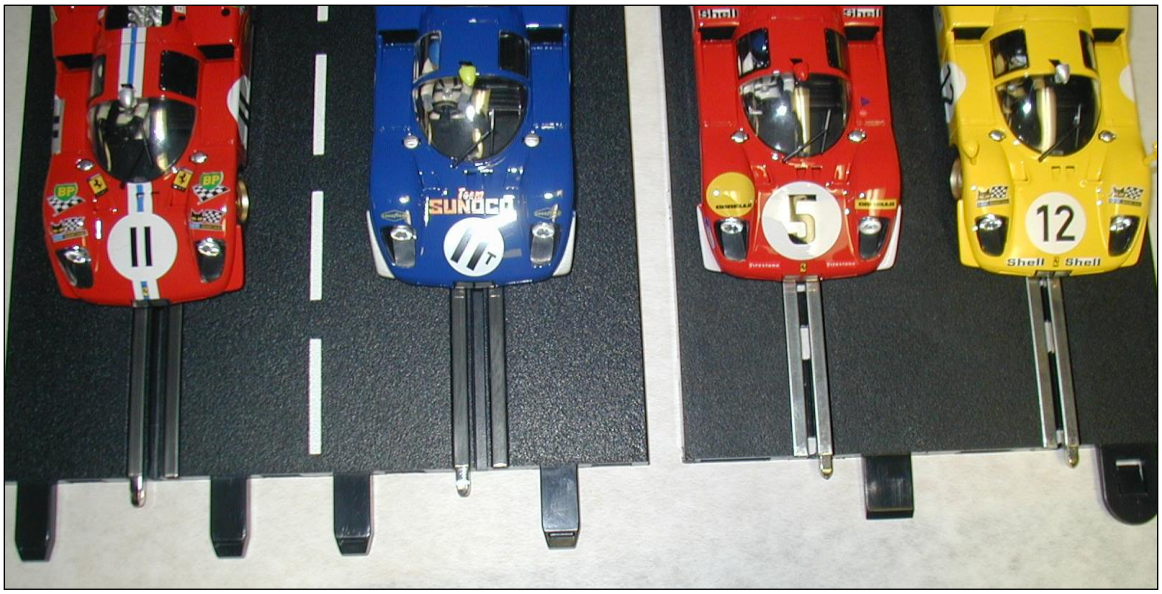
Carrera track has a greater percentage of stainless in the steel rails, which reduces magnetic down force, (reference Model Car Racing magazine magnetic downforce results in ounces, any issue). A car will quite often generate twice as much downforce on Scalextric track as Carrera. Increased magnetic downforce should result in higher cornering speeds, and reduced lap times. Thus, the reduced lap times noted between Model Car Racing magazines car comparisons between Scalextric and Carrera 36-foot Indy F1 course layouts. Model Car Racing magazine also lists skid pad comparisons between the track Manufactures, and

you will note that Carrera track generates the lowest speed results, in feet/second. Thus, Carrera track has the least amount of downforce, which requires more driving skill and results in beautiful drifts as the cars are driven on the edge of tractive adhesion through the turns.

The greater percentage of stainless in the rails of Carrera track also reduces maintenance. I rarely had to "clean" the rails on my Carrera track. Anyone who ever raced HO scale cars can relate to cleaning the high carbon steel rails with an eraser, to remove the oxidation just to get the cars to complete a lap around the circuit!

Track Width and Surface Finish

Having reasonable clearance between cars as they race side-by-side through turns allows some drifting to occur before the car on the inner lane contacts the outer and causes it to de-slot. How much clearance is reasonable? Well, I can tell you how much is not! Scalextric "Sport" track, maintains the traditional Scalextric width of 3.080" between lanes - it is the narrowest of all the brands. Carrera manufactures the widest track. Lanes are spaced approximately 100 mm apart, (I measure 3.92"). However, even with Carrera's greater lane spacing the cars will bang and "trade paint" through the turns. Note CNC Track Design uses a 4" lane spacing on fixed width layout configurations.



Four Fly Ferrari 512's lined-up on Carrera (left) and Sport/Scalextric track (right). The Sport/Scalextric track width looks diminutive in comparison to the Carrera track. Note how much closer the cars are to the edge of the track and each other! This picture also shows the interrupted slot in the bottom of the groove of the Sport/Scalextric track, which has a tendency to catch guide flags. The Sport/Scalextric has a smoother track surface texture than the original Scalextric/SCX, which could best be described as "pebbled".

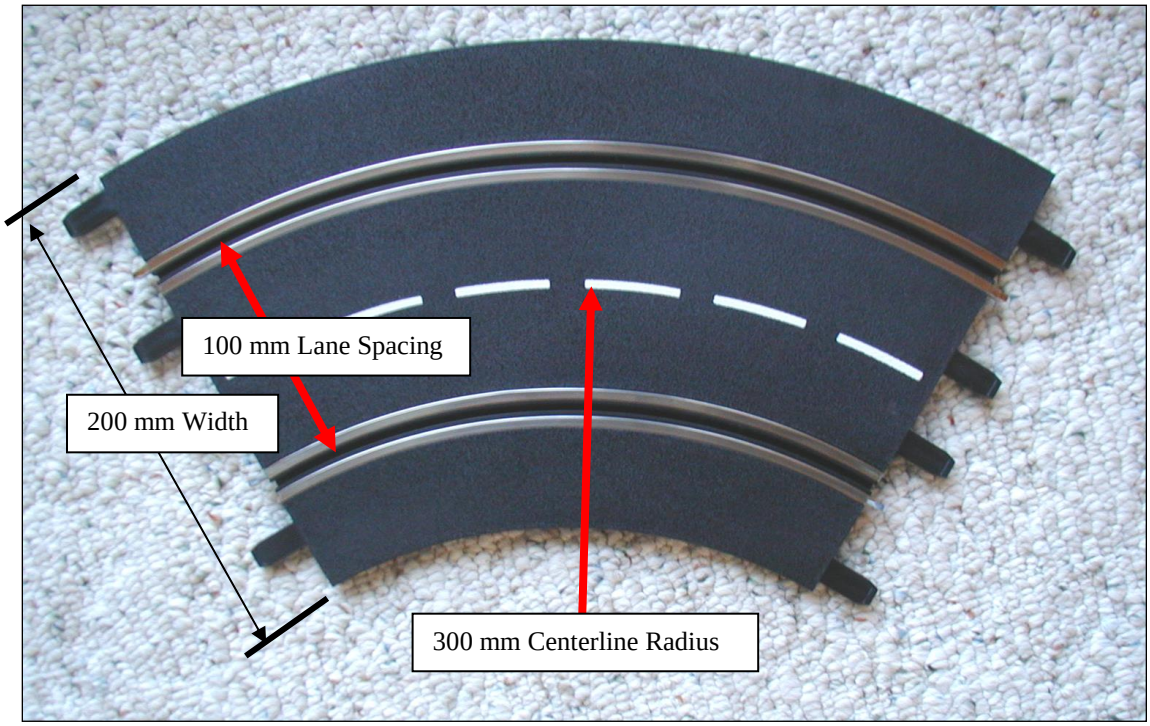
Ninco and Scalextric/SCX use a more textured track surface. It is pebbled or grainy which is noisy to race on and less predictable from a breakaway (drift) standpoint. Scalextric track is not smooth from joint-to-joint either. It tends to warp or cup, especially when nailed down, so the cars sound like they are racing on cobble stone as they bounce over the joints. It is painful to watch, especially on layouts with long straights. Carrera and Artin are both smooth and "stiff", as opposed to the others being flexible to the point of being rubbery. Thus, the rail height is more consistent with the top of the track surface. This is important for maintaining the air gap between the rail and magnet in the car. This is one parameter that determines the "ground effects" for handling.

Turn Radii

Carrera comes in 4 radii of turns, with the 'Standard' radius being as tight as I would ever put in a layout. Ninco, Artin, and the combination of SCX/Scalextric also have 4 radii of turns, but the Scalextric extra radii is one which fits inside a standard turn. An "inner" turn has an extremely tight radius that must be driven at just the right speed – too slow and the inside rear tire of the car will fall off the track – too fast and the car will de-slot. Combined with the "pebble" texture and magnetic grip of the Scalextric track, this tight radius inner turn rarely creates the fishtail or drift action that is so satisfying.

The Carrera turns are known by number series, and to a lesser degree by name. The 4-series turns didn't really have a name, so I propose that we refer to them as "Honk'n". Ninco and Carrera turns end up having the largest centerline radii due to their greater track width, (Sport/Scalextric/SCX is 159mm wide, Ninco is 180 mm wide, Carrera is 200 mm wide). Now if the Wankers at Carrera would make an even larger radii turn to fit on the outside of the Honk'n turns, people would buy a bunch of those too!

Turn Series	Name	Carrera P/N	Centerline Radius, (mm)	Centerline Length of 30 degree Segment, (mm)
1	Standard, (half)	20577 (30 deg)	300	157.0
2	Outer	20572 (30 deg)	500	261.8
3	Grand	20573 (30 deg)	700	366.5
4	Honk'n	20578 (15 deg)	900	471.2



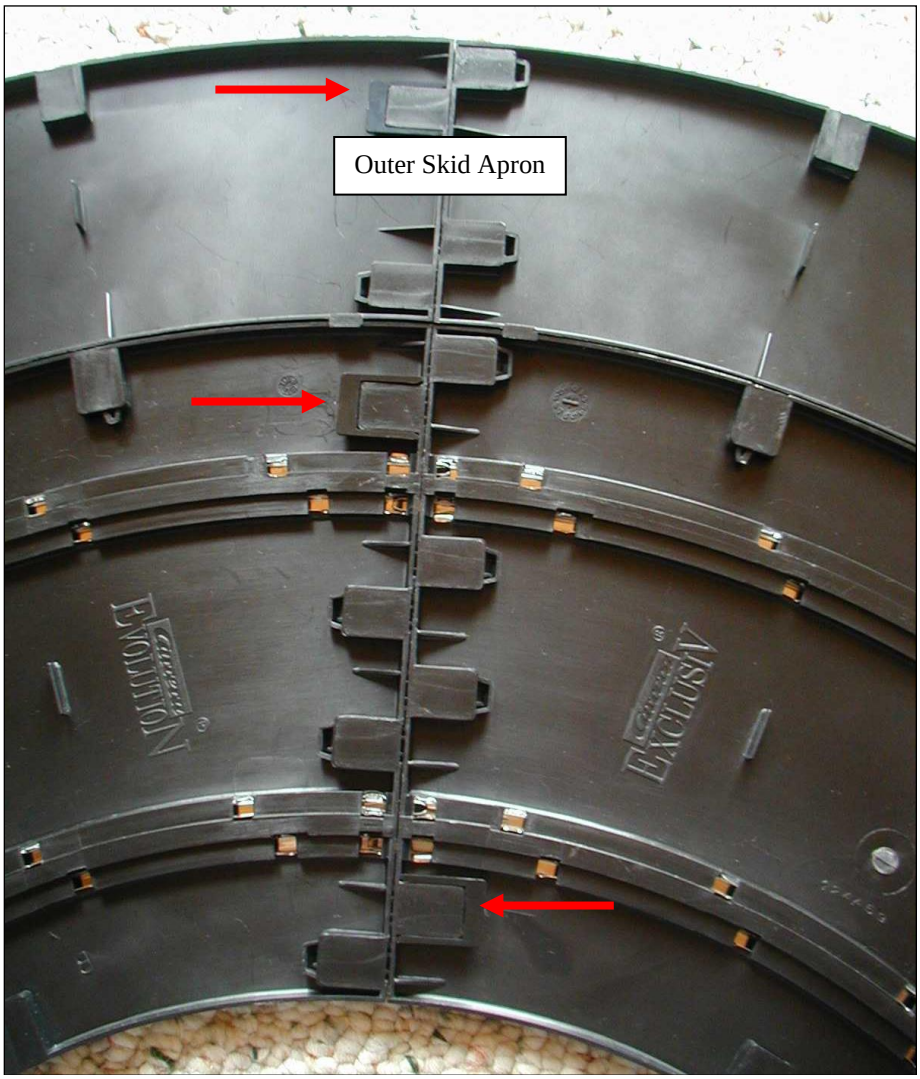
A 20571 Carrera 60 degree 1-series "Standard" turn, commonly found in boxed sets. Carrera is the widest track with greatest lane spacing. The inside lane on a Standard turn has a 250 mm radius, which is as tight as I would ever put in a layout.

The other cool thing about Carrera track is that they make banked turns in all four radii. Ninco and Artin don't have any bank turns, (what a mistake!). Many cars with large overhangs, (like the Ninco Mercedes CLK GTR), will scrape bodywork when going through the inside lane of a Standard radius banked turn.

The dragging car will not de-slot, but it just sounds bad. No matter which bank turn, all but possibly the Honk'n require momentary braking before entering the turn. If you have a car that can drive through the Grand bank turn at WOT after a long straight, (standard 14 volt set transformer), then your car is too slow!

Each Carrera 20509 straight track section is 345 mm long. Quarter and third straight sections are often required to complete a layout. You should keep multiple pairs of each on hand, P/N's 20611 & 20612.

The Carrera track assembles tightly with the supplied track clips. I have found that you really only need 2 track clips between each straight section. The use of skid aprons on the turns necessitates an extra clip for each inner or outer apron between each section. When you settle on a layout and permanently mount it, I would double the number of track clips between each section. Installing the clips just inboard of the edge of the track sections makes it easy to reach them during final track assembly. I typically build a layout in sections, (3 or 4 pieces of track at a time). It makes it easier to arrange and join the groups of sections, and figure out the lengths of straight sections to make it all work out.

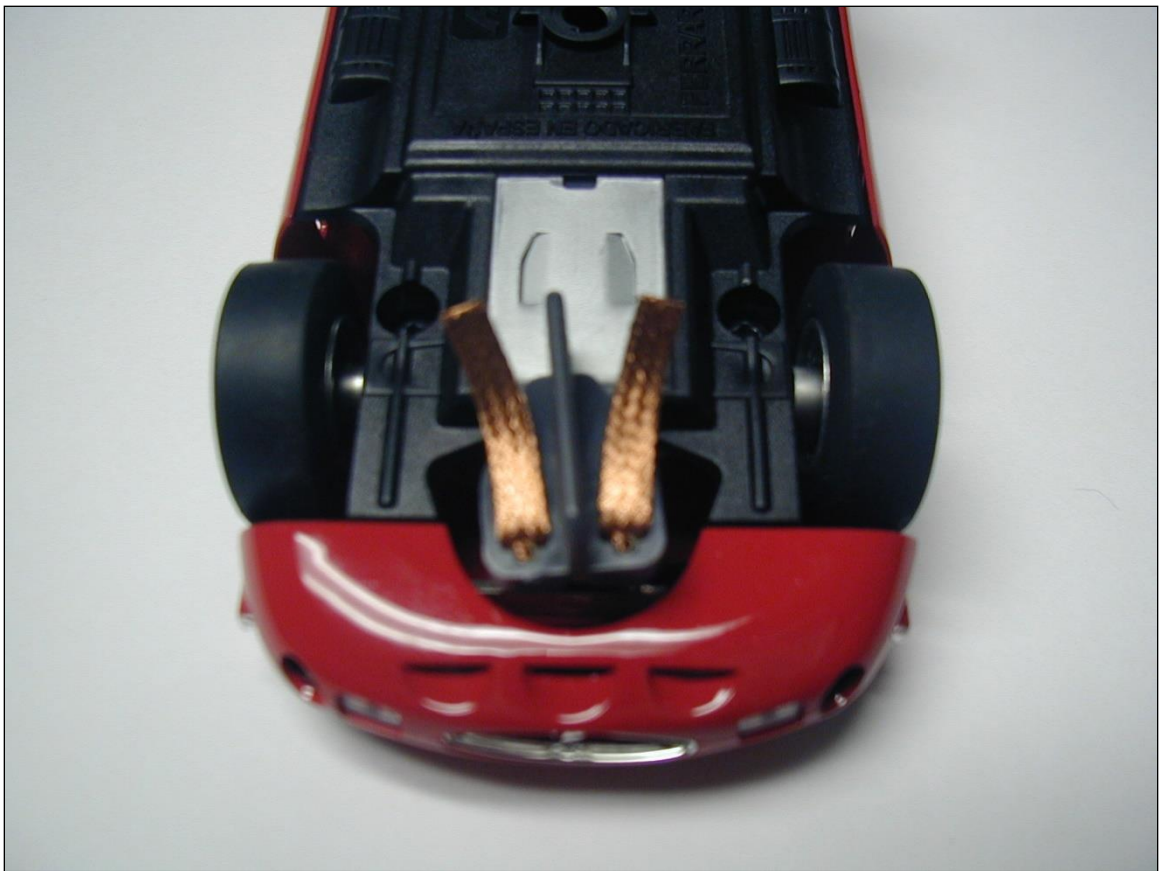


Note how clips are used along the track edge and outer skid apron to hold the joints tightly together. Turns with both inner and outer skid aprons get really wide, and hard to access anything but the edges with clips.

<u>'Da Groove</u>

Scalextric has an interrupted slot or bottom of “groove” that requires trimming the guide depth on some cars, (The guide flag of the car will catch on the bottom of the slot!). This is especially true if you are racing on a layout with an over pass (figure 8) where one track rises over the other. The Carrera slot is smooth plastic lined on all sides, and slightly wider, (0.125” vs. 0.100” wide for Scalextric). I loathe the thought of trimming guide depth so I can race on someone’s lumpy Scalextric track!

