CONTENTS


VIPER GTS-R

RACING. ON A HIGHER LEVEL.

GRAN TURISMO™ 2 is the world's most advanced racing game. This game was carefully designed to create the simulation of real race car driving. Just about every racing nuance imaginable has been incorporated to deliver the most heart-pounding physics and realistic experience.

When hitting the race track, smoothness is the key to doing well. Sudden steering, braking, or acceleration inputs should be avoided. On pavement, tire-smoking slides may look spectacular, but a car that is sliding is slower than one that is not, and damages its tires. (Sliding is more acceptable for off-road racing.) Different cars will handle and react differently. Proper suspension set-up, including tires, springs, shock absorbers, and anti-roll (sway)bars, is important.

The following pages will cover different important aspects of vehicle dynamics and driving techniques. But first, there are two terms that you should know: understeer and oversteer.

UNDERSTEER AND OVERSTEER

Understeer, also called "push", is a condition in which a car's change in direction is less than the steering input. If you turn the steering wheel and the car keeps on a straight path or doesn't turn as much as you expected, that's understeer. Understeer happens when the front wheels lose traction first.

Oversteer is a condition that occurs when a car turns more than expected. The rear of the car seems to step out of line. An oversteering car is often referred to as a "loose" car. Oversteer happens when the rear wheels lose traction first.

Keep these terms in mind throughout the following pages. There are many causes of understeer and oversteer. Understanding them will help you be a more successful driver.

ACCELERATION

Acceleration from a standstill or from a corner is an important factor in winning races. If your car has an automatic transmission, acceleration is simple — just "put the pedal to the metal" and "floor it" for maximum acceleration. But, even with an automatic, there will be times that you'll need less than the maximum amount of acceleration. Slippery surfaces such as a wet or oily track, and dirt roads used in rallying require careful attention when accelerating. Also, because of rearward weight transfer under acceleration, a powerful front-wheel drive car may get wheelspin on its front wheels under hard acceleration, particularly uphill. If this happens, use less throttle.

All of these factors and more apply to cars with manual gearboxes. Careful, coordinated control of the clutch and engine speed is necessary for fast acceleration in a manual-transmission car. If the engine speed is too high when the clutch is engaged, and the clutch is engaged suddenly, wheelspin will occur. "Smoky burnouts" are quite a spectacle, but are usually bad for the tires.

On the other hand, if there is absolutely no indication of wheelspin, you could accelerate more quickly. Bring the revs up and try again. Tires have maximum straight-line traction with just a little slip.

Try to keep your engine's revs constant when you shift gears. The exact RPM to use will depend on the car you're driving, road conditions, and the condition of your tires.

The only way to get the quickest acceleration for a car is to practice.

BRAKING

Correct braking technique is one of the most important aspects of fast driving. If you make too little use of your brakes, you will not slow your car enough, and you may go wide or spin in a corner. With too much use of the brakes, you will be slower than necessary and may have more wear on your tires and brakes. Use of the brakes at the wrong time can put you in a spin. Braking is complex, and takes practice to master.

Be sure to use enough pressure on the brakes at the beginning of braking. This will transfer weight forward, allowing the front wheels to take a heavier braking load without locking (see page 18 for more information on weight transfer). Be careful. If you use too much pressure, you will lock the wheels and go into a skid. A car with locked wheels is uncontrollable. Steering inputs will do nothing. If you lock your wheels, gently decrease brake pressure and try to regain control. Smoothness is very important to successful braking.

For maximum braking capability in a straight line, you want to be at the threshold of lock-up. As in acceleration, tires have maximum traction with just a little slip, and, when this is occurring under braking in a straight line they will "chirp" a bit. If they start to squeal, they've locked up and you'll soon be in trouble. (See page 13 for more information about tires and their behavior).

Threshold braking control is difficult but very important. Keep practicing until you've mastered it.

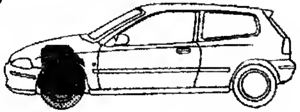
FRONT ENGINE/FRONT-WHEEL DRIVE

In the Gran Turismo 2 specifications, "FF" stands for front engine/front-wheel drive. Most passenger sedans and many sports coupes are of this engine/drivetrain layout.

For a passenger vehicle, the front engine/front-wheel drive design offers advantages in space utilization. Particularly with a transversely-mounted engine, the drivetrain takes up minimal space, allowing more interior room. This is obviously an advantage for a sedan. Since many sports coupes are made from sedan platforms, they inherit the sedan's drivetrain.

There are some handling advantages for the FF design. Because the weight of the engine and transmission is over the driven axle, traction in wet or slippery conditions can be very good. At steady speeds or under a low rate of acceleration in poor conditions, a front-wheel drive car can outperform a rear-wheel drive car. Front-wheel drive cars have a long history of success in rallying because of their abilities in poor conditions. Forward weight distribution also contributes to stability.

However, there are disadvantages to the FF design. Under high rates of acceleration, weight transfer to the rear of the car can cause wheelspin in a front-drive machine, limiting its ability to accelerate. Also, because of the forward weight bias of the FF design, front-drive cars understeer. This is a good characteristic on the street in a car driven by an inexperienced or even average driver — if he or she goes into a corner too fast, lifting the throttle, the natural reaction, will most likely bring the car back into line. For racing purposes, severe understeer can contribute to high tire wear, as does front-wheel wheelspin. A car that understeers does not make the best use of its tires.



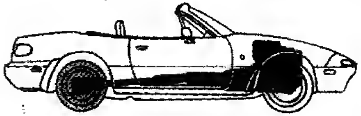
That said, there are plenty of quick, good handling front-wheel drive cars.

FRONT ENGINE/REAR-WHEEL DRIVE

"FR" means front engine, rear-wheel drive. This was once the most popular drivetrain for both street and competition cars, and is still used in many high-performance sports cars and sports sedans.

The front-engine/rear drive layout has several advantages over front-wheel drive for high-performance cars. Most importantly, power transmission and steering functions are separated, allowing for more precise steering control, especially in extreme conditions. Under high rates of acceleration, rearward weight transfer benefits traction. Careful placement of the engine and transmission in the chassis can result in good weight distribution, necessary for good handling. A car with a near-even front-to-rear balance of weight can be set up for very neutral handling, and is easier to drive fast than a more nervous mid-engined car.

For sports sedans or street-legal two-seat sports cars, the FR design allows a good amount of interior space. Although it fell out of favor for pure racing cars many years ago, there are some new sports-racing cars that use the FR drivetrain. Ultra-high-performance street-legal sports cars with this design are also finding increasing favor.

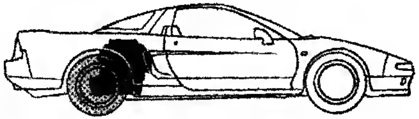


MID-ENGINE/REAR-WHEEL DRIVE

"MR" means mid-engine/rear-wheel drive. Most competition cars use this drivetrain design, and so do many high-performance sports cars.

