

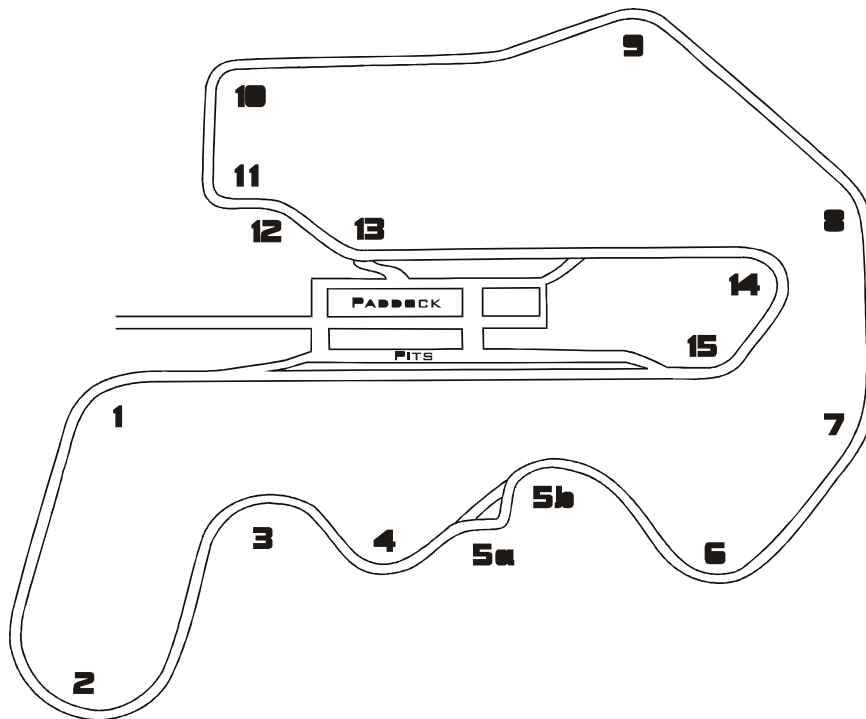
Thunderhill Park Normal Direction (Counter-Clockwise)**Hank Watts and Brad Maker**

DISCLAIMER: The following information is provided by the Golden Gate Region of the Porsche Club of America as an orientation to this track. It is intended to be used only as a guideline and intended only for use by drivers at GGR events. All drivers are responsible for determining the safest and best approach for themselves and their cars. Under no circumstances will the region, its officers, event organizers, instructors or other members be responsible for any consequences to any driver as a result of completely or partially following the recommendations herein. This exclusion applies to events conducted by GGR as well as other events where drivers may choose to use these guidelines to assist in learning to drive this track.

©2003 by Henry Watts, Brad Maker and the Golden Gate Region, Porsche Club of America. All rights reserved. Permission for individual use (single copy electronic download and printing) is granted. This document may not be printed for distribution, either as a single document or included in any type of publication such as compilation or book.

Thunderhill Park is owned and operated by the San Francisco Region of the Sports Car Club of America. It is a delightfully open course with lots of run-off room. Smooth, wide pavement, many elevation changes, and a good variety of turns make Thunderhill a great choice for first-time time trialers. The track was expanded in 1998 to include 15 turns over 3.0 miles, and can be run in either driving direction, although the counter-clockwise direction is most commonly used. Amenities include a large paddock, fuel service, shade pavilion, and showers. Paddock camping is permitted; motels and restaurants are available in the nearby city of Willows, CA.

Thunderhill Park is located off Interstate 5, north of Sacramento. From the Bay Area, follow I-80 East, then take I-505 north, just past Vacaville, until it joins I-5 North. On I-5 at the second Willows exit, take Highway 162 west for about 7 miles. Entrance is on the right just at the beginning of the Coast Range hills and is well-marked.