The guide width on most current slot cars measure 0.060” thick, (some Scalextric measure 0.070”), or slightly less than half the width of the groove in Carrera track. Thus, the guide will shuttle from side to side in the groove. To compensate for this, the braided wire pick-ups should be spread apart as well as arched towards the track to improve their contact with the track rails.



The wider groove and rail spacing of Carrera track requires the braid wire pick-ups on the guide flag to be spread, as shown above. Gently stretch and curl the braid into an arch. Arching the braid improves contact with the steel rails. Note molded suspension and underbody details on beautiful Fly Ferrari GTO.

Track Appearance and Skid Aprons/Borders

Talladega Tip #1. Real race tracks typically do not have “lanes” separated by a white hash, as found on Carrera track, (the exceptions being most city circuits or oval tracks).

In this regard, the other Manufactures’ track looks more realistic. Would I bother to paint the track surface to eliminate the white hash? No. It might be worth adding detail to though on a city circuit, where cement sections may interrupt the standard black top, and man hole covers and pedestrian cross walk striping would be appropriate.

Montreal city circuit with temporary concrete barriers and fencing. Note lane markings are interrupted by cross walk. Man hole covers need to be welded down so the suction from down force generated by the over passing race cars doesn't lift them. The yellow Chevron border adds some color to the surrounding grey concrete. A cheat'n Honda got between the 1998 Dodge Stratus NA Super Touring cars. Photo courtesy of FCA Photographic.

Robert Schleicher in his book "Racing and Collecting Slot Cars" states that adding borders is the most important accessory you can add to your layout. Amen Brother! (Robert Schleicher has been a huge life - long contributor to slot car racing, and has many publications to his credit.) Carrera has the widest skid aprons or borders, which enable major drift action. **Drifting a car sideways through a corner is one of the greatest spectacles you'll experience!** It is generally not the fastest way through a turn, but it looks so cool! Quite often I get so distracted watching a Competitor's car drift through a turn, that I lose track of my car and crash!

Carrera produces borders for both the inside and outside of all 4 turn radii. You should have outer borders for all of your turns, (The exception being every stinking 1-series turn that came with the set. Only get enough inner and outer borders for the 1-series turns you expect to use.). You don't need to use inner borders on turns in your layout that are continuous right or left-handed, but I think it looks better. Especially since you need to use them where ever there is a chicane, switch back, or ess turn. Building one of these S-type turns with only outer borders will result in an interrupted edge. The interrupted edge not only looks bad (unfinished) but a fish tailing car will drop the wheel off the track and deslot. Don't be a Tight-Wad…get yourself inner and outer borders for all of your turns and a fair number of straight borders too!

Inner and outer skid aprons should be used whenever LH and RH turns are linked together. Otherwise, a fish tailing car may drop a wheel off the track. Don't be tacky and mix yellow Chevron with red/white FIA borders. Take the time to paint the majority of your outer borders black.

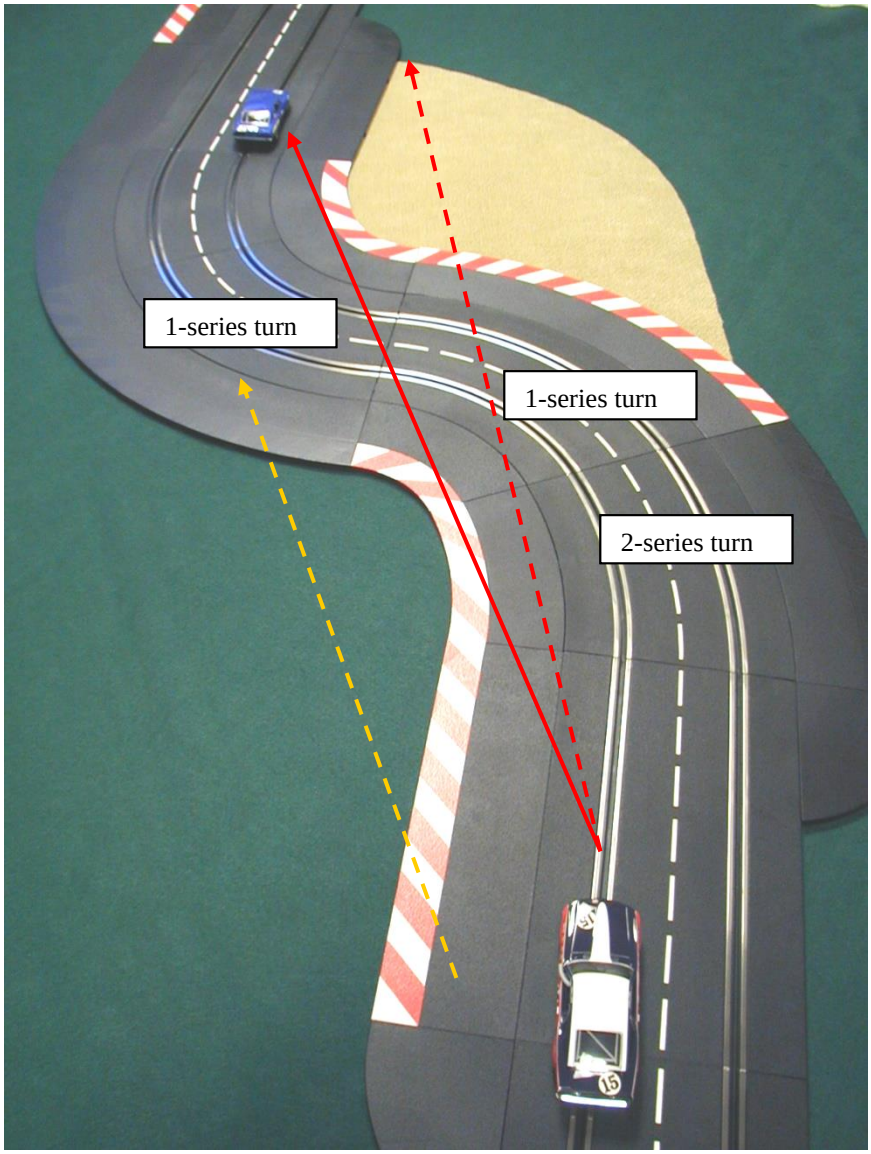
The yellow Chevron border on Carrera track looks a lot like the border at LeMans. Carrera track has the center lane stripe like LeMans, but does not have the solid track edge stripe. The Chrysler LMP and Viper practice prior to qualifying. The LMP finished 4th in 2001, Vipers owned GT-2 until we pulled our factory support. FCA photographic.

Talladega Tip #2. Most *real* road race tracks have elevated curbing on the inside of turns, with red/white striping to FIA standards. Curbing (or is that Kerbing) can be located on the far side of a turn at the edge of the straight as well.

Raised FIA curbing on the inside radius of a curve. Dominic Dobson driving the Dodge Stratus NATCC, top. Chrysler LMP at Donnington, above. Photos courtesy of FCA Photographic.

Carrera outer and 1-series inner skid aprons once used a yellow hash or Chevron, which I don't find all that objectionable. It is representative of what you find at some real circuits, like Hockenheim, Montreal or LeMans. However, the yellow Chevron does provide a strobe effect which is more tiring on your eyes.

Carrera now offers red/white markings on both inner and outer skid aprons like the other slot car Manufactures. As previously mentioned, real road race tracks typically have FIA curbing just on the *inside* of turns, and occasionally on the outer edge of a straight entering or exiting a turn. Most real race tracks also have a solid white line bordering each edge of the track. The exceptions are ovals which have the outer edge ringed with a cement or 'soft' wall, and a yellow line on the inner edge of the racing surface.



There is a bit of art in positioning colored vs. blacked-out inner and outer skid aprons. You need to look at each turn and say to yourself, "How would Parnelli Jones take this turn or sequence?". The Parnelli (15 car entering turn) racing line is straight over the curbs, (solid arrow), to get where the Donahue Camaro resides. "Wrapping" FIA curbs around both inner and outer edges of the track is typically not necessary or realistic of real racing circuits. However, the first 1 series turn is bordered on both sides to discourage the sand run off area short-cut (dashed red arrow). The leading straight has an inner border to discourage a short cut (dashed gold arrow), and the exit straight has a border in line with the racing line as well.

For many years I was on a quest to find a product that would remove the yellow Chevron from the outer boarders, without harming the plastic. The paint and goo removers tended to melt the plastic track surface. I resorted to 'Plan B' which was to cover the outer aprons with black paint. Matching the sheen of the plastic track with paint was a difficult task. Satin paints are too glossy, and flats are too dull. The desired sheen is semi-flat. After extensive spray can evaluations, I settled on RUST-OLEUM brand textured paint for plastic, black #223717. Second choice was Krylon semi-flat black #1613.

This is what happens when you don't properly clean and/or break the painted "sheen" of the track surface before painting – fish eyes! I recommend scrubbing (hard) with Rhino blue cleaner and a plastic bristle brush and then rinsing with soapy water. The tabs are masked to protect from overspray, as is the edge of the apron (not apparent in this picture). It takes multiple coats of the black RUST-OLEUM textured paint #223717 to hide the pesky yellow Chevron or red/white edging on the borders.

The only point I would like to make is that my skill level with a paint brush is nill…I'm much better with a spray can. You won't find me painting a grassy edge or changing the red FIA curbing to blue with a paint brush. The texture of the track surface makes masking an edge difficult. You would be better off to use Pactra pin stripe tape if you are attempting to add a border line.

Scalextric makes a raised FIA curb which nearly matches the inner edge radius of a Carrera 2-series turn. Setting the curbing on ¼ inch masonite gets it to the proper elevation relative to the track surface. Carrera track is 0.330 inch thick, and the Scalextric curb (or Kerb?) is 0.175 inch thick. Thus, the curb ends up 0.095 inch proud of the track surface, or slightly lower than the ground clearance of most slot cars. This is about perfect, and representative of real race track curbing.

The Scalextric curbing can be bent to match the inner radius of standard, grand or honk'n radii curves with moderate heat. Make a bending fixture out of masonite to the same inner edge radius of 1, 3 and 4-series turns, (rather than applying heat directly against your track). Grind or file the tabs off of the outer radius and bottom of the Scalextric curbing so it butts tight to the track. Using elevated Scalextric curbing gets the border closer to the car on the inner lane, for a more realistic look. However, it is a lot more work and doesn't provide a continuous width border for chicane, switch back and ess turns as using a Carrera border.

Scalextric FIA curbing inside a Carrera outer 2-series turn. The curbing can be heat coaxed to follow the inside edge radius of other radii turns. Arrows point to tabs that should be removed from Scalextric curbing to allow it to butt tight to the edge of the track. I'd paint the outer skid apron black when using FIA curbing. Stick with either a Red/White or Yellow border theme. If you choose to add a single line along the perimeter, I'd do it with Pactra or similar vinyl pin stripe tape. The textured track surface does not mask well, so a painted line will look rough.

Have I beat this to death? I know the Sport/Scalextric track comes in nice looking packaging, and they have some cool track accessories. Add their accessories to your Carrera layout! No one says you have to remain loyal to only one brand for everything. Part of the fun is investigating how each slot car track Manufacturer has modeled each feature. There will be times when you "kit bash" various items from different Manufactures. For example, you may want to integrate the Sport/Scalextric RMS (Race Management System) into your Carrera layout by using the tower and LED switches from a Carrera #71590 lap counter/timer. This would be a nice improvement relative to the reed switches that are used to trigger the RMS and come integral with the special Sport/Scalextric track section.

There are things I don't like about Carrera track too. I have e-mailed them at www.Carrera-Toys.com to note my recommendations. If more people do the same, we are likely to get their attention. Carrera deserves to be brow beat for a number of reasons, like the obscure versions of cars they model. Who finds the "Custom" or "Liberty Eagle" versions of their cars desirable? Why do they choose to do #22 and #79 versions of the 1970 NASCAR Plymouth Road Runner, when they could have done a #42 or #43 Petty version? Likewise, the #41 charger should have been the #6 Buddy Baker car. Actually, I do understand the licensing issues that Carrera and all toy makers face. Everyone wants a cut of the profits…

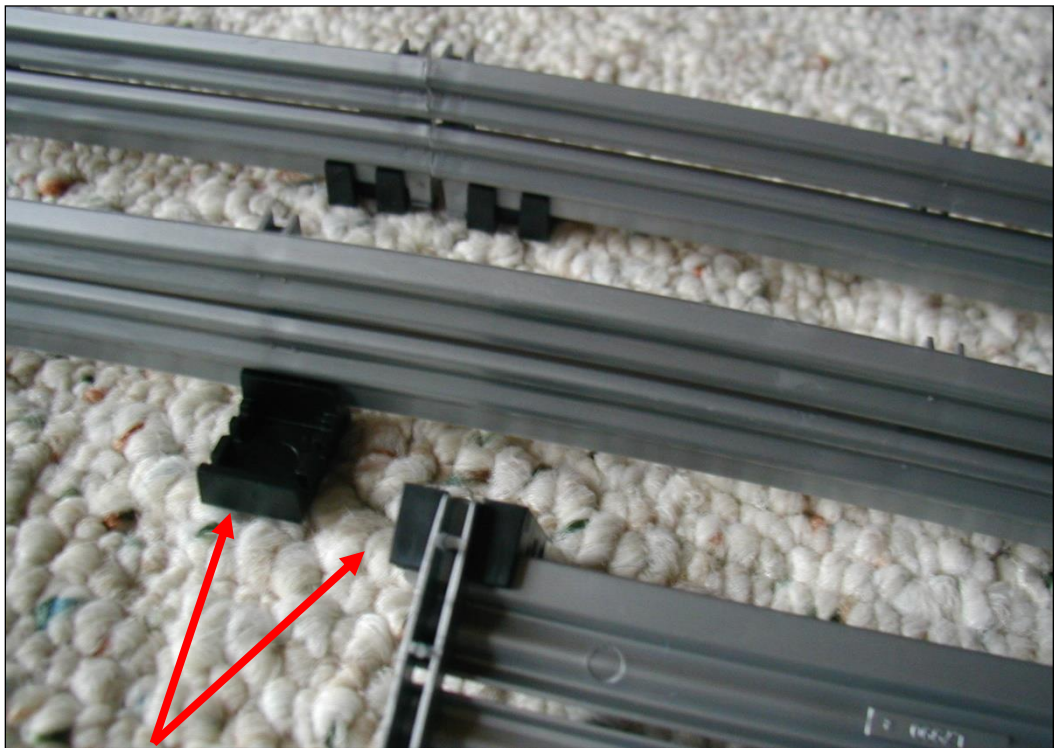
Track Accessories

All of the slot car track Manufactures supply guard rails. However, Scalextric has the most realistic 'Armco', as it comes stacked 2 beams high, is the most common color (silver), and is segmented in a decent length. The Ninco is similar, but comes in shorter segments. The guard rail clips can be installed facing towards the track (as designed), and hooked to the underside edge of the track. This will border the edge of your layout with guard rails, which is not very realistic. A more realistic usage for guard rails is to use them as a secondary barrier at some distance from the track.

Tire wall is SCX #88100 and comes with removable sponsor bill boards. Scalextric conveniently sells the "KERBS/BARRIERS/CLIPS" together as package #C8126, or just BARRIERS/CLIPS as #C8212. Get plenty if you choose to experiment with shaping the curbing and cutting to length.

Talladega Tip #3. Guard rails should be used in moderation, and at a distance from the track surface. The guard rail clips can be installed 'backwards', so they do not show trackside. Installing the clips just inboard of the guard rail ends allows the guard rails to be butted close, for a continuous look. The clips could then be attached to your table top with double sided tape, or tacked/screwed in place.

Casey Mears qualifying a Dodge NASCAR Busch Series car at Michigan International Speedway. Note armco is used at a distance from the track, as a secondary barrier to infield pedestrians. The primary barrier is a concrete wall with tall fence attached. Both sides of the track are lined with a primary barrier.



'As designed' use of the Scalextric guard rail clips. This does not allow the guard rails to be butted close. Installing the clips inboard of the end post allows them to butt together for a continuous look, (top). Guard rails are not intended for impact. Real tracks rely more on concrete walls, barriers, and lots of fencing. As a matter of fact, we will not test our NASCAR vehicles at tracks that rely on steel guard rails, (dangerous for drivers as guard rails tend to "pierce" through cars). Modern city circuits use temporary concrete barriers.

Martinsville Speedway, basically two drag strips connected with turns. Cement walls are higher than the bed of the NASCAR Craftsman trucks. Track and pit has lane markers. Note Dodge trucks qualified in first 4 positions. Joey Arrington was our Engine R&D shop, and supplied all of the engines for the above Dodge factory supported trucks. A 6.5:1 final drive gear ratio gives new meaning to the term "haul"!

Note run-off area between stacked Armco guard rails and track. Pactra's "Racing Finish" brand flexible paint for lexan could be used to color Scalextric guard rails. The Carrera guard rails are red, but so ugly I didn't even take them out of the set packaging. I was part of the Engine Team when Dodge ran the North American Super Touring Car series, 1996-8. David Donahue piloted this car. FCA photographic.