The MR layout was first widely used in single-seat racing cars. In a narrow, rear-wheel drive single-seater, the driveshaft of a front-mounted engine must pass underneath or beside the driver. This means that the body will be higher or wider than otherwise. For a single-seat racing car, decreased frontal area for less aerodynamic drag is an advantage of the mid-engine design. When mid-engined single-seat racers gained acceptance in the late 1950s, two-seat sports-racers were developed from them. Mid-engined high-performance road cars followed.

The MR design can also decrease the frontal area of a two-seat sports car, and allow other aerodynamic advantages. But perhaps the most important advantage of the design for a high-performance vehicle is that it concentrates the vehicle's mass near its center of gravity. This decreases its inertial resistance to quick changes of direction, increasing its maneuverability. Because of this maneuverability, a mid-engined car can be set up to make full use of its tires and corner faster by having just a small amount of oversteer designed in. That can make it very nervous and tricky to drive at the limit. It takes skill and fast reactions to be able to drive such a car well, but a skilled driver can take full advantage of a mid-engined car's cornering abilities.



REAR-ENGINE/REAR-WHEEL DRIVE

"RR" means rear engine/rear-wheel drive. Although mid-engined cars are sometimes referred to as "rear-engined", that is incorrect. A truly rear-engined car has its engine behind the rear axle.

As with a front-engined/front-wheel drive car, this increases space within the wheelbase for the passenger compartment. For this reason, some small cars used the rear-engine chassis design in the past. There have been rear-engined high-performance cars as well.

A rear-engined design can have very good traction, because of engine weight over the rear wheels. But, if the engine is too heavy, extreme rearward weight distribution can contribute to serious understeer. Go into a corner too fast in a rear-engined car, and lift the throttle quickly (the natural reaction) and presto! You'll see where you just came from as you spin out.

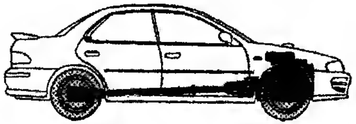
Primitive swing-axle rear suspension designs used in older rear-engined cars also contributed to their reputation for evil handling. Careful suspension design and a lightweight engine go a long way toward taming a rear-engined car, and the few surviving examples have a reputation for good handling.

FOUR-WHEEL DRIVE (FWD)

If front-wheel drive has advantages in some conditions, and rear-wheel drive has advantages in others, wouldn't a system that drives both the front and rear wheels be best? Yes, indeed. Four-wheel drive (FWD) offers the best traction in a very wide range of road and weather conditions. Note that "four-wheel drive" here refers to systems that are designed for high-speed used on roads or race tracks, not for low-speed cross-country, off-road purposes. FWD systems do not have the dual-range transfer case that low-speed, off-road systems use.

Often thought of as advantageous only on low-traction surfaces like snow, ice, or dirt, FWD improves traction and handling on all surfaces, even dry pavement. Although the basic handling characteristics of an FWD car are like those of its non-FWD counterpart — a front-engine FWD car will have the same basic dynamics of a front-engine, rear-drive car, and a mid-engine, FWD car will handle basically like a mid-engined, rear-drive car — all-wheel drive decreases understeer, gives a greater margin between tire slip and sliding, and allows greater acceleration while turning. These factors add up to faster cornering ability.

Four-wheel drive does have some disadvantages. The extra mechanical parts necessary add complexity and up to several hundred pounds in weight. But FWD is the way to go in rallying, where a wide variety of road surfaces and conditions will be encountered. The fastest rally cars today all use FWD. It has been used in most other forms of racing as well, but has been outlawed in many because of its performance advantages.



TIRES

The most important equipment on a car is its tires. The tires are the car's only connection to the road. Acceleration, braking, and cornering are all, ultimately, dependent on the car's tires. Engine power is useless if it can't completely reach the road. The most powerful brakes are worthless if the tires cannot transmit the stopping power. And the best-designed suspension can't do its job without proper tires. High-performance tires can improve a car's handling, and even acceleration and braking, better than almost any other factor.

The contact patch is the roughly rectangular spot where the tire contacts the road. Traction, the friction between the tire and the road surface at the contact patch, is the key to getting the best performance from a car. Traction is dependent on the tire's rubber compound, the size of the contact patch, and the load on the tire. Differing amounts of traction at each end of a car can significantly change a car's handling. Maximum traction is necessary for the best acceleration, deceleration, and cornering.

SLIPPING AND SLIDING

Ever wonder what happens when you turn the steering wheel? First the car's front wheels turn, and then the turning force is transmitted down each front tire's sidewall to its contact patch. The car then yaws — it changes its path around a vertical axis toward the direction to which the front wheels point. The rear wheels follow, flexing their sidewalls and then the rear contact patches.

TIRES (Continued)

Because of the flexibility of the tire sidewalls, the wheels and contact patches point in slightly different directions. This difference is known as slip angle.

If the front slip angle is greater than the rear slip angle, the car will understeer. If the rear slip angle is greater than the front slip angle, the car will oversteer.

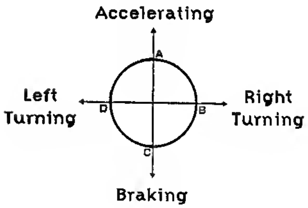
Each tire has a maximum slip angle that it can handle. Beyond that angle it skids, scrubbing across the road like a giant rubber eraser. The point at which the tire starts to skid is known as the breakaway point.

There is one more concept to understand, slip in a fore-and-aft direction. This is expressed in percent. At zero percent slip, there is no slip at all. At one hundred percent slip, the tires rotate but the vehicle doesn't move. Most high-performance tires develop maximum traction at between five and ten percent slip.

If significant amounts of slip occur, you'll hear familiar skidding sounds. Slight skidding noises indicate that the car is right at its limit. Loud skidding noises mean that the car's limit has been exceeded. To drive as fast as possible, you must be able to drive the car right to its friction limit. Skidding sounds give you feedback on how close you are to the limit.

TRACTION CIRCLE

The relationship between the straight-line traction of acceleration and braking and the lateral traction of turning is best illustrated by the traction circle. The vertical axis represents the traction associated with acceleration and braking; the horizontal axis represents the traction associated with turning. The rubber molecules at the contact patches have a limit to the amount of force they can generate, but the direction of the force doesn't matter. So the circle represents the limit of traction in any particular direction.



As can be seen from the circle, there may be linear and lateral components to the traction forces generated at any time. If the forces acting on the car exceed the traction between the road and tires, the car will start sliding. This limit where sliding begins — the breakaway point — is represented by the traction circle. Everything within the circle is less than the car's limit; everything outside of the circle is beyond the car's limit. High slip angles (or percent) are generated just inside the circle's boundary.

EXAMPLES

BRAKING

To brake in the shortest distance possible, you must use the tires' gripping ability all the way to point C (refer to diagram on page 15). Any point within the circle does not take full advantage of the tires' traction capacity. Anything outside the circle induces skidding and potential tire locking, greatly increasing braking distance and potentially ruining the tires.

ACCELERATION

To accelerate as quickly as possible, you must use the tires' traction all the way to point A. For most street-legal cars, this won't be a problem. Cars with moderate amounts of power usually can't exceed the traction limits of their tires in a straight line — they won't get near point A. However, extremely powerful cars, like racing and rally cars, may be capable of exceeding their tires' limits under acceleration. If the tires smoke excessively under acceleration, use less throttle.