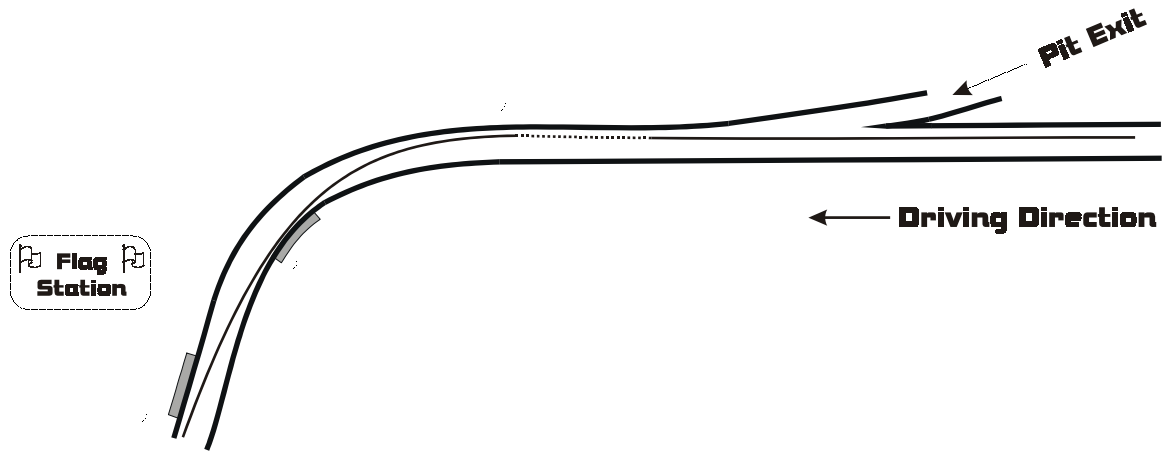


The text occasionally indicates likely gear choices as a very general guideline only. The gear chosen will, in many cases, depend not only on the gearing, rev limit and torque curve of the car, but also on driver preference. There are places where higher gears may add smoothness and may make a high-horsepower or low-available-traction car more controllable but at the expense of critical acceleration. Cars with narrow horsepower bands obviously need more careful gear selection; cars with broad torque curves may care less.

Entry, apex and exit berms at ThunderHill are either flat painted concrete or mounded concrete. Many of the flat berms (apexes of turns 8, 12 and 13) should be fully driven on.

The lines described in this document are qualifying or time trial lines. With appropriate adjustments for the specifics of your car, they should produce the fastest lap times available for your driving level.

Turn 1



Enter the track from pit lane, watching for other cars coming down the main straight at high speed.



From the main straight, steer smoothly to the right edge of the track after passing the pit exit. Pick up the brake markers (white pickets) and apply the brake smoothly as you enter the braking zone. Look to the apex, and begin moving toward it as you reach the turn-in point. The high speed here rewards very gentle braking and smooth steering inputs. Most cars should be in 4th gear. Avoid starting your turn-in too late, since marbles from tire debris at the outside of the turn will be slippery. Instead, turn in gently at first, then more firmly as the car settles.



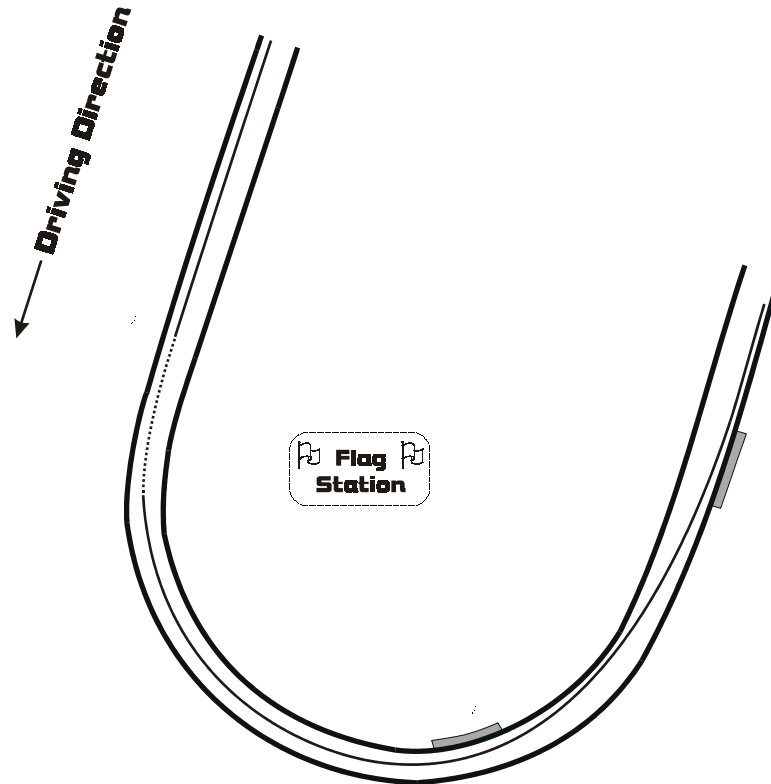
As you approach the apex, look ahead to the exit cone (if one is there) and squeeze on the throttle, reaching full power at or just before the apex. Apex just past the middle of the berm. This is a good turn at which to note a reference speed or rpm achieved at the exit. This will help you identify an optimal braking zone, entry speed and line. By making safe, incremental adjustments, you should be able to maximize your average speed through this long sweeper, thereby dramatically lowering your lap times.