In addition to concrete walls with fencing, road race tracks typically have sand or gravel run-off areas and tire walls or barriers at logical crash points. SCX makes a nice looking tire wall in a white/blue striped pattern with removable "billboard". You could paint them any color you like using a flexible paint. Pactra makes a paint (Racing Finish brand) for lexan slot and radio controlled car bodies which works well. Be sure to buy their corresponding RC Thinner, as it works much better than mineral spirits for clean-up.

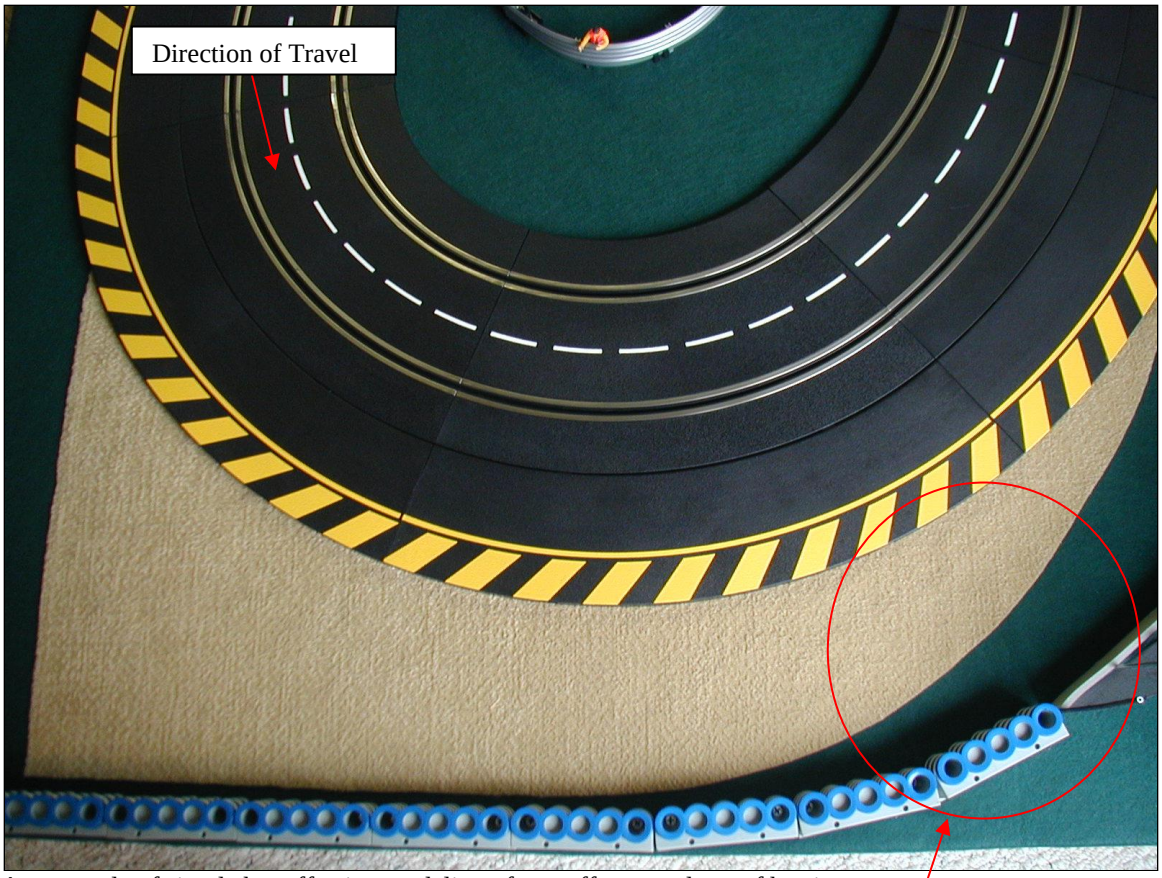
Wide open spaces, sand or gravel run-off areas, black tire wall and cement barrier in background at LeMans. FCA photographic.

Adding barriers to your layout can be relatively painless to construct and provide protection to errant cars. When I built temporary Carrera track circuits, I used green felt stretched and stapled to the underside of 1/4" or 3/8" thick plywood on top of my table as a base. I used thin plywood because it was more flexible for creating over passes and elevation changes. The felt is easy on tumbling cars and provides a grippy surface for textured fabric used to model sand/gravel run-off areas and other scenery.

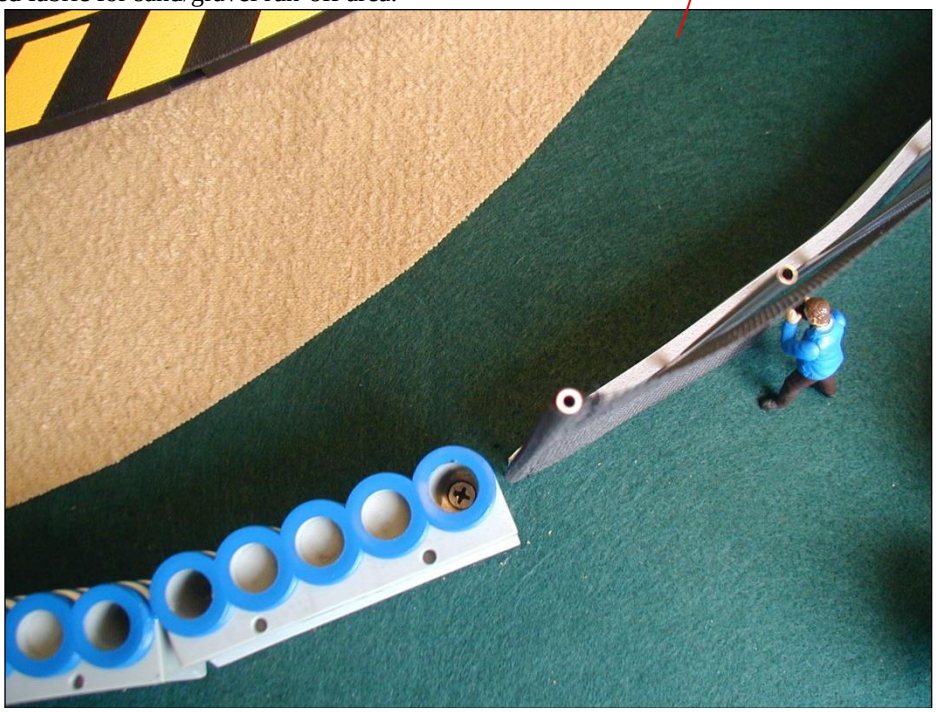
Cement barriers modeled from wood strips are secured with top of a 2"-6D finishing nail exposed so they can be easily extracted. I used rectangular wood trim for straight barriers that measures 1.36" tall x 0.41" thick. Drill a 1/8" diameter hole for the 6D finishing nail to avoid splitting the wood. For curved concrete barriers, I used truck camper mount weatherstrip closed cell PVC foam tape from Ace Hardware #85017. It has similar dimensions as the wood trim, and comes with a sticky backing that would adhere against fence posts.

I've modeled fencing using fiberglass window screen wrapped around 1/8" aluminum tube installed over 2-1/2" hard trim finishing nails. The finishing nails need the heads ground off prior to nailing them into 1/4" or 3/8" thick plywood, (the O.D. of the nail matches the I.D. of the aluminum tube for a nice slip fit). The aluminum tube is cut in 6" lengths by scribing with a utility knife, (roll tube on table while applying moderate pressure with blade to create a fracture line, and snap tube to break). After cutting the fiberglass window screen to size, you just have to wrap the screen around the last "post" and weave a stitch of dark thread to keep it tight, (see pictures).

Talladega Tip #4. The fence "posts" can be damaging to cars and should be located outside of barrier walls.



An example of simple but effective modeling of run-off area and use of barriers.
Note shape of textured fabric for sand/gravel run-off area.



Detail of SCX tire barrier showing counter sunk screws, 1/8” tube screen fence with truck camper tape barrier wall attached to fence posts. Photographer and Corner Worker are pre-painted from SCX #88320.

I use #4 x 3/8” Phillips head sheet metal screws to attach the Scalextric Armco to the plywood base, and #8 x 3/4” counter sunk Phillips flat head wood screws to attach the SCX tire barriers. I use the tire barriers in the most logical crash locations, as they are sturdy and work really well.

A larger view of the same turn showing cement barriers made from wood strips along straightaways and Scalextric Good Year tire bridge so corner workers and photographers can get to infield area. The painted wood ‘cement’ barriers are secured with top of finishing nail exposed so they can be easily extracted, (I changed my temporary Carrera track layouts quite often). The SCX tire wall and Scalextric Armco are just screwed in place. Note the a-symmetry of barriers relative to edge of track to reflect the likely hood of a crash point. The textured fabric used to model the sand run-off area is not glued in place. The green felt wrapped over 1/8” plywood provides enough grip to keep it in place.

I’m not going to go into great detail on available scenery, structures, and track side accessories from the various manufacturers, as these types of items are constantly changing. I would rather show you examples from real race tracks, and you can decide if/how to model them. More on this and other ideas if you click on the “Trackside Realism” link.

The best part about slot car racing is collecting your favorite cars. Then you have to get cars that aren’t really your favorites, but run in the same class so you can have pairs of cars to display. Then you think, “Wouldn’t it be cool to build a 4 lane layout! I’d better get a couple more Trans-Am cars, touring cars, LMP, NASCAR stockers, etc. so that I can have four from a series.” Then you start bidding on eBay to get the cars you could find at any hobby store last month, but are now out of production. No wonder our Wives/friends think we are totally over the edge!

You can find many of your favorite 1/32 scale slot cars with die cast display quality from Racer/Sideways, Fly/GB Track, NSR/Thunder Slot, Slot.it, Sport/Scalextric, Monogram/Revell, Vanquish MG, Spirit, Ninco, SCX, Pro-Slot, MRRC, Carrera and Pink Karr (generally listed in order of descending detail). In general, you will be pleased with most of the current cars for appearance and performance.

The 2001 LeMans winning Audi R8 LMP. Slot.it, SCX (and probably others) make various liveries of this car ready to race. However, some brands require you to spend money on aftermarket wheels/tires and a motor to make this (or most other SCX cars) competitive with your other cars. By now I hope you've figured out that all of the good looking photographs are courtesy of FCA.

Racing and collecting slot cars allows me to own a replica of the real cars that I can't afford, and exercise my 'racing' skills. I started collecting primarily Fly/GB Track and now have a number of cars from almost all of the Manufactures. I have run out of places to "hide" them from my Wife… Each slot car has unique qualities and is fun to race against other cars of similar performance. Experiment with cars from each Manufacture, as the variety is what keeps things interesting.

If you are willing to paint your own car, "white" kits, static model kits and resin cast bodies can be purchased, (eBay is a pretty good way to find these), and converted into a slot car. Finding the appropriate decal set really finishes the car…

A few of the "Custom" slot cars that I have made. Chevelle vintage NASCAR stocker is converted from a Carrera street car with Road Runner caged interior. 55 Chevy "Gasser" with flip front and McEwen "Mongoose" Duster Funny Car are made from model kits, with a fair amount of "kit bashing" and adaptation of Slot.it and aftermarket running components.

For me the biggest struggle is how to display all of these beautiful cars. Lining shelves or filling a display case is the easiest, but I think dioramas (like Maxi-Models) are far more interesting. Pit stop scenes or "hero card" back drops are also nice. Some of the slot car Manufactures package cars or sets of cars in flip lid display boxes. The only problem with these is that they become too valuable to race. As it is, about half of my cars are display only, the other half get thrashed on the race track.

'Hero cards' (found at Team haulers in the pits, major auto shows, or special Dealer events), racing posters and photographs make nice backdrops for displaying your cars. A Scalextric Dodge Viper in pre SRT trim.

I have found most ready to run slot cars to be very durable and provide many hours of maintenance free entertainment. I find the racing most enjoyable when the magnets are removed, and traction is limited by a set of slip-on rear silicone tires. Get a good power supply and turn the voltage down to 9 VDC +/- 1.5 for the range of stock cars we run and you will have a blast!

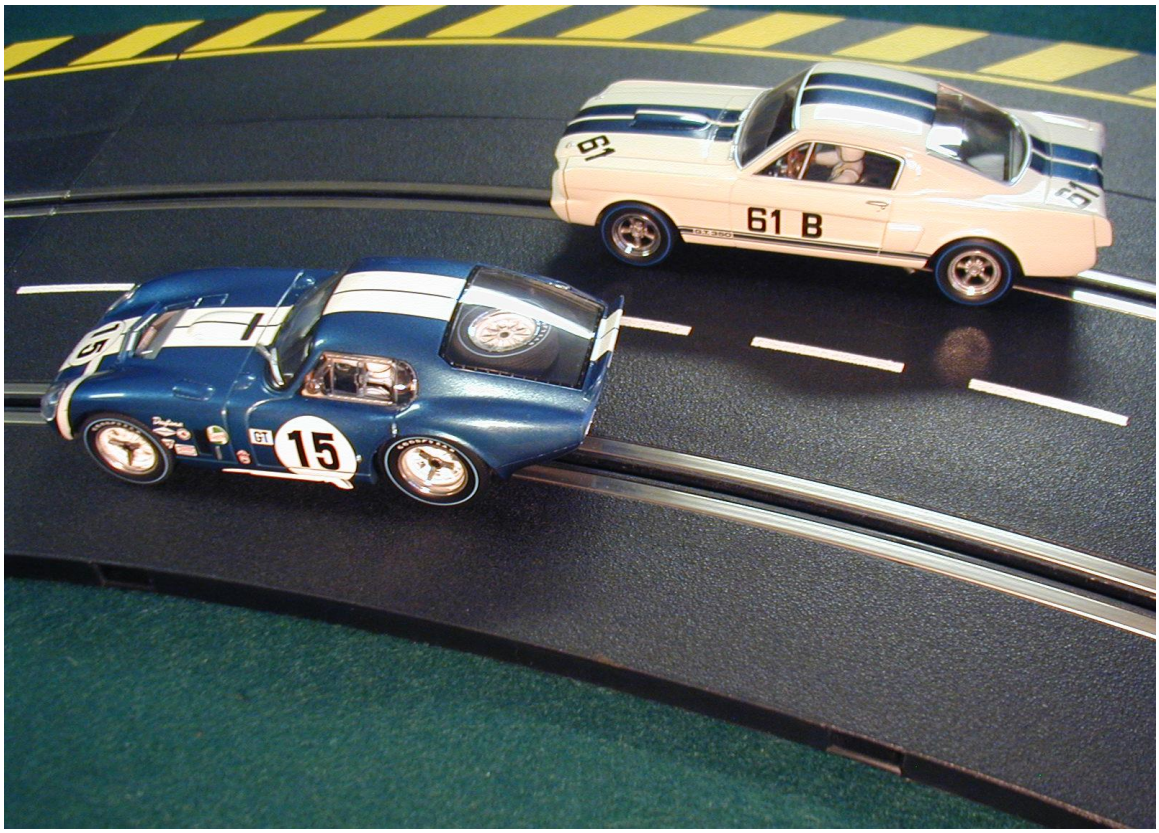
I hope by now you are hyped-up on caffeine and sugar, sitting among your favorite slot cars, ready to design and construct your own custom CNC routed slot car layout. Please continue reading my mole skin jacket wearing friend … we're finally getting to the good stuff!

Those of us in the SE Michigan Slot Car Racing Club get to race on some fantastic routed tracks, like Ray Newbauer's shown above. Ray retired from FCA as an Engineering Prototype Machinist, and his usual attention to detail and precision shows on his layout. Everything is dead straight, smooth, and perfect. Needless to say, a lot of time was spent building this layout! Some of the "Hardcore" slot car celebrities in the Detroit, MI area. Left to Right: Paul Coppin, Ray Newbauer, Rich McMahon, Doug Sloan, Jimmy Attard (Northline Raceway), and Andy "Professor Motor" Smith.

Speaking of Jimmy Attard, his "Northline Raceway" and James Harlan's "White Lake F1 Ring" are two of the most fantastic AC2 raceways ever designed! Look them up on the web. Their attention to scenery detail is excellent and a model for us all.

I was originally planning to make an AC2 raceway as well, but learned after numerous visits that the interrupted AC2 power delivery has a detrimental effect on motor life, (brush arcing, heat). Plus, the basic premise of AC2 and digital racing is to re-create Motorsports in miniature, meaning more nose to tail racing with options for passing. (For a description of AC2, go to the AC2Car website.) I found greater satisfaction from conventional slot car racing where you can be wheel-to-wheel with your opponent. Many of the races at my house come down to "photo finishes" where it is hard to tell who won! Can't get any more exciting than that!

Slot Car Layout Philosophy



This Dodge Boy collects FoMoCo product too. Beautiful Monogram Cobra Daytona Coupe and Mustang GT350.

Track ***Rhythm***, (rith-em) *n*. 1. A movement with a regular succession of strong and weak elements. 2. A constantly recurring sequence of events. 3. Long periods of WOT finger position and distinct braking points with modulated throttle skill enhancing switch-back turns. Allows for consistent driving on the edge of tractive forces and close side-by-side racing. Periods of short trance-like concentration are broken by shouts of "I'm in the groove!" followed by much laughter when someone finally crashes.

Some track layouts are easier to drive because they have a good rhythm. A layout with equal lane length and speed lane-to-lane is challenging to design. My layouts are generally a modified form of a figure 8, which is necessary if equal lane length is a priority. If you design a track layout using the following recommendations, it will have a greater chance of having good rhythm and equal lane speed. **These seven recommendations are key to a successful slot car track design**!