TURNING

If you exceed the car's turning ability, represented by the horizontal axis in the figure, the car may not respond to the steering wheel and may understeer off the road or oversteer into a spin.

COMBINATIONS

Cars rarely coast around corners, especially when racing. When cornering, there is usually some acceleration or braking also taking place. As previously mentioned, the tires are capable of generating a certain amount of traction. The direction of that tractive force doesn't matter. The areas of the turning circle off of the axes represent those situations in which the car is braking or accelerating while turning.

The car's braking or acceleration limits will be lower when it is also turning because some traction is used to turn and some is used to brake or accelerate. This can be represented on the traction circle. Braking while making a left turn is represented by a point to the left of C. The closer the point is to C, the more the available traction is used for braking and less for turning. Near point D, most traction is used for turning and relatively little for braking.

Obviously, 100 percent of braking or acceleration traction can't be used while turning, and 100 percent of cornering traction can't be used while braking or accelerating.

- If the traction circle represents 100% of your total traction capacity and you use 10% of that traction to turn right, then you would only have 90% of total traction available for braking.
- If you use 100% of traction for braking, then 0% is available for turning. In other words, you would not be able to turn at all.
- If you want to turn slightly while braking, you must ease up on the brakes to avoid using them 100%. The same logic applies for acceleration while turning.

In race car driving, it is most common to accelerate or brake in combination with turning, creating a complex variety of forces on your tires. To drive as fast as possible, you must know your car's limits and push your car continuously to its performance limits.

BASIC RULE

Always remember to use the tires' traction all the way to the limit represented by the edge of the traction circle. Also remember that a car's performance limits will change continuously depending on tire quality, road conditions, and driving technique.

WEIGHT TRANSFER

Remember that in the tire section of this manual we said that traction was dependent on, among other things, the load on the tire. That load changes as the car moves. A car's weight distribution is changed as it moves. Weight is transferred in both fore-and-aft and sideways directions. That weight transfer affects almost all components of a car's handling. Understanding the effects of weight transfer will enable you to better understand the reasons a car handles as it does, and will help you be a better driver.

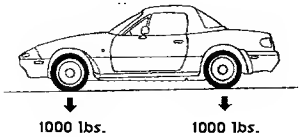
Imagine a 2000-lb. car with 50/50 weight distribution in both lengthwise and sideways direction. At rest, each wheel is loaded with 500 lbs.

Under acceleration, weight will be transferred to the rear of the car. This loads the rear tires more, and so increases rear-wheel traction while decreasing front-wheel traction. The front wheels may have 800 lbs total instead of the 1000 lbs. when static; the rear wheels would then have 1200 lbs. of weight on them. The rear of the car may squat down during acceleration. This is a result of the weight transfer, not the cause. In extreme cases, such as in a top-fuel dragster under acceleration, all of the vehicle's weight may be transferred to the rear wheels, causing the front wheels to lift in the air.

The opposite occurs during braking. As the car slows, weight is transferred toward the front of the car. This increases front-wheel traction and decreases rear-wheel traction. The front wheels of our example car may have a loading of 1200 lbs.; the rear wheels would then have a loading of 800 lbs. total. The front end may dive as a result of the weight transfer. The unloading of the rear wheels can cause rear-brake lockup in extreme cases or if the car's brake balance is not correct.

Weight transfer gets more complex when a car turns. At a steady-speed in a corner, weight will be transferred from the inside wheels to the outside wheels. The car will also roll towards the outside of the corner on its suspension. The body roll is an effect of weight transfer, not the cause. A steady speed in a corner is a rare situation when racing.

Even weight distribution at constant speed or at rest.



If the car is turning while braking, weight will be shifted forwards and away from the direction of the corner, loading the outside front tire heavily. On the 2000-lb. car, it could get 800 lbs., with the inside rear tire having 200 lbs. If the car is accelerating out of a corner, weight will transfer toward the outside rear tire. The outside rear tire may have 800 lbs., with the inside front having a 200 lb. load.

As can be seen from the examples, weight transfer changes the weight loading on a car's tires. This causes major changes in traction for each tire. The relation between weight loading and traction is not linear. Traction does not increase as quickly as weight is added. Conversely, when weight is removed, traction decreases more quickly than the decrease in weight. So even a 50 or 100-lb. change in weight loading between opposite tires may noticeably change a car's handling characteristics. A car that has sudden changes in handling can be extremely difficult to drive.

SOME EFFECTS OF WEIGHT TRANSFER:

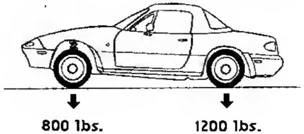
Weight transfer under acceleration can increase traction for rear-wheel drive cars, but decreases traction for front-wheel drive cars.

It can change a car's tendency to understeer or oversteer. Under heavy braking while turning, an understeering car may oversteer because of the shift of weight off of the rear wheels.

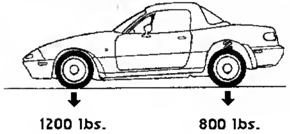
Under heavy braking, the lighter load on the rear wheels of any car may cause the rear brakes to lock, sending the car into a spin. Also, the extra load on the front wheels in that situation may stress front-wheel drive components.

It is important to be aware of the effects weight transfer on your car's handling.

Weight transfer to rear during acceleration.



Weight transfer to front during braking.



CORNERING

The key to winning races is in the corners. Going fast on the straight-aways is easy; getting through the corners quickly is not. An understanding of the effects of tire traction and weight transfer in cornering will help you understand the best techniques for fast cornering.

In this section we will consider the parts of a corner, and some basic driving techniques. For simplicity, we will consider only a single corner between two straight-aways. On a racetrack or road, corners may come in a sequence with no straight sections between. Techniques for such corners will be covered in the Multiple Corners section.

There are three parts to any corner: entry, apex, and exit. Corner entry is that section between the straightaway and the apex. The apex is the point at which the car is closest to the inside of the corner. Corner exit is the section from the apex to the point at which the car is on the next straightaway. There are certain lines through a corner that are quickest; we will cover them in the next section. Here we cover basic braking, steering, and acceleration as they relate to a corner, and the effects of weight transfer from that braking, steering, and acceleration on a car's behavior.

CORNER ENTRY

Corner entry is critical because it is during this phase that the car is positioned for the correct apex and exit. If you don't enter correctly, at best, time will be lost and at worst, the car will spin out.

The first step is to slow for the corner. Remember from the section on tires that a tire can only use 100% of its traction for braking while it is traveling in a straight line. Any cornering force from turning reduces the maximum amount of traction available for braking. And remember from the section on weight transfer that the weight of the car shifts forward while braking and toward the outside while cornering.