The exit is at the top of a small rise, limiting visibility to the next turn until the hill is crested. The car can become light as it passes over the rise, decreasing traction. Stay inside the cement exit berm which ends abruptly, dumping the outside wheels into a hole or soft dirt. Note the flag station protecting the blind section of track beyond the exit. Full power over the rise, staying at the right side of the track to enter turn 2.



Turn 2



The approach to turn 2 is down a shallow hill. White numbered pickets off the left side of the track provide reference markers for braking. Most cars will need to downshift to 3rd gear prior to turn-in and will likely stay in 3rd until at least turn 5.



Enter from the right third of the track, then spend the turn squeezing toward the apex, using a very late apex as shown. Be sure to look at the apex point from the moment of turn-in, a technique which is difficult at first. You will, sometimes, actually be looking out the side window. Use this long turn to develop a feel for the car and tires. Relaxing your hands slightly on the steering wheel may help improve feel here.



A slight throttle lift near the half-way point of the corner may help rotate stubborn cars toward the apex, after which the throttle should be squeezed firmly to full power.



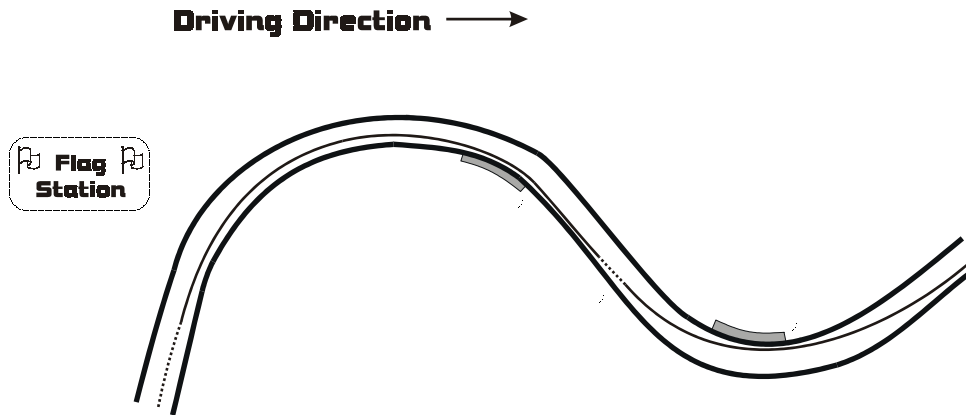
Once comfort has been achieved with the late apex, most cars will be faster using a slightly earlier apex, but this adjustment should be made in very small increments, as too early an apex will put the car off the track at the exit.

Exit in the second half of the exit berm. Given the very late apex, you may have to steer out to the exit by the right-side berm if the car will not drift on its own. Build the habit of reaching the exit anyway; it will serve you well as you become faster. Past the exit, move the car decisively back across the track to the left and up the slight hill toward the entrance of turn 3.



When you become comfortable with this line you may wish to use a double apex for turn 2. The final part of the turn is the same. The entry is different. At the entry, instead of braking at the normal point, turn the car in, heading towards an early apex. Once the car is settled on this line, begin aggressive braking. The braking should end with the car about 20% through the turn and at the middle, or just past, of the track width. At this point the car needs to be rotated to rejoin the line described above.

Turn 3 and Turn 4



There are several popular lines through Turn 3, which begins at the crest of a shallow rise past the exit of Turn 2, then turns downhill and off camber. A flag station, located off the left side of the track, is plainly visible as you approach the corner. Most cars will need to be in 3rd gear through this corner.



Some braking will be necessary at the entrance, and should be done before cresting the hill. The combination of a light car and adversely cambered road surface will make the car twitchy here, so the turn-in and transition from brake to throttle and must be done smoothly.



The standard approach is to enter about 3/4 of the way to the left before the crest, and then spend the corner squeezing in very gradually toward a very late apex/exit near the end of the inside berm



An alternate line through turn 3 simply hugs the inside of the track all the way around, where camber is arguably better.