<u>Track Layout Recommendations</u>

1. **Keep straight sections as long as possible.**
2. **The entrance of each turn should be in the opposite direction from the last.**
3. **Use an equal number of right and left hand turns of each radii.**
4. **Create increasing radius turns that feed onto long straights.**
5. **Make each turn or series of turns on the layout unique.**
6. **Make a modified version of a figure 8 to equalize lane lengths, (providing recommendation #3 is met).**
7. **Use larger radii turns whenever possible and group tight turns together.**

Keep straight sections as long as possible.

Recommendation #1 is obvious. If you can fit a 30 foot long main straight in your hobby cave, do it! If you can't, I'd suggest you move and look for a home or carriage house style garage that will allow layout design freedom. For some reason, home builders always want to interrupt a nice long wall with a door way in the middle of it. Super Idiots! They do not have your interests in mind. I generally build island style layouts, so doors and things around the perimeter of the room are still functional. Sometimes being able to store your layout is helpful, like when out-of-town folks are visiting with grubby handed kids. Hopefully your hobby cave has a locking door, to keep snooping kids and Spouses out.

The entrance of each turn should be in the opposite direction from the last.

Turn, (tunn) *v*. 1. To aim or become aimed in a certain way. 2. Single change in direction. Turns are either right or left-handed relative to the forward direction of the car. A right hand turn with a straight section and another right hand turn is a segmented turn, which in reality is two turns.

Recommendation #2 is difficult for the uninspired, who are trying to fill up a couple of 4' x 8' sheets of plywood with the most track possible. They tend to border the perimeter of the available space with track, which means a segmented series of turns all in the same direction. This type of layout has poor rhythm because it is difficult to extract speed from the short sections of straight tracks that link like handed turns. Also, these types of layouts have portions where one lane is much faster than the other. So side-by-side racing of two equal cars/drivers doesn't happen, instead the car in the outer lane falls further behind.

Talladega Tip #5. To fit a track layout into a rectangular space, and keep recommendation #2 may require that the main straight be angled. This will make for a more interesting looking layout too.

If a straight between two like handed turns is long enough, then it doesn't seem like a segmented turn. A minimum length of 3 Carrera straight sections allows a WOT stab between turns. Though this section between like handed turns won't seem as much like a segmented turn, the car on the inside lane will have an advantage, (shorter distance) unless one of the like handed turns is an entrance to a chicane or S-turn.

Use an equal number of right and left hand turns of each radii.

I literally go through a layout and count the number of segments of each radii turn and note if it is right or left handed. A layout with equal lane length will have equal numbers of each radii segment of right and left-handed turns. Granted, you may end up using a standard or grand radius turn in a spot that you really didn't want to for the numbers to match, and this is the trick to making a truly slick layout. You want to put the large radius turns where they are going to do some good, like before a long straight section or in a chicane. **A 'turn' is counted for each 30 degree segment**. Every blue moon I violate this recommendation, if after testing a layout, I find one lane to be easier to drive. Then I may change some turns to increase the overall difficulty of the layout.

Turn counting template:

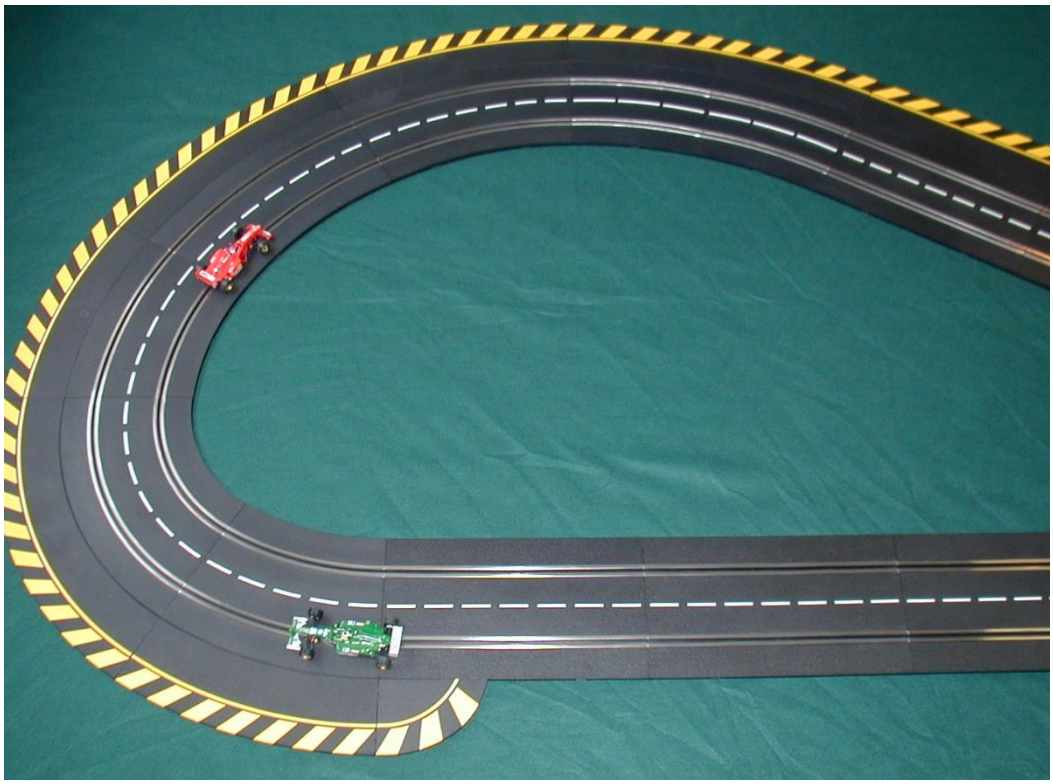
Radii	Left Hand	Right Hand
1-Standard		
2-Outer		
3-Grand		
4-Honk'n		

Note: A 60 degree Standard turn counts for '2' turn segments. Conversely, it takes two pieces of 15 degree honk'n track to make '1' turn segment.

Create increasing radius turns that feed onto long straights.

Always try to fit a grand or honk'n radius turn before a long straight section. It allows the driver to "lengthen" the straight by getting to WOT earlier. What we want to do is design slot car layouts that take into consideration the "racing line", (this will get discussed in greater detail in the next segment, so just roll with me). Meaning we want to 'soften' the entrance and exit of each turn with larger radii segments.

Decreasing radius turns are very difficult to drive through fast. They require modulation of the throttle which usually doesn't happen fast enough (it's hard to lift the throttle when racing side-by-side) and results in a car which exits the course. Drifting a car *into* a turn is difficult. It requires late braking, and time is usually lost while admiring a sweet drift before getting back on the throttle. Build a 180 degree turn using 2 grand sections, followed by 2 outer sections, and one 60 degree standard turn, and you'll see what I mean. It'll be a Crash-O-Rama during the heat of competition.



A Ninco Ferrari leads an SCX Jaguar F1 through a typical "racing line" turn. The entrance is 'softened' with 30 degrees of 2-series turn before decreasing to 60 degrees of 1-series standard turn. Braking for this turn should have started on the straight and continues through the decreasing radii segments. The Ferrari is on the increasing radii part of the turn, made up of 30 degrees of 2-series, 60 degrees of 3-series, and 30 degrees of 4-series turn segments. The driver of the Ferrari is accelerating by progressive squeezing, (or what we call 'rolling'), into the throttle. The car on the inside lane usually has the advantage getting around the turn quicker due to the shorter lane length. Driving through this turn 'backwards' would be a decreasing radius turn.

Make each turn or series of turns on the layout unique.

A layout is most interesting and challenging when each turn is unique. Real race cars don't complete turns like they are of a constant radius, so reflect this in your layout. If turning 180 degrees or more, it is best to add some difficulty to the turn by having a radius change. The radius change doesn't always have to be incremental. A good example is having a 180 degree standard radius U-turn with a grand radius exit onto a long straight. The next section has plenty of examples of unique turns.

Make a modified version of a figure 8 to equalize lane lengths.

A layout with equal lane lengths eliminates some (not all) of the whining among competitors. Even if your organized form of racing means you spend even increments of time and rotate to each lane, equal lane lengths are of just as great importance, because everyone wants an equal chance of winning on each lane!

It is possible to have a cross-over in a layout and not have equal lane lengths. Many of the HO scale Tyco boxed sets were like this, where the layout was all right-hand turns. How Moronic! This mistake will be averted when you count and balance the number of right and left-hand turns.

A layout that is mirror imaged will have equal turns, lane lengths, and potentially good rhythm. Albeit, it potentially will be less interesting than one where each turn is unique.

Use larger radii turns whenever possible and group tight turns together.

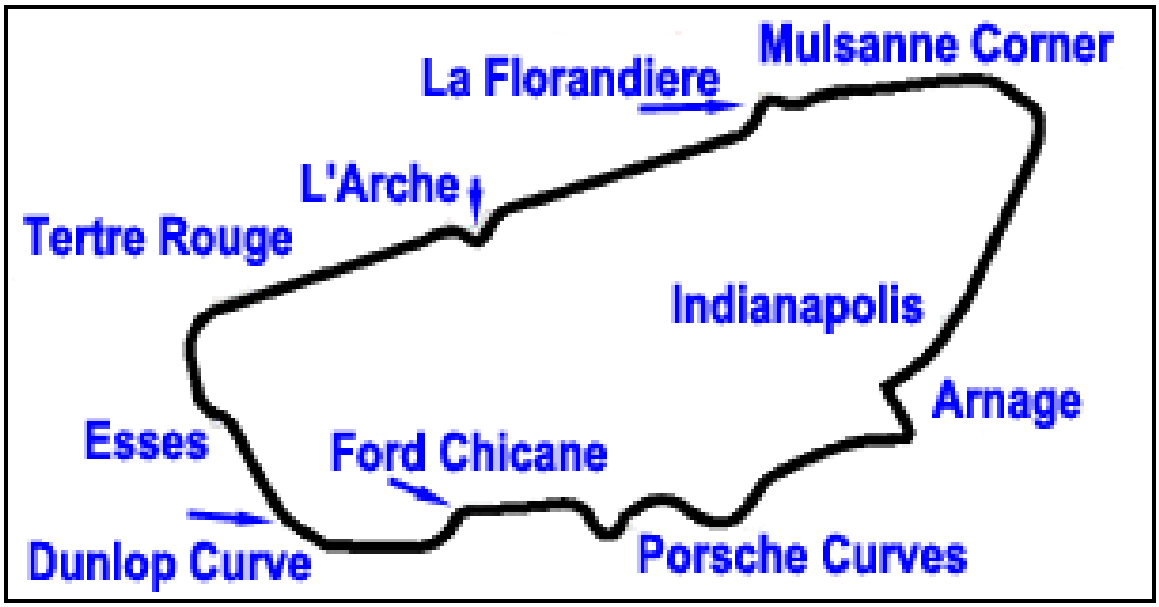
Don't feel compelled to use every stinking tight radius turn you own, just because it came with the set! Obviously tight radius (standard) turns have to be driven slower. Surprisingly, it is relatively easy to learn a braking point after a long straight to negotiate a hairpin curve. Standard radius chicanes are very difficult, especially in the middle of a long straight. If you choose to put a chicane in your layout, bias it towards the slower end of a straight section.

Parts of your layout will be slower, based on the number of turns and their radii. Locate the slower sections of the layout where marshalling of errant cars will be within easy reach. This may mean putting hairpin or chicane sections within reach of the drivers, if you don't expect to have people standing around as Marshals.

Some of my Dodge Motorsports Engine Group co-workers @ Daytona, 2001. What they lack in good looks, they more than make up for with unique character! Actually, these guys are very talented and were a joy to work with. Left to Right: Dave Eovaldi, David James and Roger Doll.

Talladega Tip #6. Slot car layouts that are supposed to be scale models of real race tracks usually stink.

Don't try to build a miniature version of Daytona, Long Beach, or LeMans. Carrera does not make the proper turn radius for the front D of Daytona, the tight turns replicating Long Beach would be a drag, and LeMans would be huge and difficult to marshal.

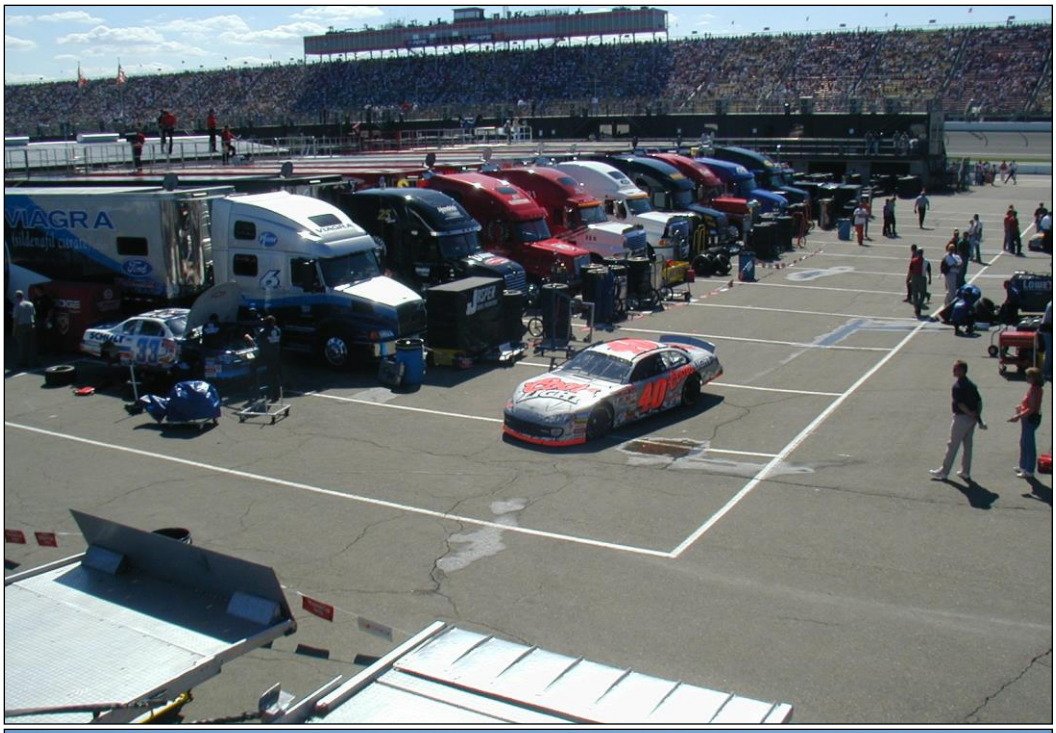


LeMans is 8.41 miles = 44,405 feet x 1/32 = 1,388 feet!

You could build a modified figure 8 loosely based on Suzuka, or a hilly road course like Sears Point or Spa, Belgium. The old California Riverside course was nice because it didn't have a lot of segmented turns. A few real race tracks that adapt best to a slot car layout are shown in the track design section. Some are heavily modified from the "real" circuit to make them race better. Since few real circuits have overpasses (rule #6), many are shown with cross-over track sections to equalize lane length. Note: I almost never built plastic circuits with cross-over track sections, and I would not advocate them on a routed track either!

Sebring is shown as an example of a track with lots of segmented turns that I couldn't equalize lane lengths with a pair of cross-over tracks. (You want to put cross-over tracks where they make sense, like at the entrance of hairpin turns where passing often takes place.) Sebring, and other real circuits with lots of segmented turns, end up being crash prone when modeled as a slot car layout. This is primarily due to the difference in corner speed that will accumulate with consecutive like handed turns. The Driver of the car in the outside lane will see their car falling behind (since the inside lane is shorter and typically faster). So if you are attempting to race side-by-side, the Driver in the outside lane will overdrive and crash in an attempt to keep up. We are talking human nature 101. Sorry, but I don't make this stuff up, or know of any way to fix this. I don't have any discipline either.

I know a lot of people wish to replicate their favorite track in miniature. **However, I think you will be disappointed with how it races, (no rhythm).** Rather it is best to just make your own layout not based on any particular real track. If you want your layout to look like a particular track, do so by using ground cover landscaping indigenous to that area. However, most of the real race tracks I visit are mostly parking lots and campers.



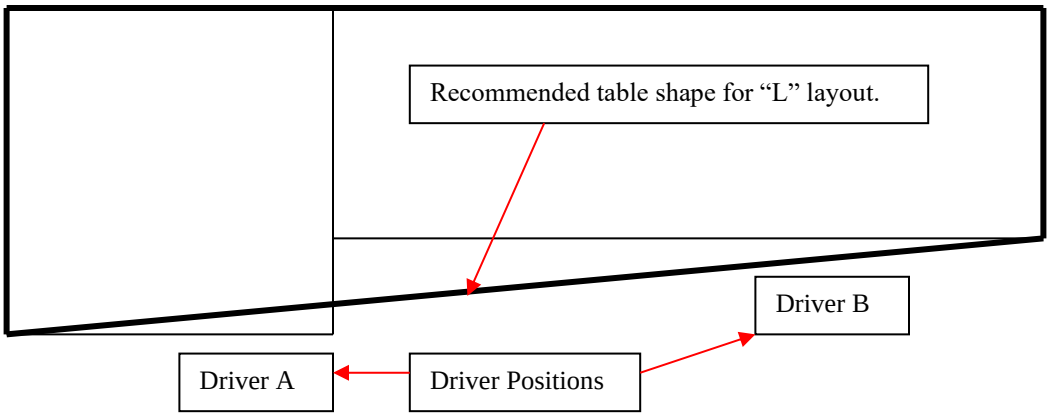
The infield at Michigan International Speedway, hauler top views. What did I say, parking lots and campers…

Ahh, Home Sweet Hauler. A place to seek refuge from all of those autograph hounds. Candy bars are in the upper left drawer, under the microwave. Two cars fit nose-to-tail above this work space. The race engine in the middle of the hall receives some TLC before replacing the qualifying engine in the car, (no longer allowed since 2002, as we now have to race the same engine all weekend).