The best way to slow for a corner is to first apply the brakes to their maximum while you are still traveling in a straight line. At the same time, you may need to downshift, and will also need to ease up on the throttle. This slows the car as quickly as possible and shifts the weight forward, increasing the grip of the front tires and reducing the grip of the rear tires to help the car turn into the corner. You want to be sure not to lock the brakes. Once the correct speed for the beginning of entry to the corner is reached, gently (gently, NOT suddenly!) release the brake while beginning to turn in to the corner. This is called "trail braking", because you gently trail off the brakes as you enter the corner. Suddenly releasing the brakes could reduce front-wheel traction because of rearward weight transfer, causing severe understeer. Suddenly releasing the throttle while in the corner will cause a forward weight transfer, which may cause oversteer as the rear-wheel grip will be reduced. A balance between braking and cornering speed must be maintained — you should stay within the limits represented by traction circle or suffer the consequences.

CORNER EXIT

At some point, usually at or just before the apex, you will want to begin to accelerate out of the corner. At this time, the brakes should be fully released. The steering wheel is still turned into the corner. It's time to begin to accelerate. Again, "gently" is the best technique. Remember that weight is transferred rearward under acceleration, and sudden inputs destabilize a car.

Too much throttle too soon can cause trouble. A front-wheel drive car will understeer towards the outside of the turn as the front wheels lose traction because of the rearward weight shift. Shifting weight forward will usually solve the problem. Gently reduce the throttle to shift weight to the front wheels, and only then gently increase the steering input.

A rear-wheel drive car, especially a powerful one, may get tire-destroying wheelspin and power oversteer if too much power is applied exiting a corner. Remember that a tire only has so much traction capability, and, when exiting a corner, the lateral component of the car's direction uses some of that ability. If the rear of your car steps out of line, countersteer — in a right turn, turn the steering wheel left — and stay on the power. You might save it, but a spinout is likely. More information on this will be found in the section on "Drifting" later in the manual.

A small, controlled amount of oversteer can enable an expert driver to go faster, but can be difficult to control. But this is a small amount, not a sideways, full opposite-lock power slide. Sliding looks spectacular, but it's slow and hard on tires. Slides and four-wheel drift will be covered later.

Learning the proper technique and speed for a corner takes practice. Smoothness counts! Work on being smooth and speed will come. If you try to go too fast too soon, many agricultural expeditions will result. The fastest drivers are usually not spectacular to watch, and the most spectacular are rarely the fastest.

GT2 GRAN TURISMO

CORNERING LINE

"Line" is the racing term for a path through a corner. There are many lines through any corner, but some are faster than others. The best line is not necessarily the most obvious one.

Theoretically, the fastest line through a corner would seem to be the one with the maximum radius, as in figure A. It does allow the fastest constant speed through the corner. The major problem is that the car's speed must be kept constant throughout the corner. All braking must be done before the turn-in point, and no acceleration may be done until the car is on the straight after the corner. Taking corners in this manner does not lead to the fastest lap times.

A line similar to that shown in figure B is better. Turn-in is sharper and so the first third of this line is slower than the constant-radius line in figure A. However, the apex is delayed until after the geometric apex of the corner and the line for the second two-thirds of the corner not only has a larger radius than the constant-radius line, it has an increasing radius. This allows acceleration out of the corner and a higher exit speed, essentially making the following straight longer and allowing your car to reach a higher speed. Also, since turn-in to the corner is delayed, the straight leading to the corner is made longer. Figure B is somewhat exaggerated, but much like the ideal line in a corner. Experiment with similar lines to find the fastest way around a racetrack.

Figure A

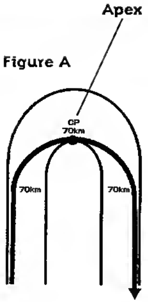
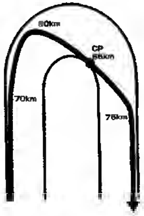
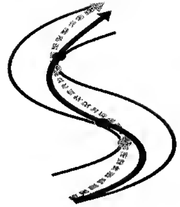


Figure B



There's an old racer's saying: "Slow in, fast out." The opposite of that is "Fast in, slow out." Watch two cars dicing in a race. Often one car brakes later than the other and passes it going into a corner only to be re-passed on the exit. If you do have to take an early-apex line in a corner because of passing, slow down enough to stay to the inside of the corner until the usual late apex, and then accelerate away on the late apex line. No matter what line you use through a corner, be sure to use the entire road.

Figure C



MULTIPLE CORNERS

On both race courses and roads, corners are often linked together. Alternating left and right turns, called "esses" because of their resemblance to the letter "S", are fairly common. They can be extremely challenging, especially when several are combined in sequence. It is best to think of such corners as one long, complex corner.

Remember: slow in, fast out. Set up your line for the fastest exit from the last corner, even if it means a slower entry speed into the first corner or corners. In figure C, the dotted line is the maximum-radius line and the solid line is the late-apex line. Notice that although the entry into the first turn will be a little slower on the late-apex line, the late-apex exit gives a correct entry for a continued late-apex line in the second corner and a much faster exit out of that last corner in the sequence.

Always look ahead and plan ahead.

DRIFTING

Drifting is that fine line of control just before an uncontrolled skid. In racing, a car is usually considered to be drifting when all of its wheels are slipping, but the front wheels are still more-or-less pointed in the direction of the corner, or at least straight. Beyond that, when the car gets more sideways and even harder to control, it's sliding. Drifting is the fastest way through a corner, and makes full use of the tires' capabilities. But sliding is not the fastest way. Although sliding sideways, with the tail of the car hanging out and the steering in full opposite lock, looks spectacular, it's slow. And it causes excessive tire wear.

A drift is started by breaking the rear tires loose in a controlled manner in a corner. There are several ways to do this, and all work because of weight transfer. An understanding of the effects of weight transfer under braking, cornering, and acceleration is vital for understanding why a car will drift instead of spin out, and when it will cross the line from drift to spin. Fast reactions by the driver and a high level of driver skill are also necessary — drifting is not a beginner's technique.

A rear-wheel drive car with understeering handling near its limit of cornering but enough power to break its rear wheels loose in a corner is the ideal machine for drifting. An all-wheel drive car with sufficient power will also work. Even a front-wheel drive car can be made to drift, but that takes special techniques to be explored later.

At the limit in a corner in an understeering car, the slip angle of the front tires is greater than the slip angle of the rear tires. The front tires are being worked to their maximum capability, but there is some traction in reserve in the rear. Remember from the section on tires that tires can only handle a certain amount

of force. If sufficient power is applied to the rear tires of that car in a corner, the traction available to counteract the centrifugal force of cornering will be decreased and the rear of the car will move outward in response to that centrifugal force. But, because of the weight transfer toward the rear under power, the rear tires gain more traction capability (to a point) at that time, and can handle more power or resist more sideways force than might be expected. As long as there is a balance between the power applied and the centrifugal force due to the car's cornering speed, the drifting car will be stable. But it is a precarious, knife-edged balance that requires skill and careful attention to attain. Smoothness is absolutely important. Smooth changes in throttle can steer the car; sudden changes in steering, throttle, or braking can send the car out of control.