Turn 4

The transition from the exit of 3 to the entry to 4 (about a car length past the end of the berm at 3) is critical. It needs to be precise within a couple of feet. If done right, a slight lift off the throttle will turn the car in ...



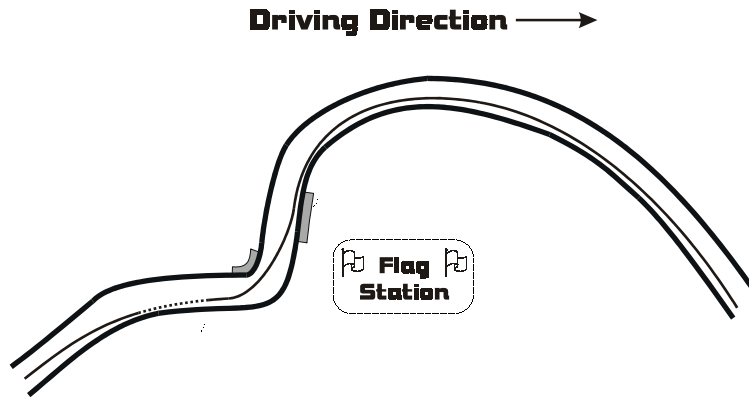
... and you can stay floored through the apex and all the way up the hill to the braking point for 5.



Don't worry if you get a LITTLE wide at the exit of 4. There's usually time (though not much) to get a little left and then move right for the entry to 5.



Turn 5 and Turn 5a



Turn 5, the “Cyclone”, is a blind left-right combination over a sharp hill. There is a well-positioned flag station at the top of the hill.



Brake as you near the top of hill. It's a short hill and will not slow the car much, but, climbing the hill, the brakes will be extremely effective. The appropriate turnin point will provide a relatively straight path across the crest and to an exit on the right. This straightness is essential to maintaining any speed in this turn. Second gear will be less smooth but will launch the car nicely off the crest. The shift to 3rd will almost have to be made mid-air, but is worth it for the increased acceleration.



Once the car is rotated, apply as much throttle as possible. The apex is so sharp that the difference between early and late lines is really just in the angle at which you pass by the berm.



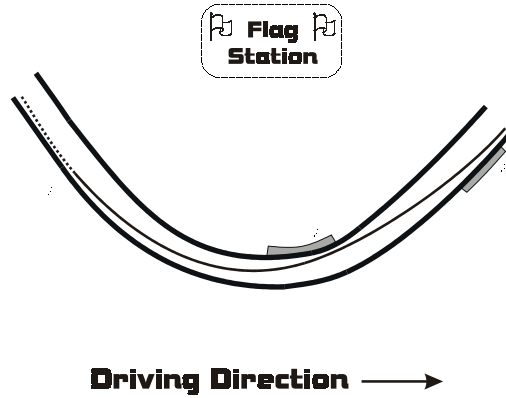
Avoid a left-side exit as you come down over the hill. If you used 2nd gear, you'll need to shift to 3rd at or soon after the exit.



There is time enough, as you head down the hill, to get organized around 5A, a right-hand sweeper, and set up for 6. The main objective here is to be in the right place for the entry to turn 6. If the car will accept more throttle and stay on a reasonable path towards the right side of the track for the turn 6 entry, provide the throttle. If the car is already just barely coping, hold the throttle steady until control of the line is regained. It's a negotiation process between you and the car.



Turn 6



Turn 6 is relatively straightforward, but is a visual challenge. The track seems wide here, luring you deep into the braking zone. You will do much better with this turn if you can keep your eyes well ahead of the car. Look ahead to the apex while still under braking...



... and ahead to the exit as soon as you turn towards the late apex near the end of the berm. This corner precedes a very long fast section of the track, so additional exit speed achieved here will be carried forward to great effect. If necessary, forego a little entry speed in exchange for the fastest possible exit from this corner.