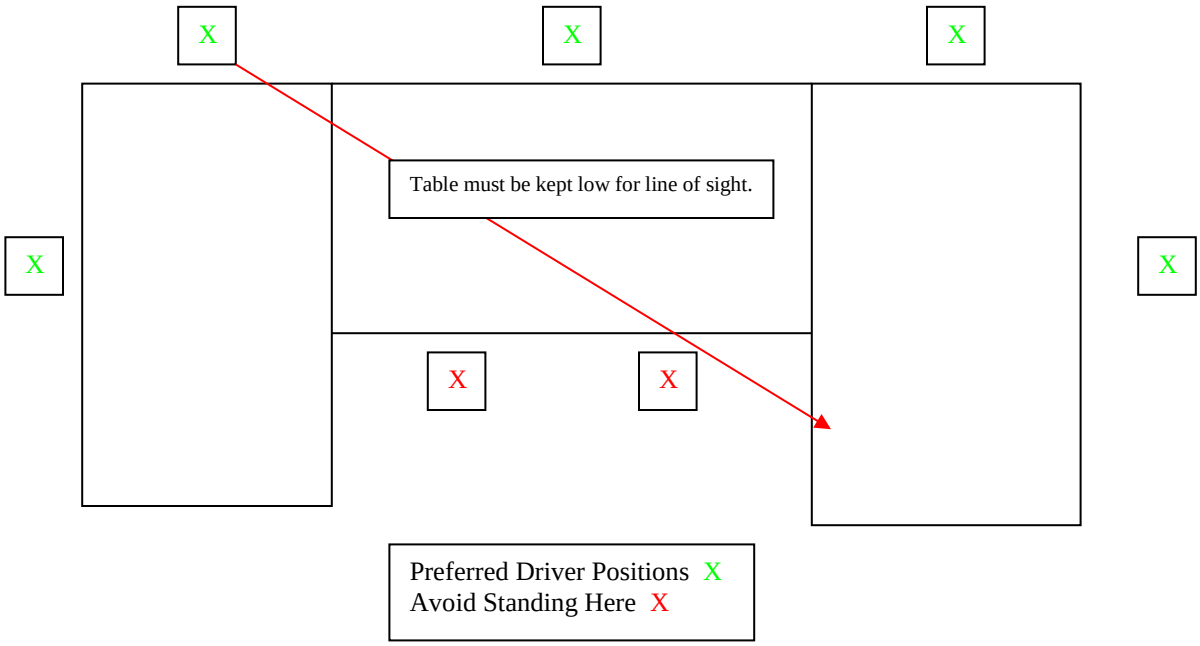
When you build a table for your layout, it is tempting to butt it against a long wall. This gives it stability, when your hefty weight friends lean against it to retrieve an errant car. However, it forces you into a very narrow layout, as reaching across a 10 foot wide table is almost impossible. Think instead of building your table as a peninsula, attached to a wall on an end, so you can walk around most of it and retrieve cars from three sides.

This isn't about constructing tables or how to create scale model scenery. There are plenty of model train-based books and you-tube videos for that. So attached are plan views of just 2 tables to get you thinking about a line-of-sight view of the entire track for the competitors.

Talladega Tip #7. Don't wrap the layout around you, it makes for blind spots.



A good way to avoid blind spots is to create a straight border for the Drivers to stand along. The L-shaped table (graphic) was modified to the dark edged profile. This allows Driver A to have a line of sight to the far-right end of the track. If Driver B is allowed to step closer to the edge of the original L-shaped table, his fat belly will block the view of Driver A. 'C' or 'U' shaped tables are the worst for this, so avoid standing in the locations noted with a red X. Even then, the table must be kept low so that edge borders (if used) do not block the line of sight of the Drivers.



Now that you are armed with the rules of slot car layout design, don't skip right to designing your own track. Instead read the next segment to get some ideas on how to construct unique turn elements.

Turn Elements

Fly makes a faithful reproduction of this 2001 Viper at LeMans. Ref.: A203. FCA Photographic.

As noted in the layout philosophy segment, a "turn" implies a change in direction. When you say to your Buddy, "Slim, hand me one of them there turns.", what he should instinctively do is hand you a 30 degree radius piece of Carrera track. Note that 30 degrees of a 1-series track section is called a "half", due to the standard being 60 degrees like those found in boxed sets. Two and 3-series turns only come in 30 degree bends. A pair of 4-series turn sections are required for a 30 degree bend. Thus, the minimum change in direction with Carrera track is a single 15 degree 4-series turn. A turn "element" is a combination of track turn pieces that are grouped together.

A turn-straight-turn where the turns are in the same direction is what I call a segmented turn. A lot of people end up building segmented turns into their layout to make things "fit". They are either trying to fill an available space with track, or make the two ends of the layout meet. I find segmented turns annoying and a product of poor planning. Many real race tracks have segmented turns, and a lot of them! Examples of some famous tracks with segmented turns are A-1 Ring (Austria), Elkhart Lake (USA), any city circuit or airfield like Sebring (USA). This is the reason why I don't think most real race tracks make for good rhythm slot car layouts.

Your brake point on the straight before the turn will determine if your car will make it through the turn. Too late a brake point and your car will understeer or roll out of the groove after traveling through about 45 degrees of any turn. If you are lucky, your car will oversteer drift until slowing enough to get back in a neutral track position. It is almost impossible to dig back into the throttle whence assuming the neutral position, so time is lost through the turn.

Your minimum corner speed will determine how fast you can make it around a turn, and around the circuit in general. **Thus, vehicle handling is the primary factor for a fast car, whether it is a slot car or real race car,** (Don't know why I did not make this key statement a Talladega Tip!).

Constant Radius Turns

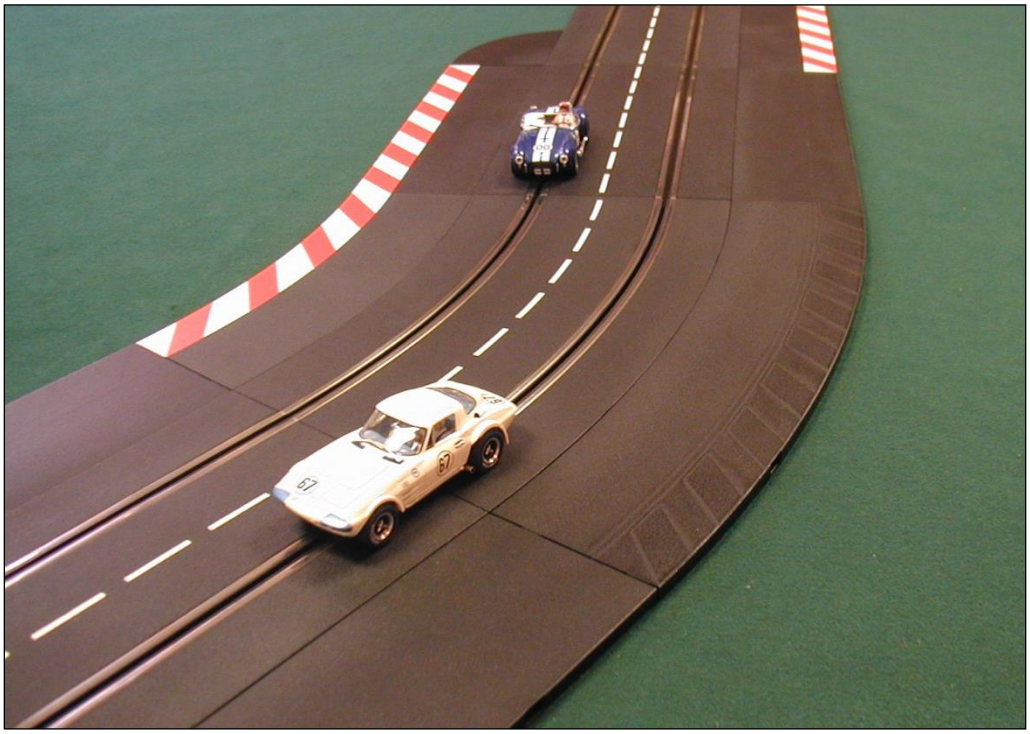
A constant radius turn is one made completely from the same radii of track. One would think that a constant radius turn would be the easiest to negotiate, but you will find this is not true. You never really go all the way through a constant radius turn at a constant speed. You will slow into the turn, and then accelerate out. Entering or exiting a constant radius turn is a likely crash point. If the turn is 180 degrees or more, you will be forced to have essentially a constant average speed through the turn. This is not very race-like. Racers drive a corner or series of turns to utilize the "racing line". The width of the road is used to minimize the steering input angle and maximize vehicle speed at the apex of the corner. An easy to read book on this subject with racing line examples is "Competition Driving" by Alain Prost, Motorbooks International.

Talladega Tip #8. A constant radius turn made from grand or honk'n radii segments should not be used for more than 120 degrees. Otherwise, the car on the inside lane will have a faster route, taking away from the side-by-side racing factor. The exception to this rule is a bank turn, which I usually build as a constant radius. Why? Because the speed differential through a banked turn is reduced, and a big grand radii bank turn looks cool!

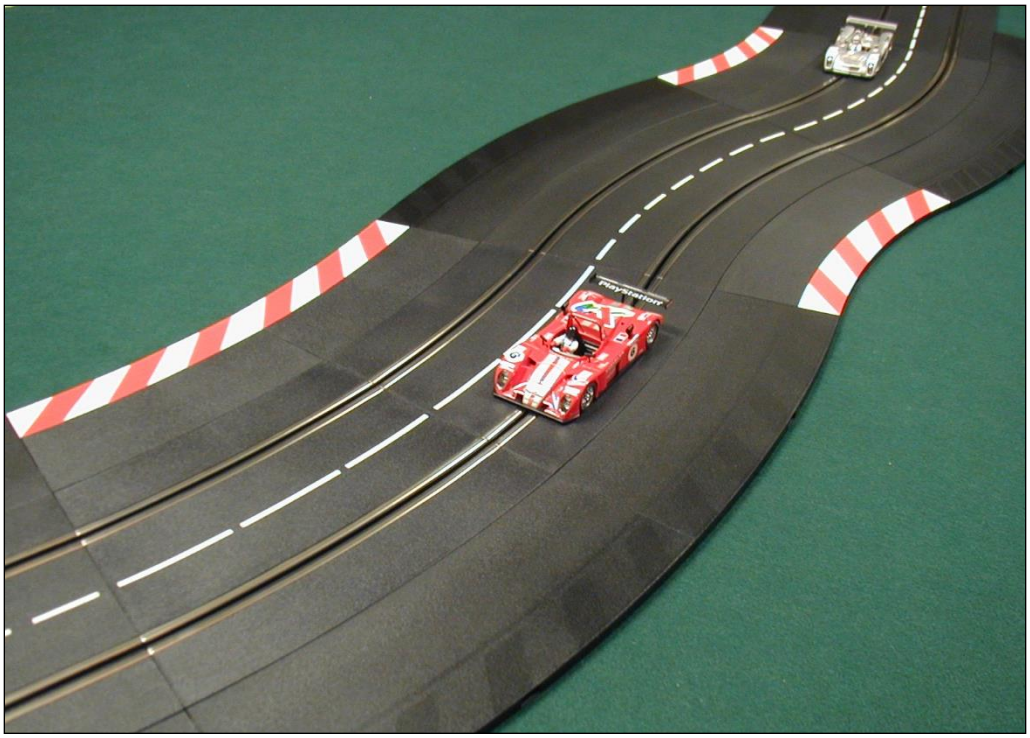
Talladega Tip #9. A bank turn without skid aprons is far more challenging! It therefore must be driven at the proper speed with less margin for error.

Talladega Tip #10. A 90 degree or less constant radius turn made from standard radii segment(s) is a guaranteed crash point. This is especially true if there is a decent length straight before the turn. In the heat of a race, it is difficult to control one's desire to catch-up. The result is a missed break point.

Examples of real race circuits with a 30 degree constant radius turn after a long straight include the first turn at Pau (France), Turn 7 at Nurburgring (Germany), and even the infield "Kink" at Daytona (USA).



A limited edition Revell/Monogram 1963 Jim Hall Corvette leads Ken Miles in a MRRC Team Shelby Cobra through 30 degrees of a 3-series turn. Looks simple, gentle, and easy to negotiate…don't believe it! A kink like this is a guaranteed crash point, no matter what radius it is built from, especially after a generous length of straight track.



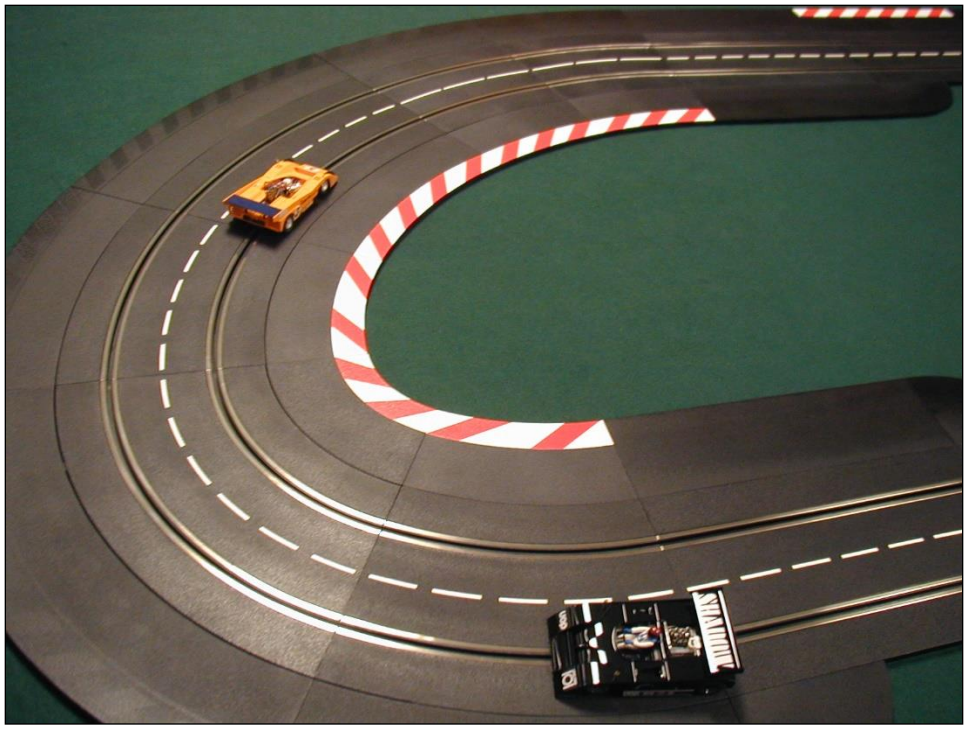
A much better alternative to a single 30 degree change in direction is this fast chicane made up of 3 and 4 series turns. It still results in a 30 degree change in direction, but your brain will assess this as a difficult turn sequence and force your finger to lift momentarily from the throttle trigger, (especially if it is *your* car at risk). Don't ask me how this works, but it just does! A couple of 2000 LeMans Prototypes, Scalextric Cadillac being led by a Spirit Chrysler, blaze through it. Note that most of the FIA striping on the borders has been painted black, including the start/end pieces. Too much striped border will make your layout look like the Circus was in town, and have a strobe effect on your eyes. You can see I need another coat of paint or two to hide the original yellow Chevron on the outer borders.

Changing Radius Turns

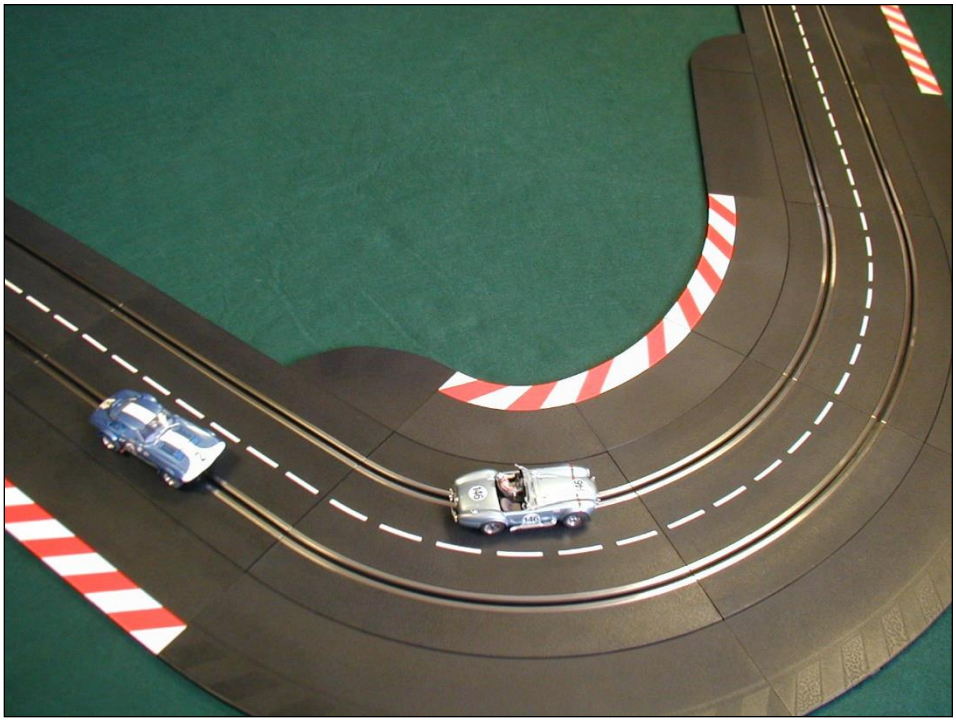
A turn can be increasing radius, decreasing radius, or both. Decreasing radius turns are the most difficult to drive through on the edge of adhesion. This is especially true if they are around 180 degrees. However, if we take a constant radius turn and add a 30 degree decreasing radius segment at the start of the turn, and 30 degrees or more of increasing radius at the end of the turn, we get a turn that is quite nice to drive. The decreasing segment at the start of the turn allows some error in braking point, and the increasing radius allows us to fulfill our burning desire to get back to WOT sooner.