In an all-wheel-drive car, a drift may also be initiated by sharply turning the steering wheel into the corner, and then accelerating and decreasing the steering a certain amount. You'd want to do this after the turn-in process is completed, just before the apex, while setting up for the corner exit. The car is still decelerating, so weight is shifted forward, giving the front tires increased traction. When the steering wheel is turned (sharply but in a controlled manner), the front wheels pull the car forward in the direction in which they are pointed. The rear wheels develop an increased slip angle and swing wide. Acceleration at this point transfers weight back toward the rear wheels, increasing their tractive ability as in the rear-drive car above. Coordinated use of the throttle and steering wheel keeps the car pointed in the desired direction, as with a rear-drive car.

If you can shift weight rearwards faster than the tail goes out in oversteer, you can control an oversteer slide. This will work if the oversteer is caused by the car's suspension design. Some highly-skilled racing drivers prefer a car that oversteers at its limit because of this. The car will need rear-wheel drive and plenty of power in order for this technique to work! For most cars and most drivers, this may be a more theoretical than a useful technique. If the car is already in a power oversteer slide, weight is already transferred to the rear and the power through the rear wheels is overpowering their lateral traction. More power at that point is not what is needed.

It is also possible to start a drift in an understeering rear-drive car by momentarily locking up the rear wheels while turning. This reduces their traction, and they will slide toward the outside of the corner. Immediate application of power will control the slide. One way to do this is to shift down to a lower gear in a turn. This will momentarily lock the rear wheels. If the driver is skilled enough, a quick application of power can prevent a spin. This technique has been used by racing drivers in the past, but is not recommended except as a last-ditch effort to keep from understeering off the road. The forces through the car's drivetrain and suspension in this situation may easily break something important, particularly with the grip of modern tires.

We've mentioned rear- and four-wheel drive cars. What of front-wheel drive? As has been mentioned in several previous sections, disadvantages of front-wheel drive for racing purposes include its inherent understeer and lack of power through the rear wheels to combat the understeer in the "traditional" ways mentioned above. But, if the rear wheels could be broken loose, understeer would be negated. And the front wheels could pull the car out of the corner more quickly as they would have less steering lock and so could use more of their traction for acceleration. But how to break the rear wheels loose?

Not, in this case, the gearbox, as the drive wheels are at the wrong end. (Lock the front and you get massive understeer. And you might break something in the drive-train, anyway.) But a careful jab at the brakes (or, actually, a series of careful jabs at the brakes) while turning into the corner under power will break the rear wheels loose, pointing the car into the direction of the corner. The rear wheels break loose because under braking, weight is transferred forward. And front-drive cars have forward weight balance anyway. So very little weight is on the rear wheels, and the rear brakes lock. Centrifugal force does the rest. The front wheels don't lock (unless too much brake is applied) because they have more traction, aided by the forward weight shift. Ease off the brakes, and the front wheels to pull the car out of the oversteering condition.

This is not an easy technique, as it requires use of the brakes and throttle at the same time. Coordination and fast reflexes are necessary. It was developed by rally drivers who drove small-displacement front-wheel drive cars on loose or icy surfaces.

In circuit racing, drifting is not what it used to be. Slip angles of modern racing tires are small, and the traction they can generate is very, very high. Breakaway can be sudden, and at speeds too fast for human reflexes to react to. On pavement, drifting is primarily found in touring car racing. Top-level open-wheel and prototype racers hardly drift at all — most of their high-speed cornering ability is generated by aerodynamic downforce, and the devices that create the downforce work well only in a straight line and at very small yaw angles. A large yaw angle would cause a catastrophic loss of downforce resulting in an uncontrolled spin.

In modern racing, classic drifting is found in two places: on pavement in wet conditions, and in rallying, which takes place on nearly any conceivable surface in almost any weather conditions.

RALLYING

Drivers who race on purpose-built circuits or even special courses made from closed public roads have it easy. They can drive on the course before the race in order to set up their car and find the best lines through the corners. Corner workers warn them of dangerous conditions or a spin by a competitor with a set of flags or lights. If the weather is too bad, the race may be slowed behind a pace car or even stopped. If anything on the car breaks, they might make it back to the pits and be able to repair the car and continue racing.

Rally drivers have none of these comforts. Rallying is the form of motorsport most like the point-to-point races of a century ago. Rallys are run from one point to another over all imaginable types of road surface, and in any sort of weather. The worse the weather and the poorer the road surface, the better the rally. Drive in a rally and you'll be driving on pavement, dirt, gravel, snow, and ice, often in winter weather conditions. Although it's sometimes possible to pre-run parts of a rally route, the conditions may change on that route between the time you do your reconnaissance and the time you run the rally. And, with sections tens or even hundreds of miles long, memorizing the course is not possible. Rallying just may be the most challenging form of motorsport.

That said, you, the Gran Turismo 2 player, are lucky. The rally mode in Gran Turismo 2 is a little different from a real-life rally. Real rallies have sections of high-speed driving called special stages connected by timed drives on public roads. Special stages may be on dirt forest roads, race courses, or hillclimb courses. Real rallies are long and difficult tests of human and mechanical endurance.

In Gran Turismo 2, the Rally Mode is like a special stage in a rally. There is only one open course, Pike's Peak International Hill Climb. It is a relatively long-distance hillclimb course with separate starting and finishing points, as in a real rally special stage. The other courses are closed circuits where each lap is relatively short in distance.

Also, in Gran Turismo 2's rally courses, drivers never drive on snow or ice. There is only pavement, dirt, and gravel. So you won't get any nasty surprises. Well, not too many—don't forget to pay attention! Further, only one kind of tires are available in this mode, keeping your life much simpler. Real rally teams sometimes completely change the car's suspension setup for each stage, with different geometry, springs, shocks, and wheel and tire sizes and tire compounds.

Although nearly all types of vehicles except open-wheeled pure racers have been run in rallys, the top rally cars today use four-wheel drive. Traction can be hard to find on a rally course, and four-wheel drive makes the best of what can be had. Small front-wheel drive cars have also been popular, and drivers of these cars have discovered some interesting techniques to help them get through corners faster. Braking under acceleration into a corner, explained in the section on "Drifting" is one such technique, and there are others.

Basic rally driving techniques are not too different from other driving styles. Rally cars are subject to the same laws of physics as any other cars. There are two major differences between rally driving and driving in more controlled situations: traction and suspension setup, including ride height.

Circuit racers are blessed with sticky tires designed for maximum adhesion on high-traction pavement, and a clean, clear, debris-free track that allows a low ride height for a low center of gravity and minimal weight transfer. Rally drivers aren't so lucky. They race on low-traction surfaces like dirt, gravel, snow, and ice as well as on paved roads. A rally car needs more ground clearance, and sometimes protective "skid plates" underneath the engine, transmission, and gas tank to deal with the rough and unpaved roads of a rally. To get sufficient clearance to deal with the rocks and other debris that may be found on a rally road, rally cars are set up with a considerably higher ride height than their circuit-racing relatives. They usually have longer suspension travel, again to deal with the various road surfaces. Increasing ride height increases the car's center of gravity and weight transfer during maneuvers. The long-travel suspension also increases weight transfer.

So, even with the best specialized rally tires, a rally car won't corner like a modern race car. It will, however, corner much like a race car from the days before wide, sticky tires and aerodynamic devices. What drifting occurs in circuit racing today is usually limited to a near-imperceptible few degrees. In rallying, lurid high-angle powerslides are common, at least on loose surfaces. Some rally drivers only seem happy looking forward out of the side window.