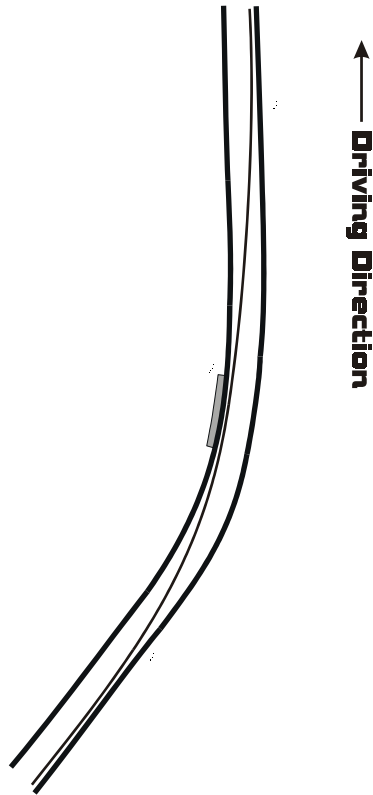


When executed correctly, the car will drift out nicely to the exit berm. Most cars will require an upshift from 3rd to 4th at this point.



Trail braking may be used in Turn 6 as an advanced technique to help rotate the car, but timing is tricky.

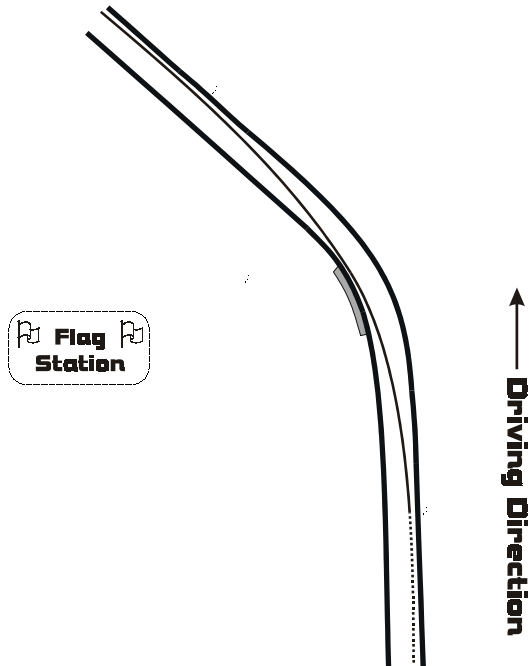
Turn 7



Although it appears to be just a casual dogleg, treat turn 7 as a real turn, and a late-apex turn at that. Braking is not required. This is normally a passing area, so check your mirrors and let faster cars by while also watching for slower cars. Speeds get high in this stretch and, if you are not getting off line to let someone pass, you will be much more comfortable setting up for turn 8 if you wait a bit before turning in, and then hit a real (and late) apex.



Turn 8



Be careful of turn 8. ThunderHill has worked to channel away the water that once tended to puddle there, and smooth the once bumpy pavement. However, speeds are very high, and there are likely to be both terrain and hay bales off the track to the right (clearer pasture is available to the left, if you can control the direction in which the car leaves the track!). Most cars will stay in 4th gear through turn 8.



The turn is much less than 90 degrees. Since this means a very large arc will fit into your entry-apex-exit path, the turnin is earlier than your eyes may suggest. This is not to attempt an early apex, just to note that an early turnin is needed to hit the late apex properly.

Before the entry most cars will apply light braking...



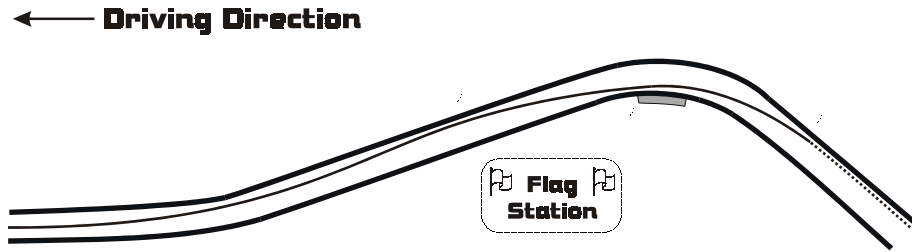
... followed by strong throttle through a late apex. The track is sometimes rough near the right edge of the apex berm, so either climb well into the berm or stay about six inches away as you pass. The recommendation is to drive fully on the apex berm, with the left edge of the inside (left) tires at the inside edge of the concrete red and white berm.



This will head you through the exit and up the hill into turn 9. The long upward slope of the track between here and turn 9 radically reduces your car's ability to accelerate. This exaggerates the beneficial effects of any extra speed you can carry through Turn 8 (and by the same token exaggerates the negative effect of any speed you leave on the table there).



Turn 9



Turn 9 is an uphill left, less than 90 degrees, followed by a gentle right bend as you traverse a broad crest.