The easiest changing radius turn to negotiate of 180 degrees or less is one made of honk'n radii segments, with a single grand radii segment after a honk'n radii entrance. As you replace honk'n radii segments with grand or tighter radii segments in this turn, it becomes more difficult. As previously noted, constant radius turns are difficult. A constant radius turn made of outer radii is probably the most difficult to negotiate. You know you have to go slow through a standard radii turn, so you focus on the brake point for these as it has a measurable effect on lap times. It is more difficult to judge the maximum speed through an outer radii turn. So if you want to add extreme difficulty to a track have a constant radius turn made of outer (2-series) radii segments.

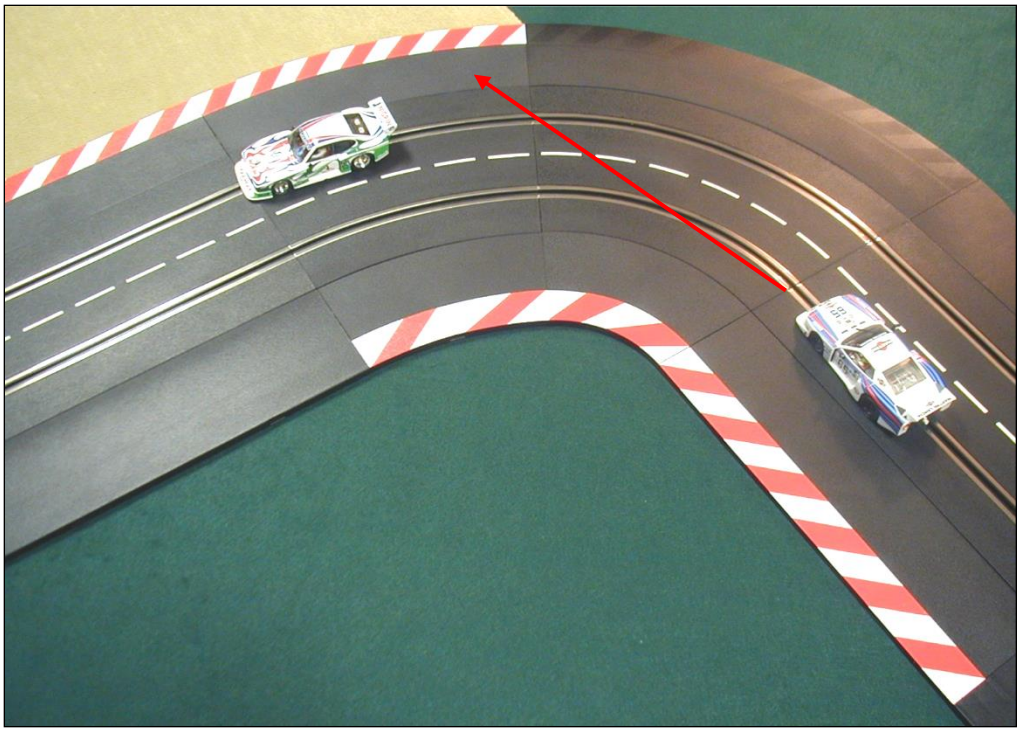
Most of the track layouts shown in chapter 4 use changing radius curves. You will have to decide how difficult you want your layout to be, which will determine if you use a decreasing radius segment on the entrance of each turn. I would recommend building the track in a number of different configurations before you settle on one to hard mount to a table.



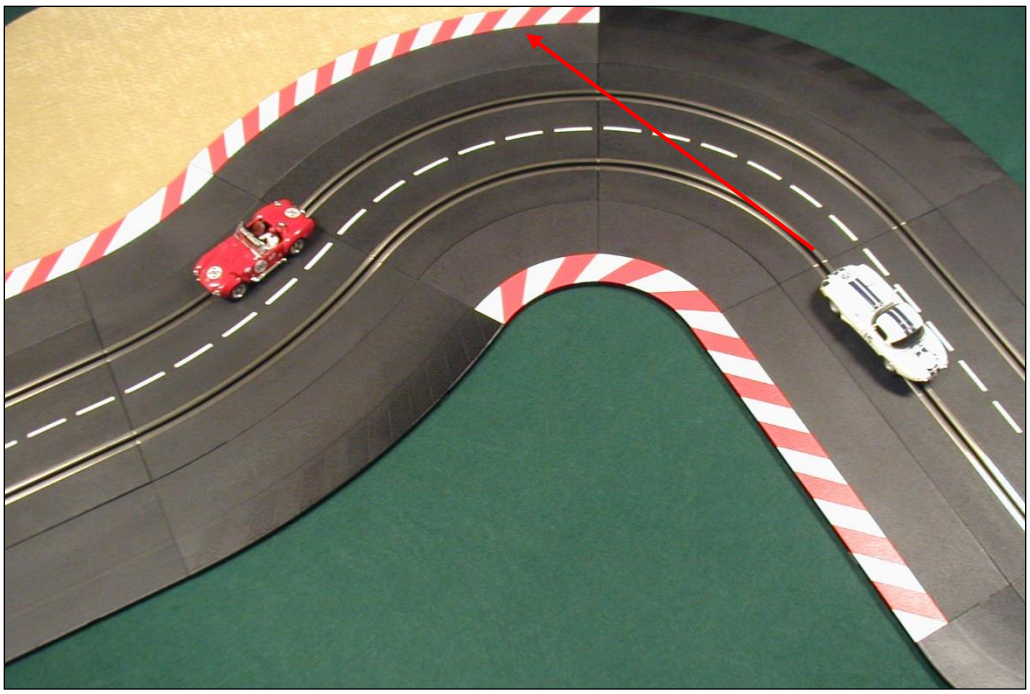
1971 era Vanquish MG McLaren and Shadow Can-Am cars negotiate a changing radius turn. The 30 degrees of 2-series entrance offers some relief to the 60 degrees of 1-series turn following. The cars then accelerate through the remainder of the turn which is increasing in radius, made from 30 degrees of 2, 3 & 4-series turns. Two straights worth of outside skid apron are used for 'loose' handling cars.



It is Sebring 1964, as a MRRC cobra leads a Monogram Corvette Gran Sport through 120 degrees of an increasing radius turn. The FIA curbing butts up to the entrance of the 60 degrees of 1-series turn because the racing line is an early apex, to take advantage of the 2 and 3-series exit. The length of curbing is fairly well balanced in length between the inner and outer parts of the curve.



A simple 90 degree increasing radius turn made from a standard 1-series 60 degree segment followed by 30 degrees of 2-series turn. 1981 era DRM represented by Fly Ford Capri RS and Lancia Beta Montecarlo.

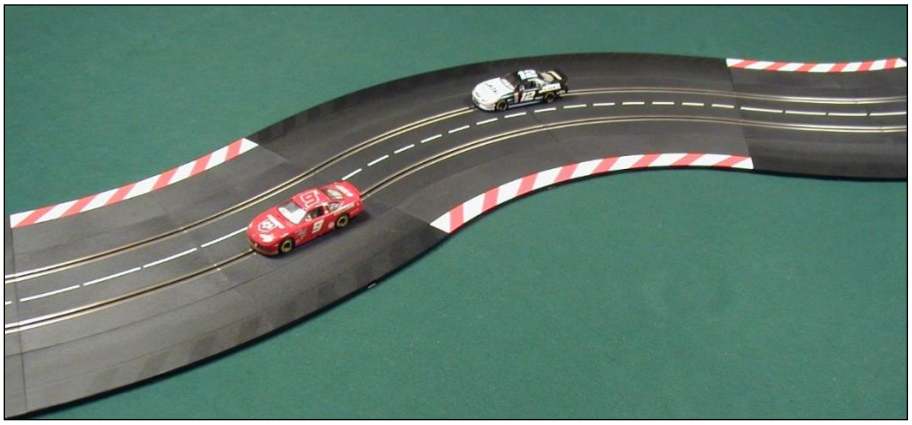


A nice alternative to the simple 90 degree turn shown above is the switch back made up of two standard 1-series curves followed by 30 degrees of 2-series turn in the opposite direction. To me, this is a much more interesting turn, which doesn't take up much more space. It is a nice way to break up what might otherwise be a series of segmented turns. Note the second piece of turn in each of these tight bends has FIA inner and outer borders, because if you sight through this turn the long side (red arrow) is an obvious crash point. Note 'sand' run off area, modeled with cloth. The length of inner and outer curbing is well matched. A MRRC Cobra updated with Ninco Halibrand knock-off wheels leads a Revell lightweight Jaguar.

Chicane, Switch Back & Ess Turns

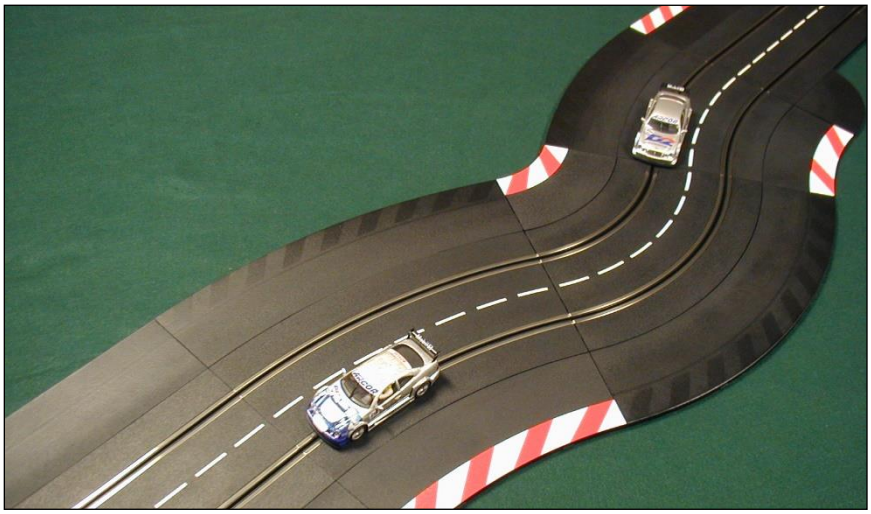
Chicane, switch back and ess turns are difficult because the entry turn upsets the car for the exit turn. They make for a more interesting track layout. Switch back and Ess turns can be loosely termed “S-turns”. Driving on the edge through an S-turn almost always guarantees fish tail action.

Chicanes often appear symmetric. Symmetry implies that the same number and radii of turns are used about the center of the sequence. For example, if a right hand grand radii entry is followed by a left hand grand radii exit turn, it is symmetric. A chicane can be made from 2 or 4 turn segments. Thus a chicane can be a “wiggle” or a “U”. A “wiggle” is a left-right series of turn segments, or right-left. Obviously, you could make a really long wiggle with a bunch of segments, but that would be dorky. Not even Autocross courses in big parking lots have more than 4 turns in series that drive like a wiggle.



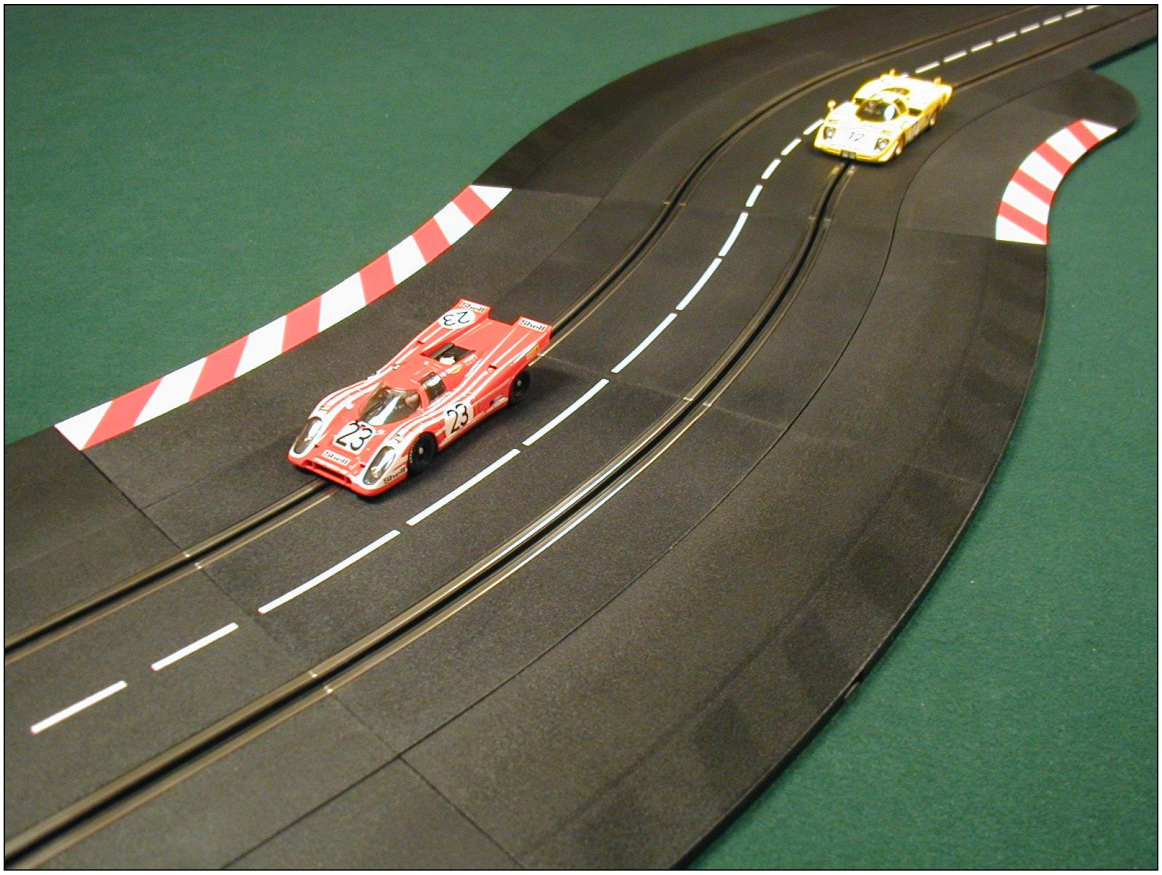
A custom painted and decaled Scalextric ‘side winder’ NASCAR Ford stocker converted to an Evernham #9 Dodge leads a Penske #12 through a high speed U chicane. It is symmetric about the center, (location of #12 car) with 30 degrees of 4-series RH turn, followed by 60 degrees of 3-series LH turn, then exits with 30 degrees of 4-series RH turn.

Chicanes can also be non-symmetric. I think they look and drive more realistic this way.



A couple of Ninco Mercedes CLK DTM Touring Cars negotiate a tough non-symmetric chicane whose apex is made from a 60 degree 1-series turn. The 2-series entrance, and 3-series exit make this a quick off-on the throttle slam that requires precise timing.

The “U” chicane is used to break up the Mulsanne straight at LeMans, in its most famous application. Chicanes are another nice way to break up what would be a segmented series of like handed turns. Not even I would be cruel enough to use standard radii turns in a chicane, unless it is used as the entrance for a hairpin or located in a slower part of the layout.