Because of the low-traction surfaces, smoothness is even more important in rallying than in other forms of motorsport. Although rally drivers look out of control, they're not. Driving on low-adhesion surfaces is just like driving on high-adhesion surfaces except for lower limits. Speeds are lower and yaw angles are higher, but it's easier to lose control. Start developing your rally skills by driving smoothly. Understand the effects of weight transfer on handling and drifting. And practice basic driving techniques before trying any special rally techniques.

DRAG RACING (1/4 MILE RACE)

What's exciting about racing? Direct competition. Even if two cars are trading places throughout a race, the best part is at the end. It all comes down to seeing who gets the best line out of the last corner, and storms up the straight to win. The last few hundred yards between the last corner and the finish line are the most exciting part of the race.

That's what drag racing is all about. Drag racers have done away with the sometimes boring preliminaries and distilled racing down to its essence. Car versus car, driver versus driver, and one-quarter of a mile to see who's best.

It seems easy. Just sit at the starting line, and when the light goes green, put the pedal to the metal, right? You wish.... Because there are only a few seconds in a drag race, there's no room for error. If you don't get a good start, you're unlikely to make up time in only a quarter of a mile. And you must be able to coax the best acceleration out of your car.

Driver reaction time at the start is important in all forms of racing. But nowhere is it as important as in a drag race. Wait too long after the light has gone green, and your opponent will be halfway down the strip. Start too soon, and you'll "redlight" and be disqualified.

To get a really good start, you'll need to have just the right revs on the engine before dropping the clutch so that you get just the right amount of wheelspin. If the revs are too high, the clutch, or the tires, or both can go up in smoke. Then you need to shift quickly, at the proper rpm for fastest acceleration. Even with an automatic transmission, proper revs are important.

Read the manual section on "Acceleration" again, and practice your starting technique.

HANDLING PROBLEMS: QUESTIONS & ANSWERS

1) Q: I've heard that skilled drivers will enter a corner at 60mph, so I tried cornering at the same speed. But when I turn the steering wheel, the car doesn't turn.

A: This is probably due to insufficient weight transfer. When you apply the brake, the car's weight will shift forward, increasing the traction of the front tires. If you turn the car with the weight shifted forward, the car should turn. Even though you may be traveling at the same speed of 60km/h, there is a big difference in turning ability depending on whether the car's weight is shifted forward or not. If you find yourself in understeer, the safest counter-measure is to relax without applying the brake or throttle. As the front tires begin to regain traction, the car should begin to turn properly.

2) Q: I turn the steering wheel while applying the brake just like it says in the manual, but the car doesn't turn.

A: In Gran Turismo 2, all the cars are equipped with anti-lock brakes, so you should be able to turn with the brakes applied. But the timing for applying the brakes and turning the steering wheel are still vital in making a good turn. If you're going into the corner too fast, it is still possible to understeer even with anti-lock brakes. Give yourself a little more breathing room and apply the brake a little earlier. This should lead to more positive results. If you're already deep into the corner and the car is understeering, it's best to take your foot completely off the brake.

3) Q: I opened the throttle as I was getting ready to exit the corner, but the car just veered to the outside.

A: This problem was discussed in the section on exiting corners. For both front-wheel and rear-wheel drive, if the car understeers when you accelerate, the best remedy is to release the throttle (don't accelerate so hard). As the weight which had been transferred to the rear shifts forward, the steering wheel should begin responding again. However if the car decelerates too quickly, the rear tires may lose too much traction and slip, which will cause the car to go into a spin. This is called "trailing throttle oversteer". To prevent it, release the throttle slowly, until the car is back in line.

Note: Releasing a throttle may be more difficult with the directional buttons. Avoid oversteering by tapping on the accelerator buttons numerous times.

4) Q: For some reason, I'm not able to turn and approach the apex of the turn. My tires are not slipping either.

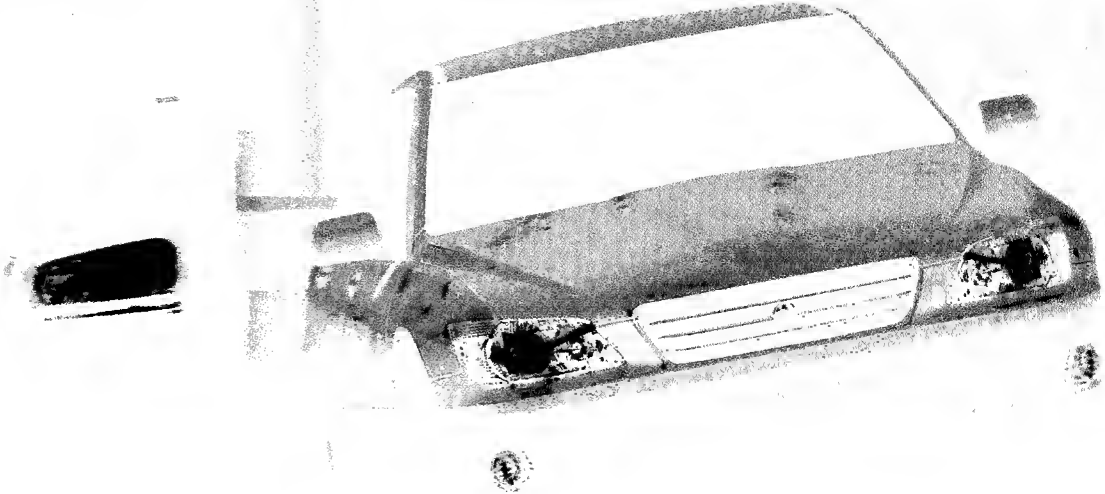
A: If your tires still have not reached their traction capacity and the car is not turning enough, the problem is simply that you need to turn the steering wheel more. This is a common problem for beginners, but it also happens to advanced drivers when they get nervous and fail to turn the wheel sufficiently because of a loose grip. The best advice is to get a feel for your surroundings, settle down, and assume good driving posture.

5) **Q:** I spin out as I start to enter a corner.

A: This is due to excessive weight being shifted to the front of the car, resulting in oversteer. Trailing-throttle oversteer, again. One way to remedy this is to turn the steering wheel in the direction opposite the turn, in other words, counter-steer. When oversteer occurs, the rear tires are traveling outside of the path taken by the front tires. Counter-steering compensates for this by turning the front tires to the outside as well. Although people will instinctively counter-steer when oversteer occurs, this move won't be mastered properly without plenty of practice. If the counter-steer is applied too long, as soon as the rear tires regain their traction the car will start moving in the opposite direction of the corner. The car will be traveling very fast, so this will make restoring the car in the right direction even more difficult. Counter-steer should be applied quickly and in the right amount. As soon as the car has recovered, the steering wheel must be returned. Getting the feel for this will simply require time and practice. During counter-steer, the throttle and the steering wheel must be manipulated simultaneously. To increase the traction of the rear tires, the throttle must be opened to transfer weight to the rear. As described earlier in this manual, for rear-wheel drive cars, it is important that the throttle be opened gently, or else the traction capacity of the rear tires will be exceeded, causing the car to go into a spin. For front-wheel drive cars, however, it's preferable to open the throttle as much as possible to re-stabilize the car quickly.