Only light braking is required at the entrance. Many cars will shift down to 3rd for this turn. You can carry a surprising amount of speed through turn 9 as you become more experienced. Do not be afraid to climb halfway into this apex berm. It will not upset the car overly much as long as you are on a late enough line.



The apex is near the middle of the berm. With experience in learning where the car must be pointed to come over the blind crest and stay on the pavement, a slightly earlier apex will allow more speed to be maintained through the turn.



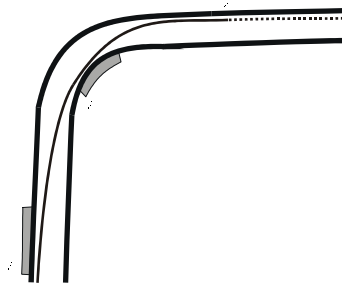
You will need to turn back to the right just a bit more before the crest and the exit, creating a straight line over the top and down the far side. You are likely to be a bit cautious as you exit 9, since the edge of the track at the exit cannot be seen as you pass the apex and crest the hill.

The car will be light at the crest and for a while descending the hill, so you should avoid turning at all. Just let the car run straight where it's pointed until it settles. This may take you to the left edge of the track. Once the car settles, move to the right to prepare for turn 10.



Turn 10

← **Driving Direction**



The 9-10 straight is a good passing zone. Check your mirrors and allow faster cars by. At the end of this straight speed will be high and you will still be traveling downhill.



The entrance to turn 10 is a hard braking point. The downhill slope of the track exaggerates this. Most cars will need to downshift from 4th to 3rd.



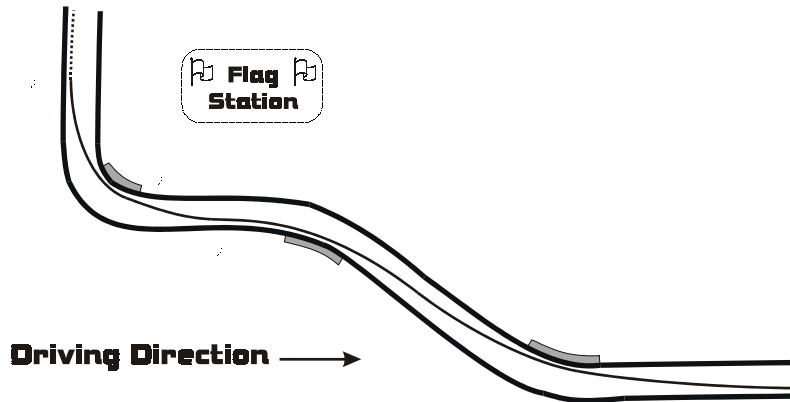
Keeping your eyes well ahead of the car will help to carry more speed through the apex, which is about 60% along the apex berm. An earlier apex can be used once experience is gained, allowing even more speed through the turn, but decreasing the margin for error at the exit.



Pick up the exit spot with your eyes as soon as possible, and stay to the right to set up for turn 11.



Turn 11, and Turns 12 and 13 (The Esses)



Turn 11 is a very slow, sharp corner that begins up a low hill from turn-in to apex, then levels out toward the exit and into the esses that form turns 12 and 13. Rear-engined cars are likely to prefer 2nd gear here, but others may prefer 3rd gear to allow an earlier application of full throttle and avoid throttle-oversteer.

There are two distinct approaches to this turn. In the first, the exit of turn 11 is at the edge of the track. This will work well for cars that have relatively balanced power and cornering ability.



The exit for turn 11 can't be seen until you reach the apex, so pay careful attention to making a consistent turn-in so that you come over the hill on the proper line each lap.



With a proper entry, power can be applied aggressively at the apex. The car may become a bit light as you crest the hill at or just past the apex, so beware of throttle-on oversteer. Finish the turn at the edge of the track. As soon as the exit is reached the car needs to be gently moved to the left, away from the track edge, by just a little bit, perhaps a foot and a half or two feet. This will set the car up to begin turning into 12.



The other approach for turn 11 is to use a very late turnin, a very late apex and end up in the middle of the track. This is an appropriate approach for cars that have more power than turning ability and which will therefore exit the turn faster by being able to get the power down much sooner, even at the expense of coming through 11 a little slower to begin with.