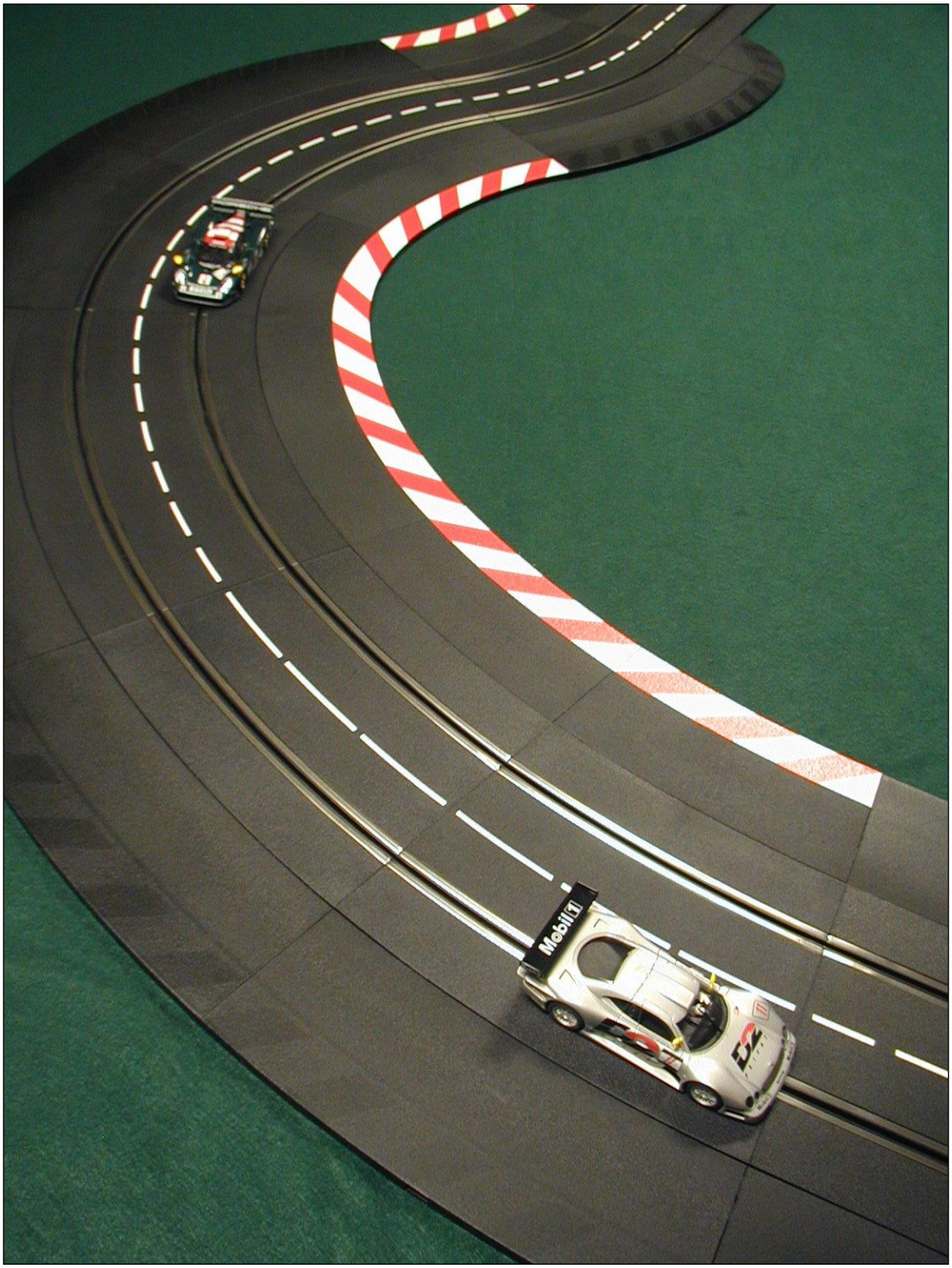
This is a very fast wiggle-style of chicane. It is non-symmetric, since it is made up of 30 degrees of 3-series turn for the entrance, and 30 degrees of 4-series turn at the exit. Beautiful Fly reproductions of the 1970 LeMans winning Porsche 917K leads a Ferrari 512S Coda Lunga “long tail”.

A switch back is an S-turn that is not symmetric. A switch back has a single 30 degree turn at either the entrance or exit which is in the opposite direction of the rest of the turn. I use switchbacks in almost every layout to avoid having a segmented like handed set of turns.

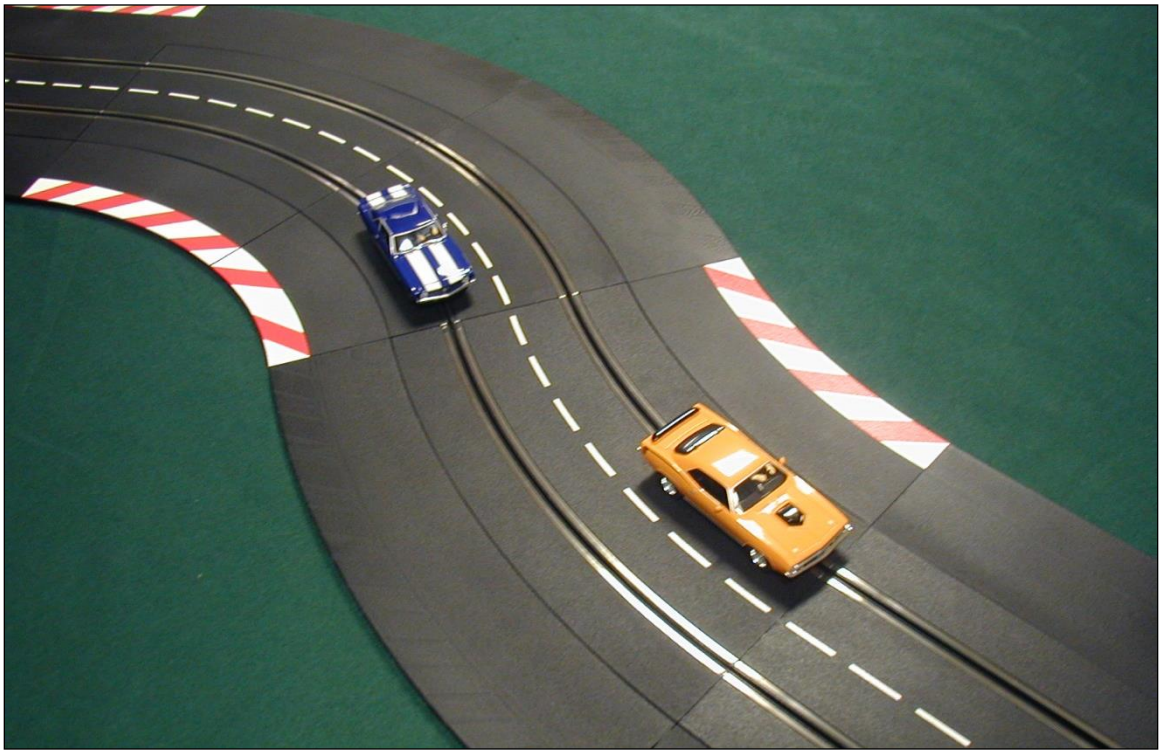
Talladega Tip #11. Use grand or honk’n radii segments for the entrance and exit turns of switch backs or chicanes whenever possible.

Switch backs which begin with a standard radius turn are very difficult and slow. However, if that is your objective, then by all means build one. A slow corner on the race track should be located close to (at least one) driver(s) or at least in an area easy to marshall. I prefer to locate switch back turns ahead of other slow parts of the track. This keeps the rest of the track fast for good rhythm.

You could put an opposite turn segment in the middle of a turn. One could imagine something like this on a rally layout. However, it would totally break the rhythm of the turn. It would end up driving like three short combined turn segments.

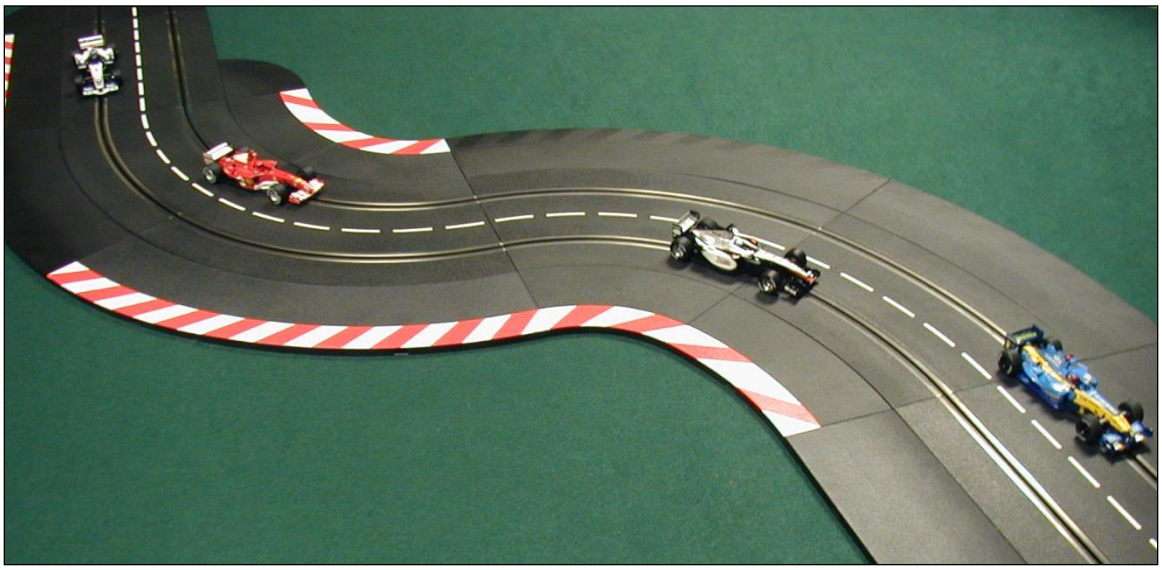


A Mercedes CLK GTR (by Ninco) leads a Fly Porsche GTR through a switch back. The 3-series RH is followed by a LH sweeper with 2-series apex (location of Porsche) leading to an increasing radius exit made from 30 degrees of 3 and 4-series turns. These are some of the most enjoyable turns to drive as you can really roll into the throttle after the apex. Controlled oversteer is easy to invoke with these long wheel base cars.



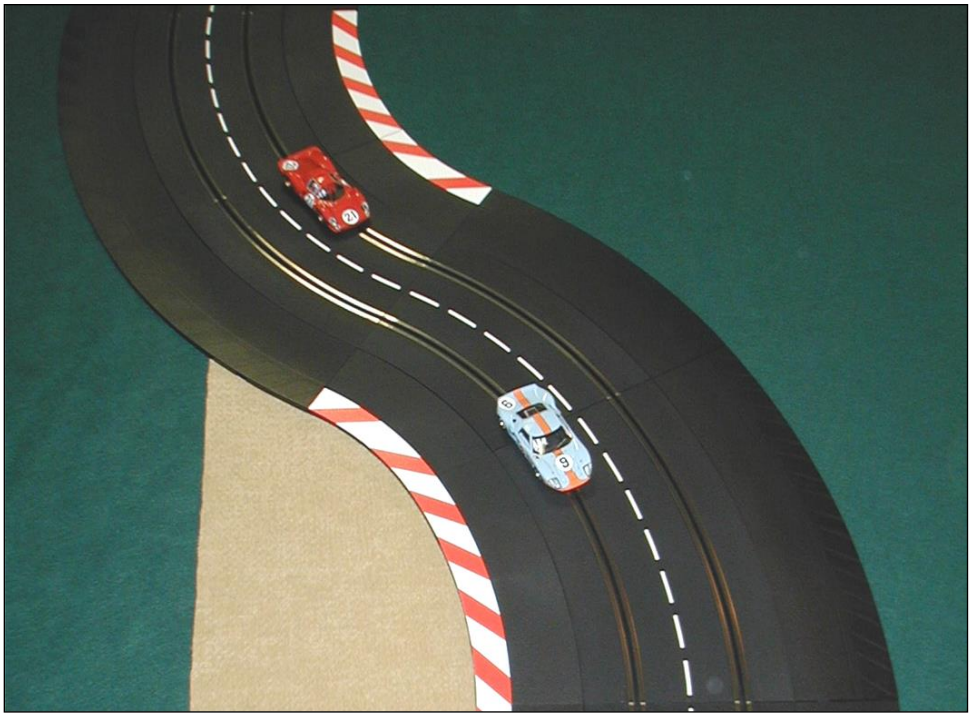
Two Carrera big block muscle cars traverse the most difficult of switch back turns, one where 30 degrees of exit is in the opposite direction. This 2-series apex (location of blue Camaro) with 3-series entrance/exit is the most challenging turn in "Mother of WOT". Yea, the 'Cuda has a Hemi!

I call a turn an ess if both right and left-handed portions are 60 degrees or more. A track with a lot of ess turns is what my friends and I call a "noodle" track. You won't find any noodle tracks in this book, as they are typically difficult to drive and have NO rhythm.

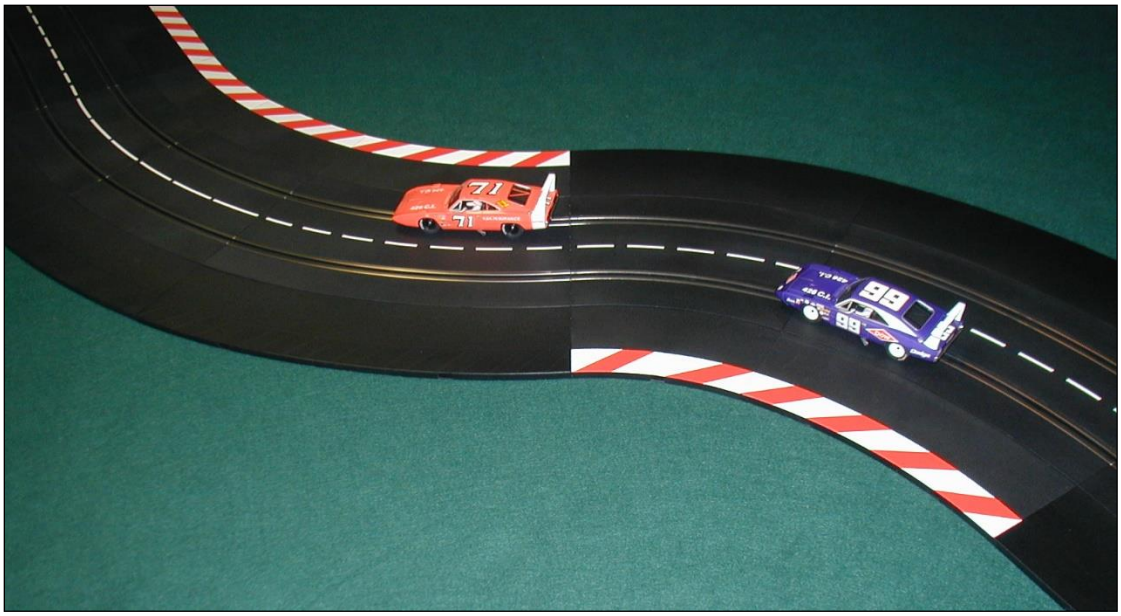


This is a tight symmetric ess made from 60 degree 1-series standard curves with 30 degrees of 2-series entrance/exit. 2004/5 era F1 cars are all from Scalextric, with Renault leading a Mercedes McLaren,

Ferrari and BMW. These are not “digital” cars that can race two to a lane. I just posed them to depict the “racing line” for this photo.
A layout with a single ess turn adds some challenge to the otherwise loop and U turns, (descriptions to follow). See layouts “S8”, “Thunder Road”, “Mountain Pass”, and others in the layouts (next) section.



Scalextric Ford GT40 and Ferrari 333 P4 race through a symmetric ess made from 2 and 3-series turns. The non-symmetric version shown below is faster.



This is about as gentle an ess turn as you will find due to the 3 and 4-series exit. Carrera Dodge ‘wing’ cars with 426 Hemi power. These cars handle more like 1969 era NASCAR stockers when the magnet under the rear axle is removed. Add silicone tires and they are smooth running, door handle banging, fun to race cars. The same can be said for the other Carrera vintage stock cars.

Talladega Tip #12. Sight through chicane, switch back and ess turns to determine the racing line, and apply FIA borders accordingly. I think the red/white FIA striped borders for S-turn sequences look best when the first turn has a short border, the second turn has more length of border, and the exit straight has a short length of border. Match the total left and right-side border lengths for aesthetic purposes whenever possible. Note that often one side will have the total length segmented in two.

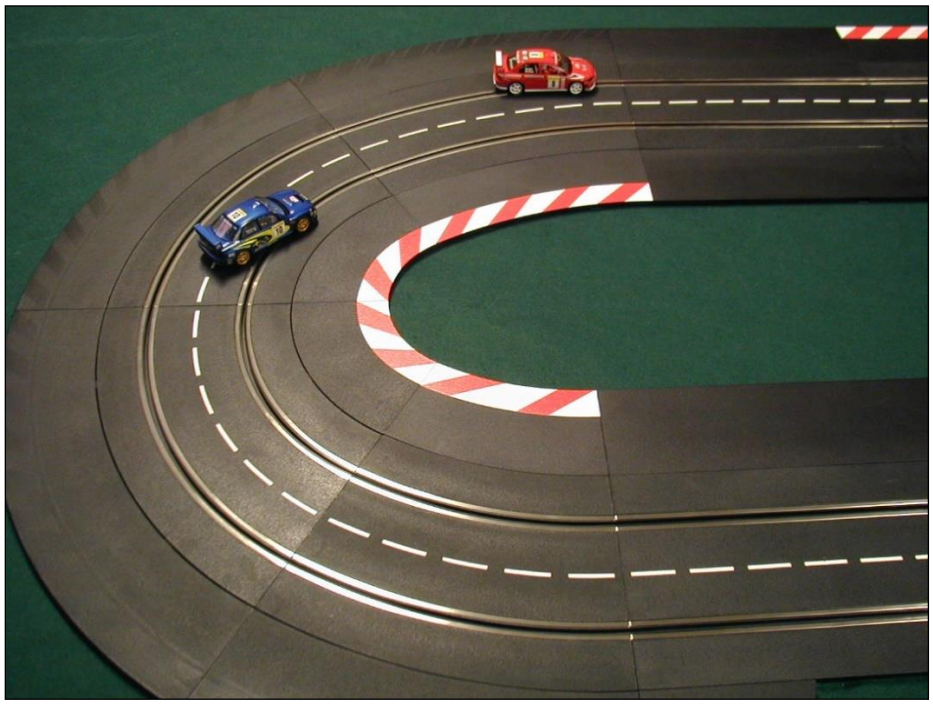
Talladega Tip #13. Racers are superstitious!