6) **Q:** I was rounding a long corner without any problems when the rear tires started to slide.

A: If it's not a case of the throttle being opened too much on a rear-wheel drive car, then it's probably because the car's cornering speed is too fast. The centrifugal force acting on the car will exceed the lateral traction capacity of the rear tires, causing them to slide. You could say your driving is a bit too aggressive. If you can solve this with a bit of counter-steer, then you're close to the fastest cornering speed possible. If you must counter-steer for a long time or if the car spins out, then this is clearly a case of oversteer. Slow down a little bit and see if that isn't the perfect speed for that corner. Try the tips in the answer above as well. The one thing to avoid is to tense up and suddenly take your foot off the accelerator. If this happens, the weight transferred to the rear will shift forward, causing the rear tires to lose traction and the car to spin out instantly.



MODIFICATION PARTS

MUFFLER

Sports

Combines a less-restrictive replacement sports-model air cleaner with a low back-pressure sports muffler to improve intake and exhaust flow. Ideal as a first-time turbo upgrade. Improves high-rpm torque in non-supercharged engines.

Semi-Racing

A competition-grade air cleaner with urethane sponge filter is combined with a low-back pressure muffler designed to enhance engine performance at high rpm. Ideal for large-displacement turbo engines. When using with a non-supercharged engine, proper tuning beforehand is a must.

Racing

Delivering even better intake efficiency than the semi-racing model, this racing air cleaner with a velocity stack is combined with a high-efficiency straight muffler designed for racing cars that normally operate in the high-rpm range. Suitable for tunings that maximize peak power. Reduces low-rpm torque and so requires proper consideration of engine characteristics, gear ratio, and other factors.

BRAKES

Sports Brakes

Contains carbon metallic brake pads for dependable stopping power, even during long-distance driving. With far more initial stopping power and fade resistance than ordinary brakes, these brakes are also suitable for endurance races. Brake fluid (DOT 5) is also changed.

Brake Balance Controller

Controls the anti-lock braking system to maintain the desired balance in braking power between the front and rear brakes. Strengthen the front to increase under-steer for extra stability, or strengthen the rear to increase oversteer for better maneuverability. Remember that a too-strong rear brake balance setting increases the likelihood of spinout.

ENGINE

Performance Chip

The most basic upgrade. Altering the Engine Management Program settings allows you to boost power by adjusting engine ignition timing, the air/fuel ratio, and other variables. For turbocharged vehicles, the air filter and muffler are also replaced, for a beginner's-level upgrade.

Full-Engine Balancing

An extensive upgrade that includes piston and connecting rod weight balancing, and a precision-balanced crankshaft. Reduces vibration and bearing loads, and allows higher engine speeds. The rev limiter is reset to take advantage of this.

Port and Polish

Polishes the interior of the intake ports, reducing air-flow resistance boosts engine power by what may seem a low degree, but is essential for normally-aspirated and supercharged engines alike.

NA Tune-up

STAGE 1

Boosts the power of non-supercharged engines by adjusting the ignition and valve timing and by installing thinner head gaskets for a higher compression ratio. The exhaust manifold is also replaced. Peak power is enhanced without affecting low-rpm torque.

STAGE 2

Picks up where Stage 1 leaves off. Not only raises the compression ratio even further with high-compression pistons and head polishing, but also boosts high-rpm output by replacing the cams, mounting reinforced valve springs, and Port and Polish. Although low-speed torque is diminished somewhat, the emphasis here in on boosting high-rpm power. The Engine Management Computer is also reset according to your vehicle specs.

STAGE 3

Following up on Stage 2 enhancements, this upgrade completely overhauls the engine to enhance high-rpm performance. Higher-compression pistons, special high-lift racing cams with a large amount of valve overlap, heavy-duty competition valve springs and connection rods, and engine block strengthening are all part of the package. The power band is shifted to the medium to high range to boost maximum horsepower.

Displacement Increase

There's no replacement for displacement. This upgrade raises cylinder displacement by increasing engine bore and stroke. Greater displacement generally boosts the engine's torque in all rpm ranges.

DRIVETRAIN

Transmissions

Sports Transmission

Replaces a normal transmission assembly with a transmission with closer gear ratios in all five gears. Prevents revs from dropping below the powerband when upshifting, and allows smoother downshifts. Ensures useful power in a variety of turns. Recommended for non-supercharged engines.

Semi-racing Transmission

These gear ratios are even closer than those of the Sports Close-Ratio Transmission. This gearbox is ideal for highly-tuned cars with a narrow powerband. Note that upshifting and downshifting will become more frequent. Because of time loss during shifting, this transmission may be counterproductive in cars with high-torque, wide-powerband engines.

Full-racing Transmission

For races that permit the replacement of all gears, including the final drive gear. This upgrade also makes it possible to fine-tune the gear ratios according to vehicle specs and circuit features.

Clutch

Heavy-Duty Single Plate Clutch

Changes the clutch feeling during shifting, so that upshifting feels more direct than with a normal clutch.

Twin Plate Clutch

This racing clutch kit features dual clutch plates, ideal for high-torque, high-power vehicles. Reduces clutch slippage during upshifting, improving acceleration.

Triple Plate Clutch

Featuring three clutch plates, this clutch kit boosts torque transmission and enhances the directness of the power. Ideal for highly-tuned cars.

Limited-Slip Differential (For Professionals)

2-Way Limited-Slip

An limited-slip differential that delivers the limited slip effect during both acceleration and deceleration. Stabilizes vehicle attitude during braking, thereby permitting even harder braking. Delivers powerful traction during acceleration, but clearly makes turning more difficult and so is suited to drivers who are skilled at turning.

1.5-Way Limited-Slip

Reduces the limited-slip effect during deceleration while maintaining the full limited-slip effect during acceleration. This ensures powerful traction and, during braking, prevents excessive reduction in the force of the car attempting to turn. Free of quirkiness, this a good all-around limited-slip unit.

1-Way Limited-Slip

This limited-slip activates the limited-slip effect only during acceleration, and so is suitable for front-wheel-drive vehicles, which are difficult to turn under any conditions. The absence of the limited-slip effect during braking makes it possible to maximize turning power. However, the tendency of the vehicle to lose stability during braking should be noted. The shortcoming of this type of limited-slip is that vehicle characteristics during acceleration change greatly when the accelerator is released to decelerate.

Full Customization

This special racing modification allows independent adjustment of the limited-slip effect during acceleration and deceleration. Although capable of greatly changing a car's performance, this modification requires careful adjustment as improper adjustment can destroy the car's balance.

Flywheel

Sports

A lightweight flywheel made with chrome molybdenum steel. Lets the engine rev more quickly. Improves acceleration slightly, but with narrow-powerband engines revs may drop below the powerband unless a close-ratio transmission is also used.