Turn 12

No matter which line was taken for turn 11, turn 12 involves driving into the painted portion of the apex berm (near the beginning of the berm). Do not drive around this, it makes the esses too hard, dangerous and slow. The line is actually to drive onto the beginning of the berm. You will be back on pavement about halfway around the turn. Continue turning until the proper turnin for turn 13 is reached.

If you used 2nd gear for turn 11, you'll need to shift, probably at the 12/13 transition.



Turn 13

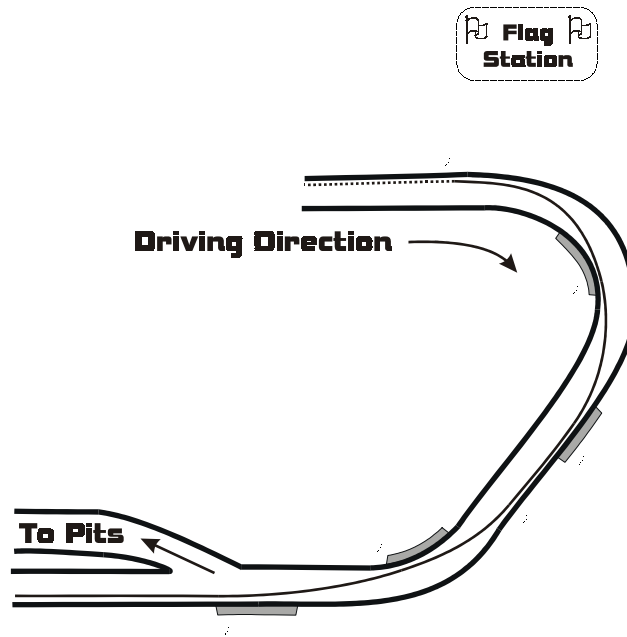
The appropriate apex for turn 13 is just before the mid-point of the berm, as shown in the photo. As with turn 12, be sure to be running well into the berm.



Let the car drift off to the right. Maintain a decent distance from the very hard and unforgiving concrete wall, but do not pinch the turn off trying to stay on the left side of the track. Doing this will just unsettle the car unnecessarily and increase, rather than decrease, the chances of contacting the wall. The esses empty onto the longest of the back straights, an excellent cooperative passing zone. 4th gear will be needed.



Turn 14 and Turn 15



At 14/15, try to have faith in the late apex approach. It's very easy to either turn in to 14 too early, or to bring so much speed that the apex cannot be achieved. For most cars 2nd gear will be needed.



The turn-in is made after very heavy braking, so your speed is changing rapidly and timing is critical. Be patient enough to turn in late (after the 1 brake marker) and hit the late turn 14 apex at the end of the apex berm, holding the car in if necessary.



At this point the car can pretty much be held full throttle, swinging wide between the two turns (Cat's exit) and then proceeding through 15 onto the front straight with little or no lift. Before 15 most cars will need to shift to 3rd



The steering wheel will be held straight for just a brief moment before beginning the turn-in to 15. Like turn 8, this is a dogleg; a very large arc fits into it and the turnin will be early even to achieve a medium to late apex.

You may want to brake before 15, but, if the line is right, it won't be truly necessary for most cars. Obviously, work up the excitement at 15 in very gradual steps.



Lifting your eyes to the exit point down the main straight will help with smoothness and speed through the apex. The exit point will normally be midway down the exit berm on the left.



Unlike most of the track, the presence of the pit wall on the right side of the main straight means that this is a place where cars and people can get hurt much more easily. If you do go wide and off the track at the exit of 15, drive off purposefully and stay off in the dirt where there is plenty of room. Do not try to muscle the car back onto the track here until speed is low and control is complete, since a spin can snap the car back across the track to the right and into the pit wall (and watch for turnworker guidance any time you are re-entering the track from being in the dirt).

That's one lap of SCCA's ThunderHill Raceway, a relatively safe place to learn to drive well and a series of delightful challenges for drivers of all skills.

Credits: The GGR track driving documents were prepared primarily by Hank Watts (GGR Chief Instructor) and Brad Maker. Hank did the photography and the text first draft; he had the final say about the text and is therefore responsible for it. Brad did the larger amount of work, putting the text, photos and graphics together, graphics parsing and editing, the entire layout and provided input to the text as well. Others contributed to the photography process (Neil Yonk, Fred Nelson, Warren Walker, Evan Williams) and in suggesting modification and additions to the text (especially John Tavernetti). Source trackmaps were by Trevor Swallow.