Hairpin Turn

A hairpin implies a U-turn of tight radius. The standard radius banked turn could be considered a high speed hairpin. When building a layout with the standard banked turn, I usually have a standard radius hairpin to equalize lane lengths. Hairpin turns after a long straight are cool because the brake point is so challenging.

Adding a 2 or 3-Series turn to the exit of a hairpin makes for a much faster turn. I usually use a 2-Series turn at the entrance of a hairpin, to allow some error in break point. "Softening" the hairpin in this way reduces the crash tendency. Who wants to be constantly chasing de-slotted cars?

Talladega Tip #14. The terminal track should be as far from turns as possible, preferably in the middle of a long straight. Fish tailing cars exiting a turn, especially a hairpin turn, can hit the raised terminal pad and deslot.



The entrance of this predominately 1-series hairpin is softened with 30 degrees of 2-series turn, and exit onto long straight enhanced by 30 degrees of 3-series turn. Have plenty of straight skid apron after a hairpin turn, (2 straight sections recommended), as plenty of fish-tail action occurs. Scalextric WRC Mitsubishi and Suburu are especially fun to drive with stock tires and the magnet in the center position. If you want the cars to get totally sideways on every turn, then remove the magnet completely!

Hairpin turns are a nice way to save space on table width. If the layout runs up and down the table twice, a hairpin helps to keep the overall table width within marshalling reach.

Banked Turn

Carrera makes banked turns in all four radii. The bank angle is approximately 35 degrees. Most of the layouts that I built with Carrera track using a banked turn were a full 180 degrees. Robert Schleicher shows in his book how to use part of a standard bank to make a replica of the Laguna Seca cork-screw - very interesting! I used this in the layouts in a few plastic track layouts as well. The same technique could also be used on a turn with more than 180 degrees (loop) to make it less tedious. The only down side of using standard radius bank turn (segments) is that some cars that are either low or have long body overhangs will scrape the track. It may eventually leave a shiny scrape mark on the track, and makes an awful noise in the process.

It may seem obvious to even the most casual observer that a bank turn should be located between two reasonably long straight-aways. This enhances the rhythm of the fast portion of a layout. Imagine WOT dwell, quick breath of throttle followed by another long WOT dwell. It feels so good - now you're living! Likewise, a properly located fast bank turn is slot car Nirvana.

This is what 33 degrees of banking looks like. This is turn 1 at Talladega. At 90 mph the car still wants to drop down the banking. Driving around this track is surreal, and gives one tremendous respect for those who add another +100 mph. The track must seem really narrow at those speeds!

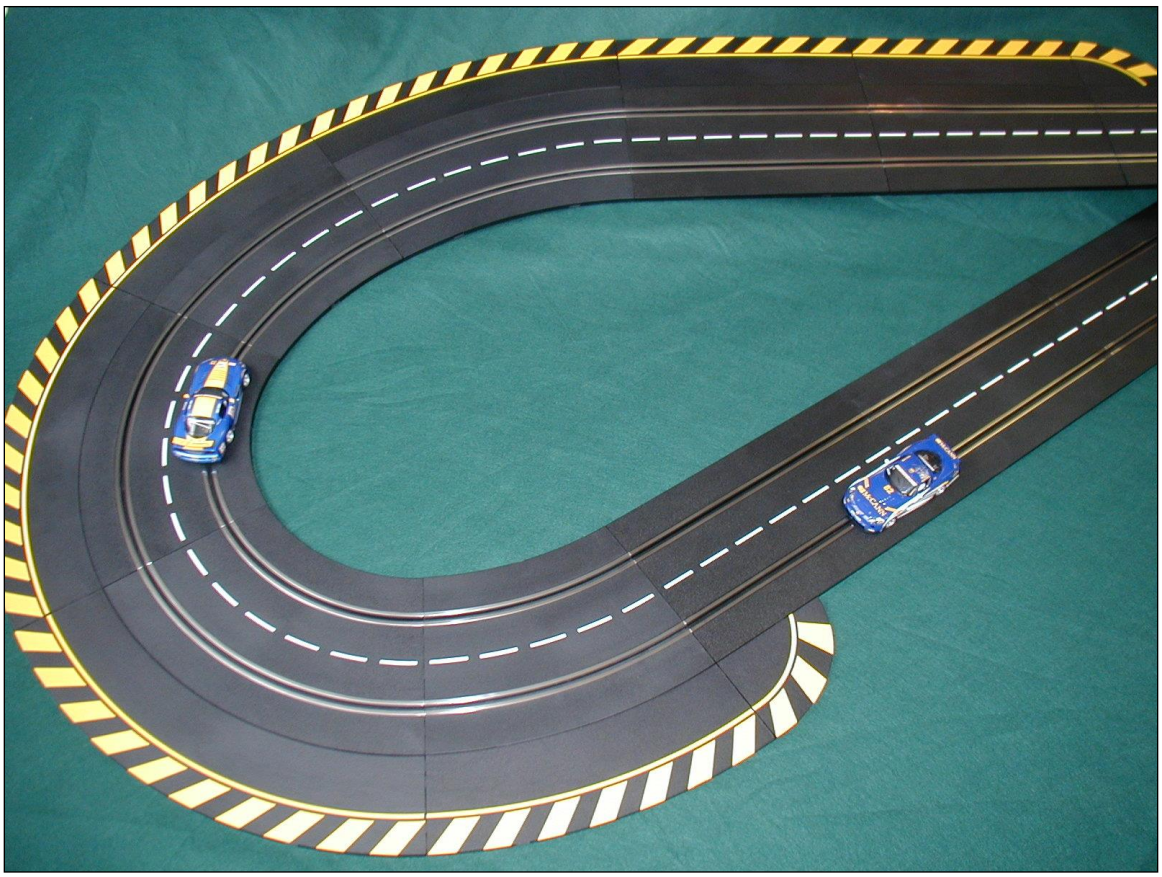
If you really like banked turns, a plastic Carrera track layout is hard to beat. As previously mentioned, the speed difference between lanes of a banked turn is reduced. I like the 3-Series grand radius banked turn the best. If you are space limited, but still want a banked turn, a changing radius may help.

Obviously routing a banked turn is much more difficult. Not saying it is impossible, but for sure the gain must be routed before arcing into a bank. Adding a few degrees (up to 5 degrees) of banking into a routed MDF track is no problem, as the ½" thick MDF is relatively flexible.

Loop Turn

A loop is a turn of more than 180 degrees. Thus you will have an overpass near a loop section. This said, the overpass will occur further from the loop section if the turn is 210 degrees. Loops greater than 210 degrees will require a faster rate of change in elevation of the track layout. Loops that are 270 degrees should be made primarily from outer, grand and/or honk'n radii segments so that the elevation change takes place over a longer distance of track.

Loops that run uphill are my favorite since you can lay down more power as you spiral up. Down hill loops have a tendency for the cars to roll out of the slot near the exit of the loop, and get wedged sideways under the overpass. Obviously the height of the overpass should be greater than your tallest (or widest) slot car. You may want to size the overpass based on the Fly "Big Rig" trucks. They require at least 4 inches of vertical height, 6" is preferred.

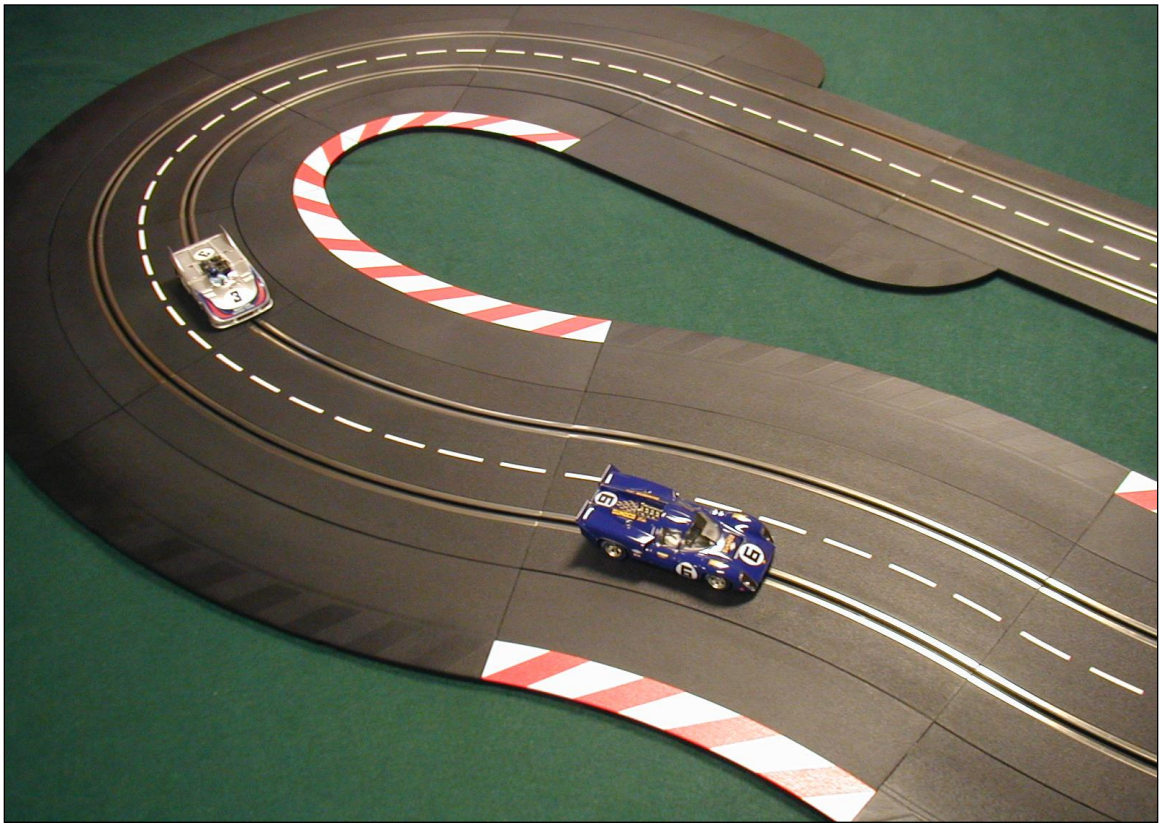


A couple of Scalextric 2004 'Speed World Challenge' Dodge Viper Competition Coups power uphill through a 210 degree loop. Although this loop is relatively tight, made from 2 standard 60 degree curves, and decreasing/increasing entrance and exit track sections, the overpass occurs at a reasonable distance because it is 210 degrees. Downhill loops that are 270 degrees are torturous and cars tend to get wedged sideways under the overpass when they de-slot. Turns that are all right or left handed can get away without inner skid aprons, (borders). I find the yellow Chevron border to have more of a "strobe" effect than blacked-out borders with FIA curbing just on the inner aprons. Series Driver's Champion Tommy Archer leads Rookie-of-the-Year Mike McCain. Both of these cars were autographed by the Drivers.
Implied is that all figure 8 layouts will have a loop turn of sorts, so there will be one overpass. You can have an overpass and un-equal lane lengths if you do not balance out the RH and LH turn sections, or if the loop and the majority of the other turns are all in the same direction, (like many old Tyco HO boxed layouts). An odd number of overpasses are required to maintain equal lane length.

Combination Turns

These are as the name implies, a combination of turns that are linked together. You will rarely find what I call a combination turn on a real race track, but I think they can make for a more interesting layout. For example, turn 8 at Suzuka (Japan) is a simple 60 degree constant radius bend. A guaranteed crash point as it occurs after a long straight. It would be better to straighten this part of the track out, or make the turn more significant by combining some of the features of turn 9 (chicane) into turn 8.

A nice combination turn is what I call a carousel. It is a U-turn with switch back. Adding ess turns to the entrance/exits of loop or otherwise conventional turns adds difficulty to a layout, (see "Narrow 8" and "Ess 8" in Chapter 4).

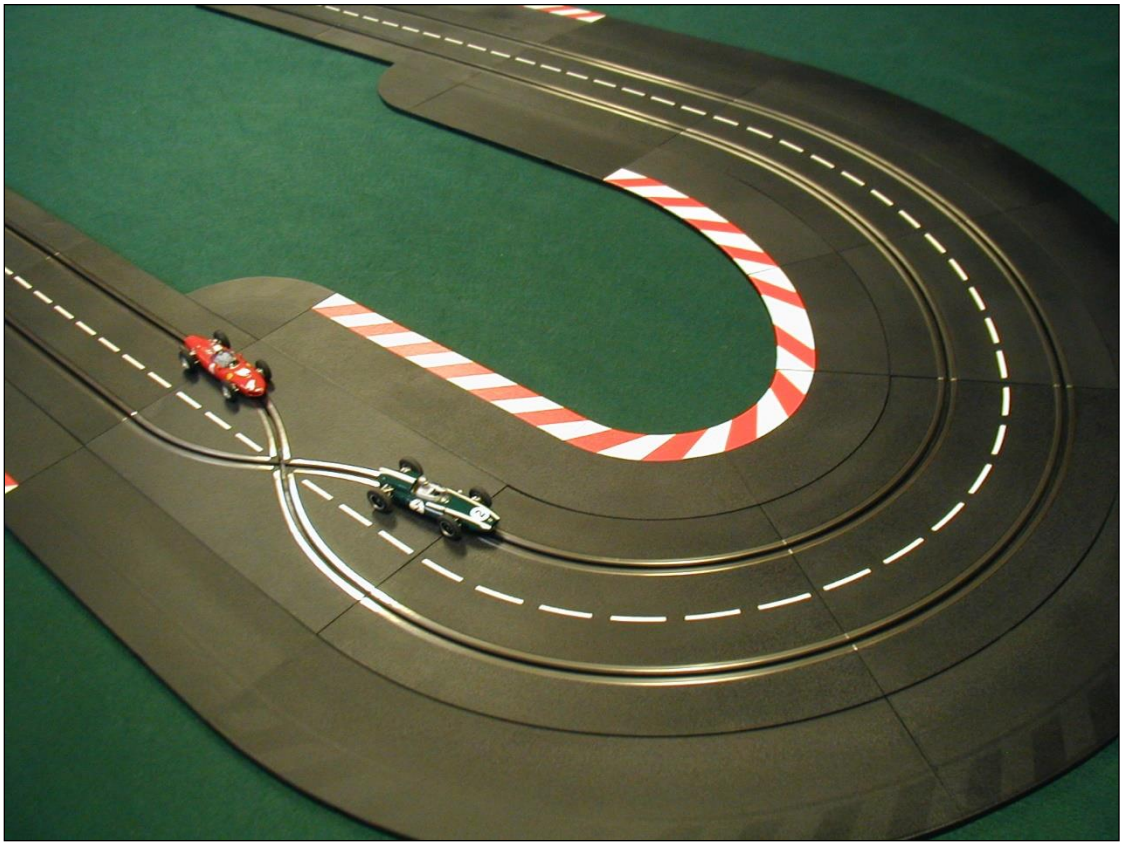


A Fly Penske Lola leads a Porsche 908/3 through a carousel made from a symmetric 1 and 2-series hairpin U-turn combined with an S-turn. The 3-series ess provides an increasing radius switch back that makes for a fast and challenging exit.

Specialty Track Sections

I do not care to use specialty track sections in my layouts, such as squeeze, cross-over (X-over), or hill sections. Even though the squeeze or X-over tracks may add realism in the form of blocking, crashes, or driving challenge, they do not promote the side by side racing action that I enjoy. But hey, do what you want. Just don't invite me over and expect me to play demolition derby with my cars!
A number of flat layouts in the next section are shown with (optional) X-over tracks in the spirit of equalizing lane lengths. I tried to put the X-over tracks in locations that make the most sense, (where crashes occur on real circuits), like the entrance to the first turn, and where necessary to equalize lane length. Some layouts can not be made to have equal lane length even with X-over tracks, (see "Sebring"). You may want to build the layout with and without X-over tracks to determine if equalizing lane length

should be a priority. I think you'll find the racing better without them. I have no courtesy or ability to "lift" in the heat of a race. Ask Jimmy Attard, or on second thought, don't remind him that I beat the front bumper off of one of his TransAm Mustangs. Be sure to use "jumpers" (reference track wiring) on layouts with X-crossings, as the current drop across the spindly wire beneath these tracks is significant!



Sir Jack Brabham in a Coventry Climax powered Cooper leads Phil Hill's shark nose Ferrari. These 1963 era vintage Scalextric F1 cars are quick and will dart through the X-crossing, located at the slow entrance of an increasing radius hairpin curve.

A racing format that compensates for un-equal lane lengths is to alternate lanes and keep track of laps on each lane over a time interval. You will want the time interval to be large enough relative to the track layout (enough time to complete a minimum of 25 laps on each lane, for example) so that partial laps are less of a factor.

I don't like hill sections because many cars will scrape due to lack of ground clearance. However, they do look neat catching air going down one. I prefer to build rolling hills using long straight sections, as they look more realistic and are less crash prone.

Got an idea for a neat pit lane, off-camber turn (shallow reverse bank), or huge radius with tight "racing line" lane spacing? E-mail the Wankers at www.Carrera-Toys.com and let them know. Don't bug me at 4:00 AM with your ideas, no matter how cool they may be, 'cause I can't manufacture it for you!

However, if you are ready to build a dedicated MDF track, we can design and CNC route just about whatever you want. That is the beauty of what CNC Track Design represents!