Semi-Racing

Even lighter than the sports type, this flywheel is especially designed for racing. Makes for a quick-revving engine. Improves acceleration slightly, but with narrow-powerband engines revs may drop below the powerband even more easily unless a close-ratio transmission is also used.

Racing

A super-lightweight flywheel exclusively for racing. Makes for a quick-revving engine that also drops revs quickly. Improves acceleration and deceleration, but with narrow-powerband engines revs may drop below the powerband unless a close-ratio transmission is also used and the driver can master proper shifting technique.

Driveshaft

Carbon Driveshaft

A lightweight driveshaft made with a carbon composite. Situated between the engine and the differential gear in front-engined, rear- wheel drive or all-wheel drive cars, the driveshaft is just as important as the flywheel for acceleration performance.

TURBO

Turbo Kit

STAGE 1

A turbo kit that uses a compact turbocharger to generate high-rpm torque without sacrificing torque in the low to medium range. Minimal turbo lag and high response combine to create an excellent balance suitable for all types of circuits. Metal gaskets, oil cooler, a reinforced oil pump and other high-durability parts are also installed.

STAGE 2

A turbo kit that stresses high-rpm peak power and low to mid-range balance. Torque in the low range is somewhat low compared to Turbo Kit 1, but mid to high range power is boosted considerably. In addition to metal gaskets, oil cooler, reinforced oil pump and other high-durability parts, a fuel pump, injector, computer and other turbo components are also installed.

STAGE 3

A turbo kit that focuses on quarter-mile acceleration. The power band shifts further into the high-rpm range than with Turbo Kit 2. For greater effectiveness, this turbo kit should be combined with a close ratio transmission and other parts. The cam is also replaced with one designed for turbo characteristics. In addition to metal gaskets, oil cooler, reinforced oil pump and other high-durability parts, a fuel pump, injector, computer and other turbo components are also installed.

STAGE 4

An oversized, high-rpm, high-output turbo kit designed purely with maximum horsepower in mind. Suitable for maximum-speed contests, for instance. The cam is also replaced with one designed for turbo characteristics. In addition to metal gaskets, oil cooler, reinforced oil pump and other high-durability parts, a special fuel pump, injector, computer and other turbo components are also installed.

INTERCOOLER

Sports

This air-cooled intercooler cools the hot intake air after it is pressurized by the turbocharger. By lowering the intake air temperature, air density is increased, allowing for more fuel to be used and boosting power. An essential part for a high-performance turbo engine.

Racing

Boosts the power of a supercharged engine by lowering the intake air temperature. The larger capacity increases the temperature-reducing capabilities but slightly lowers engine response. This high-capacity intercooler is a suitable upgrade for engines with a high maximum supercharging pressure.

SUSPENSION

Suspension Kits

Sports

An all-purpose, beginner-friendly suspension kit that covers all types of driving, from street to circuit. Both front and rear shock absorbers are adjustable to one of 10 damping force levels. Camber angle is also adjustable. Clearance is lowered approximately 1 inch in the front and back. Two-way low-pressure gas shock absorbers (adjustable to 10 levels).

Semi-Racing

A ride height-altering suspension kit for intermediate drivers. Spring rate and the shock absorber damping force are harder than with normal sports suspension. Front and rear ride height is adjustable in 1-millimeter increments. Damping force is adjustable to one of 10 levels, and camber angle is also adjustable. Single high-pressure gas shock absorbers.

Full Customization (For Professionals)

Enables tuning of all suspension parts. Adjusts shock absorbers, replaces springs with ones with different spring rates, and replaces the stabilizer (anti-roll bar), which controls the vehicle's lateral roll stiffness. Wheel camber can be changed, and toe-in is also adjustable. Shock absorber compression (bump) and extension (rebound) are independently adjustable to one of 10 levels.

TIRES

Sports Tires

Sports tires are for paved-road driving and have a greater grip than normal tires. Mounting high-performance tires enhances a car's cornering, acceleration, and braking performance and is the most effective upgrade. Purchasing tires entitles you to subsequent tire services for as long as you own those tires. Front and rear tires must be purchased together.

Racing Slick Tires

Racing Hard

A set of front and rear slick tires for racing on paved surfaces. These tires have low grip but are made with a durable compound that ensures consistent grip over the long term. Because these tires warm up slowly, use proper caution during the first 2 laps on a racing course.

Racing Medium

A set of front and rear slick tires for racing on paved surfaces and made of a special compound that provides a proper balance between grip and durability. Tires heat to the appropriate temperature after 1 lap to ensure high grip. These tires are not as durable as hard tires but last longer.

Racing Soft

A set of front and rear slick tires for racing on paved surfaces and made of a special compound that provides excellent grip, although at the expense of some durability. Ideal for time trials, for instance. After only one-half lap, these tires heat sufficiently to provide excellent grip. Limited durability requires more-frequent tire replacement.

Racing Super Soft

A set of front and rear slick tires for racing on paved surfaces. These tires, which cast durability to the wind to provide maximum grip, require only several turns to warm up to the point of maximum grip. Caution is required as loss of grip due to wear can occur suddenly.

Real-life Tires (For Professionals)

A tire that even more closely approximates the characteristics of actual, real-life tires. These tires make driving with the game controller extremely difficult and so provide a virtual experience of real-life driving (as opposed to video-game driving), requiring early braking, careful steering, and delicate accelerator manipulation. This is a set of front a rear tires for paved surfaces.

Dirt Racing Tires

Dirt racing tires, which must be mounted on all 4 wheels for racing on dirt courses. These tires are designed to ensure vehicle controllability on slippery gravel and other unpaved surfaces. Dirt racing tires are available only for certain vehicle types.

OTHERS

Weight Reduction

STAGE 1

Lightens the vehicle by removing unnecessary parts and replacing others with parts made of lightweight material. The numerous advantages of a lighter car include enhanced acceleration performance, improved cornering and braking, and better tire durability.

STAGE 2

Lightens the vehicle more by removing more parts and/or replacing more with lighter materials.

STAGE 3

Takes Stage 2 lightening a step further.

Racing Car Modifications

Upgrades the car's materials and shape, changes the coloring, and adds aerodynamic parts, which adds downforce to the vehicle. Adjusting the front and rear downforce makes it possible to change the vehicle balance in the high-speed range.

For Professionals

Yaw Control System

This component changes the setting of the Yaw Control System, which generates rotational moment in the vehicle by controlling the distribution of torque between the left and right drive wheels. Raising the setting creates rotational moment during cornering, making turning easier. Note that too high a setting increases the likelihood of tire spinning.

Active Stability Controller

Prevents spinning due to oversteering by actively controlling the braking power of all four wheels. A high setting stabilizes the car but makes cornering more difficult. A low setting permits greater freedom of movement in cornering but diminishes the spin-prevention effectiveness of the device.

TCS Controller

For adjusting the setting of the TCS (Traction Control System), which prevents wheelspin by automatically releasing the accelerator when a drive wheel is detected to be spinning. Changing the traction control setting changes a car's handling. A high setting stabilizes the car by eliminating wheelspin, but may diminish acceleration. With powerful rear-wheel-drive cars, a low setting can result in oversteering when the accelerator is being pressed.